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Z B O R N I K
BOOK OF PROCEEDINGS





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Jure Urbančič

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Foreword

Spoštovani,

v neizmerno čast mi je sodelovati pri prvem slovenskem strokovnem dogodku, na katerem zdravniki in izvajalci zdravstvene nege skupaj predstavljamo svoje dosežke, znanje in pravzaprav same sebe. Ni lahko biti kritičen do lastnih pogledov, dejanj, znanja in izidov. A prav to je še kako pomembno, ko pomislimo na skupno os našega delovanja – dobrobit pacienta.

Seveda poznamo tudi dneve, ki niso lahki, ko se kljub osebemu trudu počutimo utesnjene, pozabljene in neslišane. Sčasoma si nadenemo obraz, ki tega ne kaže, globoko v sebi pa vemo, da smo svoj poklic v zdravstveni negi ali medicini izbrali zaradi lepih dni, polnih ponosa na dobre izide, na dobro opravljeno delo, na novih pet, deset ali še veliko več let, ki jih podarimo pacientom in njihovim svojcem. Včasih moramo biti ponosni tudi na en sam dan več.

Pred vami sta dva zbornika, ki predstavljata to, kar smo in kar temelji na delu naših učiteljic in učiteljev, ter to, kar želimo postati. V vsakem prispevku, tako v zdravniškem zborniku kot v zborniku zdravstvene nege, je velik delež tega, kar znamo in zmoremo skupaj. To je Klinika za otorinolaringologijo in cervikofacialno kirurgijo UKC Ljubljana. To smo mi: ljudje, obrazi, znoj in solze, nasmehi in ponos. Ponosni smo lahko na vse nas, na naše predhodnike in na naše naslednike.

doc. dr. Jure Urbančič, dr. med.
predstojnik Klinike za ORL in CFK
Oktober 2026

01

Otologija

Otology

Programme Evolution of Three Decades of Cochlear Implant Hearing Rehabilitation at University Medical Centre Ljubljana: Outcomes and Future Perspectives

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STRUCTURED ABSTRACT

Background/Introduction: The cochlear implant rehabilitation programme at the Department of Otorhinolaryngology and Cervicofacial Surgery, University Medical Centre Ljubljana, began in May 1996. Over three decades, candidate selection, surgical methods, device technology and rehabilitation goals expanded. This review describes the programme's development, outcomes and implications for lifelong, user-centered care.

Methods: We conducted a chronological narrative review of programme reports and studies published in the proceedings of the Slovenian conferences on rehabilitation of cochlear implant users from 2002 to 2022, supplemented by publications and institutional developments through 2026. Milestones, aggregate activity data, outcomes and changes in diagnostic, surgical and rehabilitation practice were extracted. No new individual-level analysis was performed; STROBE principles were followed where applicable to retrospective aggregate reporting.

Results: The programme progressed from electroaudiometric confirmation of auditory pathway function and cautious candidate selection to genetic diagnostics, universal newborn hearing screening, bilateral implantation, adapted surgery for complex ears and robotic-assisted electrode insertion. Earlier detection reduced the mean age at diagnosis of congenital deafness from approximately three years to seven months, with implantation generally undertaken at around eleven months in otherwise healthy congenitally deaf children. By the end of July 2026, the programme included 581 users and 36 reoperated patients. Reported benefits extended beyond speech perception to voice control, language, safety, participation and quality of life. Long-term surveillance identified the need for prompt management of infection, channel-related adverse effects and device failure, while reimplantation generally restored effective auditory rehabilitation.

Conclusion: Cochlear implantation is not an isolated operation but the beginning of lifelong, multidisciplinary rehabilitation. Early access to sound is crucial, particularly in children, while meaningful outcomes must be individualized across age groups and associated disabilities. Future progress depends on precise diagnostics, atraumatic sur-

gery, objective fitting, coordinated follow-up and sustained partnership with users and families.

Keywords: Cochlear Implants; Cochlear Implantation; Hearing Loss, Sensorineural; Rehabilitation of Hearing Impaired; Quality of Life

Short Abstract

The cochlear implant programme at University Medical Centre Ljubljana began in 1996 and has developed into a comprehensive, lifelong pathway for children and adults with severe hearing loss or deafness. This historical review synthesizes conference proceedings, peer-reviewed publications and institutional developments through 2026. The programme evolved from cautious candidate selection and electroaudiometry to genetic diagnostics, universal newborn hearing screening, bilateral implantation, complex-ear surgery and robotic-assisted electrode insertion. Earlier diagnosis enabled implantation near the sensitive period for auditory and language development. Outcomes are now assessed not only through speech perception, but also through language, participation, safety and quality of life. Long-term experience confirms the importance of infection prevention, device surveillance, individualized fitting and access to reimplantation. The central lesson is that a cochlear implant is not a single surgical intervention: successful outcomes require realistic expectations, multidisciplinary rehabilitation, family involvement and lifelong follow-up tailored to each user's goals and circumstances.

Keywords: Cochlear Implants; Cochlear Implantation; Hearing Loss, Sensorineural; Rehabilitation of Hearing Impaired; Quality of Life

Introduction

When we performed the first cochlear implantation at the Department of Otorhinolaryngology and Cervicofacial Surgery, University Medical Centre Ljubljana, in May 1996, we embarked on a path along which almost everything would continually change: technology, indications, candidates' ages, diagnostic procedures, users' expectations and rehabilitation methods. One fundamental insight, however, has remained unchanged: a cochlear implant is not a single surgical event. It marks the beginning of a long-term process - developmental in children and rehabilitative in adults.

The proceedings of the conferences held in Maribor provide a valuable record of this journey. They show how the initial question of whether electrical stimulation of the auditory pathway would enable sound perception evolved into questions of speech understanding, language development, listening in noise, safety, quality of life and lifelong support. This paper brings together the key findings of studies in which I first participated and later led between 1996 and 2026, presenting them to fellow physicians, speech and language therapists, cochlear implant users and their families.

The aim of this paper is to provide a chronological account of the programme's development, summarise the most important aggregate outcomes, and identify the clinical and organisational lessons relevant to physicians, speech and language therapists, cochlear implant users and their families.

Methods

This manuscript is a historical narrative review combined with a descriptive institutional programme report. The source corpus comprised contributions authored or co-authored by Battelino in the proceedings of the Slovenian conferences on rehabilitation of cochlear implant users published between 2002 and 2022 [1-19], two related peer-reviewed articles [20,21], and an institutional report on the first robotic-assisted cochlear implant insertions [22]. The review period extended from the first implantations in May 1996 to August 2026. At the ends in presenting last publications, as a result of the enrolment of first author in European status, statement and recommendation for pediatric cochlear implantation, auditory brainstem implants and genetic testing in hard of hearing people is listed [22 - 25].

Information was extracted on diagnostic pathways, candidate groups, surgical and fitting practices, rehabilitation aims, safety, language and quality-of-life outcomes, programme volume and technological milestones. Published numerical findings were retained as reported and arranged chronologically. No systematic meta-analysis, hypothesis testing or new statistical analysis of individual-level clinical data was performed; consequently, no statistical software was required. Because the manuscript includes retrospective aggregate descriptions of programme activity, relevant STROBE principles were applied where feasible, while recognising that this is not a conventional cohort study. All tables and figures contain aggregate, previously published or institutional programme data. No clinical photographs or identifiable patient information are included.

Results

1996-2002: Establishing auditory pathway function and realistic expectations

During the CI programme early years, one of the most important tasks was to confirm deafness reliably and assess the preservation of the auditory pathway. Electroaudiometry, presented in 2002, formed part of the preoperative assessment of cochlear implant candidates. It enabled direct electrical stimulation of the auditory system and determination of the lowest perceived electrical stimulus. It was particularly important in individuals for whom conventional audiological methods could not reliably predict the potential benefit of implantation [1].

The beginnings of the auditory rehabilitation programme, initially intended only for deaf persons, were cautious. In young children, objective tests were supplemented by

observation of behavioral responses; in adults, considerable attention was given to the duration and onset of deafness and to communication ability. It became clear early on that technically successful surgery does not guarantee an identical outcome for every person. The development of listening, speech and language depends on age at onset of deafness, duration of auditory deprivation, the condition of the central auditory pathways, cognitive abilities, motivation and the quality of rehabilitation.

Equally important was the establishment of realistic expectations. Candidates and families had to understand that improved sound perception does not automatically mean complete speech understanding and that progress after activation is individual. This principle remains relevant today: good information before surgery is the first stage of rehabilitation.

2002-2006: From the cause of deafness to targeted management

Cooperation with the Genetic Laboratory of the Division of Paediatrics, University Medical Centre Ljubljana, began in 2002. In the 2006 paper, we described 52 examined individuals; genetic testing was completed in 41, including 26 persons with congenital non-syndromic deafness and 15 with progressive non-syndromic sensorineural hearing loss. GJB2 mutations affecting connexin 26 were found in 12 individuals, or 29%. The most frequent mutation was 35delG [2].

A genetic diagnosis does more than name the cause. It enables more appropriate counselling for the family, helps the physician plan further investigations and allows timely involvement of other specialists in syndromic forms. The development from single-gene testing to present-day exome sequencing illustrates how the cochlear implant programme has become part of a broader aetiological and comprehensive approach to deaf and severely hard-of-hearing persons [2,16,20]. During the same period, we participated in a study of phonation control after implantation. In prelingually deaf children, several acoustic voice parameters improved significantly 12 to 18 months after implantation, whereas changes in adults were less pronounced. The acquisition of auditory feedback therefore has its greatest developmental effect while the phonatory system remains plastic. For speech and language therapy, this means that early access to sound is not an end in itself, but the basis for the formation of voice, speech and language [3].

2006-2010: Expanding indications and recognizing the importance of time

By 2010, the programme had progressed from demonstrating effectiveness to distinguishing groups for whom rehabilitation goals needed to be defined differently. The paper on cochlear implants in postlingual deafness emphasised that adults who had developed speech and language before losing their hearing could regain effective auditory communication after implantation. Outcomes, however, are closely related to

the duration of deafness, preservation of auditory memory, regular processor use and participation in auditory training [4].

For prelingually deaf adults, the goals are generally more limited: perception of environmental sounds, support for lip-reading, improved safety and easier contact with the environment. Decision-making must therefore be individual, avoiding both unrealistic promises and automatic exclusion. The essential question is not merely how much a person hears on the audiogram, but what meaningful benefit new auditory information can provide in everyday life.

2010-2014: Extending care to the full spectrum of users

The 2014 papers demonstrated an important expansion of the programme. Cochlear implantation was considered in children with congenital and acquired developmental disabilities, patients with Usher syndrome type 1 and older adults. The common denominator was an individual assessment of benefit: success cannot be measured by a single speech test [5-7].

In children with additional developmental difficulties, benefit may mean responding to their name, recognising warning sounds, improved orientation, easier cooperation, greater interest in the environment or access to a new channel of communication. Progress may be slower and less predictable, yet still highly important for the child and family. The preoperative team must therefore define attainable goals together with the family and review them regularly [5].

Usher syndrome type 1 combines congenital deafness, bilateral vestibular areflexia and progressive visual impairment. In the Slovenian cohort, hearing loss was identified by one year of age, and the children generally began walking later. Six children received cochlear implants, one bilaterally; all achieved very good aided sound-field thresholds of approximately 25 to 35 dB. Early implantation is especially important because hearing may eventually become their most reliable distance sense. Management must also include vestibular rehabilitation and ophthalmological and genetic follow-up. In exceptional cases, implantation is considered in adulthood despite prelingual deafness [6].

Chronological age itself was not found to be a barrier in older adults. General physical and psychological condition, duration of deafness, motivation, cognitive abilities, support from the environment and readiness for rehabilitation are more important. In a small comparative study of users aged over 60, cochlear implantation significantly improved communication and quality of life. This finding is increasingly relevant as population ageing increases the number of people with severe hearing loss and associated social isolation [7].

Table 1. Key developmental stages of the cochlear implant programme at the Department of Otorhinolaryngology and Cervicofacial Surgery, University Medical Centre Ljubljana, 1996-2026 [1-22].

Period	Key development	Significance for rehabilitation
1996-2002	Programme launch; electroaudiometry and multistage confirmation of deafness.	Safe candidate selection and realistic expectations.
2002-2006	Introduction of genetic testing; study of voice after implantation.	Aetiological diagnosis and evidence for the importance of early auditory feedback.
2006-2010	Expansion to postlingually and prelingually deaf adults. Universal hearing screening programme for newborns.	Individually defined functional goals. Age of detection of severe hearing loss drop from 3 years up to 7 months. Age of baby implantation is around 12 months.
2010-2014	Children with additional disabilities, Usher syndrome, older adults; bilateral implantation.	Benefit assessed more broadly than by speech testing alone.
2014-2018	Systematic monitoring of replacements, infections, channels, language and quality of life.	The programme becomes measurable, comparable and lifelong.
2018-2022	416 users; modern imaging and genetic diagnostics; complex surgery; individualised selection.	Comprehensive, safe and user-centered care.
2022-2026 (July)	581 users and 36 reoperated patients, Advanced genetic testing (NGS, WES)	Experience with malformed inner ears, reoperations and intracranial disease; genetic treatment pathways; robotic-assisted electrode insertion; systematic vestibular monitoring before and after implantation. Age of implantation in babies dropped to 7 – 10 months.

2014-2018: Safety, reliability, language and quality of life

As the number of users grows, monitoring safety becomes as important as assessing new candidates. An analysis of 346 implantations performed between 1996 and 2017 in 200 children and 146 adults demonstrated high system reliability. Replacement of the internal implant was required mainly because of device failure and less frequently because of infection, incorrect electrode position or other complications. The estimated probability of fault-free operation remained high during long-term follow-up [8].

Users need to understand that a cochlear implant is a lifelong medical device that may eventually require replacement. This does not represent programme failure. It means that the centre must maintain accurate records, provide prompt diagnosis when hearing changes suddenly and preserve the surgical and audiological capacity for reimplantation. In the analyzed series, auditory rehabilitation after replacement was generally successful again [8].

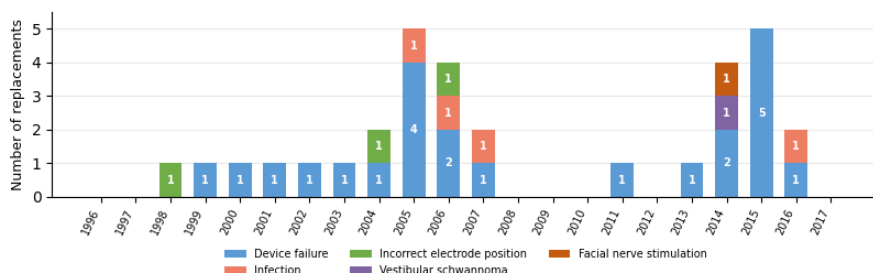


Figure 1. Cochlear implant replacements by year and cause, 1996–2017. Adapted from Steiner, Kolman and Battelino [8].

Particular attention was devoted to infectious complications. Otitis media, mastoiditis, chronic inflammation and cholesteatoma require early recognition and cooperation among the user, primary care physician, paediatrician and implant centre. Pneumococcal vaccination is required before implantation, together with appropriate antibiotic prophylaxis during surgery and the early postoperative period. In chronically diseased ears, we gradually progressed from conventional staged procedures to subtotal petrosectomy with simultaneous implantation in selected cases [9,13].

Deactivation of individual channels in the internal implant may also be part of safe, high-quality fitting. A channel is switched off when it causes discomfort, non-auditory sensations, facial nerve stimulation or abnormal electrophysiological measurements. The objective is not the greatest possible number of active electrodes, but the best usable auditory perception without adverse effects [10].

Language development in a child with a cochlear implant is not automatic. A study of grammatical knowledge in 44 children aged six to nine years demonstrated statistically significant differences between cochlear implant users and their hearing peers. Age at implantation, hearing age and other factors influence the outcome; even in a child implanted early, grammar, vocabulary, narrative skills and understanding of complex instructions must be monitored systematically. A good aided threshold on pure-tone audiometry does not necessarily mean equivalent language mastery [11].

For speech and language therapists and teachers of the deaf, intervention must extend beyond exercises involving the perception of individual sounds. The child must use hearing in spontaneous conversation, noise, learning, understanding figurative meaning and social relationships. Parents and teachers need clear guidance on creating a listening-rich environment while remaining attentive to the child's other communication needs.

In adults, an important development was the inclusion of quality of life as an independent outcome. After implantation, users report greater self-confidence, sociability and safety, as well as better relationships. Speech tests remain important but do not

capture everything: a person may participate more easily in family conversation, use the telephone again, return to the workplace or feel less apprehensive about independent mobility. Such achievements are often more important to the user than the percentage of correctly repeated words in the clinic [12].

2018-2022: A mature Programme providing comprehensive, lifelong care

By autumn 2022, we had assessed 751 candidates and implanted 416 persons with severe hearing loss or deafness. Numbers alone do not tell the whole story, but they demonstrate the growth of the centre and the need for an organised, lifelong commitment by both the healthcare team and the user [14].

Universal newborn hearing screening after 2005 produced the greatest change in paediatric care. During the Programme's first decade, definitive confirmation of deafness took approximately three years, and the mean age at implantation was therefore 3.2 years. After screening was introduced, deafness was diagnosed at a mean age of seven months, and congenitally deaf children without additional medical problems were generally operated on at around eleven months. We thereby moved closer to the sensitive period for development of the auditory pathways and language [14].

Preoperative diagnostics became both simpler and more comprehensive. Procedures requiring general anaesthesia that did not materially affect the decision were discontinued as routine tests and retained for selected cases. In children, deafness is confirmed by at least two objective tests and appropriate subjective methods. Anatomy is assessed with thin-slice CT and, when necessary, MRI; software-based estimation of cochlear length can guide selection of the most appropriate electrode. In adults, monosyllabic word understanding is essential in addition to pure-tone audiometry. Candidates generally score below 50% and report that hearing loss significantly restricts everyday life. All adult candidates also undergo brain MRI before cochlear implantation to exclude intracranial disease [14,17].

We have performed bilateral implantations since 2010. Hearing with two ears improves speech understanding in noise, sound localisation and listening effort. The decision must also include discussion of two devices, two rehabilitation pathways and likely replacements during the user's lifetime. Bilateral auditory rehabilitation is particularly recommended in Usher syndrome because vision may progressively deteriorate [15].

In complex anatomical conditions and chronic inflammation, we use adapted surgical techniques, including subtotal petrosectomy. In severe inner-ear malformations or absence of the auditory nerve, cochlear implantation is not always possible; in exceptional cases, an auditory brainstem implant may be an option. The first such procedure at University Medical Centre Ljubljana was performed through international co-operation in 2018 in a six-year-old girl [13,14,18, 23].

Table 2. Components of a contemporary, comprehensive cochlear implant rehabilitation Programme.

Domain	Current Programme approach
Confirmation of hearing loss	Combination of objective and subjective methods; functional speech understanding also assessed in adults.
Aetiological diagnosis	Genetic diagnostics, CT/MRI and assessment for syndromic and associated disorders.
Candidate selection	Shared decision based on expected benefit, everyday limitations, motivation and anatomy. The vestibular function was tested regularly preoperatively and postoperatively. The age of implantation for babies is now around 7 – 10 months, in elderly there is no age limitation.
Surgery	Preservation of residual hearing, facial nerve monitoring, individual electrode selection and adapted techniques for complex ears. The surgery become less traumatic with optimal approaches. Systemic and intratympanic corticosteroids are used routinely.
Fitting	Adequate time for initial fitting; use of objective measurements of hearing, using also pupillometry in selective pediatric cases.
Rehabilitation	Development of listening, speech and language; functional communication in real environments; family support.
Long-term follow-up	Regular reviews, processor upgrades, management of complications, reimplantation and quality-of-life monitoring.

2022-2026: Robotic assistance and continuous improvement

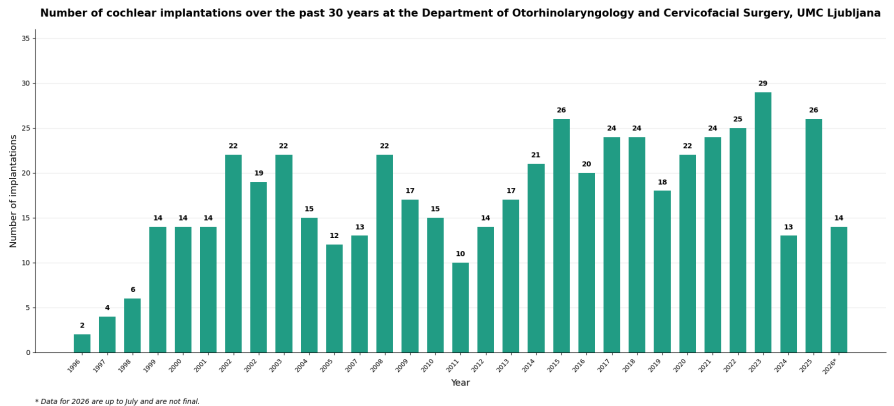


Figure 2. Annual number of cochlear implantations performed at the Department of Otorhinolaryngology and Cervicofacial Surgery, University Medical Centre Ljubljana [22].

Progress is not limited to cochlear implants themselves; surgical techniques also continue to evolve. As in other areas of life and surgery, robots and robotic instruments are being developed for cochlear implantation. In early November 2025, University Medical Centre Ljubljana became the first centre in Slovenia to insert cochlear implant

electrodes in an adult and an 11-month-old child with the assistance of a robotic arm. The system enables slow insertion with constant force into the inner ear. This reduces trauma to cochlear tissues compared with manual insertion and may also reduce stress and potential injury to the vestibular part of the inner ear. This is important because the inner ear will be stimulated for decades. The robot enables slow (0.1 mm/s), uniform electrode insertion. The team prepared for the procedure for several months, and cooperation among the surgeon, the manufacturer's engineers and the scrub-nurse team were essential. We also simultaneously measured auditory nerve responses to electrical stimulation during slow electrode insertion. The concept and implementation were received extremely well by the manufacturer and have since become part of its routine insertion and measurement procedure [22]. With the rapid development of genetic testing, we now manage hearing loss associated with more than 120 syndromes and have genetically tested 1,570 hard-of-hearing and deaf individuals and their blood relatives, using next-generation sequencing (NGS) and whole exome sequencing (WES) [2,16,20,24]. As the result of the echo of our genetic research we co-authored the Genetic Evaluation of Prelingual Hearing Impairment: Recommendations of a European Network for Genetic Hearing Impairment [24].

Discussion

Three decades of experience show that programme success cannot be reduced to implantation counts or speech scores. Four principles have remained consistent despite major technological change: timely access to auditory stimulation, individualised definitions of benefit, multidisciplinary teamwork and lifelong follow-up. These findings accord with the Programme's studies of early genetic diagnosis, complex candidacy, bilateral stimulation, language development and quality of life [5-21].

First, time matters, but it is not the only criterion. In children, early diagnosis and implantation enable development of the auditory pathways, speech and language. In adults, it is important to shorten the period of inadequately compensated hearing loss. Individual anatomy, aetiology, associated disabilities and life goals must also be considered.

Second, outcomes must be defined from the user's perspective. For one person, success means conversation without lip-reading; for another, perception of warning sounds; for a child with multiple disabilities, it may mean better contact with the family. Clinical tests and the user's experience complement each other.

Third, rehabilitation is teamwork. A surgeon cannot replace an audiologist, an audiologist cannot replace a speech and language therapist, and neither the therapist nor the family can replace the professional team. The best outcomes arise when everyone shares observations, adjusts goals promptly and speaks with the user rather than merely about the user.

Fourth, follow-up is lifelong. Children grow up, communication environments become more demanding, processors change, and infections, device failures or new health conditions may occur. The Programme must therefore remain connected with the user long after the surgical wound has healed.

Future perspectives

Over the next decade, we expect more precise genetic diagnosis, more individualised selection of electrodes and coding strategies, better preservation of residual hearing and more objective processor fitting in young children and people unable to cooperate reliably. Greater attention will need to be given to listening in noise, music perception, listening effort, mental health, ageing among implant users and access to rehabilitation outside major centres [20,21].

Technological progress will be meaningful only if the organisation of care keeps pace. We need high-quality databases, agreed outcome indicators, stable links among healthcare, rehabilitation and educational institutions, and timely access to renewed intervention. Users must know whom to contact in the event of a sudden change in hearing, a technical problem or new communication demands. Users and their families must trust their therapists and rehabilitation professionals while committing themselves to the child's or adult's lifelong rehabilitation with the cochlear implant.

Limitations

This review is based primarily on conference proceedings and aggregate institutional descriptions, Pub Med published papers rather than a prospectively designed registry analysis. Definitions, outcome measures, follow-up duration and reporting practices changed during the 30-year period, limiting direct comparison across eras. Several cited studies involved small or clinically heterogeneous samples, and not all Programme developments were evaluated with standardised patient-reported outcome measures. The most recent activity figures and robotic-assisted procedures are descriptive and have not yet undergone long-term comparative evaluation. These limitations mean that the manuscript should be interpreted as a documented Programme history and synthesis of lessons, not as evidence of causal effectiveness for any single intervention.

Conclusion

Three decades of the cochlear implant Programme at the Department of Otorhinolaryngology and Cervicofacial Surgery, University Medical Centre Ljubljana, are more than a sequence of operations, new electrodes and speech processors. They are stories of children who heard their parents' voices for the first time, adults who returned to conversation and older people who once again became active members of their families and communities. They are also stories of professionals from different disciplines who learned from one another and alongside users.

We can be proud of the path travelled. We began cautiously, with many questions and more limited possibilities; today, we have a modern, safe and successful Programme capable of adapting to children, adults, older people and individuals with highly complex medical circumstances. The finest evidence of its value is not found in numbers, but in the moments when sound becomes a word, a word becomes a conversation and conversation restores a relationship. Also, the acknowledgment from international superb professionals in cochlear implant rehabilitation, as writing together the European consensus statements on pediatric cochlear implantation, Recommendations of a European Network for Genetic Hearing Impairment and Current status of pediatric auditory brainstem implantation in inner ear malformations is a great value and stimulation for our further development [23 - 25].

We therefore enter the future with the same commitment with which the Programme began: to follow the science, continually improve the care of people who are hard of hearing or deaf, listen to one another and, above all, listen to the user. A cochlear implant opens the door to sound; we pass through it into life together.

Ethics, Consent and Funding

Ethical Approval: Formal ethical approval was not required because this manuscript is a historical narrative review and descriptive Programme report based on aggregate, previously published information and contains no new analysis of identifiable individual-level data.

Informed Consent: Not applicable. No identifiable patient information or clinical photographs are included.

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We thank Nada Hernja, teacher of the deaf and initiator and long-standing organiser of the Maribor conferences on cochlear implant rehabilitation.

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Data Availability: The aggregate information supporting this review is available in the cited publications. Additional non-identifiable Programme information may be available from the corresponding author on reasonable request and subject to institutional requirements.

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Šest let endoskopske kirurgije ušesa na Oddelku za otorinolaringologijo Splošne bolnišnice Celje

Six years of endoscopic ear surgery at the Department of Otorhinolaryngology, General Hospital Celje

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STRUCTURED ABSTRACT

Izhodišča / Background: V zadnjih šestih letih se je na Oddelku za otorinolaringologijo Splošne bolnišnice Celje endoskopska kirurgija ušesa (EES) uveljavila kot pomembna dopolnitev tradicionalne mikroskopske tehnike pri zdravljenju bolezni srednjega ušesa. EES omogoča minimalno invaziven transkanalni dostop in boljšo vizualizacijo skritih anatomskega področij. Namen prispevka je predstaviti tehniko EES in njeno uvedbo v naši ustanovi, deliti ključna operativna opažanja ter podati oceno varnosti in učinkovitosti metode na osnovi lastnih izkušenj. Kljub številnim prednostim uvajanje te tehnike zahteva ustrezno usposabljanje, prilagoditev instrumentarija in spremembo operativne ergonomije.

Metode / Methods: Od uvedbe leta 2020 sta dva otokirurga izvedla več kot 330 posegov z uporabo pretežno ali izključno endoskopske metode. Uporabljene so bile različne indikacije, od timpanoplastik in rekonstrukcij slušne verige do operacij holesteatoma in stapedotomij. Sodobni specializirani instrumenti in ergonomične prilagoditve operacijskega okolja so ključni za uspešno izvedbo posegov. Spekter indikacij smo širili postopno in ob tem sproti prilagajali kirurški pristop.

Rezultati / Results: Analiza rezultatov je pokazala visoko uspešnost zapiranja perforacij in rekonstrukcij slušne verige, z nizko stopnjo zapletov. Številne operacije so bile izvedene brez dviga timpanomeatalnega režnja (flapless pristop), kar dodatno zmanjšuje invazivnost posega. Posebno dodano vrednost je tehnika pokazala pri revizijskih posegih in pri anatomskega omejitvah, kjer mikroskopski dostop ni optimalen. Metoda je omogočila krajše okrevanje ob hkratnem zmanjšanju pooperativne bolečine in potrebe po analgetikah; večina bolnikov je bolnišnico zapustila v manj kot 24 urah po posegu.

Zaključek / Conclusion: Naše izkušnje potrjujejo, da je EES varna, učinkovita in dolgoročno vzdržna metoda, ki bistveno zmanjšuje morbiditeto, zlasti pri ponavljajočih se patologijah, kot je holesteatom. Tehnika dopolnjuje in v nekaterih primerih presega rezultate klasične mikroskopske kirurgije. V prihodnje bo endoskopski pristop verjetno predstavljal standardno orodje v kirurškem repertoarju sodobnega otokirurga.

Ključne besede / Keywords: endoskopska kirurgija ušesa; timpanoplastika; holesteatom; otokirurški posegi; stapedotomija

STRUCTURED ABSTRACT (ENGLISH)

Background: Over the past six years, endoscopic ear surgery (EES) has become an important complement to traditional microscopic techniques at the Department of Otorhinolaryngology, Celje General Hospital. EES offers a minimally invasive transcanal approach and improved visualization of hidden anatomical areas. The aim of this paper is to present the technique and its introduction at our institution, to share key intraoperative observations, and to assess the safety and effectiveness of the method based on our own experience. Despite its advantages, adopting the technique requires appropriate training, adapted instrumentation and a change in operative ergonomics.

Methods: Since its introduction in 2020, two otologic surgeons have performed over 330 procedures using predominantly or exclusively endoscopic methods. Indications included tympanoplasties, ossicular chain reconstructions, cholesteatoma surgery, and stapedotomies. Modern specialized instruments and ergonomic adjustments to the operating environment are essential for successful implementation. The spectrum of indications was expanded gradually and the surgical approach adapted accordingly.

Results: Analysis of outcomes showed high graft take rates and successful ossicular reconstructions, with a low complication rate. Many procedures were performed without elevating the tympanomeatal flap (flapless technique), further minimizing surgical trauma. The technique proved particularly valuable in revision cases and in anatomically challenging situations where microscopic access is limited. It also allowed shorter recovery times while reducing postoperative pain and analgesic requirements.

Conclusion: Our experience confirms that EES is a safe, effective, and sustainable method that significantly reduces morbidity, particularly in recurrent pathologies such as cholesteatoma. The technique complements and, in some cases, surpasses the outcomes of conventional microscopic surgery. In the future, the endoscopic approach is likely to become a standard tool in the surgical repertoire of the modern otologic surgeon.

Keywords: endoscopic ear surgery; tympanoplasty; cholesteatoma, middle ear; otologic surgical procedures; stapes surgery

Introduction

Endoskopska kirurgija ušesa (endoscopic ear surgery – EES) se je v zadnjem desetletju uveljavila kot pomembna dopolnitev tradicionalne mikroskopske tehnike pri kirurškem zdravljenju bolezni srednjega ušesa. Glavna prednost EES je izboljšana vizualizacija anatomske zahtevnih struktur in minimalno invaziven pristop brez potrebe po retroaurikularnem rezu. Kljub številnim prednostim uvajanje te tehnike zahteva ustrezno usposabljanje, prilagoditev instrumentarija in spremembo operativne ergonomije.

Na Oddelku za otorinolaringologijo Splošne bolnišnice Celje smo s sistematičnim uva-
janjem endoskopske tehnike pričeli leta 2020. V šestih letih sva dva otokirurga izvedla
preko 330 posegov, pri čemer sva postopno razširjala spekter indikacij in prilagajala
kirurški pristop. Namen prispevka je predstaviti tehniko EES in njeno uvedbo v naši
ustanovi, deliti ključna operativna opažanja ter podati oceno varnosti in učinkovitosti
metode na osnovi lastnih izkušenj.

Zgodovina in razvoj EES

Endoskopska kirurgija ušesa ima svoje začetke v poznih 90. letih preteklega stoletja,
ko so nekateri pionirji pričeli uporabljati endoskope kot pomožno orodje pri tradicio-
nalni mikroskopski kirurgiji. V začetku so bili endoskopi uporabljeni predvsem za vizu-
alizacijo skritih anatomskih predelov, kot so sinus tympani, protympanum in recessus
epitympanicus [1,2]. Med prvimi je bil dr. Muaaz Tarabichi, ki ga pogosto imenujejo
»očeta endoskopske kirurgije ušesa«; že leta 1997 je opisal uporabo endoskopa kot iz-
ključnega optičnega sredstva pri ušesni kirurgiji [3]. Drugi pomembni pionirji so bili dr.
Livio Presutti, ki je razvil klinične protokole za endoskopsko kirurgijo holesteatoma [4],
ter dr. Daniele Marchioni, ki je prispeval k sistematični anatomski klasifikaciji dostop-
nih področij z endoskopom [5].

Med pomembnejšimi mejniki je bil leta 2011 objavljen pregledni članek Marchionija in
sodelavcev o kirurških pristopih pri endoskopski timpanoplastiki, kar je pripomoglo k
širši uveljavitvi metode [6]. Leta 2012 je bila ustanovljena Mednarodna delovna skupi-
na za endoskopsko kirurgijo ušesa (International Working Group on Endoscopic Ear
Surgery – IWGEES), ki odtlej redno organizira kongrese in izobraževanja ter oblikuje
smernice za prakso [7]. Skozi zadnje desetletje so številne primerjalne študije pokaza-
le primerljive ali celo boljše klinične izide EES v primerjavi s tradicionalnimi mikroskop-
skimi pristopi [8,9].

V zadnjem desetletju se je EES uveljavila kot resna alternativa mikroskopski kirurgiji pri
določenih indikacijah, predvsem zaradi svoje minimalno invazivne narave in boljše vi-
zualizacije. Številne študije in primerjalne analize so pokazale primerljivo ali boljše kli-
nične izide pri določenih posegih [8,9]. Posebej se je EES izkazala kot koristna pri pa-
cientih z ozkim sluhovodom [10], pri anteriornih perforacijah bobniča, kjer je dostop z
mikroskopom omejen [11], ter pri operacijah epitimpanona in sinus tympani, kjer endo-
skop omogoča neposreden pogled na sicer skrite anatomske predele [5,6]. Prav tako
so novejša študija pokazale, da endoskopski pristop pri revizijskih stapedektomijah
omogoča izboljšano vizualizacijo ovalnega okna in bolj natančno manipulacijo pro-
teze, kar lahko vodi v boljše slušne izide ter nižjo stopnjo zapletov [12]. Poleg revizij-
skih primerov se endoskopski pristop vse pogosteje uporablja tudi pri primarnih sta-
pedotomijah. Klinične študije poročajo o primerljivih ali boljših slušnih rezultatih v pri-
merjavi z mikroskopskimi metodami, ob hkratni zmanjšani stopnji traume na sluhovod
in bobnič ter boljši vizualizaciji posteriornih in anteriornih krakov stremenca [13]. Po-

sebej pri pacientih z anatomsko omejenim dostopom, kot so izbočena zadnja stena sluhovoda ali ozki sluhovodi, se je EES izkazala kot tehnično prednostna metoda. Poleg tega omogoča boljši nadzor nad krvavitvijo in manipulacijo proteze, kar pozitivno vpliva na stabilnost vsadka in dolgoročni izid [13].

Pri EES imajo pomembno vlogo tudi specializirani instrumenti za enoročno kirurgijo, kot so npr. mikroinstrumenti Panetti, ki omogočajo hkratno manipulacijo tkiv in nadzor aspiracije ter so posebej zasnovani za delo v ozkem operativnem polju z uporabo endoskopa.

Razvoj je omogočila tudi širša dostopnost endoskopskega instrumentarija, mednarodna izobraževanja ter publikacije, ki so podpirale varnost in učinkovitost te metode.

Methods

Zasnova prispevka

Prispevek je zasnovan kot retrospektiven pregled lastne kirurške prakse in opis kirurške tehnike, dopolnjen z narativnim pregledom literature. Podatki o posegih so bili zbrani iz operacijskega programa oddelka in so predstavljeni opisno. Vnaprej določenih izidnih mer, kontrolne skupine in formalne statistične analize prispevek ne vključuje, zato ne sledi metodologiji izvirne klinične raziskave in tudi ne poroča po smernicah, namenjenih temu tipu študij.

Uvedba EES v SB Celje

S prvimi endoskopskimi posegi sva (s kolegom Jernejem Novakom, dr. med.) pričela v letu 2020. Motivacija za pričetek je prišla iz KBC Rebro v Zagrebu, kjer je kolega dr. Mislav Malič pričel prve posege izvajati v letu 2018. V pričetku 2020 je dr. Malič organiziral 1. tečaj EES v Zagrebu pod vodstvom pionirja tehnike dr. Danieleja Marchionija, ki sva se ga z dr. Novakom udeležila. Že nekaj dni po tečaju se je pričela epidemija COVID-19 in operacije ušes so bile med redkimi ORL posegi, ki so imeli v tem obdobju zeleno luč, kar je omogočilo hitrejše pridobivanje izkušenj.

Indikacije in potek uvajanja

Prve operacije smo pričeli izvajati z uporabo 4 mm nosnega 0° endoskopa, SD kamere in standardnega otokirurškega instrumentarija. Sprva je uvedba pomenila daljši operativni čas in pogostejše konverzije v klasično mikroskopsko tehniko. Temu primerna je bila tudi izbira indikacij. Za prve posege smo izbirali paciente s centralnimi perforacijami zadnjih kvadrantov s širokim sluhovodom, nato pa smo širili indikacije na večje perforacije in pridružene defekte slušne verige. Ob pridobivanju izkušenj in vzpodbudnih rezultatih smo kmalu tudi dopolnili opremo po priporočilih stroke. Naslednji korak je bila uporaba EES pri operaciji holestatomov, kjer ima tehnika tudi največjo dodano vrednost. Ob dobri slikovni diagnostiki smo se naučili oceniti, kateri pacienti bodo potrebovali še dodatno mastoidektomijo. Številnim je bila prihranjena tudi CWD mastoi-

dektomija. Do konca 2022 je bil delež endoskopskih operacij večinski. Zaradi popolnoma osebne preference se sam (avtor) nisem poslužil EES za primarno stapedotomijo, ki jo izvajam transkanalno mikroskopsko.

Zaradi velike podobnosti s FESS in dolgoletne otokirurške tradicije na našem oddelku uvedba EES ni prinesla velikih sprememb v operacijski dvorani. Spremembe so bile zlasti pri pozicioniranju pacienta, monitorja in instrumentarke. Pomemben vidik je bilo tudi interaktivno usposabljanje medicinskih sester in anesteziološke ekipe. Postopoma smo dosegli, da je bila EES izvedljiva kot rutinska metoda pri večini elektivnih ušesnih operacij.

Kirurška tehnika in ergonomija

Najbolj pogosto uporabljamo 0° endoskop premera 3 mm, dolžine 13 cm proizvajalca Karl Storz, ki ima superiorno rigidnost, kvaliteto slike in ergonomijo. Pri disekciji holesteatoma iz epitimpanona, antruma, facialisovega recesa ter sinusa timpani je pogosto v pomoč 30° optika, ki omogoča boljšo vizualizacijo v navedenih zakotjih. Pri EES je dobra vizualizacija ključnega pomena, zato je poleg kvalitetne visokoločljivostne kamere (HD ali 4K) poudarek na zagotavljanju čim bolj brezkrvega in čistega operativnega polja. Krvavo polje močno zmanjša vizualizacijo in ob enoročni tehniki onemogoča delo. Pri EES je tako izjemnega pomena natančna infiltracija anestetika z vazokonstriktorjem ter delo s prilagojenimi ušesnimi instrumenti, ki imajo vgrajeno odsesavanje. Na našem oddelku uporabljamo komplet instrumentov dr. Panettija, ki omogočajo enoročno disekcijo srednjega ušesa. Kadar je potrebno odstraniti kost pri čiščenju holesteatoma, je v pomoč ušesni mikrobrusilnik z nižjimi obrati in ozkimi dolgimi kanali za sveder, kot je Skeeter. Ključnega pomena pri zagotavljanju dobre preglednosti je tudi pogosto izpiranje kirurškega polja.

Posebnosti so tudi v ergonomiji: prilagojena višina mize, pozicioniranje monitorja in osvetlitve. Zelo pomembna je stabilizacija endoskopa, ki mora biti v vsakem trenutku naslonjen na sluhovodno steno, medtem ko druga roka operira. Morebiten zdrs endoskopa v globino lahko povzroči hude poškodbe slušne verige (luksacija stapesa!). Na našem oddelku operaterja sediva in uporablja stol, ki ima naslon na roke. Številni operaterji EES pa preferirajo operacije v stoječem položaju.

Same operacije in njihovi cilji so pri EES popolnoma enaki kot pri klasični mikroskopski ušesni kirurgiji, vključno z materiali, ki jih uporabljamo za timpanoplastiko ali rekonstrukcijo slušne verige. Glavna razlika je v tem, da EES ne potrebuje incizije za pristop, zaradi česar najbolj pogosto posežemo po perihondriju ali hrustancu tragusa kot presadek izbire za timpanoplastiko.

V literaturi se vse bolj uveljavlja uporaba endoskopske timpanoplastike brez dviga timpanomeatalnega režnja (»flapless« pristop), kar dodatno zmanjšuje invazivnost posega. Raziskave so pokazale, da so uspehi pri zapiranju perforacij primerljivi z metoda-

mi, kjer je reženj eleviran, hkrati pa se skrajša čas operacije in zmanjša pooperativna morbiditeta. Chang in sod. so v sistematični meta-analizi ugotovili, da flapless pristop omogoča enako visoko uspešnost presadka in izboljšanje sluha kot tradicionalni postopki, ob znatno krajšem operativnem času [14]. Lou in sod. so poročali o višji uspešnosti presadkov in manjšem številu zapletov pri uporabi dvoplastnega hrustančno-perihondrijskega presadka brez dviga režnja [15]. Tehnike brez dviga režnja, kot so »butterfly inlay« in »fat plug«, so posebej primerne za manjše perforacije ter pediatrične bolnike, kjer se izogibamo nepotrebnim travmi [16,17]. Na našem oddelku t. i. flapless pristop uporabljamo za majhne in srednje velike centralne perforacije, kjer mala kostno-zračna vrzel izključuje poškodbe slušne verige.

Results

Od 2020 dalje sva dva kirurga izvedla preko 330 operacij z uporabo pretežno ali izključno endoskopske metode. 42 % posegov so predstavljale timpanoplastike I ali zgoraj omenjene »flapless« timpanoplastike. 27 % posegov so predstavljale različne timpanoplastike z rekonstrukcijo slušne verige. Za rekonstrukcijo na našem oddelku uporabljamo tako remodelirane avtologne koščice kot prilagodljive titanove PORP in TORP proteze. 8 % opravljenih endoskopskih posegov so predstavljale primarne stapedomije. Preostalih 23 % patologije, operirane s tehniko EES, pa je predstavljal holesteatom, kjer se je spekter operacij raztezal od preproste ekscizije nepreglednega retrakcijskega žepa atika, z ohranitvijo intaktne slušne verige, preko epitimpanektomije do kombinirane tehnike s pridružno klasično CWU mastoidektomijo pri napredovali patologiji. Še posebej dobro se je EES izkazala za revizijske operacije recidivov holesteatoma, kjer tehnika predstavlja bistveno zmanjšanje morbiditete v primerjavi s klasično obravnavo, ki je predvidevala radikalne operacije za recidivantni holesteatom.

Poleg dobrih slušnih in anatomsko-funkcionalnih rezultatov EES prinaša tudi bistvene prednosti v pooperativnem okrevanju. Več študij je pokazalo, da minimalno invazivna narava transkanalnega pristopa zmanjšuje pooperativno bolečino, potrebo po analgetikah in dolžino hospitalizacije [20,21]. V primerjavi s tradicionalnim retroaurikularnim pristopom so bolniki po EES redkeje potrebovali opioide ter hitreje dosegli funkcionalno okrevanje [22]. Naše lastne izkušnje potrjujejo to: na Oddelku za otorinolaringologijo SB Celje večina pacientov po EES zapusti bolnišnico že v manj kot 24 urah po posegu, v primeru pridružene mastoidektomije pa hospitalizacija traja največ 2 do 3 dni, predvsem zaradi potrebe po kvalitetni prvi prevezi. Za analgezijo večinoma zadostuje paracetamol, ki ga po potrebi dopolnimo z NSAR.

Discussion

Na prvem mestu je pomembno poudariti uporabnost endoskopske tehnike pri revizijskih operacijah holesteatoma. Več raziskav je pokazalo, da EES v primerjavi s klasično mikroskopsko tehniko vodi k bistveno nižji stopnji rezidualne in recidivantne bolezni.

Sistematični pregled Basonbul in sod. iz leta 2021 je pokazal, da uporaba EES zmanjša verjetnost rezidualnega holesteatoma za skoraj 50 % [18]. Podobno je randomizirana prospektivna študija Hamela in sod. iz leta 2023 ugotovila, da je bila stopnja rezidualne bolezni po EES 5 %, v primerjavi z 22,5 % pri mikroskopski skupini; recidiv pa je bil prisoten v 7,5 % proti 27,5 % primerov [19]. Izboljšana osvetlitev in vidno polje omogočata natančnejšo ekscizijo patoloških tkiv in s tem zmanjšujeta potrebo po radikalnejših pristopih pri ponavljajočem se holesteatomu.

EES omogoča boljšo vizualizacijo, saj nudi neposreden pogled v anatomske niše, ki so s klasičnim mikroskopom pogosto slabo vidne (facialisov reces, sinus timpani, epitimpanon). Zaradi minimalne invazivnosti in transkanalnega dostopa brez reza je kirurška travma manjša, bolečina po posegu blažja, okrevanje pa hitrejšo, z manjšo potrebo po analgetikih in krajšo hospitalizacijo. EES zmanjšuje tveganje za rezidualno bolezen in je superiorna pri revizijah holesteatoma. Široko vidno polje omogoča ohranitev kostnih struktur (zadnja sluhovodna stena) in tako posledično zmanjšuje potrebo po radikalnih posegih. Posebej se izkaže pri posebnih anatomskih pogojih, kot so ozki sluhovodi ali anteriorne perforacije.

Za načrtovanje EES pri holesteatomu je priporočljiva kombinacija visokoločljivostnega CT-slikanja (za oceno kostnih struktur, erozij in obsega bolezni) ter MR z difuzijsko sekvenco (za zanesljivo določanje globine razširitve v mastoid) [23]. Ključna kirurška omejitev za izvedbo totalnega endoskopskega pristopa je možnost stabilne rekonstrukcije defekta zadnje sluhovodne stene – če bi bil prevelik defekt ali kostna podpora nezadostna, je pogosto potrebna kombinacija endoskopskega in mikroskopskega pristopa. Kot praktičen in reproducibilen radiološki mejnik se pogosto uporablja polovična višina lateralnega semicirkularnega kanala na aksialnem CT-rezu; kadar lezija preseže to raven, se verjetnost potrebe po mikroskopski asistenci in širšem dostopu bistveno poveča. Takšna predoperativna ocena ne optimizira le kirurške strategije, temveč tudi izboljša komunikacijo znotraj operativnega tima ter omogoča natančnejše informiranje bolnika o možnih intraoperativnih prilagoditvah.

Med izzivi tehnike in slabostmi je na prvem mestu enoročno delo, ki je olajšano z uporabo posebnih instrumentov. Tehnika zahteva dodatno kirurško spretnost in ima daljšo krivuljo učenja z nujno prilagoditvijo ergonomije. Med slabostmi sta tudi veliko večja občutljivost na krvavitve, ki hitro zmanjša vidljivost, ter omejen dostop pri obsežnejših patologijah, kjer je pogosto potrebna kombinacija z mikroskopom.

Omejitve

Prispevek ima več omejitev, ki jih je treba upoštevati pri interpretaciji. Gre za retrospektiven pregled izkušenj enega oddelka in dveh operaterjev, brez kontrolne skupine in brez vnaprej določenih izidnih mer; uspešnost zapiranja perforacij, izboljšanje sluha ter stopnja rezidualne oziroma recidivantne bolezni niso bile sistematično merjene, zato so izidi predstavljeni opisno in brez statistične analize. Deleži posameznih pose-

gov so izračunani iz operacijskega programa in ne odražajo nujno zaporedne serije vseh obravnavanih bolnikov. Obdobje sledenja ni bilo enotno, kar je pomembno zlasti pri holesteatomu, kjer se recidivi lahko pokažejo šele po več letih. Pregled literature je narativen in ne sistematičen, zato pristranskosti pri izboru virov ni mogoče izključiti. Nenazadnje je del opisanih prednosti povezan tudi s krivuljo učenja in z izborom indikacij, ki se je skozi obravnavano obdobje spreminjal.

Conclusion

EES predstavlja naravno in neizogibno evolucijo sodobne otokirurgije. Mlajšim kolegom ponuja priložnost, da jo osvojijo kot svojo primarno tehniko, saj omogoča odličen prikaz anatomije, minimalno invazivnost in hitro okrevanje bolnikov. Za izkušene kirurge pa je vključitev EES v vsakodnevno prakso priložnost, da obogatijo svoj kirurški repertoar in izkoristijo prednosti, ki jih ponuja dopolnitev mikroskopske tehnike. Naša skupna prihodnost v otokirurgiji bo nedvomno vse bolj povezana z endoskopsko vizualizacijo.

Endoskopska kirurgija ušesa se je v šestih letih klinične uporabe na ORL oddelku v SB Celje izkazala kot varna, učinkovita in dolgoročno vzdržna metoda za zdravljenje bolezni srednjega ušesa.

Etika, soglasja in financiranje

Ethical Approval: Prispevek je retrospektiven pregled lastne kirurške prakse in ne vključuje posegov ali obravnav zunaj ustaljene klinične oskrbe, zato posebna odobritev etične komisije ni bila potrebna.

Informed Consent: Prispevek ne vsebuje osebnih podatkov ali slikovnega gradiva, na podlagi katerih bi bili posamezni bolniki prepoznavni, zato pridobitev pisnega soglasja ni bila potrebna.

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Conflict of Interest: Avtor izjavlja, da nima konflikta interesov.

Use of Artificial Intelligence (AI): Generativna orodja umetne inteligence so bila uporabljena izključno za jezikovno in oblikovno urejanje rokopisa. Avtor je celotno besedilo pregledal in v celoti odgovarja za njegovo vsebino.

Data Availability: Podatki, ki podpirajo ugotovitve tega prispevka, so na voljo pri korespondenčnem avtorju na razumno zahtevo.

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Vpliv vstavitve polževega vsadka na funkcijo notranjega ušesa

The impact of cochlear implantation on inner ear function

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STRUKTURIRANI IZVLEČEK

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Uvod: Indikacije za vstavev polževega vsadka vse pogostejše vključujejo bolnike z še uporabnim preostankom sluha, zato je njegova ohranitev postala pomemben cilj implantacije. Ob tem je treba upoštevati tudi delovanje ravnotežnega organa, ki je lahko okvarjeno že pred posegom ali se poslabša po njem. Namen raziskave je bil oceniti ohranitev preostalega sluha in z njo povezane dejavnike ter delež bolnikov s predoperativno okvaro ravnotežnega organa in pojav pooperativnih težav z ravnotežjem.

Metode: Retrospektivno smo analizirali podatke 231 bolnikov, ki so med letoma 2014 in 2026 prvič prejeli polžev vsadek. V analizo ohranitve sluha smo vključili bolnike, starejše od šest let, s slušnim pragom ≤ 85 dB HL na vsaj eni frekvenci med 125 in 1000 Hz. Ohranitev smo ovrednotili po merilih skupine HEARING. V analizo ravnotežja smo vključili bolnike z opravljeno predoperativno diagnostiko ravnotežnega organa ter spremljali pooperativno vrtočlavo in motnje ravnotežja. Vpliv starosti, kirurške tehnike, vrste elektrode in etiologije izgube sluha smo preverili z multiplo linearno oziroma multinomsko logistično regresijo.

Rezultati: V analizo ohranitve sluha so bili vključeni 103 bolniki. Preostali sluh smo ohranili pri 68 % bolnikov: popolnoma pri 10,7 %, delno pri 42,7 % in minimalno pri 14,6 %. Višja starost je bila povezana s slabšo ohranitvijo sluha ($p < 0,05$). Analiza ravnotežja je zajela 127 bolnikov. Predoperativno okvaro ravnotežnega organa smo ugotovili pri 34 % bolnikov: na predvideni strani operacije pri 19 %, na nasprotni strani pri 3 % in obojestransko pri 12 %. Pooperativno je 7 % bolnikov navajalo vrtočlavo, 3 % pa nespecifične motnje ravnotežja. Višja starost je bila povezana z večjo verjetnostjo pooperativnih težav ($p < 0,05$).

Zaključek: Pri večini bolnikov je mogoče ohraniti vsaj del preostalega sluha, okvara ravnotežnega organa pa je pri pomembnem deležu prisotna že pred implantacijo. Starost je pomemben dejavnik pri oceni pričakovanega izida na področju sluha in ravnotežja ter jo je smiselno upoštevati pri predoperativnem svetovanju in načrtovanju zdravljenja.

Ključne besede: polžev vsadek; ohranitev sluha; ravnotežje; vrtoglavica; starost

ABSTRACT (ENGLISH SUMMARY)

As indications for cochlear implantation have expanded to include patients with functional residual hearing, hearing preservation has become increasingly important. Cochlear implantation may also affect balance function, which can already be impaired before surgery. We retrospectively analysed 231 patients who underwent primary cochlear implantation between 2014 and 2026. Hearing preservation was evaluated according to the HEARRING criteria in 103 patients with measurable preoperative residual hearing, while preoperative vestibular function was assessed in 127 patients. Some degree of hearing preservation was achieved in 68% of patients: complete in 10.7%, partial in 42.7%, and minimal in 14.6%. Preoperative vestibular function was abnormal in 34% (ipsilateral in 19%, contralateral in 3%, and bilateral in 12%). Postoperative vertigo was reported by 7% and nonspecific balance problems by 3%. Older age was associated with poorer hearing preservation and a higher likelihood of postoperative vestibular symptoms ($p < 0.05$). Age should therefore be considered when counselling patients and estimating auditory and vestibular outcomes after cochlear implantation.

Keywords: Cochlear Implantation; Hearing preservation; Vestibular Function Tests; Dizziness; Age Factors

Uvod

Indikacije za vstavev polževega vsadka (PV) so se v zadnjih desetletjih pomembno razširile in danes vključujejo tudi bolnike z uporabnim preostankom sluha, zlasti v nizkofrekvenčnem območju. Pri tej skupini bolnikov je poleg izboljšanja slušnega razumevanja z električno stimulacijo preko PV pomembna tudi možnost ohranitve ostankov sluha in njihova uporaba v okviru električno-akustične stimulacije [1]. Možnost ohranitve sluha je zato pomembno vplivala na razvoj sodobnih atravmatskih kirurških pristopov in na razvoj novih elektrod, katerih cilj je čim manjša poškodba občutljivih struktur notranjega ušesa.

Na ohranitev preostalega sluha po vstavitvi PV lahko vplivajo številni dejavniki, vključno s predoperativnim stanjem notranjega ušesa, starostjo, etiologijo izgube sluha, lastnostmi elektrode in kirurško tehniko. Rezultati posameznih raziskav so zaradi razlik v preiskovanih populacijah, opredelitvi ohranitve sluha in času spremljanja težko neposredno primerljivi. Zato je skupina HEARRING predlagala standardiziran sistem razvrščanja ohranitve sluha, ki omogoča primerljivejše vrednotenje rezultatov med posameznimi raziskavami in ustanovami [2].

Poleg možnosti ohranitve ostankov sluha je pri kandidatih za vstavev PV pomembna tudi ravnotežnostna funkcija. Čutni organi za sluh in ravnotežje si delijo anatomsko omejen prostor notranjega ušesa, zato lahko vstavev PV vpliva tudi na delovanje ravnotežnega aparata [3]. Okvara ravnotežnega aparata je pri kandidatih za PV pogosto prisotna že pred operacijo, pri čemer je njena pogostnost višja kot v splošni populaciji. Sistematični pregledi kažejo, da lahko po vstavitvi PV pride do dodatnih sprememb vestibularne funkcije, predvsem pri merjenju cervikalnih evociranih vestibularnih potencialov (cVEMP) in pri bitermalnem kaloričnem testu (VTG), medtem ko so spremembe pri video testu hitrih zasukov glave (vHIT) praviloma manj izrazite [3,4].

Namen naše raziskave je bil oceniti možnost ohranitve preostalega sluha po vstavitvi PV pri bolnikih z merljivim predoperativnim sluhom ter opredeliti dejavnike, povezane z uspešnostjo njegove ohranitve. V vestibularnem delu raziskave smo želeli ugotoviti pogostnost predoperativne okvare vestibularnega aparata pri kandidatih za PV ter oceniti delež pooperativno izraženih simptomov vrtoglavice in motenj ravnotežja.

Metode

Retrospektivno smo analizirali bolnike, ki so med letoma 2014 in 2026 prvič prejeli PV na Kliniki za otorinolaringologijo in cervikofacialno kirurgijo v Ljubljani.

Analiza ohranitve sluha

Od skupno 231 bolnikov, ki so v opazovanem obdobju prejeli PV, smo v analizo vključili bolnike, starejše od 6 let, z merljivim predoperativnim preostankom sluha, opredeljenim kot prag ≤ 85 dB HL na vsaj eni frekvenci med 125 in 1000 Hz. Za oceno pooperativne ohranitve sluha smo izračunali razliko med predoperativnim in pooperativnim povprečjem slušnih pragov (PTA) pri frekvencah 125, 250, 500 in 1000 Hz. Stopnjo ohranitve sluha smo izračunali po priporočilih skupine HEARING (Slika 1) in bolnike razvrstili v kategorije popolne (>75 %), delne (25–75 %) in minimalne (0–25 %) ohranitve sluha [2]. Analizirali smo vpliv starosti, kirurške tehnike (vstavev preko okroglega okenca ali kohleostome), vrste uporabljene elektrode in etiologije izgube sluha na stopnjo ohranitve preostalega sluha.

$$S = \left[1 - \left(\frac{(PTA_{\text{post}} - PTA_{\text{pre}})}{(PTA_{\text{max}} - PTA_{\text{pre}})} \right) * 100 \right] [\%]$$

Slika 1. Enačba za izračun stopnje ohranitve preostalega sluha po priporočilih skupine HEARING. (S – stopnja ohranitve preostalega sluha (%); PTA_{post} – povprečje pooperativnih slušnih pragov;

PTApre – povprečje predoperativnih slušnih pragov; PTAmox – povprečje največjih izhodnih ravni avdiometra pri izbranih frekvencah.)

Analiza vestibularne funkcije

Vestibularno funkcijo smo analizirali pri 127 bolnikih, starejših od 6 let, pri katerih je bila predoperativno izvedena vestibularna diagnostika (vsaj en od testov: VTG, VHIT, cVEMP). Glede na rezultate razpoložljivih vestibularnih testov smo bolnike razvrstili v skupine z normalno vestibularno funkcijo, ipsilateralno, kontralateralno ali bilateralno vestibularno parezo. Analizirali smo tudi pojav pooperativne vrtoglavice in nespecifičnih motenj ravnotežja ter njuno povezanost s starostjo, kirurško tehniko, vrsto uporabljenih elektrode in etiologijo izgube sluha.

Statistična analiza

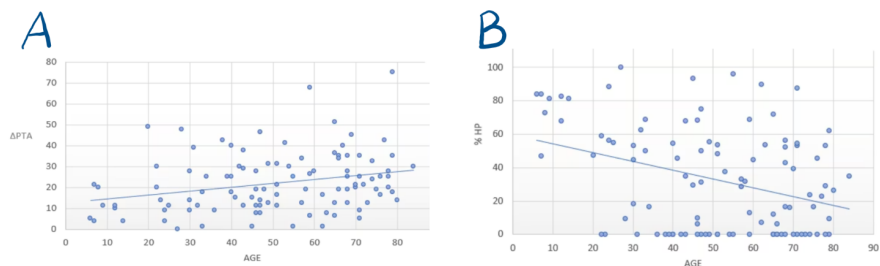
Statistične analize smo izvedli v programskem okolju R (R Core Team, 2023). Za obdelavo podatkov, opisno statistiko in grafični prikaz rezultatov smo uporabili ustrezne pakete programskega okolja R, vključno s paketi ggplot2, emmeans in dplyr. Za analizo dejavnikov, povezanih z ohranitvijo preostalega sluha, smo uporabili multiplo linearno regresijo. V modele smo vključili starost kot kovariato ter ocenili vpliv kirurške tehnike, vrste vsadka in etiologije izgube sluha. Analizirali smo tudi interakcijo med kirurško tehniko in vrsto vsadka ter med vrsto vsadka in etiologijo izgube sluha. Za oceno deleža pojasnjene variance smo uporabili prilagojeni koeficient determinacije (prilagojeni R^2). Rezultate smo prikazali kot z modelom prilagojene marginalne srednje vrednosti (estimated marginal means).

Za analizo povezanosti starosti, kirurške tehnike in etiološke skupine z vestibularnimi izidi smo uporabili multinomsko logistično regresijo. Odvisni spremenljivki, stopnja oziroma vrsta vrtoglavice ter predoperativni vestibularni status, sta bili obravnavani kot nominalni kategorični spremenljivki brez naravnega vrstnega reda. S tem pristopom smo ocenili neodvisen vpliv posameznih napovednih spremenljivk ob hkratnem upoštevanju drugih spremenljivk v modelu. Statistično značilnost posameznih dejavnikov smo ocenili s testom verjetnostnega razmerja oziroma analizo variance tipa II.

Mejo statistične značilnosti smo določili pri $\alpha = 0,05$ oziroma $p < 0,05$.

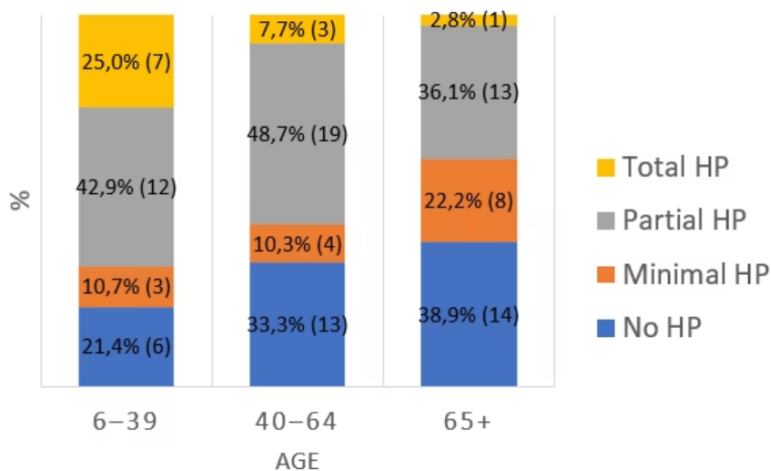
Rezultati

V obdobju med letoma 2014 in 2026 je bilo na naši kliniki prvič implantiranih 231 bolnikov. V analizo ohranitve sluha so bili glede na vključitvena merila vključeni 103 bolniki z merljivim predoperativnim preostankom sluha. Določeno stopnjo ohranitve preostalega sluha smo dosegli pri 68 % bolnikov. Popolna ohranitev sluha je bila prisotna pri 10,7 %, delna pri 42,7 %, minimalna pa pri 14,6 % bolnikov.

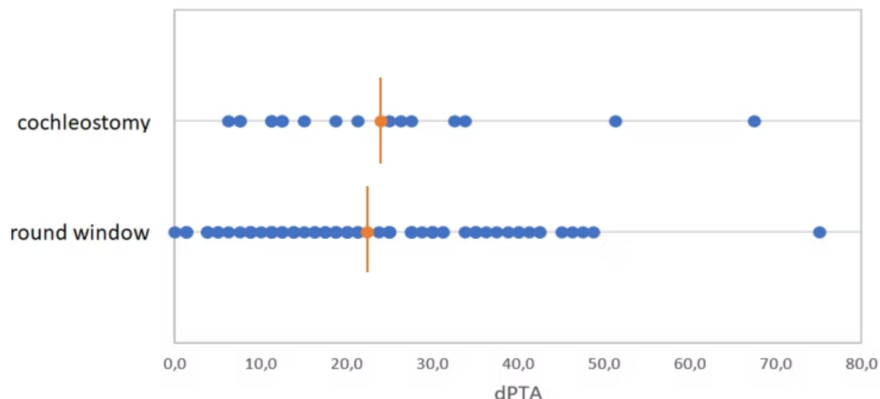


Pri analizi napovednih dejavnikov je bila statistično značilna povezava ugotovljena s starostjo ($p < 0,001$). Mlajši bolniki so imeli večjo verjetnost ohranitve preostalega sluha, medtem ko je bila višja starost povezana s slabšim izidom (Slika 2 in Slika 3).

Slika 2. Povezanost starosti z ohranitvijo sluha po vstavitvi PV. A: sprememba povprečja slušnih pragov (Δ PTA, v dB) po operaciji glede na starost bolnika; B: odstotek ohranitve sluha (HP) glede na starost bolnika. Točke prikazujejo posamezne bolnike, črta pa linearni trend.

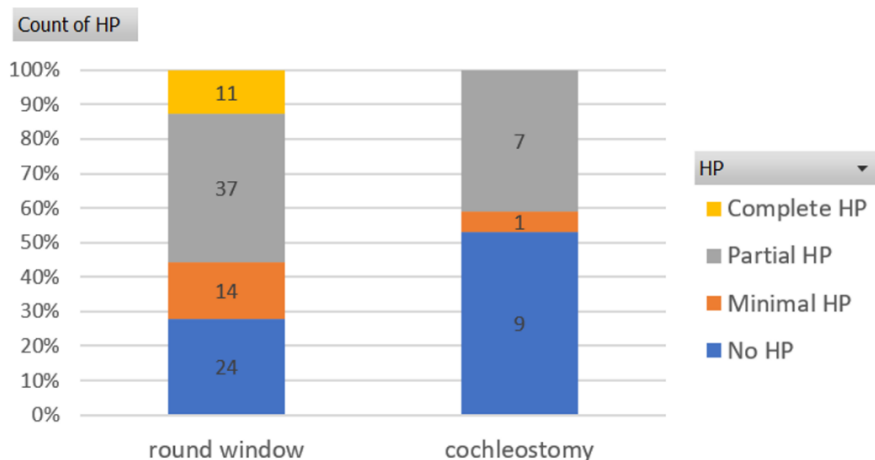


Slika 3. Porazdelitev bolnikov glede na stopnjo ohranitve sluha (HP) v posameznih starostnih skupinah. V stolpcih sta navedena delež in število bolnikov v posamezni kategoriji ohranitve sluha.



Pri analizi vpliva kirurškega pristopa na ohranitev sluha med vstavitvijo elektrode skozi kohleostomo in skozi okroglo okence ni bilo statistično značilne razlike. Povprečno poslabšanje PTA je znašalo 23,94 dB pri kohleostomi in 22,36 dB pri pristopu skozi okroglo okence (slika 4). Pri razvrstitvi bolnikov glede na stopnjo ohranitve sluha pa se je nakazoval trend ugodnejših izidov pri vstavitvi elektrode skozi okroglo okence (Slika 5). Statistično značilne povezave med ohranitvijo sluha in vrsto elektrode ali etiologijo izgube sluha nismo ugotovili.

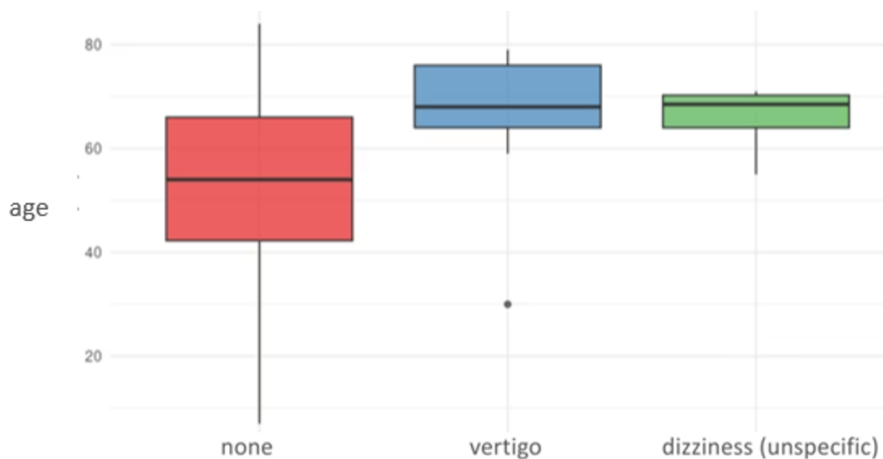
Slika 4. Sprememba povprečnega slušnega praga (dPTA) glede na pristop vstavitve elektrode skozi okroglo okence (round window) ali kohleostomo (cochleostomy). Modre točke prikazujejo vrednosti posameznih bolnikov, oranžne točke pa povprečne vrednosti.



Slika 5. Porazdelitev bolnikov glede na stopnjo ohranitve sluha (HP) in kirurški pristop – skozi okroglo okence (round window) ali kohleostomo (cochleostomy). Številke v stolpcih prikazujejo število bolnikov.

V skupino z opravljeno predoperativno vestibularno diagnostiko je bilo vključenih 127 bolnikov. Normalno vestibularno funkcijo smo ugotovili pri 66 % bolnikov. Pri 19 % je bila prisotna pareza na predvideni strani vstavitve PV, pri 3 % kontralateralna pareza, pri 12 % pa bilateralna pareza ravnotežnega aparata.

Po vstavitvi PV je 7 % bolnikov navajalo vrtoglavico, medtem ko so bile nespecifične motnje ravnotežja prisotne pri 3 % bolnikov. Višja starost je bila statistično značilno povezana z večjo verjetnostjo pooperativne vrtoglavice oziroma motenj ravnotežja (Slika 6). Statistično značilne povezave med pojavom vrtoglavice po vstavitvi PV ter kirurško tehniko, vrsto elektrode ali etiologijo izgube sluha nismo ugotovili. Bolniki z pooperativnimi motnjami ravnotežja so opravili dodatno vestibularno diagnostiko z vHIT in/ali kaloričnim preizkusom; pri dveh bolnikih (1,5 %) je bila ugotovljena novonastala vestibularna pareza na operirani strani.



Slika 6. Povprečna starost v treh različnih skupinah po vstavitvi PV: brez težav (none); vrtoglavica (vertigo); nespecifične motnje ravnotežja (dizziness (unspecific)).

Razprava

V naši raziskavi smo določeno stopnjo ohranitve preostalega sluha po vstavitvi PV dosegli pri 68 % bolnikov, kar je primerljivo z objavljenimi rezultati. V raziskavah pri bolnikih z merljivim preostankom sluha se delež bolnikov z vsaj določeno stopnjo ohranjenega sluha pogosto giblje približno med 40 in 70 % [5–7], medtem ko so bile pri pediatričnih bolnikih v posameznih raziskavah opisane še višje stopnje ohranitve sluha, približno 60–90 % [8,9]. Rezultati potrjujejo, da je ohranitev preostalega sluha pri

pomembnem deležu bolnikov dosegljiva, vendar nanjo vpliva več medsebojno povezanih dejavnikov, vključno s predoperativnim slušnim stanjem, starostjo, etiologijo izgube sluha, kirurškim pristopom, lastnostmi in položajem elektrode, globino vstavitve ter pooperativnim vnetnim in brazgotinskim odzivom [6,10].

Starost

V naši skupini je bila višja starost povezana s slabšo ohranitvijo preostalega sluha. Podobne ugotovitve so opisane tudi v drugih raziskavah [11]. Možni dejavniki vključujejo zmanjšano regenerativno sposobnost struktur notranjega ušesa, starostno pogojene spremembe mikrocirkulacije ter manjšo odpornost že prizadetega kohlearnega sistema na dodatno kirurško in vnetno poškodbo [12,13]. Tudi ugodni rezultati pri pediatričnih bolnikih podpirajo domnevo, da ima starost pomembno vlogo pri sposobnosti ohranitve kohlearne funkcije [8,9].

Kirurška tehnika

Kirurška tehnika je eden najpomembnejših potencialno spremenljivih dejavnikov pri ohranitvi sluha. Sodobni koncept čim manj travmatske kirurgije temelji na zmanjševanju mehanske poškodbe notranjega ušesa med pripravo dostopa in vstavitvijo elektrode. Možni mehanizmi poškodbe vključujejo neposredno poškodbo struktur polža, bazilarne membrane ali kostne spiralne lamine, krvavitev, izgubo perilimfe, akustično poškodbo zaradi vrtnja ter poznejši vnetni in brazgotinski odziv [1,10]. Pri zgodnjih postopkih ohranjanja sluha je bila elektroda pogosto vstavljena skozi kohleostomo. Anatomske raziskave so pokazale, da je kohleostoma, izvedena na konveksnem delu promotorija, povezana z večjim tveganjem za poškodbo bazalnih struktur, medtem ko se kot manj travmatska pristopa navajata neposreden pristop skozi membrano okroglega okenca oziroma kohleostoma v neposredni bližini okroglega okenca, nekoliko spodaj in spredaj od njega [1]. Pristop skozi okroglo okence ima več teoretičnih prednosti, saj omogoča neposreden vstop v skalo timpani (lat. scala tympani) in zahteva manj vrtnja, s čimer se lahko zmanjša vnos kostnega prahu, poškodba spiralne lamine in krvavitev v notranjost polža. Kljub temu rezultati raziskav niso enotni, saj so nekatere metaanalize pokazale boljšo ohranitev sluha pri vstavitvi PV skozi okroglo okence [15], druge pa pri vstavitvi preko kohleostome [14]. Tudi v naši raziskavi med pristopoma nismo dokazali statistično značilne razlike v ohranitvi sluha, vendar se je nakazoval trend ugodnejšega izida pri pristopu skozi okroglo okence. Pomemben element travmatske kirurške tehnike je tudi počasna in nadzorovana vstavitve elektrode, ki zmanjšuje sile v polžu in tveganje poškodbe njegovih občutljivih struktur ter lahko prispeva k boljši ohranitvi sluha [10,14]. K ohranitvi preostalega sluha lahko prispeva tudi periooperativna uporaba kortikosteroidov, ki zmanjšujejo vnetni odziv v polžu, čeprav rezultati kliničnih raziskav niso povsem enotni [10].

Elektroda

Pomemben dejavnik je tudi zasnova elektrode. Tanke in prožne elektrode, zlasti elektrode, ki potujejo ob lateralni steni polža, so bile v nekaterih raziskavah povezane z ugodnejšim ohranjanjem sluha, verjetno zaradi manjše nevarnosti poškodbe občutljivih struktur med vstavitvijo [10]. V naši raziskavi statistično značilnega vpliva vrste uporabljene elektrode na ohranitev sluha nismo dokazali.

Klinični pomen ohranitve sluha

Ohranitev preostalega sluha je pomembna predvsem zaradi možnosti kombinirane električno-akustične stimulacije, ki lahko izboljša razumevanje govora. Vendar povezava med ohranjenim sluhom in pooperativnim razumevanjem govora ni povsem enoznačna. Ohranitev preostalega sluha praviloma ne izboljša razumevanja govora v tišini, lahko pa prispeva k boljšemu razumevanju govora v hrupu in zaznavanju glasbe [5,16].

Prihodnji razvoj

Ohranjanje sluha je pomembno ne le zaradi neposredne funkcionalne koristi, temveč tudi zaradi ohranjanja funkcionalnih struktur notranjega ušesa za morebitne prihodnje načine zdravljenja. Med obetavnimi pristopi so lokalno dovajanje zdravil, elektrode s postopnim sproščanjem protivnetnih učinkovin, spremljanje kohlearne funkcije med operacijo, regenerativni in genski pristopi ter robotsko podprta kirurgija, ki bi lahko omogočila natančnejše in bolj nadzorovano vstavljanje elektrode [10].

Ravnotežje

V naši raziskavi je imelo predoperativno okvaro ravnotežnega aparata 34 % bolnikov. Najpogostejše je šlo za parezo na predvideni strani operativnega posega (19 %), redkeje kontralateralno (3 %) ali bilateralno (12 %). Ti rezultati potrjujejo, da je zmanjšana vestibularna funkcija pri kandidatih za PV pogosta že pred operacijo, kar je verjetno povezano s samo etiologijo izgube sluha. Predoperativno zmanjšana vestibularna funkcija je klinično pomembna predvsem zaradi omejene vestibularne rezerve in možnosti dodatne okvare po vstavitvi PV, zlasti ob vedno pogostejši obojestranski vstavitvi PV.

Pooperativno je 7 % naših bolnikov navajalo vrtoglavico, 3 % pa nespecifične motnje ravnotežja. Ta delež je primerljiv z ugotovitvami metaanalize 95 raziskav, v kateri je bila pojavnost subjektivne pooperativne vrtoglavice ocenjena na 9,3 % [17]. Subjektivne težave pa ne odražajo nujno vseh sprememb vestibularne funkcije po vstavitvi PV. Metaanalize so namreč pokazale pogostejše spremembe pri objektivnih vestibularnih preiskavah, predvsem pri cVEMP in VTG, medtem ko so bile spremembe pri vHIT redkejšje [3,4]. V eni od metaanaliz so bile spremembe cVEMP ugotovljene pri 37 % bolnikov, novonastala asimetrija pri VTG pa pri 34 % bolnikov po vstavitvi PV [18]. Kljub objektivno merljivim spremembam vestibularne funkcije pri subjektivnih težavah, oce-

njenih z vprašalnikom Dizziness Handicap Inventory (DHI), ni bilo ugotovljeno statistično značilno poslabšanje [4].

Ker pooperativna vestibularna diagnostika v naši raziskavi ni bila sistematično izvedena pri vseh bolnikih, ne moremo oceniti dejanske pogostnosti merljivih oziroma subkliničnih sprememb vestibularne funkcije po implantaciji.

V naši raziskavi je bila višja starost povezana tako s slabšo ohranitvijo preostalega sluha kot z večjo verjetnostjo pooperativnih vestibularnih simptomov. Rezultati tako poudarjajo pomen starosti kot pomembnega dejavnika pri napovedovanju izida po vstavitvi PV.

Zaključek

Pri večini bolnikov z merljivim predoperativnim ostankom sluha je po vstavitvi PV mogoče ohraniti vsaj del preostalega sluha, pri čemer so izidi ugodnejši pri mlajših bolnikih. Okvara ravnotežnega aparata je pri kandidatih za vstavev PV pogosto prisotna že pred operacijo, pooperativna vrtoglavica pa se pojavi le pri manjšem deležu bolnikov in je pogostejša v višji starosti. Starost je zato pomemben dejavnik pri oceni pričakovane slušne in vestibularne izida po vstavitvi PV.

Etika, soglasja in financiranje

Etična odobritev: Raziskavo je odobrila Komisija Republike Slovenije za medicinsko etiko (št. 21/06/15).

Financiranje: Raziskava ni prejela zunanjega financiranja.

Navzkrižje interesov: Avtorji izjavljamo, da ni navzkrižja interesov.

Uporaba orodij umetne inteligence: Pri pripravi prispevka niso bila uporabljena orodja generativne UI.

Razpoložljivost podatkov: So anonimizirani pri kontaktnem avtorju.

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Terapija s hiperbaričnim kisikom kot možnost dodatnega zdravljenja pri nenadni izgubi sluha – naše izkušnje

Hyperbaric oxygen therapy as an adjunctive treatment option for sudden hearing loss – our experience

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STRUKTURIRANI IZVLEČEK

Ozadje/Cilji: Za zdravljenje nenadne zaznavne izgube sluha je kot možnost dodatnega zdravljenja poleg kortikosteroidov že več desetletij znana tudi terapija s hiperbaričnim kisikom, vendar do danes ne obstajajo jasni mednarodni protokoli zdravljenja. Z raziskavo smo želeli prikazati, kateri bolniki so primernejši kandidati za reševalno zdravljenje s hiperbaričnim kisikom. **Metode:** Retrospektiven pregled dokumentacije in izračun spremembe povprečnega praga sluha (PTA) bolnikov z nenadno zaznavno izgubo sluha, ki so kot reševalno zdravljenje prejeli hiperbarično terapijo s kisikom med letoma 2017 in 2024. **Rezultati:** Bolniki z večjo začetno izgubo sluha (PTA > 60 dB) so imeli po zdravljenju s hiperbaričnim kisikom povprečno izboljšanje PTA za 31,92 dB. Pri bolnikih z blažjo izgubo sluha (PTA < 60 dB) ni bilo opaženega izboljšanja PTA po terapiji s hiperbaričnim kisikom. **Zaključek:** Hiperbarična terapija s kisikom (2,4 ATA) kot reševalna terapija nenadne zaznavne izgube sluha po terapiji s kortikosteroidi je bolj koristna pri bolnikih z večjo izraženo izgubo sluha, medtem ko pri bolnikih z blagimi oblikami bolezni ni opaziti pomembnega izboljšanja. **Ključne besede:** nenadna zaznavna izguba sluha; hiperbarična terapija s kisikom; kortikosteroid; povprečen prag sluha.

ABSTRACT

Hyperbaric oxygen therapy (HBOT) has been used for decades as an adjunctive treatment for sudden sensorineural hearing loss (SSNHL), particularly in patients who do not respond adequately to corticosteroid therapy. However, clear international treatment protocols and criteria for selecting patients who may benefit from salvage HBOT remain lacking. We retrospectively reviewed the medical records of patients with SSNHL who received HBOT as salvage treatment between 2017 and 2024. Changes in pure-tone average (PTA) before and after HBOT were assessed according to the severity of initial hearing loss. Patients with more severe initial hearing loss (PTA >60 dB) demonstrated a

mean improvement in PTA of 31.92 dB following HBOT, whereas no improvement was observed in patients with milder hearing loss (PTA <60 dB). HBOT at 2.4 ATA may therefore be more beneficial as salvage therapy following corticosteroid treatment in patients with severe SSNHL, while patients with milder hearing loss appear to derive limited benefit. **Keywords:** sudden sensorineural hearing loss; hyperbaric oxygen therapy; corticosteroid; pure-tone average.

Uvod

Nenadna zaznavna izguba sluha (angl. sudden sensorineural hearing loss - SSNHL) je opredeljena kot poslabšanje sluha za najmanj 30 dB na treh zaporednih frekvencah, ki nastopi v treh dneh [1, 2, 3, 4]. Patogeneza SSNHL ni dobro razumljena, vendar najverjetnejše teorije o njenem nastanku vključujejo virusne okužbe, motnje krvnega obtoka in avtoimunske bolezni. V večini primerov pravi vzrok SSNHL ostane neznan. Lahko je povezana tudi z vrtoglavico in šumenjem oz. piskanjem v ušesih [3, 4]. V Združenih državah Amerike prizadene približno 5 do 27 oseb na 100.000 prebivalcev na leto, nekatere ocene za Nemčijo segajo celo do 160 na 100.000 prebivalcev [1].

Zdravljenje

Glede na nepojasnjeno etiologijo možnosti zdravljenja SSNHL vključujejo sistemske in lokalne kortikosteroide (KS), protivirusna zdravila, hiperbarično terapijo s kisikom (angl. hyperbaric oxygen therapy - HBOT), reološka sredstva, diuretike in druga zdravila [1].

KS so najpogostejša terapija izbora za zdravljenje SSNHL. Apliciramo jih lahko sistemsko (per os ali intravenozno) ali lokalno intratimpanalno (IT). IT aplikacija KS je postala pogost način zdravljenja, saj ne povzroča sistemskih neželenih učinkov in objavljenih je mnogo raziskav z dobrim učinkom zdravljenja. Lahko je uporabljena kot primarno in edino zdravljenje, kot dodatno zdravljenje s sistemskim KS ali pa kot reševalna terapija [1, 5, 6, 7]. Visok enkratni odmerek IT deksametazona se je izkazal kot učinkovita reševalna terapija pri bolnikih, pri katerih sistemski KS ni pokazal izboljšanja sluha. Zgodnji pričetek zdravljenja vpliva na izid zdravljenja [8]. Še večje izboljšanje sluha je bilo doseženo ob takojšnjem sočasnem zdravljenju z nizkim odmerkom sistemskega metilprednizolona (48 mg sedem dni in nato zmanjševanje naslednjih sedem dni) in visokim enkratnim odmerkom intratimpanalnega deksametazona (0,5-1 ml, 24 mg/ml). Slednje se je izkazalo za varno in učinkovito zdravljenje SSNHL, saj se je sluh 77% bolnikov povrnil na uporabno raven. Povprečen PTA se je v šestih mesecih iz 60 dB izboljšal na 43 dB, 37% bolnikom pa se je sluh povrnil na normalno raven [9].

Smernice Ameriške akademije za otorinolaringologijo - kirurgijo glave in vratu priporočajo uporabo kortikosteroidov kot začetno terapijo pri bolnikih s SSNHL v dveh tednih po začetku simptomov. Kot možnost predlagajo HBOT v kombinaciji s kortikosteroidi v

dveh tednih po začetku SSNHL. Ena od možnosti je tudi HBOT v kombinaciji s kortikosteroidi kot reševalna terapija v enem mesecu po začetku SSNHL ali intratimpanalna uporaba steroidov pri bolnikih, ki imajo nepopolno okrevanje od SSNHL v obdobju od 2 do 6 tednov po začetku simptomov [1, 2].

Leta 2016 so na deseti evropski konferenci o hiperbarični medicini podali tudi mnenje o HBOT pri SSNHL, kjer predlagajo HBOT v kombinaciji z medikamentozno terapijo v roku dveh tednov od nastanka SSNHL. Svetujejo uporabo HBOT pri bolnikih, ki prezentirajo med dvema tednoma in enim mesecem od nastanka SSNHL, kot dopolnilno zdravljenje k medikamentozni terapiji. Odsvetujejo HBOT kot samostojno ali v kombinaciji z zdravili, če je od nastanka SSNHL preteklo več kot šest mesecev [10].

Hiperbarična terapija s kisikom

HBOT je način zdravljenja, pri katerem oseba diha 100 % kisik, medtem ko je izpostavljena povečanemu atmosferskemu tlaku. Zdravljenje poteka v enoprostorskih ali večprostorskih komorah. Tlak v komorah običajno znaša od 2 do 3 absolutne atmosfere (ATA), kar predstavlja vsoto atmosferskega tlaka (1 ATA) in dodatnega hidrostatskega tlaka, ki ustreza eni ali dvema atmosferama (1 atmosfera = 101 kPa). Terapije trajajo običajno od 1,5 do 2 uri, odvisno od indikacije, in se lahko izvajajo enkrat do trikrat dnevno. Enoprostorske komore se običajno polnijo s čistim kisikom. Večprostorske komore pa se polnijo z zrakom, bolniki pa dihamo čisti kisik preko tesno prilagajoče se obrazne maske, kapuce ali endotrahealne cevke. Med zdravljenjem napetost kisika v arterijski krvi pogosto preseže 2000 mmHg, koncentracije v tkivih pa dosežejo vrednosti med 200 in 400 mmHg [11, 12].

Sprva se je HBOT uporabljala predvsem za zdravljenje zastrupitve z ogljikovim monoksidom in dekompresijske bolezni, vendar se je v zadnjih letih začela široko uporabljati tudi pri zdravljenju ishemične možganske kapi, travmatske poškodbe možganov in osteomielitisa lobanjske baze [13, 14]. Kot možnost zdravljenja SSNHL je bila HBOT opisovana že konec 70. let prejšnjega stoletja [15].

HBOT zmanjša ishemijo in hipoksijo v notranjem ušesu z zvišanjem oksigenacije notranjega ušesa in povečanjem parcialnega tlaka kisika v perilimfi, zmanjša agregacijo trombocitov in viskoznost plazme. Pripomore k vzdrževanju normalne fosforilacije v mitohondrijih, ki je pri SSNHL neučinkovita, kar vodi v povečano nastajanje reaktivnih kisikovih spojin, ti pa v polžku sprožijo nastajanje interleukina (IL)-6 ter faktorja tumorske nekroze alfa, ki lahko poškodujejo dlačnice. Reaktivne kisikove spojine lahko aktivirajo signalno pot, ki sproži programirano celično smrt dlačnic v polžku [13]. HBOT zavira vnetje tako, da zmanjša produkcijo IL-1, IL-1B, IL-6, ciklooksigenaze, prostaglandina E2 ter poveča produkcijo protivnetnega citokina IL-10, izboljša baktericidno delovanje levkocitov, povzroči vazokonstrikcijo in tako zmanjša lokalno vnetje in lokalno otekanje [13, 16]. HBOT spodbuja angioneogenezo s povečanjem izražanja transkrip-

cijskega faktorja HIF-1 α . Prav tako zavira škodljive učinke celičnega staranja in posledično ponovno vstopanje v celične cikle ter krajšanje telomer. HBOT povečuje število krožečih matičnih celic s spodbujanjem njihove mobilizacije ter vpliva na njihovo proliferacijo in diferenciacijo [17, 18].

Neželeni učinki zdravljenja s HBOT so različne oblike barotravme, toksičnost kisika v centralnem živčevju in pljučih, očesni zapleti, klavstrofobija, povišanje sistoličnega in diastoličnega krvnega tlaka, pljučni edem in hipoglikemija pri diabetikih. Boylov zakon navaja, da je prostornina plina pri stalni temperaturi obratno sorazmerna z zunanjim tlakom. Tako povečanje zunanjega tlaka povzroči zmanjšanje prostornine plina, kar se izrazi v zračnih votlinah v telesu, torej v srednjem ušesu in obnosnih votlinah [12].

Metode

Retrospektivno smo pregledali zdravstveno dokumentacijo bolnikov, ki so bili na Kliniki za otorinolaringologijo in cervikofacialno kirurgijo Univerzitetnega kliničnega centra Ljubljana med letoma 2017 in 2024 obravnavani zaradi SSNHL ter so prejeli poleg zdravljenja s sistemskim in/ali intratimpanalnim kortikosteroidom še HBOT. V raziskavo smo zajeli bolnike stare med 18 in 65 let. Izključitveni kriteriji so bili potencialni drugi vzroki za izgubo sluha (poškodba glave, akustična travma, barotravma, ototoksična zdravila, obsevanje, infekcije (herpes, HIV, hepatitis B in C, vnetje srednjega ušesa, meningitis), retrokohlearne bolezni (švanom), kongenitalna ali avtoimuno pogojena izguba sluha, prevodna ali mešana izguba sluha (strukturne spremembe na bobniču, perilimfatska fistula, Menierova bolezen, otoskleroza)) ter predhodno zdravljenje akutne izgube sluha ali tinitusa.

Bolniki so pred pričetkom zdravljenja opravili pražno-tonska avdiometrija obeh ušes pri frekvencah 250, 500, 1000, 2000, 4000 in 8000 Hz. Na strani, kjer se je pojavila SSNHL (slabše slišče uho), smo iz slušnega praga na govornih frekvencah (500, 1000, 2000 in 4000 Hz) izračunali PTA (pure-tone average) kot vsoto slušnega praga na teh štirih frekvencah in rezultat delili s štiri. Pri bolnikih, kjer pražno-tonska avdiometrija ni pokazala odgovora, smo zaradi statistične obdelave številskih podatkov predpostavili prag sluha 120 dB.

Bolniki so kot začetno terapijo SSNHL prejeli kortikosteroid: samostojno metilprednizolon oralno ali kombinacija metilprednizolon oralno in deksametazon intratimpanalno ali samostojno deksametazon intratimpanalno ali metilprednizolon oralno kot začetno zdravljenje in nato deksametazon intratimpanalno kot reševalno zdravljenje. Metilprednizolon oralno so prejeli po shemi 48 mg 7 dni, 32 mg 2 dni, 16 mg 2 dni, 8 mg 2 dni. Deksametazon intratimpanalno so prejeli v enkratni dozi 24 mg/ml.

Pri bolnikih, pri katerih na kontrolnem pregledu po mesecu dni nismo opažali izboljšanja sluha po začetnem zdravljenju s kortikosteroidom, smo kot reševalno terapijo predlagali zdravljenje s HBOT, ki je bilo opravljeno v hiperbarični komori Medicinske fa-

kultete Univerze v Ljubljani (MF UL), kjer so bolniki opravili različno število potopov - od 10 do največ 30 potopov/bolnika. V hiperbarični komori MF UL napravijo potop z 1,42 - 1,45 bar, kar skupno znaša 2,4 ATA. 60 minut je bolnik na predpisanem 2,4 ATA, diha 100 % kisik preko maske. Bolnik napravi 20 potopov; če je opažen klinično dober odziv, se lahko opravi do 40 potopov.

Po končanem zdravljenju s HBOT so bolniki ponovno opravili pražno-tonsko avdiometrijo obeh ušes pri frekvencah 250, 500, 1000, 2000, 4000 in 8000 Hz, iz katerih smo izračunali PTA na strani SSNHL. Primerjali smo PTA pred zdravljenjem (PTA_{pre}) s PTA po zdravljenju s KS in HBOT (PTA_{post}).

Rezultati

24 bolnikov, starih med 19 in 65 let (povprečna starost 43,6 let), smo razdelili v dve skupini: bolniki z blago do srednje hudo izgubo sluha ($PTA_{pre} < 60$ dB - skupina 1) in bolniki s hudo do zelo hudo izgubo sluha ($PTA_{pre} > 60$ dB - skupina 2). V skupini 1 je bilo 8 bolnikov, v skupini 2 je bilo 16 bolnikov. Povprečna starost v skupini 1 je bila 44,9 let, v skupini 2 43 let ($p = 0,8$). Povprečen PTA_{pre} pred pričetkom zdravljenja s sistemskimi kortikosteroidi in HBOT v skupini 1 je bil 38,9 dB, v skupini 2 pa 98,9 dB. Povprečen PTA_{post} po zdravljenju v skupini 1 je bil 39,2 dB, v skupini 2 67,0 dB. Sprememba PTA v skupini 1 je bila -0,31 dB, v skupini 2 31,92 dB ($p = 0,018$) (Tabela 1).

Tabela 1. Primerjava rezultatov med skupinama 1 in 2. PTA_{pre} – PTA pred zdravljenjem, PTA_{post} – PTA po reševalnem zdravljenju s HBOT.

	$PTA_{pre} < 60$ dB - skupina 1	$PTA_{pre} > 60$ dB - skupina 2	p vrednost
število bolnikov	8	16	
povprečna starost (v letih)	44,3	43	0,8
povprečen PTA_{pre} (v dB)	38,9	98,9	
povprečen PTA_{post} (v dB)	39,2	67,0	
sprememba PTA (v dB)	-0,31	31,92	0,018

Razprava

Bolniki s hujšo začetno izgubo sluha ($PTA_{pre} > 60$ dB) so imeli statistično značilno večje izboljšanje povprečnega praga sluha po terapiji s sistemskim in/ali intratimpanalnim kortikosteroidom ter HBOT ($p = 0,018$). Povprečno izboljšanje v tej skupini je znašalo 31,9 dB, medtem ko v skupini z blažjo izgubo ($PTA_{pre} < 60$ dB) ni bilo pomembnega izboljšanja sluha (-0,3 dB). Starost med skupinama je bila primerljiva, kar pomeni, da razlika v izidu ni bila posledica starosti bolnikov.

Več študij je pokazalo obetavne rezultate glede učinkovitosti HBOT v zdravljenju SSNHL, kjer so poročali o izboljšanju praga sluha pri določenem deležu bolnikov [4, 16, 19]. HBOT se je izkazala za bolj učinkovito pri bolnikih s hudo do zelo hudo izgubo

sluha v primerjavi s tistimi z blago do srednje hudo izgubo sluha [15, 20, 21], kar je skladno z našimi rezultati, kjer je imela skupina s $PTA_{pre} > 60$ dB izboljšanje povprečnega PTA 31,9 dB. Hwabin s sodelavci so v svoji študiji pokazali, da obstaja odvisnost med uporabljenim tlakom v hiperbarični komori in izboljšanjem sluha. Bolniki, zdravljeni pri 2,5 ATA, so dosegli boljše rezultate zdravljenja kot tisti, zdravljeni pri 1,5 ATA. Podaljšanje trajanja terapije z 1 na 2 uri pri tlaku 2,5 ATA ni povzročilo pomembne razlike. Zato so predlagali, da se HBOT pri SSNHL lahko izvaja pri 2,5 ATA v trajanju 1 ure, v skupno 10 seansah [22]. Podobno so predlagali LeGros s sodelavci 2 - 2,5 ATA za 90 minut v skupno 10 - 20 seansah [23]. Vsi naši bolniki so bili zdravljeni z 2,4 ATA 70 minut, večinoma so opravili 20 potopov. Samo 10 potopov je opravil le en bolnik, največ, torej 30 potopov je prav tako opravil le en bolnik. Tako je protokol zdravljenja, ki so ga opravili bolniki v naši raziskavi, podoben tistim, ki so ga predlagali Hwabin in LeGros.

V eni izmed študij so opisovali, da je začetek HBOT znotraj 12 dni od nastanka SSNHL imel večji učinek na izboljšanje sluha kot pričetek HBOT po 12 dneh od nastanka, hkrati pa so ugotavljali, da 6 - 10 seans s HBOT nima boljšega vpliva na izid zdravljenja v primerjavi s 1 - 5 seansami HBOT [21]. Pri naših bolnikih smo HBOT uporabili kot reševalno terapijo SSNHL šele mesec dni od prvega pregleda pri nas. Možno je, da bi bilo izboljšanje sluha pri naših bolnikih še večje, če bi HBOT uvedli takoj ob postavitvi diagnoze.

Barotravma srednjega ušesa je eden najpogostejših stranskih učinkov zdravljenja s HBOT [12, 16]. Bolniki lahko poročajo o težavah z izenačevanjem pritiska v ušesu, občutku pritiska, bolečinah in nelagodju v ušesu. Posledično se lahko pojavi retrakcija bobniča, v redkih primerih lahko pride tudi do perforacije bobniča, v zelo redkih primerih se lahko razširi na notranje uho, kjer obstaja tveganje za pretrganje okroglega ali ovalnega okenca [12]. S počasnim uvajanjem kompresije in uporabo dekongestivnih kapljic lahko zmanjšamo možnost nastanka barotravme srednjega ušesa [16]. Barotravma obnosnih votlin je drugi najpogostejši stranski učinek zdravljenja s HBOT in se pogosto pojavi v povezavi z vnetjem zgornjih dihal ali alergijskim rinitisom. Kaže se kot občutek pritiska, najpogosteje nad čelnimi obnosnimi votlinami. Opisana je bila še barotravma ob zobeh, kot bolečina, ki se lahko pojavi tako med kompresijo kot dekompresijo. Spremembe prostornine zraka se lahko pojavijo tudi v pljučih. Potencialna nevarnost za barotravmo pljuč obstaja pri astmatikih, bolnikih s kronično obstruktivno pljučno boleznijo ali emfizemom, kjer lahko pride do hiperinflacije pljuč. Zato je potrebna predhodna ocena pljučne funkcije pred vključitvijo v HBOT [12]. Bolniki v naši raziskavi niso poročali o neželenih učinkih HBOT tako med kot po zdravljenju. Pri vseh bolnikih smo pred in po zdravljenju ugotavljali prehodne zgornje dihalne poti in delujoče Evstahijeve cevi.

Naša raziskava vsebuje majhen vzorec bolnikov ($n = 24$), kar omejuje statistično moč in splošnost rezultatov. Bolniki so pred zdravljenjem s HBOT prejeli različne oblike zdravljenja (sistemski kortikosteroid z/ brez intratimpanalnega kortikosteroida) kar tudi

negativno vpliva na primerljivost rezultatov zdravljenja. Študija ni vključevala kontrolne skupine bolnikov z SSNHL popolnoma brez terapije ali le s KS terapijo, a brez HBOT, zato ni mogoče trdno sklepati o specifičnem učinku HBOT.

Zaključek

Rezultati naše raziskave kažejo, da ima začetna stopnja izgube sluha pomembno vlogo pri odzivu na HBOT pri bolnikih s SSNHL. Bolniki z večjo začetno izgubo sluha ($PTA_{pre} > 60$ dB) so pokazali statistično značilno večje izboljšanje povprečnega praga sluha po zdravljenju v primerjavi z bolniki z blažjo izgubo sluha ($PTA_{pre} < 60$ dB). Na podlagi naših rezultatov lahko zaključimo, da je HBOT najbolj koristna pri bolnikih z bolj izraženo izgubo sluha, medtem ko pri bolnikih z blagimi oblikami bolezni ni opaziti pomembnega izboljšanja. Pri bolnikih z večjo izgubo sluha se je po zdravljenju z HBOT PTA vzdignil, torej izboljšal na povprečni PTA 31,9 dB. Tako so imeli bolniki, zdravljeni s HBOT, v povprečju, po zaključku zdravljenja, PTA 67 dB, kar lahko rehabilitiramo s klasičnim slušnim aparatom. Glede na omejitve študije, zlasti majhen vzorec in retrospektivno zasnovu, so za potrditev teh ugotovitev potrebne večje, prospektivne raziskave.

Etika, soglasja in financiranje

Etična odobritev: Raziskava je bila izvedena kot retrospektivni pregled obstoječe zdravstvene dokumentacije. Pri raziskavi niso bili izvedeni dodatni diagnostični ali terapevtski postopki, podatki bolnikov pa so bili obravnavani zaupno in v skladu z veljavnimi predpisi o varstvu osebnih podatkov. Etična odobritev za izvedbo raziskave ni bila pridobljena.

Financiranje: Raziskava ni prejela zunanjega financiranja.

Navzkrižje interesov: Avtorji izjavljamo, da ni navzkrižja interesov.

Uporaba orodij umetne inteligence: Pri pripravi prispevka niso bila uporabljena orodja umetne inteligence.

Razpoložljivost podatkov: Podatki so na voljo pri kontaktnem avtorju.

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The Future of Otosurgery: OTOARM Assistance in Cochlear Implantation

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STRUCTURED ABSTRACT

Background/Introduction: Cochlear implant electrode insertion can mechanically stress delicate inner-ear structures. Manual insertion is limited by variability in insertion speed, force and angle, while robotic assistance can provide slow, stable and repeatable movement. This report describes the first robotic-assisted cochlear implant electrode insertions performed in Slovenia and the early functional outcomes.

Methods: On 6 November 2025, robotic-assisted cochlear implantation was performed at the Department of Otorhinolaryngology and Cervicofacial Surgery, University Medical Centre Ljubljana, in one adult and one 18-month-old child. The robotic arm inserted the electrode into the inner ear at a constant speed of 0.1 mm/s and uniform force. During insertion, electrode-contact impedance and auditory-nerve responses to electrical stimulation were monitored simultaneously. Postoperative clinical course, residual hearing and vestibular function were assessed.

Results: Both procedures were completed without complications. Both patients were discharged the following day with practically no difficulties. One month after surgery, residual hearing present before surgery was preserved in both patients, and vestibular function remained at the preoperative level. Both patients demonstrated excellent auditory perception and good balance after activation and fitting of the external cochlear implant component.

Conclusion: The first Slovenian experience with robotic-assisted cochlear implant electrode insertion demonstrated technical feasibility, an uncomplicated early postoperative course, and preservation of residual hearing and vestibular function in both treated patients. Robotic assistance may improve control and standardisation of electrode insertion; however, conventional manual cochlear implantation remains the current standard because of robot costs and required intraoperative adaptations.

Keywords: Cochlear Implants; Robotics; Otolologic Surgical Procedures; Hearing Preservation; Vestibular Function

Introduction

Robotics is increasingly used in healthcare, including rehabilitation, care and highly precise surgical procedures. Robot-assisted surgery first became established in urological and abdominal surgery and subsequently expanded to head and neck surgery. In cochlear implantation, robotic assistance has been applied particularly to electrode-array insertion [1, 3].

Preservation of cochlear structure and function is important for optimal cochlear implant outcomes. Residual functional acoustic hearing contributes to pitch perception, speech perception, listening in background noise and music appreciation. Nevertheless, approximately half of hearing-preservation cochlear implant recipients may experience an additional loss of residual functional acoustic hearing greater than 10 dB after surgery (1). Electrode insertion trauma can damage delicate inner-ear structures and reduce implant performance. Among factors that influence insertion trauma, insertion technique is constrained by human motor capability: continuous motion slower than 250 $\mu\text{m/s}$ is not possible, and the slowest steady manual electrode insertion has been reported as 867 $\mu\text{m/s}$ [1].

During manual electrode insertion, the insertion force and speed are largely dependent on the surgeon's experience and manual control. This may result in considerable variability in the speed, force, and angle of electrode insertion and, consequently, may increase the risk of microtrauma to the delicate structures of the inner ear.

The aim of robotic assistance is to enable slower and more controlled insertion of the electrode array into the inner ear, applying a constant force and avoiding sudden movements. The robot enables an eight-times slower insertion of the electrode. This approach is intended to minimize mechanical trauma during electrode insertion and thereby improve preservation of the delicate structures of both the auditory and vestibular parts of the inner ear.

At University Medical Centre Ljubljana, the cochlear implant programme has operated continuously since 1996, when the first cochlear implant was inserted in Slovenia. By the end of July 2026, 581 cochlear implantations and 36 implant replacements had been performed. The cochlear implant programme currently routinely includes congenitally deaf infants and infants with severe hearing loss, typically undergoing implantation at approximately 9 months of age, as well as children, adolescents, and adults with severe unilateral or bilateral hearing loss or deafness. Because implant lifetime is estimated at approximately 25–30 years, many congenitally deaf users may require one or two replacement operations during their lifetime, making minimisation of insertion trauma particularly important.

The aim of this report is to describe the first robotic-assisted cochlear implant electrode insertions in Slovenia and the early postoperative hearing and vestibular outcomes in the two treated patients.

Methods

This report describes two robotic-assisted cochlear implant procedures performed on 6 November 2025 at the Department of Otorhinolaryngology and Cervicofacial Surgery, University Medical Centre Ljubljana. The patients were one adult and one 18-month-old child.

The conventional part of the surgical approach included temporal-bone drilling behind the auricle, access to the middle ear between the facial and chorda tympani nerves, and preparation of the round window. In the final phase of the procedure, the robotic arm inserted the cochlear implant electrode into the inner ear using uniform force and a constant insertion speed of 100 $\mu\text{m/s}$. During robotic insertion, electrode-contact impedance was measured simultaneously and the auditory-nerve response to electrical stimulation was monitored directly. After insertion, the robotic arm was partially withdrawn and the operation was completed conventionally (3).

The postoperative course was monitored. One month and six months after surgery, residual hearing and vestibular function were assessed using caloric testing and audiometry in the adult patient and freefield audiometry and rotatory testing in the infant.

Results

Both robotic-assisted procedures were completed successfully and without complications. Both patients were discharged on the day after surgery and had practically no postoperative difficulties.

At one month after surgery, both patients retained the residual hearing that had been present preoperatively. Vestibular function was also preserved at the preoperative level in both patients. Caloric testing and rotatory testing revealed normal function of the peripheral vestibular organ; audiometry revealed unchanged residual functional acoustic hearing between 80 and 110 dB at 1 kHz in the adult patient and at 90–100 dB in free field in speech frequencies (unimplanted ear was unfitted) in the infant patient.

The external cochlear implant components were fitted according to the intraoperative measurements of auditory-nerve responses. Both implanted patients demonstrated excellent auditory perception and good balance.

Discussion

This first Slovenian experience shows that robotic-assisted cochlear implant electrode insertion was technically feasible in both an adult and a young child and was followed

by an uncomplicated early postoperative course. At one month, residual hearing and vestibular function were preserved in both patients.

The rationale for robotic assistance is the ability to control insertion speed and force more consistently than is possible with manual insertion. Slow and uniform insertion is intended to reduce mechanical loading of delicate cochlear structures. This is particularly relevant because the auditory and vestibular parts of the inner ear are anatomically and functionally closely connected, and injury to the cochlear structures may also affect balance.

Robotic-assisted insertion may also support standardised, repeatable and objectively comparable insertion conditions, potentially reducing variability between procedures and improving conditions for long-term monitoring of functional outcomes and further development of surgical techniques. At the same time, successful cochlear implantation remains a multidisciplinary process involving surgeons, radiologists, audiologists, clinical speech-language specialists, engineers and other healthcare professionals. According to the literature and robot technical specification, the speed of insertion is approximately 8 times slower using robotic-assisted insertion than implanting the electrode by hand (1-3).

At present, the main limiting factors for the broader implementation of robotic systems in otosurgery are their high cost and the need for adaptations to the surgical workflow. However, given the described potential advantages, the use of robotic assistance in otosurgery is expected to expand considerably in the future.

Conclusion

Robotic-assisted cochlear implant electrode insertion was successfully performed for the first time in Slovenia in an adult and an 18-month-old child. The postoperative course was uneventful and early follow-up showed preservation of preoperative residual hearing and vestibular function. The approach offers controlled, slow and repeatable electrode insertion and may provide a basis for further standardised evaluation of functional outcomes, while conventional manual implantation remains the current standard.

Ethics, Consent and Funding

Ethical Approval: (No. 21/06/15) from the Commission of the Republic of Slovenia for Medical Ethics (KME)

Informed Consent: written consent was obtained from patients for participation and/or publication of photographs

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02

Foniatrija

Phoniatrics

The Pitfalls of Laryngopharyngeal Reflux

From Accurate Diagnosis to Successful Management

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STRUCTURED ABSTRACT

Background/Introduction: Laryngopharyngeal reflux (LPR) remains challenging because nonspecific upper aerodigestive symptoms are frequently attributed to reflux without objective evidence. This review summarizes contemporary diagnostic and therapeutic principles, emphasizing pitfalls that contribute to overdiagnosis and ineffective treatment.

Methods: A narrative synthesis was performed using the 2024 International Federation of Otorhinolaryngological Societies (IFOS) Dubai definition, the 2026 European clinical practice guideline, the 2026 San Diego Consensus, and recent prospective treatment-comparison studies and systematic reviews. Diagnostic strategies, laryngoscopic findings, ambulatory reflux monitoring, salivary biomarkers, dietary interventions, pharmacotherapy and treatment are evaluated.

Results: Current consensus distinguishes laryngopharyngeal symptoms from laryngopharyngeal reflux disease (LPRD), requiring objective reflux evidence for disease classification. A major pitfall is assuming that LPR is predominantly acid-related. Most pharyngeal reflux events are weakly acidic or alkaline, which may explain the limited efficacy of proton pump inhibitors (PPIs) in patients without gastroesophageal reflux disease (GERD). European consensus recommendations therefore support a phenotype-based approach, including alginates or magaldrate for non-acid reflux management. Treatment should also consider combining diet, lifestyle modification and behavioral interventions. Proton pump inhibitors (PPIs) are not recommended as first-line treatment for LPR.

Conclusion: Successful LPRD management begins with diagnostic accuracy rather than empirical escalation. Objective reflux testing, systematic exclusion of alternative diagnoses, mechanism-directed therapy, dietary and behavioral intervention, and individualized treatment duration provide a more rational clinical pathway than reflexive acid suppression.

Keywords: Laryngopharyngeal Reflux; Proton Pump Inhibitors; Alginates; Diet

Introduction

Laryngopharyngeal reflux (LPR) was initially defined as the backflow of stomach contents into the laryngopharynx (1). This definition has recently been considered too narrow as LPR-related exposure to pepsin, bile salts, and other gastroduodenal compon-

ents may affect not only the laryngopharyngeal mucosa but the mucosa of the entire upper aerodigestive tract (2). Various definitions and diagnostic approaches have been published but a universally accepted LPR definition remains lacking because nonspecific upper aerodigestive symptoms are frequently attributed to reflux without objective evidence (2, 3, 4, 5). Symptoms such as throat clearing, chronic cough, dysphonia, excess mucus, globus and throat discomfort are nonspecific and may have several ENT, respiratory, digestive or functional causes (4, 6). The main clinical problem is therefore to distinguish laryngopharyngeal symptoms (LPS) from objectively supported laryngopharyngeal reflux disease (LPRD) (2, 4, 5).

This article aims to review the main diagnostic and therapeutic pitfalls of LPRD from an ENT perspective and to propose a practical approach to accurate diagnosis and personalized treatment. Particular attention is given to the limitations of symptoms, laryngoscopic findings, symptom scores and empirical proton pump inhibitors (PPIs). The article also discusses the importance of objective reflux testing, differential diagnosis, weakly acidic and non-acid reflux, diet and lifestyle intervention and alginate therapy.

Methods

Methodologically, this systematic review of LPR used the PubMed and Scopus databases with search terms laryngopharyngeal reflux; laryngopharyngeal; diagnosis; and treatment, mainly over the period 2020 - 2026. Articles were required to be written in English. Selection was first made on the abstract. The aim was to evaluate the latest evidence on the diagnosis and treatment of LPRD through a focused review of the Dubai/IFOS Consensus, the European Clinical Practice Guideline, the San Diego Consensus definitions and recent clinical studies addressing current diagnostic and therapeutic approaches.

Results

The diagnosis and management of LPR are now supported by three recently published guidelines that provide practical recommendations for ENT specialists – the Dubai /IFOS Consensus, the European Clinical Practice Guidelines and the San Diego Consensus. The main features of each consensus are presented below:

The Dubai/IFOS Consensus establishes a global definition and diagnostic framework for LPR. It was created because of the clinical confusion surrounding LPR, which differs significantly from gastroesophageal reflux disease (GERD). LPR often presents without classic esophageal symptoms like heartburn, making diagnosis challenging. The consensus formally defines LPR as a disease of the upper aerodigestive tract. It results from the direct or indirect effects of gastroduodenal reflux, which induce morphological or neurological changes in this region. Pathophysiologically, the backflow of gastric content containing pepsin and bile salts damages the delicate mucosal lin-

ing. Neurologically, LPR can cause laryngeal hypersensitivity and upper esophageal sphincter abnormalities. Several factors impair gastroesophageal function and predispose patients to LPR, including tobacco use, obesity, primary esophageal dysmotility, and diets high in fat, sugar, salt, or acidic content. From a clinical standpoint, LPR symptoms and signs are non-specific. Symptoms include dysphonia, dysphagia, throat pain, globus sensation, throat clearing, postnasal drip, and a troublesome cough. Physical findings often reveal arytenoid erythema, posterior commissure hypertrophy, vocal fold edema, and endolaryngeal mucus. Because these inflammatory findings can occur in other conditions, the consensus emphasizes that no specific laryngeal signs are diagnostic on their own. Therefore, diagnosing LPR based solely on laryngoscopic findings is not recommended. To systematically document symptoms and signs, clinicians should use validated patient-reported outcome questionnaires, such as the Reflux Symptom Index (RSI) or the Reflux Symptom Score (RSS), although these do not replace objective diagnostic testing. When objective diagnosis is needed, the consensus recognizes hypopharyngeal-esophageal multichannel intraluminal impedance-pH testing (HEMII-pH) as the most reliable diagnostic tool. It can suggest LPR when more than one hypopharyngeal reflux event—whether acid, weakly acid, or nonacid—is recorded over 24 hours. Testing must be conducted off acid suppression medications for at least seven days. In contrast, traditional single- or dual-channel pH probes without a pharyngeal sensor are inadequate because they miss weakly acidic and nonacidic events and do not detect pharyngeal reflux. Oropharyngeal-only pH testing is also controversial and its criteria are not transferable to HEMII-pH. If HEMII-pH is unavailable, a three-month empirical trial covering acid, weakly acid, and nonacid LPR may be prescribed with treatment success judged by symptom improvement. Salivary pepsin detection represents a noninvasive adjunctive screening tool, but it cannot confirm LPR as the sole cause of symptoms. Finally, upper gastrointestinal endoscopy is often normal in LPR patients but remains mandatory for those with "alarm" features indicating malignancy or those who do not respond to empirical therapy. High-resolution esophageal manometry is indicated primarily to rule out primary motility disorders or assist in placing reflux catheters in non-responders (2).

The European Clinical Practice Guideline serves as a crucial companion to the Dubai Consensus, specifically filling the gaps regarding LPRD management and treatment. The guideline defines LPRD as an inflammatory disease of the upper aerodigestive tract caused by the backflow of gastroduodenal contents, specifically highlighting the destructive roles of pepsin, bile acids, elastase, and trypsin.

For objective diagnosis, the guidelines confirm that 24-hour hypopharyngeal-esophageal multichannel intraluminal impedance-pH testing (HEMII-pH) remains the gold standard, requiring more than one pharyngeal event for confirmation. Oropharyngeal pH-monitoring is viewed as an alternative tool if HEMII-pH is unavailable, supporting

LPRD diagnosis if there are more than ten pharyngeal events at pH 6.0. Laryngoscopy alone cannot confirm LPRD and clinicians are strongly encouraged to use validated European instruments, like the Reflux Symptom Score (RSS) and Reflux Sign Assessment (RSA) to monitor treatment response. If objective monitoring is unavailable, an empirical trial lasting at least one to two months is a viable diagnostic alternative. Regarding treatment, a personalized approach based on the patient's specific reflux profile is highly recommended. Because most LPRD episodes are gaseous, upright, and weakly acidic or alkaline, post-meal alginates or antacids (like magaldrate) are recommended as the primary empirical therapy. These medications form a protective barrier or neutralize harmful enzymes like pepsin and bile salts. In contrast, proton pump inhibitors (PPIs) are reserved for patients with clear GERD findings, esophageal complications, or typical esophageal symptoms like heartburn. Minimal duration of initial treatment is two to three months. The guideline emphasizes lifestyle modifications, including an anti-reflux diet that reduces high-fat, high-sugar, spicy foods, caffeine, alcohol, and tobacco while increasing protein intake. Interestingly, conventional GERD recommendations like weight loss and elevating the head of the bed are not automatically validated for LPRD, as LPRD patients are typically not obese and experience daytime, upright reflux. Additionally, autonomic nerve dysfunction linked to stress, anxiety, depression, and sleep disorders must be actively addressed, as these factors contribute to upper digestive tract dysmotility. For non-responders, clinicians should first verify compliance with medication and diet. If symptoms persist after two months, treatment should be extended to three months, and changing the medication class is preferred over simply increasing the drug dosage. For successful responders, medications should be progressively tapered to prevent rebound effects and minimize long-term risks like osteoporosis. Lastly, fundoplication is an option only for patients with severe, proven GERD and hiatal hernia, and patients must be warned that its efficacy on LPRD symptoms is highly unpredictable (3).

The San Diego Consensus has made a critical interdisciplinary milestone for evaluating upper aerodigestive complaints. A key contribution is the strict differentiation between laryngopharyngeal symptoms (LPS) and true LPRD. Consensus defines LPS as chronic and frequent throat or airway symptoms occurring at least twice weekly for eight weeks or more. Common symptoms include cough, throat clearing, voice change, excess phlegm, and throat pain. However, having LPS does not equate to LPRD. LPRD requires troublesome LPS and objective evidence supporting the relationship between symptoms and reflux. Laryngoscopy is necessary to rule out alternate pathologies like malignancy. However, laryngoscopic findings alone are non-specific and can never diagnose LPRD. Scoring instruments like the Reflux Finding Score and Reflux Sign Assessment are not diagnostic of LPRD due to low specificity. Therefore, we must characterize whether patients have concurrent esophageal symptoms, such as heartburn or regurgitation or if they have isolated LPS. For patients with concurrent

esophageal symptoms, a three-month trial of twice-daily PPIs, with or without barrier alginate therapy and lifestyle adjustments, is appropriate. Conversely, empiric trials are not recommended first-line for patients with isolated LPS. For isolated LPS, objective esophageal evaluation must be performed first to personalize patient care. Objective diagnosis is achieved through upper endoscopy or ambulatory reflux monitoring. On endoscopy, Los Angeles grades B, C, or D esophagitis and biopsy-proven Barrett's esophagus provide conclusive evidence of reflux. Reflux monitoring must be performed off acid-suppressive therapy. The two primary testing options are twenty-four-hour pH-impedance and prolonged wireless pH monitoring. Twenty-four-hour pH-impedance is useful in isolated LPS because it detects weakly acidic and non-acidic proximal reflux events. In contrast, prolonged wireless pH monitoring captures day-to-day variability and is preferred for patients with coexisting esophageal symptoms. A distal esophageal acid exposure time greater than six percent confirms GERD. Oropharyngeal-only pH monitoring lacks specificity and is not supported as a standalone diagnostic tool. Importantly, many presentations of LPS are driven by laryngeal hyperresponsiveness, symptom-specific anxiety, and hypervigilance. These behavioral processes can occur with or without true LPRD. The Laryngeal Cognitive Affective Tool can help us identify patients with elevated hypervigilance. For these individuals, laryngeal recalibration therapy, provided by a specialized speech-language pathologist, utilizes voice techniques, autonomic regulation, and cognitive reframing. Cognitive behavioral therapy is also useful for targeting psychological triggers. Finally, pharmacologic neuromodulation with gabapentin, pregabalin, or tricyclic antidepressants can improve laryngeal hypersensitivity, particularly in patients with chronic cough (4).

Discussion

The following section outlines the most common pitfalls encountered in the diagnosis and management of LPR and provides further explanation of each.

1. Diagnosing LPR from symptoms alone and missing alternative diagnoses. Symptoms like hoarseness and/or lowering of your voice register, a lump or a feeling of something stuck in your throat, throat clearing, chronic cough, excessive mucus or phlegm, difficulty swallowing, chronic sore throat/throat pain, laryngitis (inflammation of your vocal cords or losing your voice), wheezing, postnasal drip, frequent upper respiratory infections, new or worsening asthma and dental erosions can be easily connected to LPR but the differential diagnosis is therefore fundamental (7). Chronic rhinitis, allergy, asthma, chronic or neuropathic cough, vocal overuse, muscle tension dysphonia and laryngeal hypersensitivity may mimic or coexist with reflux-related symptoms. Infection, medication effects, neoplasia and esophageal motility disorders should also be considered according to the clinical presentation. Persistent symptoms following empirical treatment should prompt diagnostic reassessment rather than an automatic diagnosis of treatment-resistant LPR (5, 8).

2. Diagnosing LPR from posterior laryngeal erythema alone. A frequent diagnostic pitfall is the assumption that a “refluxed larynx” can be identified by laryngoscopy. Erythema, edema, thick endolaryngeal mucus, posterior commissure changes and pachydermia have traditionally been attributed to reflux; however, these findings lack sufficient specificity to establish LPRD. Laryngoscopy remains essential in the ENT evaluation, but its primary role is to exclude structural or neoplastic pathology, identify alternative laryngeal disorders and characterize the laryngeal phenotype—not to prove reflux (5, 8).

3. Symptom scores are diagnostic tests. Similarly, symptom-based instruments such as the Reflux Symptom Index (RSI) and Reflux Symptom Score (RSS) are useful for quantifying symptom burden and monitoring therapeutic response but should not be considered diagnostic tests for LPRD. In other words, a high symptom score tells us that the patient is symptomatic; it does not tell us why (9).

4. Choosing the wrong test. Importantly, no single investigation answers every clinical question. While initial laryngoscopy effectively rules out non-reflux structural throat pathologies, laryngoscopic findings alone lack specificity to confirm LPRD. Consequently, diagnostic upper endoscopy and ambulatory reflux monitoring are recommended for persistent, treatment-refractory LPS (9). In patients with persistent hoarseness and no relevant findings on conventional laryngoscopy, the San Diego Consensus recommends videostroboscopy as an adjunctive diagnostic tool, with 79% expert agreement. Videostroboscopy provides a more detailed evaluation of vocal fold vibration and may reveal subtle mucosal or functional abnormalities that are not apparent on standard laryngoscopic examination (4). Recommended ambulatory modalities include 24-hour pH-impedance and 96-hour wireless pH monitoring, providing distinct, non-mutually exclusive diagnostic profiles. Additionally, high-resolution esophageal manometry optimally assesses esophageal motility and clearance. The European guideline identifies hypopharyngeal-esophageal multichannel intraluminal impedance-pH monitoring (HEMII-pH) as the gold-standard approach for objective LPRD diagnosis in its framework. In that guideline, more than one pharyngeal reflux event is used as the diagnostic criterion for LPRD. HEMII-pH provides information about reflux composition, acidity (acidic, weakly acidic and non-acid reflux), proximal extent, and temporal association with symptoms (3). This comprehensive multi-modal diagnostic approach ensures accurate risk stratification and reliably distinguishes true LPRD from laryngeal hyperresponsiveness or hypervigilance (9).

5. All reflux is acid. A major clinical pitfall is assuming that all reflux episodes are highly acidic. However, LPRD differs significantly from gastroesophageal reflux disease because most of its pharyngeal events are actually weakly acidic or alkaline. Traditional PPIs often fail these patients. Because PPIs target only acid, they do not show clear superiority over placebos in standard LPRD cases without GERD complications. Non-acid reflux requires a broader therapeutic approach. Recent European consensus

guidelines recommend empirical treatments like alginates or magaldrate to physically block and neutralize both acid and non-acid events. This personalized therapy succeeds (3).

6. More PPIs means better treatment. PPIs are strictly indicated just for patients with GERD (3) and PPIs clearly do not demonstrate a clear advantage over placebo in LPRD (due to the weakly acidic or alkaline nature of LPRD reflux events) (10). Consequently, European guidelines recommend alginates or magaldrate as primary empirical treatments for LPRD. Alginates form a rapid physical barrier over gastric contents to block reflux (10, 11). Combining PPIs with alginates significantly enhances symptom relief in GERD (3). Adding prokinetics also improves gastric emptying (10). Treatment should last two to three months before progressive tapering (3). For patients with acid LPR, PPI therapy is recommended, and according to the San Diego Consensus, a 3-month trial of standard-dose potent acid suppression, such as omeprazole 20 mg twice daily, is considered adequate to assess the response of LPS to treatment (4). Non-responders may benefit from changing medication classes (3).

7. Lifestyle during treatment of LPR does not matter. Diet and lifestyle measures may also be underestimated when management is focused mainly on medication (12, 13, 14). A systematic review of 10 studies including 868 patients found symptom reductions of 54% to 83.3% with dietary interventions, although the quality of evidence was limited and randomized diet-versus-medication trials were lacking (12). Prospective results in objectively diagnosed LPRD are nevertheless encouraging: a standardized low-fat, high-protein, low-rapid-release-sugar diet combined with lifestyle modification was associated with symptom relief in 88.6% of patients and complete resolution in 40.9%, with only 20.5% requiring additional medication (13). In a 2026 cohort of 145 objectively diagnosed patients, responder rates were 81.2% with a strict antireflux diet and stress-reduction program, 74.1% with antacids, 57.9% with alginates and 56.3% with PPIs (14). These numbers are clinically interesting, but they should be interpreted with restraint because the study was not randomized and the change in symptoms over time did not differ significantly between treatment groups (14).

Conclusion

Diagnosing LPR remains challenging because nonspecific upper aerodigestive symptoms may be incorrectly attributed to reflux in the absence of objective evidence. LPS should not be considered synonymous with LPRD. Laryngoscopy is essential in ENT assessment, but its findings alone cannot confirm the diagnosis. When the diagnosis remains uncertain or symptoms persist, objective reflux testing can help guide further management. Treatment should consider both acid and non-acid reflux and should be individualized, combining diet and lifestyle modification, alginates, behavioral interventions, and appropriately selected pharmacotherapy. Most importantly, persistent

symptoms despite treatment should prompt reconsideration of the diagnosis and possible alternative causes rather than automatic escalation of PPI therapy.

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Pomen psihološke obravnave pacientov s težavami na področju glasu, govora in požiranja

Prikaz primera obravnave pacientke s papilomi grla

The importance of psychological treatment of patients with voice, speech and swallowing disorders: a case report of a patient with laryngeal papillomas

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STRUKTURIRANI IZVLEČEK

Uvod: Papilomi na glasilkah in dolgotrajne glasovne težave lahko predstavljajo pomembno psihološko obremenitev, zlasti kadar vplivajo na poklicno delovanje. Pri predstavljeni 32-letni srednješolski učiteljici sta vztrajanje glasovnih težav, bolniška odsotnost ter negotovost glede zdravja in delazmožnosti spremljali čustvi tesnobe ter krivde z njej značilnimi strategijami samokritičnosti in pretirane odgovornosti. Vedenjsko-kognitivna terapija je bila usmerjena v prepoznavanje povezav med situacijo, mislimi (prepričanji), čustvi, telesnimi odzivi in vedenjem in posledično v boljše nadzorovanje miselnega in vedenjskega odziva.

Metode: Obravnava je vključevala učenje miselnega modela, prepoznavanje miselnih napak, miselno preoblikovanje, preusmerjanje pozornosti, načrtovani čas za skrbi ter trening asertivne komunikacije, socialnih veščin v obliki igre vlog kot priprave na vrnitev na delovno mesto.

Rezultati: Obravnava je pacientki omogočila boljše razlikovanje med dejstvi in nerealnimi ali nekoristnimi razlagami, prepoznavanje vzorcev pretirane odgovornosti, katastrofiziranja, personalizacije in črno-belega mišljenja ter razvijanje bolj uravnoteženih misli. Tehnike uravnavanja pozornosti so bile usmerjene v zmanjševanje premlevanja, trening asertivnosti pa v večji občutek osebne učinkovitosti pri soočanju z delovnim okoljem.

Zaključek: Primer kaže uporabnost vedenjsko-kognitivnega pristopa pri psihološki obravnavi pacientke z glasovnimi težavami in pomembno poklicno obremenitvijo. Cilj obravnave ni zmanjšanje njene zavzetosti, temveč povečanje psihološke fleksibilnosti, zmanjšanje nesorazmerne odgovornosti in razvoj učinkovitejšega spoprijemanja s stresom.

Ključne besede: papilomi na glasilkah; glasovne težave; vedenjsko-kognitivna terapija

ABSTRACT

The case describes psychological treatment of a 32-year-old secondary-school teacher with persistent voice difficulties after surgical treatment of vocal fold papillomas. The main psychological burdens were prolonged sick leave, uncertainty about returning to work, self-criticism and excessive responsibility toward students. Cognitive-behavioral treatment (CBT) included the cognitive model, identification of cognitive distortions, cognitive restructuring, attention shifting, scheduled worry time and assertiveness training. The treatment focused on reducing rumination, developing balanced interpretations and improving coping with stress and return-to-work demands.

Keywords: vocal fold papillomas; voice difficulties; cognitive-behavioral therapy

Uvod

Na Centru za motnje glasu, govora in požiranja se lahko že 50 let pohvalimo s strokovnim timom, ki ga poleg foniatra sestavljata še klinični logoped in klinični psiholog.

V zadnjem času veliko raziskav potrjuje, da kombiniranje kognitivno-vedenjske terapije (KVT) z glasovno terapijo prinaša več prednosti, vključno z izboljšanjem kakovosti glasu, psihosocialnega počutja in preprečevanjem ponovitve bolezni (1).

Zdravstvene težave lahko pomembno vplivajo na posameznikovo čustveno doživljanje, vedenje in poklicno funkcioniranje. Obratno lahko čustveno doživljanje ter vedenje vplivata na zdravstveno stanje kot vzročna, vzdržujoča ali modulirajoča dejavnika. Zaradi omenjenih razlogov je potrebno glasovne, govorne in motnje požiranja nasloviti celostno, timsko.

Tudi pacientko, ki jo bomo predstavili, smo obravnavali timsko; obravnava je bila učinkovita tudi zaradi celostnega pristopa. Ob tem je potrebno poudariti, da je kratka obravnava in uspeh terapije prav tako posledica pacientkine osebnosti. Pacientka se je zavedala, da bo za obvladovanje svojih težav morala v svoje življenje in delo uvesti spremembe in da je uspešnost obravnave zelo odvisna od nje same.

Vedenjsko-kognitivni pristop izhaja iz predpostavke, da čustvenega odziva ne določajo zgolj objektivne okoliščine, temveč tudi način njihove interpretacije (2). Namen obravnave je bil zato prepoznati neustrezne miselne vzorce, razviti bolj uravnotežene razlage in prepričanja ter okrepiti učinkovite strategije spoprijemanja z boleznijo, glasovnimi težavami, delovnim okoljem in ostalimi življenjskimi situacijami.

Diagnoza

Pacientka, stara 32 let, zaposlena kot učiteljica, je bila v kliničnopsihološko ambulantno napotena s strani foniatrije zaradi vztrajanja glasovnih težav.

Pacientka je ob foniatričnem pregledu povedala, da dve leti občasno ter ponavljajoče ostaja brez glasu. Ob prvem foniatričnem pregledu so bili diagnosticirani papilomi na

glasilkah ter načrtovano operativno zdravljenje. V kliničnologopedsko in kliničnopsihološko obravnavo je bila pacientka napotena zaradi vztrajanja glasovnih težav po operativnem zdravljenju.

V okviru psihološkega intervjuja smo ugotavljali, da tako papilomi, bolniška odsotnost ter negotovost glede vrnitve na delo, bolezni in prihodnosti predstavljajo pomembne stresorje. Psihološko breme so dodatno povečevale visoke osebne in profesionalne zahteve, samokritičnost ter občutek pretirane odgovornosti do dijakov. Ob pričetku kliničnopsihološke obravnave je bila pacientka še vedno v bolniškem staležu.

Pacientka je zaposlena kot srednješolska učiteljica nekaj več kot pet let. V zadnjih letih opravlja tudi vlogo razredničarke.

Diagnoza papilomov je zanjo predstavljala velik psihološki stres, ki ga opisuje kot dogodek, ki jo je »sesul«. Poleg zdravstvenih težav pomemben vir obremenitve predstavlja tudi delovno okolje. Pred približno dvema letoma je prišlo do spremembe vodstva na šoli; pacientka meni, da novo vodstvo njenega dela ne ceni oziroma ga ne prepozna v zadostni meri.

Daljša odsotnost z delovnega mesta pri pacientki povzroča občutke krivde in negativno vrednotenje lastnega delovanja zaradi odgovornosti do dijakov. Odkar je na bolniškem staležu, pogosto razmišlja, da je dijake »pustila na cedilu«, da jih ni dovolj pripravila ter da je zaradi svoje odsotnosti slaba razredničarka. Hkrati opisuje visoko stopnjo zavzetosti pri svojem delu: vsako učno uro skrbno načrtuje, pri čemer si prizadeva, da bi bile ure za dijake čim bolj poučne in zanimive. Navedeno kaže na visoke osebne in profesionalne standarde ter izrazit občutek odgovornosti za kakovost lastnega dela (perfekcionizem).

Glavno pričakovanje pacientke od psihološke obravnave je pridobivanje konkretnih tehnik za učinkovitejše obvladovanje stresa. V okviru obravnave je bil zato oblikovan načrt usmerjen v prepoznavanje povezav med različnimi delovnimi in življenjskimi situacijami, mislimi, čustvi in vedenjem ter v spreminjanje nefunkcionalnih oziroma pretirano obremenjujočih miselnih vzorcev v učinkovitejše strategije spoprijemanja. Ob načrtovani vrnitvi na delovno mesto je bil kot pomemben terapevtski cilj opredeljen tudi razvoj asertivne komunikacije, predvsem v odnosih s sodelavci in vodstvom.

Zdravljenje

Vedenjsko-kognitivni pristop temelji na predpostavki, da na posameznikovo čustveno doživljanje ne vplivajo zgolj objektivne okoliščine, temveč tudi način, kako jih posameznik interpretira (2). Pri tem imajo pomembno vlogo avtomatske misli, osnovna prepričanja in vedenjski odzivi. Pri pacientki smo ocenili, da zdravstvene težave in odsotnost z dela predstavljata pomembna stresorja, njuno psihološko breme pa dodatno povečujejo njena prepričanja in razlage, ki so povezane s pretirano odgovornostjo, samokritičnostjo in visokimi standardi.

Situacija daljše bolniške odsotnosti pri pacientki sproža misli, kot so: »Dijake sem pustila na cedilu«, »Nisem jih dovolj pripravila« in »Slaba razredničarka sem«. Te misli povzročajo krivdo, tesnobo in žalost. Posledično se pri njej povečuje potreba po preverjanju, analiziranju in načrtovanju ter ukvarjanju z vprašanji, kako bi morala ravnati oziroma kako bo njena odsotnost vplivala na dijake in njeno delo. Takšen proces je mogoče razumeti kot začarani krog. Negativna razlaga situacije poveča čustveno obremenitev, povečana obremenitev pa dodatno krepi potrebo po nadzoru in razmišljanju o možnih negativnih posledicah. Čeprav načrtovanje in preverjanje kratkoročno zmanjšata občutek negotovosti, lahko dolgoročno prispevata k vzdrževanju skrbi in psihološke napetosti. Psihološka napetost vpliva na zvišano stopnjo telesne napetosti in modulira ter vzdržuje njene zdravstvene oziroma glasovne težave.

Prvi korak vedenjsko-kognitivne obravnave je predstavljalo spoznavanje osnovnega miselnega modela, s katerim je pacientka začela prepoznavati povezavo med situacijo, avtomatskimi mislimi, čustvi, telesnimi odzivi in vedenjem. Na konkretnem primeru pacientke je mogoče proces prikazati na naslednji način:

Situacija: pacientka je zaradi zdravstvenih težav odsotna z delovnega mesta.

Avtomatska misel: »Dijake sem pustila na cedilu.«

Čustveni odziv: razočaranje, žalost, jeza, nezadovoljstvo.

Telesni odziv: povečana napetost in ostala psihofiziološka aktivacija.

Vedenjski odziv: premlevanje, načrtovanje, preverjanje, ukvarjanje s tem, kaj bi morala storiti.

Posledica: kratkotrajni občutek večjega nadzora, vendar dolgoročno povečana zaskrbljenost.

Usvajanje modela pacientki omogoča pomembno razlikovanje med dejstvom in interpretacijo. Dejstvo je, da je zaradi zdravstvenega stanja odsotna z dela; interpretacija pa je, da je zaradi tega »slaba razredničarka«. Takšno razlikovanje predstavlja osnovo za nadaljnje terapevtsko delo.

Miselni model ima pri pacientki predvsem funkcijo povečanja metakognitivnega uvida, saj ji omogoča, da svoje misli opazuje in preverja, namesto da bi jih avtomatično sprejemala kot dejstva. S tem se zmanjšuje njihova čustvena moč in povečuje občutek nadzora nad lastnim odzivanjem.

Naslednji korak obravnave je bil namenjen prepoznavanju miselnih napak oziroma značilnih vzorcev mišljenja, ki lahko prispevajo k povečanju stresa. Pri pacientki so posebej pomembni črno-belo mišljenje, katastrofiziranje, pretirana odgovornost, personalizacija, sklepanje o mišljenju drugih ter rigidna pravila v obliki »moram« in »morala bi«.

Primer črno-belega mišljenja je razviden iz prepričanja, da lahko odsotnost z dela pomeni, da je pacientka »slaba razredničarka«. Pri takšnem načinu mišljenja se kompleksna ocena profesionalne kompetentnosti reducira na eno samo okoliščino. Pacientka pri tem spregleda številne druge informacije, ki govorijo o njeni zavzetosti in kakovosti dela.

Pri pretirani odgovornosti prevzema odgovornost za posledice, ki jih v celoti ne more nadzorovati. Njena odsotnost je posledica zdravstvenega stanja, vendar jo pacientka interpretira kot osebni neuspeh oziroma kot svojo odgovornost do dijakov.

Prepoznavanje miselnih napak omogoča, da pacientka začne zaznavati miselne vzorce, ki povečujejo stres. S tem pridobi možnost, da se na njih odzove bolj realno, preden vodijo v intenzivnejšo čustveno obremenitev.

Na podlagi prepoznanih miselnih napak je sledilo učenje miselnega preoblikovanja. Gre za strukturiran proces ocenjevanja avtomatskih misli in oblikovanja bolj uravnoteženih misli. Namen tehnike ni pozitivno razmišljanje, temveč razvoj misli, ki so realistične, dokazljivo utemeljene in bolj funkcionalne.

Pri pacientki se lahko misel »Ker sem na bolniški, sem dijake pustila na cedilu« obravnava z vprašanji: Kateri dokazi podpirajo to misel?, Kateri dokazi ji nasprotujejo?, Kaj bi o tej situaciji menila druga oseba?, Ali bi enako strogo ocenila kolegico, ki bi bila zaradi bolezni na bolniškem staležu?, Za katere vidike situacije je pacientka dejansko odgovorna?, Katere okoliščine so zunaj njenega nadzora?

Pri tem je pomembno vključiti informacije o njenem dosedanjem delovanju. Pacientka svoje učne ure skrbno načrtuje, prizadeva si, da so vsebinsko kakovostne in zanimive ter izraža visoko stopnjo odgovornosti do dijakov. Na podlagi teh informacij je mogoče oblikovati bolj uravnoteženo misel, na primer: »Moja odsotnost je posledica zdravstvenih težav in ne pomeni, da sem slaba učiteljica ali razredničarka. Dijaki so pomembni, svojo vlogo razredničarke jemljem resno, vendar ne morem biti odgovorna za bolezen in vse posledice bolezni.«

Miselno preoblikovanje lahko tako zmanjša občutke krivde, tesnobe ter hkrati oslabi potrebo po pretiranem nadzoru. Pomemben terapevtski cilj je tudi postopno ločevanje osebne vrednosti od popolnega opravljanja poklicne vloge.

Pacientko smo učili tudi tehnik preusmerjanja pozornosti, katerih namen je zmanjšati usmerjenost v ponavljajoče se skrbi, premlevanje in samokritične misli ter pozornost (ponovno) usmeriti na neposredno izkušnjo. Tehnika je posebej uporabna v situacijah, ko pacientka opazi, da se njene misli vedno znova osredotočajo na zdravstvene težave, odsotnost z delovnega mesta, dijake ali pričakovano vrnitev v šolsko okolje.

V okviru obravnave se je pacientka učila namerno usmerjati pozornost na konkretne predmete v prostoru. Pri tem predmet vizualno opazuje in pri sebi poimenuje njegove značilnosti, na primer barvo, obliko, velikost, material, površino ali druge zaznavne la-

stnosti. Namen vaje je, da pozornost odmakne od notranjega toka skrbi in jo usmeri na trenutno prisotne zunanje dražljaje. To tehniko je trenirala, da bi jo lahko kasneje uporabila v situacijah premlevanja o skrbih ali drugih negativnih mislih.

Druga uporabljena vaja je kognitivno zahtevnejše odštevanje po sedem od števila 1000, torej 1000–993–986–979 itd. Naloga zahteva aktivno vzdrževanje in usmerjanje pozornosti ter delovnega spomina, zato lahko začasno zmanjša prostor, ki ga v miselnem procesu zavzemajo vsiljive oziroma ponavljajoče se skrbi. Pri tem je pomembno, da cilj vaje ni doseganje matematične pravilnosti, temveč aktivna preusmeritev pozornosti na konkretno nalogo.

Pri pacientki se omenjena tehnika uporablja predvsem v situacijah, ko zazna povečano notranjo napetost ali začetek premlevanja. Tehnika temelji na fleksibilnem upravljanju pozornosti. Pacientka se uči, da ji ni treba slediti vsaki misli, ki se pojavi, temveč lahko sama izbere, kam bo v določenem trenutku usmerila pozornost. S tem se zmanjšuje dolgotrajno ukvarjanje z vsebinami, ki jih v danem trenutku ni mogoče učinkovito rešiti. Pomembno je poudariti, da preusmerjanje pozornosti ni namenjeno potlačevanju ali zanikanju skrbi, ampak gre za kratkoročno strategijo uravnavanja pozornosti, ki pacientki omogoča, da prekine začarani krog premlevanja. Vsebine, ki zahtevajo nadaljnjo obravnavo, lahko nato naslovi v ustreznem času, na primer v okviru predhodno dogovorjenega časa za skrbi ali v pogovoru z nekom ter v okviru terapije.

Ker pacientka veliko premleva, smo jo učili tudi tehnike načrtovanega časa za skrbi. Namen omenjene tehnike je omejiti spontano in dolgotrajno ukvarjanje s skrbmi ter posamezniku omogočiti bolj kontroliran odnos do njih. Pacientka določi časovni interval, namenjen skrb, maksimalno v trajanju 20 do 30 minut dnevno. Ko se skrb pojavi zunaj tega intervala, jo zapiše in njeno razmišljanje odloži na načrtovani čas. V času za skrbi nato oceni, ali je skrb rešljiva ali nerešljiva. Pri rešljivi skrb se oblikuje konkreten naslednji korak, pri nerešljivi pa se pacientka uči sprejemanja negotovosti in opuščanja nadaljnjega premlevanja.

Pri pacientki je to pomembno zlasti zato, ker ji omogoča razlikovanje med skrbjo kot procesom in dejanskim reševanjem problema. Na primer, razmišljanje o tem, ali bo vodstvo po njeni vrnitvi cenilo njeno delo, samo po sebi ne poveča njenega nadzora nad situacijo. Nasprotno pa lahko konkretno pripravljanje na asertivno komunikacijo poveča njeno dejansko sposobnost odzivanja.

Pomemben del nadaljnje obravnave predstavlja priprava pacientke na vrnitev v delovno okolje. Glede na njeno doživljanje novega vodstva in prepričanje, da njeno delo ni dovolj cenjeno, je smiselno razvijati predvsem asertivne komunikacijske spretnosti.

Asertivna komunikacija pomeni sposobnost jasnega in spoštljivega izražanja lastnih potreb, mnenj, pričakovanj in meja. Pri tem posameznik ne zanemara pravic drugih,

vendar se tudi ne odreka lastnim potrebam zaradi izogibanja konfliktu ali želje po odobravanju.

V okviru učenja asertivnosti uporabimo igranje vlog, pri katerem pacientka vadi različne situacije, ki bi se lahko pojavile ob vrnitvi na delo. Primeri vključujejo pogovor z vodstvom o pričakovanjih, odzivanje na kritiko, izražanje nestrinjanja, prošnjo za dodatna pojasnila ter postavljanje meja glede delovnih obveznosti.

Razvoj asertivnosti je pomemben tudi z vidika zmanjševanja stresa, saj povečuje občutek osebne učinkovitosti. Pacientka lahko postopoma razvije prepričanje, da ni potrebno, da vedno izpolni vsa pričakovanja okolice, temveč lahko svoje potrebe in omejitve izrazi na jasn in konstruktiven način.

Rezultati

V okviru obravnave smo s pacientko dosegli zastavljene cilje, saj se je vrnila na delovno mesto z ozaveščenimi odločitvami glede svojega novega načina delovnega funkcioniranja oziroma delovne etike. Naučila se je biti bolj fleksibilna v uravnoteževanju zmogljivosti in naporov, znižala je svoj perfekcionizem.

Naučila se je prepoznavati povezave med situacijami, avtomatskimi mislimi, čustvi, telesnimi odzivi in vedenjem, kar ji je pomagalo razumeti svoje doživljanje in funkcioniranje. Začela je vzpostavljati kontrolo nad svojimi mislimi in vedenjem. Z miselnim preoblikovanjem oziroma razvijanjem bolj uravnoteženih razlag je bila manj v stresu oziroma manj napeta. Posledično je lažje govorila, čutila je manj navora in utrujenosti ob govoru, nastopanju. Uporaba preusmerjanja pozornosti in načrtovanega časa za skrbi je bila usmerjena v zmanjševanje premlevanja in bolj fleksibilno upravljanje pozornosti. Igranje vlog je bilo namenjeno pripravi na asertivno komunikacijo ob vrnitvi na delo.

V okviru obravnave smo uporabili modele in tehnike, ki so predlagane v literaturi klinično psihološke obravnave oziroma kognitivno-vedenjske terapije glasovnih težav (3,4).

Razprava

Primer kaže, da lahko telesna težava v kombinaciji z daljšo odsotnostjo z dela aktivira miselne vzorce, ki povečujejo psihološko obremenitev in vzdržujejo telesne težave. Pri pacientki so bili pomembni predvsem visoki standardi, samokritičnost in občutek odgovornosti za posledice, ki jih ni moč v celoti nadzorovati. Miselni model omogoča učinkovito razlikovanje med dejstvom in razlago, kar je pomembno izhodišče za nadaljnje delo. Vedenjsko-kognitivna terapija predstavlja učinkovito obliko pomoči v okviru timske obravnave glasovnih težav (3,4,5).

Zaključek

Vedenjsko-kognitivna obravnava pacientke je usmerjena v zmanjševanje psihološke obremenitve, povezane z zdravstvenimi težavami, bolniško odsotnostjo in negotovostjo glede zdravja, kvalitete glasu, kvalitete življenja ter delazmožnosti.

Terapevtski cilj je bil povečati psihološko fleksibilnost, tako da lahko navedene osebnostne in poklicne prednosti ohrani, ne da bi pri tem prevzemala nesorazmerno odgovornost ali svojo osebno vrednost pogojevala z brezhibnim opravljanjem poklicne vloge. Takšen pristop lahko prispeva k uravnoteženi rabi glasu, govora, nadzoru oziroma preprečevanju prevelike stopnje splošnega napora ter učinkovitejšemu spoprijemanju s stresom, večjemu občutku kompetentnosti ter postopnemu in bolj vzdržnemu vračanju v delovno okolje. Hkrati pa smo z naučenimi tehnikami želeli preprečiti pogostejše ponavljanje težav tako na telesnem kot tudi psihološkem področju.

Etika, soglasja in financiranje

V prispevku so podatki o pacientki predstavljeni tako, da je identiteta posameznice varovana. Pri objavi kliničnega primera smo zagotovili ustrezno anonimizacijo in upoštevali veljavne etične zahteve glede osebnih podatkov.

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Voice Improvement Following Hyaluronic Acid Injection into the Vocal Folds under Local Anesthesia

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STRUCTURED ABSTRACT

Background/Introduction: Unilateral vocal fold paresis and other causes of glottic insufficiency may result in significant voice impairment. Injection laryngoplasty with hyaluronic acid can improve glottic closure and voice quality. The aim of this study was to evaluate subjective and objective voice outcomes following office-based hyaluronic acid injection into the vocal folds under local anesthesia. **Methods:** A retrospective review of patients treated with hyaluronic acid injection into the vocal folds at the Department of Otorhinolaryngology and Cervicofacial Surgery, University Medical Centre Ljubljana, from October 2025 onwards. The Voice Handicap Index (VHI) and acoustic voice analysis using the Multi-Dimensional Voice Program (MDVP) were assessed before and 6–23 days after the procedure. Fundamental frequency (F0), jitter (JIT), shimmer (SH), and noise-to-harmonic ratio (NHR) were analyzed. Due to the small sample size, the results were evaluated descriptively using median values. **Results:** Seventeen patients underwent office-based hyaluronic acid injection. Pre- and postoperative VHI and MDVP data were available for 12 patients. The median VHI score decreased from 72 to 44.5 points, with a median improvement of 15 points. All patients demonstrated improvement in VHI score. The median F0 decreased from 166.5 to 153.5 Hz, JIT from 3.30% to 2.15%, and SH from 5.25% to 4.8%. The median NHR showed a minimal increase from 0.14 to 0.15. Two patients underwent repeat injection after 129 and 140 days, respectively, following recurrence of symptoms and a desire for repeat treatment. **Conclusion:** Office-based hyaluronic acid injection into the vocal folds under local anesthesia appears to be a feasible treatment option for selected patients with vocal fold insufficiency and may improve patient-reported voice outcomes. Further prospective studies with larger and more homogeneous patient populations are needed to confirm these findings and evaluate long-term treatment outcomes. **Keywords:** hyaluronic acid; voice quality; vocal cord paralysis; laryngoplasty; anesthesia, local.

Introduction

Injection laryngoplasty (IL) was introduced in 1911 as a treatment for unilateral vocal fold paralysis. Over the last century, the indications have expanded to vocal cord atrophy, bowing and scarring. Historically the procedure has been performed under

general anesthesia with a transoral approach (1); it is now routine to perform IL in the office under local anesthesia by transoral, percutaneous or transnasal approaches (2). Patients selected for this technique must be cooperative and have minimal gag reflex (3). Performing IL under local anesthesia has benefits of decreased cost, operative time and immediate assessment regarding the glottic closure and voice quality during injection (1,3). General anesthesia offers superior visualization and theoretically improved injection accuracy (1).

Unilateral vocal fold paralysis is partially or fully impaired vocal cord movement due to injury to its efferent motor input at any point along the neuromuscular pathway from central nervous system to the intrinsic laryngeal muscles. The main cause is injury to the vagus nerve or its terminal branch, the recurrent laryngeal nerve (RLN), due to neoplastic, traumatic, iatrogenic or idiopathic causes. Long trajectory of vagus nerve makes it prone to injury. The RLN provides sensations below the glottis and innervates the posterior cricoarytenoid, lateral cricoarytenoid, interarytenoid, thyroarytenoid and aryepiglottic muscle. The main trunk of the RLN consists of 4 times more adductor motor fibres compared to abductor motor fibres, with both groups of fibres randomly distributed throughout the RLN. More severe RLN injury will lead to either favorable aberrant reinnervation with an improved voice or failed reinnervation with a poor voice. Laryngeal synkinesis indicates aberrant cross-reinnervation between the adductor and abductor RLN fibres, which may have positive or negative effect on voice and breathing. The final position of the paralyzed vocal fold ranges from median to lateral position and is influenced by the degree of RLN reinnervation, laryngeal synkinesis, possible aberrant reinnervation by adjacent nerves and fibrosis of the denervated laryngeal muscles (4).

During the waiting time for RLN recovery, two management options are observation or temporary IL. Studies suggest that IL improves short term quality of life, voice quality and acoustic parameters compared to observation alone and that injections may decrease the need for permanent thyroplasty (5,6). The injection of the temporary agent appears to influence final resting position of the immobile vocal fold either by altering the process of reinnervation or creating fibrosis. Synkinetic reinnervation of the immobile vocal cord while it is in a favorable position provided by the temporary agent may be responsible for the reduced rate of permanent intervention. Medialized immobile vocal cord may receive vibro-tactile feedback from contact with its mobile counterpart and this sensory feedback promotes nerve regeneration (6,7,8). Functional neuroimaging has shown that early IL can trigger a specific brainstem-mediated neuroplasticity leading to vocal fold motion recovery, while providing a proprioceptive boost offering possible long-term reinnervation benefits (4). Alternatively, the injection material may induce local inflammation and subsequent fibrosis within the paralyzed vocal fold, providing a robust surface for vocal fold vibration (8).

Historically management strategies have favored a conservative approach, waiting up to 12 months for potential spontaneous recovery. Recent studies suggest that early intervention with IL may significantly improve patient outcomes (2). The time period for early intervention is variable and can range anywhere from one to six months of diagnosis (5). Defining the time window for the beginning and end point for synkinetic reinnervation is difficult. A chronic phase of RLN regeneration following a complete transection injury may be seen 4 to 5 months post-injury. For those with less severe RLN injuries the reinnervation time may begin sooner than in 4 months (7). Early medialization reduces aspiration and improves cough ability in patients with a new onset of unilateral vocal fold paralysis after thoracic surgery. Patients who do not receive early intervention are four times more likely to undergo thyroplasty in the future (8).

Injection materials for IL can be categorized into short-lasting/temporary (bovine gelatin, collagen-based products, hyaluronic acid, carboxymethylcellulose) and long-lasting (autologous fat, calcium hydroxyapatite, polydimethylsiloxane) according to the duration of their effect (4,8). The optimal material for injection would be biocompatible, easily injectable, readily available, with minimal preparation required, have biomechanical properties that were the same as or similar to the vocal fold component being augmented, resistant to resorption and migration and easily removable in case of revision surgery. The material should have similar viscoelastic properties to the lamina propria. Hyaluronic acid is a high molecular weight glycosaminoglycan that is present in the extracellular matrix of lamina propria of vocal fold mucosa. It shows the closest match to native vocal fold viscoelasticity of any other injectable material that has been evaluated and offers an excellent biocompatibility. If the viscoelasticity of the injected material is different from the vocal fold mucosa, it might interfere with vocal fold vibration and mucosal wave propagation (9). In a comparison of two different particle sizes of hyaluronic acid, the effect of medialization using hyaluronic acid of larger particle size was more durable (10). The approximate duration of hyaluronic acid effect is between four and six months, although several studies suggest a period up to nine months. Long term effect occurs through a better psychosocial quality of life due to early involvement in social participation (3).

The complication rate of hyaluronic acid IL is low. In rare cases it can provoke inflammatory response, which may range from localized vocal fold edema to more severe airway edema accompanied by dyspnea and stridor. Such reactions usually manifest within 24 to 48 h following the procedure and may result from allergic reactions, ischemia, vascular occlusion or infection (3,4). Other complications during the procedure are patient discomfort, poor visibility, vasovagal reactions and oxygen desaturation. Post procedure complications are rapid absorption of the injected material and injection to the superficial lamina propria, vocal fold hemorrhage and paraglottic hematoma (11).

Methods

We retrospectively reviewed the medical records of patients who were treated at the Department of Otorhinolaryngology and Cervicofacial Surgery, University Medical Centre Ljubljana, from October 2025 onwards with the hyaluronic acid injection into the vocal folds under local anesthesia.

Prior to the procedure, all patients underwent an endoscopic examination of the larynx using a rigid endoscope, based on which the indication for surgery was established. Candidates for surgery had unilateral vocal fold paresis of various etiologies (ascending aortic aneurysm, esophageal carcinoma, mediastinal metastases, lung carcinoma, total or partial thyroidectomy, stenting of the right subclavian vein, and anterior cervical spine surgery), vocal fold sulcus, or vocal fold scarring (following radiotherapy and chemotherapy, or following multiple microlaryngoscopic procedures for laryngeal papillomatosis).

Before the procedure, patients completed the standardized Voice Handicap Index (VHI) questionnaire, which is used for the subjective assessment of the patient's perceived impairment caused by a hoarse voice. The questionnaire assesses the functional, physical, and psychosocial impact of voice disorders on the patient. It consists of 30 questions divided into three subscales: the functional subscale (VHI-F), the physical subscale (VHI-P), and the emotional subscale (VHI-E). The scores for each subscale are calculated separately, as well as the total score. For each question, patients rate the severity of their difficulties on a scale from 0 to 4, with a maximum total score of 120 points. A score of 0–30 points indicates a low level of impairment due to voice problems, 31–60 points indicates moderate impairment, and 61–120 points indicates severe impairment due to voice problems (12).

For an objective assessment of voice quality, acoustic voice analysis was performed using the Multi-Dimensional Voice Program (MDVP; KayPentax, USA), which is used to analyze fundamental frequency and other acoustic parameters. Three-second samples of the vowel /a/, produced at a habitual pitch and loudness, were recorded and analyzed. For each sample, the fundamental frequency (F0), jitter (JIT), shimmer (SH), and noise-to-harmonic ratio (NHR) were determined. JIT assesses variations in the frequency of the sound signal, i.e., pitch perturbation. SH indicates variations in the amplitude of the sound signal, i.e., amplitude perturbation. NHR is the ratio of the energy of inharmonic components of the sound in the frequency range of 1500–4500 Hz to the energy of harmonic components in the range of 70–4500 Hz and represents an estimate of the amount of noise present in the analyzed voice sample. According to the recommendations of the European Laryngological Society (ELS), JIT and SH are used for the assessment of voice quality (12).

The procedure was performed as a day-case procedure in the phoniatric outpatient clinic of the Department of Otorhinolaryngology and Cervicofacial Surgery, University

Medical Centre Ljubljana. Patients presented fasting. A flexible nasolaryngoscope with a working channel and a recording tower was used. A total of 4 mL of 4% lidocaine was administered intranasally using soaked pledgets; an additional 2 mL was administered by spray into the nasopharynx, and 4 mL was applied to the larynx through the working channel of the flexible endoscope. Following administration of the local anesthetic, an injection needle was introduced through the working channel, and hyaluronic acid (Juvederm Ultra Smile) was injected into the vocal fold(s), with a volume ranging from 0.15 to 0.5 mL per vocal fold.

After the procedure, patients remained under observation for 2 hours, during which oxygen saturation and blood pressure were monitored.

Between the sixth and twenty-third postoperative day, patients completed the VHI questionnaire again, underwent MDVP acoustic voice analysis, and had a follow-up endoscopic examination of the larynx using a rigid endoscope.

Results

From October 2025 until the time of writing, hyaluronic acid was injected into the vocal folds under local anesthesia in 17 patients. In two patients, the injection was repeated after 129 and 140 days, respectively, because the effect had worn off and the patients wished to undergo a repeat injection.

We obtained pre- and postoperative VHI questionnaire responses from 12 patients. The median preoperative VHI score was 72 points, compared with 44.5 points postoperatively. All patients showed a reduction in their VHI score, with a median improvement of 15 points. The greatest improvement was 79 points, while the smallest improvement was 4 points.

We obtained pre- and postoperative MDVP data from 12 patients. The median F0 was 166.5 Hz preoperatively and 153.5 Hz postoperatively. The median JIT decreased from 3.30% preoperatively to 2.15% postoperatively. Five patients had a lower JIT postoperatively, while seven had a higher JIT.

The median SH decreased from 5.25% preoperatively to 4.8% postoperatively. Seven patients had a lower SH postoperatively, while five had a higher SH. The median NHR was 0.14 preoperatively and 0.15 postoperatively.

Discussion

In this retrospective case series, office-based hyaluronic acid injection into the vocal folds under local anesthesia was associated with an improvement in patient-reported voice-related disability. The median VHI score decreased by 15 points. These findings suggest that hyaluronic acid injection may provide a clinically relevant improvement in subjective voice-related outcomes in appropriately selected patients.

The observed improvement in VHI scores is consistent with previous studies reporting beneficial effects of IL on patient-reported voice outcomes (3,5,6).

In our study, the median F0, JIT and SH decreased. However, the individual results were heterogeneous: five patients demonstrated a reduction in JIT, while seven showed an increase, and seven patients demonstrated a reduction in SH, while five showed an increase. The median NHR showed only a minimal increase from 0.14 to 0.15. These findings indicate that although the overall median values of some acoustic parameters improved, the response was not uniform across patients. This variability may reflect differences in the underlying etiology of vocal fold dysfunction, the degree of glottic insufficiency, vocal fold tissue characteristics, and the amount and location of injected material. The decrease in VHI scores appears particularly relevant from a clinical perspective, as it reflects the patients' subjective perception of their voice-related impairment. In contrast, acoustic parameters provide an objective assessment of specific characteristics of the voice and may not always correspond directly to the patient's perceived improvement. The finding that all patients with available VHI data demonstrated improvement therefore suggests that the procedure may have a meaningful impact on patients' everyday voice-related functioning, even when changes in individual acoustic parameters are less consistent.

An additional potential advantage of the described technique is that the procedure can be performed in an outpatient setting under local anesthesia. Office-based IL avoids general anesthesia and may therefore be particularly useful in patients who are poor candidates for general anesthesia or in whom an early, minimally invasive intervention is desirable. Previous literature reported comparable voice outcomes for IL performed under local and general anesthesia, supporting the feasibility of performing the procedure under local anesthesia (1).

The repeated injection required in two patients after 129 and 140 days, respectively, is consistent with the temporary nature of hyaluronic acid augmentation. Both patients requested repeat treatment after the initial effect had subsided. This observation is in accordance with previous reports describing hyaluronic acid as a temporary injectable material and highlights the potential need for repeated treatment depending on the duration of clinical benefit and the patient's individual needs (6,9).

Several limitations of this study should be acknowledged. First, the study included a small number of patients, and only 12 had pre- and postoperative VHI and MDVP data available. Therefore, the findings should be interpreted as preliminary and descriptive, and no definitive conclusions regarding treatment efficacy can be drawn. The duration of follow-up was also limited, preventing a comprehensive assessment of the long-term durability of treatment. Because the amount of hyaluronic acid injected was individualized, differences in injection volume may also have influenced the postoperative outcomes. Despite these limitations, our findings support the feasibility of office-

based hyaluronic acid injection into the vocal folds under local anesthesia and suggest a potential benefit in terms of subjective voice-related outcomes. Larger prospective studies with standardized follow-up intervals, a more homogeneous patient population, longer follow-up, and a control group are needed to confirm these findings and to better define the clinical indications and long-term effectiveness of this approach.

Conclusion

Office-based hyaluronic acid injection into the vocal folds under local anesthesia appears to be a feasible and well-tolerated treatment option for selected patients with vocal fold insufficiency. The observed improvement in patient-reported voice outcomes suggests a potential clinical benefit of the procedure. Further prospective studies with larger and more homogeneous patient populations are needed to confirm its effectiveness and long-term outcomes.

Ethics, Consent and Funding

Ethical Approval: The study was conducted as a retrospective review of existing medical records. No additional diagnostic or therapeutic procedures were performed as part of the study. Patient data were treated confidentially and in accordance with the applicable regulations on the protection of personal data. Ethical approval for the conduct of the study was not obtained.

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Logopedska terapija pri glasovnih motnjah – uspešen konzervativni pristop s kliničnimi primeri

Voice therapy for voice disorders – a successful conservative approach with clinical cases

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IZVLEČEK

Uvod: Glasovna terapija predstavlja uveljavljen konzervativni terapevtski pristop pri številnih glasovnih motnjah, zlasti funkcionalnih, hiperfunkcionalnih ter nekaterih benignih fonotraumatskih spremembah glasilk. Njen cilj je izboljšanje glasovne funkcije, zmanjšanje fonatornega napora ter vzpostavljanje učinkovitejšega načina glasovne produkcije, pri čemer se terapevtski postopki prilagajajo značilnostim glasovne motnje, potrebam posameznika, terapevtskim ciljem in njegovemu odzivu na terapijo. Glasovna terapija vključuje indirektno postopke, usmerjene predvsem v izobraževanje, skrb za glas ter prepoznavanje in spreminjanje glasovno obremenjujočih vedenj, in direktne postopke, namenjene neposrednemu spreminjanju glasovne produkcije. Obravnava lahko poteka individualno ali skupinsko. Individualna terapija omogoča večjo prilagoditev potrebam posameznika, skupinska pa dodatne možnosti učenja z opazovanjem, medvrstniškega modeliranja in uporabe naučenih glasovnih strategij v komunikacijskih situacijah. Dosedanje primerjalne raziskave niso pokazale jasne prednosti individualne pred skupinsko glasovno terapijo glede končnih terapevtskih izidov. Pomemben cilj obeh oblik je prenos učinkovitejšega načina glasovne produkcije v spontano komunikacijo, pri čemer imajo pomembno vlogo aktivno sodelovanje posameznika, izvajanje vaj in spreminjanje vsakodnevni glasovnih navad. V ustni predstavitvi bodo teoretična izhodišča ponazorjena z izbranimi kliničnimi primeri različnih glasovnih motenj in terapevtskih pristopov.

Ključne besede: glasovna terapija, glasovne motnje, konzervativno zdravljenje, klinični primeri

ABSTRACT (ENGLISH SUMMARY)

Voice therapy is an established conservative approach in the management of a range of voice disorders, particularly functional and hyperfunctional disorders and selected benign phonotraumatic vocal fold lesions. Treatment is individualized according to the characteristics of the voice disorder, the patient's needs, therapeutic goals, and response to therapy. Contemporary voice therapy combines indirect interventions, including education and modification of vocally demanding behaviors, with direct interventions

aimed at improving voice production and phonatory efficiency. Therapy may be delivered individually or in groups. Individual therapy allows greater adaptation to individual needs, while group therapy offers opportunities for observational learning, peer modeling, and practice in everyday communication. Current comparative evidence does not demonstrate a clear advantage of individual over group therapy in terms of treatment outcomes. Successful therapy also depends on active participation, regular practice, and generalization of newly acquired vocal strategies to everyday communication.

Keywords: voice therapy, voice disorders, conservative treatment, clinical cases

Uvod

Glasovne motnje predstavljajo heterogeno skupino motenj, ki se lahko kažejo z odstopanji v višini, glasnosti, kakovosti glasu, ritmu in prozodičnih značilnostih ter lahko negativno vplivajo na komunikacijo posameznika [1]. Tradicionalno jih delimo na organske in funkcionalne. Pri organskih glasovnih motnjah je prisotna strukturna sprememba, ki vpliva na glasovno produkcijo, medtem ko so funkcionalne glasovne motnje povezane s prekomerno ali neustrezno uporabo na videz normalnega glasovnega aparata [2]. Mathieson [3] med hiperfunkcionalnimi glasovnimi motnjami razlikuje mišično-tenzijsko disfonijo (MTD) brez opaznih sprememb na sluznici glasilk in MTD s sluzničnimi spremembami, med katere sodijo tudi vozličji in polipi.

Sodobnejši okvir vokalne hiperfunkcije razlikuje med fonotravmatsko in nefonotravmatsko hiperfunkcijo. Fonotravmatska hiperfunkcija je etiološko povezana z nastankom benignih lezij lamine proprie, medtem ko nefonotravmatska hiperfunkcija predstavlja ključni mehanizem primarne MTD brez prisotne tkivne poškodbe. Hiperfunkcija je lahko sprva prehodni odziv na povečane glasovne zahteve, nezadosten glasovni počitek, psihofizični stres, dehidracijo ali neugodne okoljske dejavnike, pri nekaterih posameznikih pa lahko takšen vzorec preide v kronično stanje [4].

Glasovne motnje ne vplivajo samo na kakovost glasu, temveč lahko omejujejo vsakodnevno komunikacijo, socialno udeležbo, poklicno delovanje in kakovost življenja. Pri osebah z glasovnimi motnjami so opisane funkcionalne, fizične in čustvene omejitve [5]. Opisana je tudi večja psihološka obremenitev, vključno z anksioznostjo in depresivnimi simptomi [6]. Glasovne motnje predstavljajo tudi ekonomsko breme zaradi izgube delovnih dni in stroškov zdravljenja [7] ter so povezane z odsotnostjo z dela [8–10].

Glasovna terapija

Glasovna terapija predstavlja uveljavljen konzervativni terapevtski pristop pri številnih glasovnih motnjah. Klinične smernice American Academy of Otolaryngology–Head and Neck Surgery Foundation podajajo močno priporočilo za uporabo glasovne terapije pri bolnikih z disfonijo, katere vzrok je primeren za takšno zdravljenje. Priporočilo

temelji na kakovostnih dokazih iz sistematičnih pregledov in randomiziranih raziskav. Med pričakovanimi koristmi smernice navajajo izboljšanje z glasom povezane kakovosti življenja, preprečevanje ponovitve težav ter možnost, da se zmanjša potreba po invazivnejšem zdravljenju [11].

Pomemben predpogoj glasovne terapije je ustrezna medicinska diagnostika. Smernice priporočajo diagnostično laringoskopijo pred začetkom glasovne terapije ter posredovanje ugotovitev logopedu. Namen takšne diagnostike je prepoznati stanja, ki niso primerna za glasovno terapijo, ter omogočiti ustrezno usmerjeno terapevtsko obravnavo [11]. Zdravljenje glasovnih motenj lahko glede na ugotovljen vzrok vključuje opazovanje, medikamentozno zdravljenje, glasovno terapijo, kirurško zdravljenje ali kombinacijo posameznih pristopov [11].

Glasovna terapija ima posebno pomembno mesto pri funkcionalnih, zlasti hiperfunkcionalnih glasovnih motnjah ter pri nekaterih bolnikih z benignimi fonotraumatskimi spremembami glasilk. Njen cilj ni nujno vzpostavitev idealiziranega oziroma popolnoma »normalnega« glasu, temveč doseganje funkcionalnega in za posameznika sprejemljivega glasu, ki omogoča učinkovito vsakodnevno komunikacijo. Med osnovne cilje sodijo izboljšanje glasovne funkcije, zmanjšanje fonatornega napora ter vzpostavljanje učinkovitejšega načina glasovne produkcije [1,12].

Glasovne terapije pri tem ni mogoče razumeti kot enotnega terapevtskega protokola, vezanega izključno na diagnozo. Izbor in kombiniranje terapevtskih tehnik se prilagajata značilnostim glasovne motnje, potrebam posameznika, terapevtskim ciljem in njegovemu odzivu na terapijo. Terapevtske tehnike se zato v klinični praksi pogosto kombinirajo ter prilagajajo značilnostim glasovne motnje in terapevtskim ciljem [1].

Sodobna klasifikacija glasovne terapije razlikuje med direktnimi in indirektnimi terapevtskimi postopki. Direktni postopki neposredno spreminjajo glasovno vedenje z motorično izvedbo ter uporabo somatosenzorične in slušne povratne informacije, indirektni postopki pa so usmerjeni v spreminjanje dejavnikov in okoliščin, v katerih glasovna produkcija poteka [13]. Indirektni pristopi tako vključujejo predvsem izobraževanje o delovanju in skrbi za glas, prepoznavanje in spreminjanje glasovno obremenjujočih vedenj, povečanje zavedanja lastnega glasovnega vedenja in oblikovanje funkcionalno ustrežnejših komunikacijskih navad [12,14,15].

Direktni terapevtski postopki so usmerjeni neposredno v spremembo glasovne produkcije. Izbirajo se glede na ugotovljena odstopanja v tvorbi glasu ter so namenjeni optimizaciji fonacije, izboljšanju respiratorno-fonatorne koordinacije in ustrežnejšemu ravnovesju glotisne in supraglotisne aktivnosti. Glasovna terapija pri tem vključuje učenje novih motoričnih vzorcev oziroma spreminjanje neučinkovitih načinov glasovne produkcije [12,16].

Glasovna terapija lahko poteka individualno ali skupinsko. Individualna obravnava omogoča večjo prilagoditev terapevtskih postopkov potrebam posameznika in večjo usmerjenost terapevta v specifična glasovna odstopanja [17,18]. Skupinska terapija omogoča učenje z opazovanjem drugih udeležencev, medvrstniško modeliranje, izmenjavo izkušenj ter uporabo naučenih glasovnih strategij v bolj naravnih komunikacijskih situacijah [16,18]. Primerjalne raziskave niso pokazale jasne prednosti individualne pred skupinsko glasovno terapijo glede končnih terapevtskih izidov; izboljšanja so bila ugotovljena pri obeh oblikah obravnave [17–19].

Ne glede na izbrano obliko in posamezne terapevtske postopke je pomemben cilj glasovne terapije prenos učinkovitejšega načina glasovne produkcije v spontano komunikacijo. Aktivno sodelovanje posameznika, izvajanje vaj ter spreminjanje vsakodnevnih glasovnih navad so zato sestavni del terapevtskega procesa in pomembni za dolgoročno ohranjanje doseženih sprememb [1,16].

Razprava

Predstavljena teoretična izhodišča bodo v ustni predstavitvi ponazorjena z izbranimi kliničnimi primeri. Primeri bodo prikazovali različne glasovne motnje, glasovne zahteve in terapevtske cilje ter uporabo individualne in skupinske glasovne terapije. Poseben poudarek bo namenjen profesionalnim in elitnim glasovnim uporabnikom ter konzervativni obravnavi hiperfunkcionalnih in fonotravmatskih glasovnih motenj.

Zaključek

Glasovna terapija ni enoten protokol, temveč individualno prilagojen proces, usmerjen v doseganje funkcionalnega in za posameznika sprejemljivega glasu. Pri glasovnih motnjah, primernih za glasovno terapijo, ta predstavlja pomemben konzervativni pristop, bodisi kot samostojna obravnava bodisi kot del kombinirane obravnave. Individualna in skupinska oblika terapije imata različne prednosti, vendar primerjalne raziskave ne kažejo jasne dolgoročne prednosti ene pred drugo. Ključ do uspešnega izida je ustrezna diagnostika, ciljno izbrana terapija ter prenos naučenih strategij v vsakodnevno glasovno rabo.

Etika, soglasja in financiranje

Navzkrižje interesov: Avtorici izjavljava, da ni navzkrižja interesov.

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Obravnava bolnika z distonijo grla

Management of patients with laryngeal dystonia

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STRUKTURIRANI IZVLEČEK

Uvod: Laringealna distonija, imenovana tudi spazmodična disfonija ali spastična disfonija, je kronična žariščna distonija, specifična za določeno dejavnost, ki prizadene predvsem govor in pomembno vpliva na kakovost življenja, povezano s komunikacijo.

Metode: standardno zdravljenje laringealne distonije je zdravljenje z injiciranjem botulinškega toksina, običajno pod nadzorom elektromiografije, ki ga je treba v rednih časovnih presledkih ponavljati, saj učinek toksina sčasoma izzveni.

Rezultati: na Kliniki za ORL in CFK zdravimo bolnike z botulinusnim toksinom od leta 1998 dalje. Sprva smo botulin injicirali perkutano z endoskopsko kontrolo, kasneje perkutano skozi votlo EMG iglo skozi krikotiroidno membrano pod EMG kontrolo. V tem času smo obravnavali 161 bolnikov, ki smo jih injicirali od 1-krat do 52-krat.

Zaključek: laringealna distonija je redka nevrološka bolezen. Pri mnogih bolnikih do pravilne diagnoze preteče več let, nekateri nikoli ne pridejo do ustreznega specialista in zdravljenja. Bolnike lahko uspešno zdravimo z injiciranjem botulinusnega toksina v mišice grla in s tem močno vplivamo na kakovost njihovega življenja.

Ključne besede: distonija grla, zdravljenje, botulinusni toksin

ABSTRACT (ENGLISH SUMMARY)

Laryngeal dystonia (LD), also called spasmodic dysphonia or spastic dysphonia, is a chronic focal, task-specific dystonia, primarily affecting speech, that can profoundly affect communication-related quality of life. The standard treatment of this disorder is with botulinum toxin injection, usually electromyography-guided, which must be repeated periodically as the toxin wears off. In Ljubljana Clinical Centre, we have been treating patients with laryngeal dystonia with botulinum toxin since 1998. During this period, we have treated 161 patients.

Keywords: laryngeal dystonia, treatment, botulinum toxin injections

Uvod

Izolirana distonija grla – laringealna distonija (LD) je redka, nevrolška, neozdravljiva bolezen, ki prizadene intrinzične mišice grla (1). Bolezen so prvič opisali leta 1871, tedaj so menili, da gre za psihogeno pogojeno motnjo govora, šele kasneje se je izkazalo, da gre za nevrolško bolezen, ki je podobna kot sta npr. tortikolis ali grafospazem (2). LD je bolezen primarne senzomotorične skorje, motoričnih in asociativnih kortikalnih predelov, talamusa, cerebeluma in bazalnih ganglijev (1). LD je multifaktorska bolezen. Etiologija ostaja nepojasnjena. Precejšnje vlogo imajo genetski faktorji, saj ima kar 25 % bolnikov pozitivno družinsko anamnezo distonije, 12 % bolnikov pa ima v anamnezi v družini nevrolške motnje gibanja (3). Dejavniki okolja, kot so respiratorne okužbe, poškodbe vratu, želodčni refluks, zlasti pa različni stresorji predstavljajo zunanje dejavnike tveganja za razvoj bolezni. Med zunanjimi dejavniki so pomembni tudi profesionalna raba glasu ter psihološke motnje, kot sta depresija in anksioznost (1, 3). Pri LD gre za selektivno hiperfunkcijo mišic. Klasifikacija LD temelji na skupini mišic, ki je prizadeta. Adduktorna LD (ADLD) je najpogostejša oblika bolezni, prizadene 80 % bolnikov. Pri tej obliki bolezni opazimo intermitentno abnormalno aktivnost tiroaritenoidne mišice (TA) in lateralne krikoaritenoidne mišice (LCA). Zato imajo bolniki nehoteno »stiskanje« grla in napeto tvorbo glasu. Abduktorna distonija zajema le 10-15 % bolnikov z LD. Pri tej obliki bolezni je povečana aktivnost posteriorne krikoaritenoidne mišice (PCA) med fonacijo, zato je glas zadihan in asteničen. Poznamo še mešano LD, LD pri petju in respiratorno LD, vendar so te oblike redke. LD se lahko pojavi tudi v sklopu generalizirane distonije (4). Ženske so prizadete pogostejše (4:1), najpogostejše zbolevalo bolniki stari okoli 40 let. Večina razvije simptome postopoma, nekateri tudi nenadno, zlasti po stresu ali akutni respiratorni okužbi (1).

Diagnoza

Diagnostični postopek predstavlja izziv, saj ni objektivne metode, ki bi potrdila diagnozo LD. V postopku sodelujejo otorinolaringolog, klinični logoped, nevrolog in klinični psiholog (1,5). Diagnoza temelji na anamnezi, analizi glasu in prepoznavi značilnih vokalnih spazmov. Pri 58 % bolnikov alkohol omili simptome. Določeni senzorni triki, kot so telesne kretnje, npr. dotik ustnice s prstom, lahko začasno prekinajo simptome LD. Bolnika lahko prosimo, da bere besedilo, ki razkrije ADLD (v besedilu naj prevladujejo samoglasniki) ali ABLD (besedilo s čim manj samoglasniki) (3). LD moramo ločiti od tremorja grla in mišično-tenzijske hripavosti. Pri LD je uspeh glasovne terapije slab, zelo dober pa je učinek injiciranja botulina, v nasprotju z bolniki s tremorjem, mišično-tenzijsko hripavostjo ali psihogeno pogojenimi težavami (1).

Zdravljenje

Bolezen je neozdravljiva. Začasno lahko omilimo simptome z injiciranjem botulinum neurotoksina (BoNT) v mišice grla, ki je kemični denervator. Blokira sproščanje acetil-

holina iz holinergičnih živčnih končičev, posledica česar je začasna paraliza mišic in olajšanje spazmov. Namen terapije je doseči tekoč govor za čim daljši čas, z minimalnimi stranskimi učinki v enem ciklu zdravljenja (3). Stranski učinki so lahko precej izraženi in so moteči. Glas je šibek, tekočina se zaletava, lahko se pojavijo težave pri dihanju. Minejo približno v treh tednih, nato nastopi obdobje dobrega učinka BoNT, ki mu sledi ponovno poslabšanje stanja in ev. ponovno injiciranje. Tako se »Botulinski cikel« ponavlja. Ugodni učinki BoNT izzvenijo v 10 -15 tednih, zaradi sinteze in razraščanja novih živčnih končičev, zato injiciranje ponavljamo na 3 -4 mesece (6).

Rezultati

BoNT injiciramo ambulantno. Uporabljamo Botulinum toxin tip A. Pri ADLD poteka injiciranje v mišice grla transkutano, skozi votlo EMG iglo skozi krikotiroidno membrano pod EMG kontrolo. Pri ABLD je pristop do PCA zahtevnejši, pri tem je potrebna lateralna rotacija grla. Po injiciranju se lahko pojavijo težave z dihanjem (3).

Na ORL Kliniki v Ljubljani smo doslej obravnavali 161 bolnikov z LD, ki smo jim injicirali BoNT od enkrat do 52-krat. Odmerke prilagajamo bolnikovi subjektivni interpretaciji učinka in stranskih učinkov. Zdravljenje je zelo individualizirano. Običajno začnemo z unilateralnim injiciranjem, z nizkim odmerkom, nato nadaljujemo v naslednjih ciklih z bilateralnim injiciranjem in dvigujemo odmerke. Bolniki navajajo povprečno 70 % izboljšanje stanja glasu in govora. V kolikor učinka ni, ali so v ospredju le stranski učinki, ugodnega obdobja pa ni, je potrebno preveriti pravilnost diagnoze. Na ORL Kliniki v Ljubljani smo BoNT za zdravljenje različnih nevroloških in drugih motenj pričeli uporabljati leta 1998. Poleg LD ga uporabljamo tudi pri zdravljenju distonije jezika, distonije odpiranja/zapiranja ust, Sy Meige, fokalne distonije glave in vratu, Sy Tourette, distonije neba in jecljanja.

Razprava

Zdravljenje z BoNT ima več pomanjkljivosti. Ena izmed njih je to, da je potrebno injiciranje dokaj pogosto ponavljati. Optimalno stanje glasu in govora dosežemo običajno le 30 % časa botulinskega ciklusa, preostali čas zavzemajo čakanje na učinek, obdobje prevelikega učinka - stranski učinki in po obdobju ugodnega učinka še čas upadanja, ki mu sledi ponovno injiciranje. Na ORL Kliniki opažamo zelo podobne rezultate zdravljenja, kot so opisani v literaturi (6).

V zadnjem času se zato pojavljajo nove tehnike zdravljenja LD, zlasti kirurške, ki imajo trajnejše učinke, vendar idealnega načina zdravljenja zaenkrat ni (7). Najpogostejše se omenja in izvaja dve kirurški tehniki in sicer endoskopsko lasersko tiroaritenoidno mio-neurektomijo, pri kateri odstranimo TA mišico, terminalne živce in živčno mišični stik ter tiroplastiko II, pri kateri razmaknemo tiroidni hrustanec v sprednjem delu in tako zmanjšamo stik med glasilkama v področju sprednje komisure (7). Na ORL Kliniki v Ljubljani omenjenih posegov ne izvajamo.

Neinvazivna nevromodulacija motoričnega korteksa in cerebeluma in vibrotaktilna električna stimulacija mišic grla so oblike zdravljenja, ki še niso prisotne v klinični praksi (8).

Invazivno globoko možgansko stimulacijo uporabljamo pri zdravljenju generaliziranih oblik distonije, pri fokalnih in segmentnih distonijah zaenkrat še ne, čeprav ima velik potencial za prenos v klinično prakso (9).

Zaključek

Laringealna distonija je zelo redka bolezen. V diagnostičnem postopku ni objektivne metode, ki bi potrdila diagnozo, zato običajno preteče veliko časa do postavitve le te. Verjetno mnogo bolnikov z LD ne pride do ustreznega strokovnjaka in pravilne diagnoze. Pri zdravljenju LD je zaenkrat najbolj standardna in široka uporaba BoNT, ki prinaša le začasno olajšanje simptomov in ga uspešno že skoraj 30 let uporabljamo tudi na ORL Kliniki v Ljubljani. V zadnjem času se vse bolj uveljavlja tudi kirurško zdravljenje, obetajo pa tudi drugi načini zdravljenja, kot so nevromodulatorno zdravljenje in nevrostimulacija.

Etika, soglasja in financiranje

Navzkrižje interesov: Avtorica izjavljam, da ni navzkrižja interesov.

Razpoložljivost podatkov: podatki, ki podpirajo ugotovitve, so na voljo pri kontaktnem avtorju na razumno zahtevo.

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Ohranjanje glasu v laringologiji: glasovni izidi po laserskih hordektomijah I–III – pregled področja

Voice preservation in laryngology: voice outcomes after type I–III laser cordectomies – a review

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STRUKTURIRANI IZVLEČEK

Uvod: Ploščatocelični karcinom glotisa je pogosto odkrit v zgodnji fazi, ko je mogoče zdravljenje izvesti z eno samo terapevtsko metodo. Transoralna laserska mikrokirurgija je uveljavljena oblika zdravljenja zgodnjega glotičnega karcinoma, vendar lahko obseg resekcije pomembno vpliva na glas. Namen tega pregleda je bil zbrati znane podatke o objektivnih in subjektivnih parametrih kakovosti glasu leto dni po zdravljenju zgodnjega karcinoma glasilk z lasersko hordektomijo I–III.

Metode: V bazi PubMed smo pregledali literaturo, objavljeno v angleškem jeziku med letoma 2015 in 2019. Po pregledu 450 zadetkov je bilo v analizo vključenih pet raziskav. Primerjali smo rezultate objektivne akustične analize glasu in subjektivne ocene kakovosti glasu eno leto po zdravljenju začetnih karcinomov glasilk z lasersko hordektomijo tipa I, II in III.

Rezultati: Število preiskovancev v raziskavah je bilo 13–66, njihova srednja starost pa 58–68 let. Postoperativna osnovna frekvenca je znašala med 149 in 174 Hz, nestabilnost frekvence (jitter) med 1 % in 3 % ter nestabilnost amplitude (shimmer) med 5 % in 17 %. Rezultati kakovosti življenja, povezane z glasom, so se precej razlikovali, pri čemer so se vrednosti indeksa glasovne oviranosti gibale od 20 do 35.

Zaključek: Razpoložljivi podatki kažejo, da se glasovna funkcija po transoralni laserski mikrokirurgiji v obdobju okrevanja izboljšuje, pri čemer je končni rezultat povezan z obsegom resekcije in drugimi dejavniki, zlasti z lokacijo tumorja. Zaradi metodološke heterogenosti obstoječih raziskav so za zanesljivo primerjavo potrebni standardizirani protokoli za objektivno in subjektivno ocenjevanje glasu.

Ključne besede: Karcinom glasilk, glas, laserska hordektomija, kakovost življenja

ABSTRACT (ENGLISH SUMMARY)

Laryngeal squamous cell carcinoma is the most common malignancy of the head and neck region, excluding cutaneous carcinomas, and is frequently diagnosed at an early stage when confined to the vocal folds. Transoral laser microsurgery is a well-established treatment for early-stage vocal fold carcinoma, although surgical resection may affect voice quality. This literature review evaluated five prospective studies published between 2015 and 2019, comparing objective acoustic parameters and subjective assessments of voice quality 1 year following laser resection. The studies included an average of 30 patients (range, 13–66), with a mean age of 60 years. Postoperative fundamental frequency ranged from 149 to 174 Hz, frequency instability from 1% to 3%, and amplitude instability from 5% to 17%. Voice-related quality-of-life outcomes varied considerably, with Voice Handicap Index scores ranging from 20 to 35. Standardized subjective and objective voice assessment methods are needed for better comparability between studies.

Keywords: Vocal fold carcinoma; voice; laser cordectomy; quality of life

Uvod

Ploščatocelični karcinom grla predstavlja približno 0,7 % vseh malignomov in je med najpogostejšimi malignimi tumorji glave in vratu, če ne upoštevamo kožnih malignomov. Med najpomembnejša dejavnika tveganja sodita kajenje in uživanje alkohola, bolezen pa se pogosteje pojavlja pri moških. Približno tri četrtine laringealnih karcinomov zajemajo glotis. Ker spremembe na glasilkah zgodaj povzročijo hripavost oziroma spremembo kakovosti glasu, so glotični tumorji pogosto odkriti v zgodnji fazi. (1–4) Začetni karcinomi glasilk so klasificirani kot Tis, T1 in T2.

Ploščatocelični karcinom glasilk zaradi skromnega limfatičnega žilja tega področja redko zaseva v regionalne bezgavke. (5) Pri načrtovanju zdravljenja zato poleg onkološke varnosti pomembno mesto zavzema tudi kakovost glasu.

Glas določajo številne akustične in fiziološke značilnosti, med drugim glasnost, višina, barva, osnovna frekvenca in glasovni obseg. Odvisen je od vibracijskih lastnosti glasilk, kakovosti glotične zapore in nadzora subglotičnega tlaka. Ker je glas pomembno sredstvo komunikacije in je za številne posameznike bistven za opravljanje poklica, lahko njegova sprememba pomembno vpliva na vsakodnevno funkcioniranje in kakovost življenja. (6)

Za zdravljenje zgodnjega karcinoma glotisa so na voljo različne terapevtske možnosti, predvsem transoralna mikrokirurgija, radioterapija in izbrane oblike odprte kirurgije. V zadnjih desetletjih se je transoralna laserska mikrokirurgija uveljavila kot ena od standardnih metod zdravljenja zgodnjega glotičnega karcinoma, saj omogoča natančno in minimalno invazivno odstranitev tumorja ob ohranjanju čim več funkcionalnega tkiva.

Za zdravljenje zgodnjih karcinomov glasilk se uporabljajo pretežno laserske hordektomije I-III. (7–10)

European Laryngological Society (ELS) je za opis obsega in globine endoskopske resekcije uvedla standardizirano klasifikacijo hordektomij. V prvotni klasifikaciji so bile opredeljene subepitelna (tip I), subligamentna (tip II), transmuskularna (tip III), totalna (tip IV) in razširjene resekcije (tip V), pozneje pa je bila uvedena tudi resekcija spretnje komisure (tip VI). (11,12) Obseg resekcije je pomemben dejavnik funkcionalnega izida, saj odstranitev dela glasilke spremeni maso, geometrijo in biomehanske lastnosti vibrirajočega tkiva.

Po resekciji tumorja se lahko zmanjšata masa in površina vibrirajočega tkiva, nastanejo brazgotinske spremembe, spremeni pa se lahko tudi kakovost glotične zapore. Posledično se lahko spremenijo osnovna frekvenca, jitter, shimmer, razmerje med harmonično in šumno komponento (ang. Noise to harmonics ratio - NHR) ter drugi parametri fonacije. (8,13)

Ocena kakovosti glasu po zdravljenju je zahtevna, saj nobena posamezna metoda ne zajame vseh vidikov glasovne funkcije. Objektivna akustična analiza omogoča kvantitativno ocenjevanje parametrov, kot so osnovna frekvenca (F0), jitter, shimmer in NHR, medtem ko subjektivni vprašalniki, zlasti Voice Handicap Index (VHI), ocenjujejo bolnikovo zaznavanje glasovne prizadetosti in njen vpliv na vsakdanje življenje. (14–17)

Namen tega prispevka je bil pregledati vpliv transoralne laserske mikrokirurške resekcije zgodnjega karcinoma glasilk na izbrane objektivne parametre glasu in kakovost življenja ter oceniti ustreznost in primerljivost razpoložljivih metod ocenjevanja glasovne funkcije.

Metode

Literaturo smo iskali v bibliografski podatkovni zbirki PubMed. Iskanje je bilo omejeno na raziskave v angleškem jeziku, objavljene med 1. januarjem 2015 in 30. decembrom 2019. Iskanje je bilo izvedeno 30. decembra 2019.

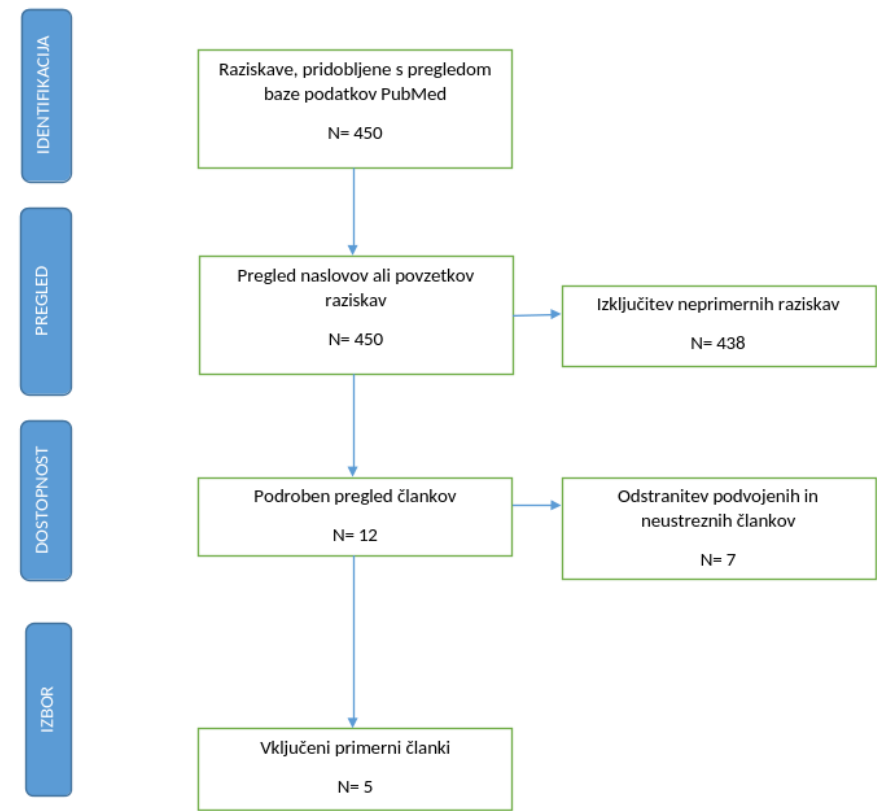
Pregledali smo 450 naslovov. Na podlagi naslova in vsebine povzetka je bilo v ožji izbor vključenih 12 člankov. Vključitveni kriteriji so bili: Stanje po laserski hordektomiji v sklopu zdravljenja začetnega karcinoma glasilk (Tis, T1, T2), raziskava z vzorcem velikosti 10 preiskovancev ali več, članek v angleškem jeziku, meritve parametrov kakovosti glasu opravljene tudi 12 mesecev po posegu. Izključitveni kriteriji: multimodalno zdravljenje karcinoma glasilk, vključene hordektomije tipa IV in več. Po odstranitvi podvojenih in vsebinsko neustreznih člankov je bilo za končno analizo izbranih pet raziskav. Vključene so bile raziskave z najmanj desetimi preiskovanci, ki so ocenjevale kakovost glasu leto dni po laserski mikrokirurški resekciji zgodnjega karcinoma glasilk z uporabo laserske hordektomije tipa I-III.

Ključne besede	Število najdenih člankov	Število ustreznih člankov
GLOTTIC CARCINOMA LASER	159	3
EARLY GLOTTIC CANCER VOICE	73	2
EARLY GLOTTIC CANCER LASER	125	4
VOCAL CORD CARCINOMA VOICE	51	1
VOICE QUALITY LASER CARCINO- MA	42	2

Tabela 1: Iskalni nizi in nabor ustreznih raziskav

Analizirali smo podatke o osnovni frekvenci (F0), jitterju, shimmerju in NHR. Med subjektivnimi merami smo upoštevali Voice Handicap Index (VHI), vključno s fizično, čustveno in funkcionalno podlestvico, kadar so bili podatki na voljo.

Pri interpretaciji rezultatov smo upoštevali pomembne metodološke razlike med raziskavami, saj so raziskovalci uporabljali različne protokole, ki so se v sestavi merjenih parametrov prekrivali le v določenih sklopih.



Graf 1: PRISMA pretočni graf nabora literature

Rezultati

V petih vključenih raziskavah je bilo število preiskovancev med 13 in 66. Starost bolnikov je bila med 34 in 86 let, srednja oziroma povprečna starost posameznih skupin pa približno 58–68 let. V raziskavah so bile uporabljene laserske hordektomije treh različnih stopenj (I–III) in različni protokoli ocenjevanja glasu, zato neposredna primerjava vseh rezultatov ni bila mogoča.

AVTOR/LETO	Demir et al., 2019 (7)	Lombardo et al., 2017 (10)	Bertino et al., 2015 (8)	Shin Lee et al., 2015 (15)	Sencan et al., 2019 (18)
Število preiskovancev	18	30	66	21	46

AVTOR/LETO	Demir et al., 2019 (7)	Lombardo et al., 2017 (10)	Bertino et al., 2015 (8)	Shin Lee et al., 2015 (15)	Sencan et al., 2019 (18)
Starost	49-78 Me=64,5	57-86 Me=68,2	41-86 Me=65	34-70 Me=59	42-68 Me=58
F0 (Hz)	174,61±46,17 Me=163,96	149,7±44,06	Me=156	151,1±38,13	-
Jitt.(%)	3,37±2,34 Me=2,57	1,18±0,81	-	1,5±1,12	-
Shimm.(%)	16,24±7,57 Me=17,1	12,92±7,95	-	5,52±2,78	-
NHR	-	0,25±0,25	-	0,14±0,04	-
VHI-tot.	-	35,78±12,06	-	20,7±26,8	28±12,5
VHI-p	-	19,6±3,7	-	6,1±8,7	10,5±4,7
VHI-e	-	8,7±7,3	-	7,3±10,5	6,1±4,1
VHI-f	-	12,4±5,3	-	6,7±8,9	11,3±5,8

Tabela 2: Parametri analize glasu 1 leto po laserski odstranitvi tumorja glasilke in rezultati vprašalnika VHI (Voice Handicap Index). F0 – osnovna grlna frekvenca, Jitt. – delež nestabilnosti frekvence, Shimm. – delež nestabilnosti amplitude, NHR – Noise to harmonics ratio (razmerje med hrupno in čisto komponento glasu), VHI-tot. – celokupni rezultat vprašalnika VHI, VHI-p – fizični del vprašalnika, VHI-e – čustveni del vprašalnika, VHI-f – funkcionalni del vprašalnika.

UPOŠTEVANE MEJNE VREDNOSTI: F0 (moški)- 85-196Hz (Me=128Hz) , JITT – 1,04 % , SHIMM- 3,81% , NHR- >0,2 (13). VHI-tot.: 0-30 – minimalen vpliv na kakovost življenja, 31-60 – zmeren vpliv na kakovost življenja, 61-120 – pomemben vpliv na kakovost življenja.

V razpoložljivih podatkih je bila pooperativna osnovna frekvenca med 150 in 175 Hz, vendar zaradi neenotnega poročanja rezultatov po spolu in različnih metod merjenja F0 med raziskavami ni mogoče zanesljivo sklepati o enotnem pooperativnem trendu. Jitter je bil v poročanih skupinah približno 1,2-3,4 %, shimmer približno 5,5-16,2 %, NHR pa 0,14-0,25. Rezultati VHI so bili heterogeni. V nekaterih raziskavah je bila glasovna prizadetost leto dni po operaciji minimalna, zlasti po manj obsežnih resekcijah, medtem ko so bile pri obsežnejših resekcijah spremembe glasovne funkcije in vpliv glasu na kakovost življenja izrazitejše.

Razprava

Pregled literature potrjuje, da se zgodnji glotični karcinom najpogosteje pojavlja pri bolnikih po 50. letu. V pregledanih raziskavah je bila starost preiskovancev večinoma okoli 60 let, kar je skladno z epidemiološkimi podatki. (19)

Transoralna laserska mikrokirurgija omogoča natančno odstranitev tumorja z ohranjanjem čim več funkcionalnega tkiva. Pri zgodnjem glotičnem karcinomu so onkološki

rezultati laserske kirurgije praviloma zelo dobri, vendar je treba pri oceni zdravljenja poleg lokalnega nadzora upoštevati tudi funkcionalni izid. (7–10)

Obseg resekcije je eden najpomembnejših dejavnikov vpliva na kakovost glasu. Berti-no in sodelavci so pokazali, da je bila stopnja disfonije povezana z obsegom resekcije, podobno pa je Lee s sodelavci ugotovil boljše dolgoročne glasovne rezultate pri bolni-kih z manj obsežnimi hordektomijami tipa I in II.(8,15) Tudi računalniška biomehanska simulacija je pokazala, da globina resekcije vpliva na akustični izid, vendar sama po sebi ne določa celotnega funkcionalnega rezultata.(13)

Pomemben dejavnik je tudi lokalizacija tumorja. Vključenost sprednje komisure lahko vpliva na kakovost glasu in je povezana z večjim obsegom potrebne resekcije.(16,36–38) Zato je pri primerjavi raziskav nujno upoštevati mesto in razširjenost tumorja.

Objektivna akustična analiza je uporabna za spremljanje akustičnih sprememb glasu v času okrevanja po posegu, vendar je potrebno upoštevati nekatere omejitve. F0 je od-visen od spola in starosti, jitter in shimmer pa sta občutljiva na kakovost snemanja, programsko opremo in prisotnost kompenzatornih fonacijskih mehanizmov. NHR je lahko koristen kazalnik šumne komponente glasu, vendar je zaradi razlik v merilnih sistemih potrebno natančno navesti programsko opremo.(16,17)

Po operaciji se lahko razvijejo kompenzatorni mehanizmi fonacije, vključno s poveča-no napetostjo notranjih in zunanjih laringealnih mišic ter supraglotično kompenzacijo. Ti mehanizmi lahko pomembno vplivajo na akustične parametre in povzročijo, da objektivne meritve ne odražajo neposredno anatomskega obsega resekcije. Zato av-torji priporočajo kombinacijo akustične analize, perceptivne ocene in videolaringostro-boskopije.(15–17)

Subjektivna ocena z vprašalnikom VHI je posebej pomembna, ker meri bolnikovo za-znavanje glasovne prizadetosti. Rezultati so lahko med populacijami zelo različni zara-di starosti, poklica, pričakovanj in kulturnih dejavnikov. Zato primerjava absolutnih vre-dnosti VHI med raziskavami brez upoštevanja značilnosti vzorca ni zanesljiva.(6,21,23)

Pomemben vidik je tudi čas ocenjevanja. Glas je neposredno po laserski resekciji po-gosto izrazito slabši, vendar se v naslednjih mesecih postopoma izboljšuje. Pregleda-ne raziskave kažejo, da se večina funkcionalnega okrevanja pojavi v prvih 6–12 mese-cih, zato je treba dolgoročni izid ocenjevati šele po zadostnem času za stabilizacijo glasu.(10,24)

Ob pregledu literature smo ugotovili nekaj ključnih omejitev raziskav, ki so v obdobju 2015–2019 preučevale vpliv laserskih hordektomij tipov I–III na kakovost glasu. Številne raziskave so retrospektivne, vzorci so majhni, uporabljeni instrumenti niso enotni, prav tako pa se razlikujejo obseg resekcije, mesto tumorja, čas spremljanja in način analize glasu. Nobena od raziskav za opredeljevanje kakovosti glasu ni uporabila multimodal-nega ELS protokola. Prisotna je izrazita heterogenost raziskav.(9)

V prihodnjih raziskavah bi bilo potrebno uporabljati standardizirano klasifikacijo hordektomij ELS, enotne akustične in perceptivne protokole, standardizirane vprašalnike ter jasno opredeliti časovne točke merjenja in meritve ponavljati periodično tudi več let po operaciji. Pri analizi bi bilo potrebno upoštevati starost, spol, poklicno glasovno obremenitev, kajenje, lokacijo tumorja, vključenost sprednje komisure, obseg resekcije in morebitno vključenost v glasovno terapijo. Potrebna je primerjava hordektomij tipov I, II in III med sabo.

Zaključek

Transoralna laserska mikrokirurgija je uveljavljena in učinkovita metoda zdravljenja zgodnjega karcinoma glotisa. Razpoložljivi podatki kažejo, da je subjektivno zadovoljstvo bolnikov z glasom leto dni po laserski hordektomiji I-III dobro. Obseg in mesto resekcije pomembno vplivata na glasovno funkcijo, vendar rezultatov ni mogoče razlagati neodvisno od starosti, spola, glasovnih navad in drugih dejavnikov. Objektivni akustični parametri so koristni za spremljanje sprememb, vendar sami ne zadoščajo za celovito oceno glasovne funkcije. VHI je pomemben komplementarni instrument, saj omogoča oceno bolnikovega doživljanja glasovne prizadetosti. Za zanesljivejšo primerjavo terapevtskih metod so potrebne metodološko bolj enotne prospektivne raziskave z večjimi vzorci in standardiziranimi protokoli ocenjevanja glasu, ki se mora za oceno dinamike kakovosti glasu izvajati periodično na daljši rok.

Etika, soglasja in financiranje

Etična odobritev: ni bila potrebna, saj je šlo za sistematični pregled literature.

Informirano soglasje: ni bilo potrebno

Financiranje: raziskava ni prejela zunanjega financiranja.

Navzkrižje interesov: Avtorji izjavljamo, da ni navzkrižja interesov.

Uporaba orodij umetne inteligence: niso bila uporabljena.

Razpoložljivost podatkov: vsi znanstvenoraziskovalni članki, uporabljeni v prispevku, so javno dostopni.

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03

Rinologija

Rhinology

Normative values for the Sniffin' Sticks Screening 12 test in the Slovenian population: a pilot study

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STRUCTURED ABSTRACT

Background/Introduction: The Sniffin' Sticks Screening 12 test (SST-12) is widely used to screen olfactory function, but its interpretation depends on the language of the descriptors and on the reference population, and no normative values exist for the Slovenian version. Screening may also be needed outside the clinic, for example in museums. This pilot study aimed to obtain preliminary normative SST-12 values for healthy Slovenian adults and to assess whether testing in a non-clinical setting affects the results.

Methods: Healthy Slovenian adults were tested with the Slovenian version of the SST-12 in a library (n = 12) or in an ENT clinic (n = 12) and retested after 7 days in the same setting. We compared these scores with two reference groups of healthy volunteers tested in the clinic in previous studies (n = 9, aged 27–65 years; n = 12, aged 18–38 years). We compared groups using the Kruskal–Wallis and Mann–Whitney U tests. Normative values were derived from the pooled first-test scores.

Results: Mean SST-12 scores were 10.67 (SD 0.89) in the library, 11.17 (SD 0.40) in the clinic and 10.56 (SD 0.73) and 11.08 (SD 0.79) in the two reference groups; the groups did not differ (p = 0.142). Retest scores did not differ from the first test in either setting (p = 0.470 and p = 0.381). In the pooled sample (n = 45; aged 18–65 years), the mean score was 10.89 (SD 0.75), the median 11, and the 10th percentile 10. Eight participants (18%) scored 10 or less, which the manufacturer classifies as impaired.

Conclusion: In healthy Slovenian adults, SST-12 scores clustered at 11, and a score of 10 lay within the normal distribution. Testing in a library gave results comparable to the clinic. Larger, age- and sex-stratified samples are needed to establish definitive Slovenian norms.

Keywords: Smell; Olfaction Disorders; Reference Values; Slovenia; Environment

Introduction

Smell is essential to how humans perceive the environment. It plays a key role in how people assess and categorize locations, objects, and individuals, and it influences subjective rankings and preferences. The Sniffin' Sticks Screening 12 test (SST-12) is a well-established tool for evaluating olfactory function in clinical environments, but its application in non-clinical settings remains underexplored. These settings are becoming increasingly relevant: when people encounter objects of intangible cultural heritage in a museum and show suboptimal smell performance, a brief on-site test could help interpret their experience. The present study is part of the research project J7-50233, Smell and Intangible Cultural Heritage.

The commonly used interpretation of the SST-12 classifies scores of 0–6 as functional anosmia, 7–10 as impaired identification (hyposmia), and 11–12 as normal identification. In a German community study of 7,267 people, researchers applied these manufacturer-recommended categories, but they did not independently establish their sensitivity and specificity against a full olfactory assessment [1]. Diagnostic studies show that the performance of a given cut-off depends on the population and on the question asked. In 54 patients with persistent post-COVID-19 smell complaints, a score of 6 best balanced sensitivity (81%) and specificity (100%) for identifying anosmia, but only 33 of the 54 patients received the same normal/hyposmic/anosmic classification as with the full Sniffin' Sticks battery [2]. In a separate study of 113 post-COVID-19 patients, the SST-12 detected smell loss with 93.4% sensitivity and 68.2% specificity [3].

Because odor identification relies on verbal descriptors, the test also depends on language and culture. In Estonia, replacing 14 of 48 response options with culturally familiar ones raised the mean correct-answer rate from 83% to 87% [4]. In Denmark, revising unfamiliar descriptors raised the mean score of healthy adults from 11.0 to 11.6 without changing the odor pens, and a score of 10 or more was treated as normal, rather than the manufacturer's 11 or more [5]. Age also changes how a score should be read: in 2,224 U.S. adults aged 66–89 years, the mean SST-12 score was 9.8, and the authors provided demographically adjusted percentiles instead of a single cut-off [6]. For the full Sniffin' Sticks battery, normative studies define hyposmia by the 10th percentile of healthy subjects [7]. Comparable normative data for the Slovenian version of the SST-12 are not available.

This pilot study therefore aimed to obtain preliminary normative values for the Slovenian version of the SST-12 in healthy adults. Because the normative sample included participants tested in different settings, a secondary aim was to assess whether testing in a non-clinical setting (a library) yields results comparable to testing in a clinical setting and whether results are stable on retest.

Methods

Study design and participants. This prospective pilot study included healthy Slovenian adult volunteers. One group (library group; $n = 12$; 6 men, 6 women; aged 22–27 years) was tested in a non-clinical setting and another (clinic group; $n = 12$; 6 men, 6 women; aged 21–24 years) in a clinical setting. We retested each group using the same procedure in the same setting after 7 days. Inclusion and exclusion criteria were subjective: good health and willingness to participate as a control group subject. We recorded coexisting factors that may affect olfaction: residual odor in the testing room, age, sex, acute respiratory infection, and nasal congestion. To cover a wider age range, the analysis also included two reference groups of healthy volunteers who had been tested in the clinical environment in previous studies at our department: an older group ($n = 9$; 4 men, 5 women; aged 27–65 years) and a younger group ($n = 12$; 6 men, 6 women; aged 18–38 years).

Testing environments. The non-clinical testing took place in a ventilated library room, NUK, Ljubljana, Slovenia. Clinical testing took place in an ENT outpatient examination room at the Department of Otorhinolaryngology and Cervicofacial Surgery, University Medical Centre Ljubljana.

Olfactory testing. Olfactory function was assessed with the Sniffin' Sticks Screening 12 test (Burghart Messtechnik, Germany) using the Slovenian version of the descriptor sheets. Following the manufacturer's instructions, each of the 12 odor pens was presented for approximately 3 seconds, after which the participant chose the correct odor from four descriptors (forced choice). The test score was the number of correctly identified odors (range 0–12). Scores were also classified using the manufacturer's categories [1].

Nasal symptoms. The subjective severity of nasal symptoms was rated on a visual analogue scale (VAS).

Statistical analysis. Data were managed in Microsoft Excel (Microsoft Corp., Redmond, WA, USA) and analyzed with GraphPad Prism V10 (GraphPad Software, San Diego, CA, USA). Because SST-12 scores are ordinal and bounded at 12, we used non-parametric tests. We compared test-retest results within each setting using the Mann–Whitney U test. We compared the four groups (library and clinic first test, older and younger reference groups) using the Kruskal–Wallis H test and compared age between pairs of groups using the Mann–Whitney U test. For normative values, we pooled the first-test scores of all four groups so each participant contributed one score. We described the pooled scores by mean, standard deviation (SD), median, interquartile range (IQR), and the 5th and 10th percentiles (linear interpolation). Following the convention of Sniffin' Sticks normative studies, we used the 10th percentile as the provisional lower limit of normal [7]. A p -value below 0.05 was considered statistically significant. The study is reported in accordance with the STROBE guideline.

Results

All participants in the library and clinic groups completed the test and the 7-day retest. Table 1 summarises demographic data, nasal symptom scores, and SST-12 results for all groups. The groups differed in age: the library group (mean 26 years) was older than the clinic group (mean 22 years; $p < 0.001$), and both were younger than the older reference group (mean 48.1 years; $p < 0.001$ for both) and the younger reference group (mean 32 years; $p = 0.035$ and $p = 0.033$, respectively). The two reference groups also differed ($p = 0.011$).

In the library, the mean SST-12 score was 10.67 (range 8–11) on the first test and 10.83 (range 8–12) on retest after 7 days ($p = 0.470$). In the clinic, the mean score was 11.17 (range 11–12) and 11.33 (range 10–12) on retest ($p = 0.381$). The older reference group scored a mean of 10.56 (range 9–11) and the younger reference group 11.08 (range 10–12). SST-12 scores did not differ significantly among the four groups ($p = 0.142$). Mean VAS scores for nasal symptoms were 2.1 and 2.0 in the library group ($p = 0.405$), 1.6 and 1.5 in the clinic group ($p = 0.473$), and 3.5 and 2.2 in the older and younger reference groups; VAS scores did not differ between the four groups ($p = 0.126$).

Table 1. Demographic data, nasal symptom scores and Sniffin' Sticks Screening 12 test (SST-12) results by group.

Group	n	Age, years, mean (range; SD)	Sex, M/ F	VAS nasal, mean (SD)	SST-12 score, mean (range; SD)
Library, test	12	26 (22–27; 2.26)	6/6	2.1 (1.5)	10.67 (8–11; 0.89)
Library, retest (7 days)	12	26 (22–27; 2.26)	6/6	2.0 (0.7)	10.83 (8–12; 1.03)
p, test vs retest				0.405	0.470
Clinic, test	12	22 (21–24; 0.67)	6/6	1.6 (0.7)	11.17 (11–12; 0.40)
Clinic, retest (7 days)	12	22 (21–24; 0.67)	6/6	1.5 (0.4)	11.33 (10–12; 0.65)
p, test vs retest				0.473	0.381
Older reference group	9	48.1 (27–65; 11.9)	4/5	3.5 (2.3)	10.56 (9–11; 0.73)
Younger reference group	12	32 (18–38; 9.7)	6/6	2.2 (1.9)	11.08 (10–12; 0.79)
p, all groups*		see text		0.126	0.142

Retests were performed after 7 days in the same setting. Test vs retest: Mann–Whitney U test. *Kruskal–Wallis H test across the four first-test groups (library, clinic, older and younger reference groups); pairwise age comparisons are reported in the text. VAS, visual analogue scale; SD, standard deviation.

For the normative analysis, we pooled the first-test scores of all 45 participants (22 men, 23 women; mean age 31.0 years, range 18–65) (Table 2, Figure 1). The pooled mean SST-12 score was 10.89 (SD 0.75), the median 11 (IQR 11–11) and the range 8–12; both the 5th and the 10th percentile were 10. One participant scored 8, one scored 9, six scored 10, thirty-one scored 11 and six scored 12. According to the manufacturer's categories, 37 participants (82%) had normal identification, 8 (18%) impaired identi-

fication, and none had functional anosmia. Two participants (4%) scored below the 10th percentile.

Table 2. Preliminary normative values for the Slovenian version of the Sniffin' Sticks Screening 12 test (first test only).

Group	n	Age, years, mean (range)	Mean (SD)	Median (IQR)	Range	10th percentile	Score $\geq$ n (%)
Library	12	26 (22–27)	10.67 (0.89)	11 (11–11)	8–11	–	10 (83%)
Clinic	12	22 (21–24)	11.17 (0.40)	11 (11–11)	11–12	–	12 (100%)
Older reference group	9	48.1 (27–65)	10.56 (0.73)	11 (10–11)	9–11	–	6 (67%)
Younger reference group	12	32 (18–38)	11.08 (0.79)	11 (10.75–12)	10–12	–	9 (75%)
All participants	45	31.0 (18–65)	10.89 (0.75)	11 (11–11)	8–12	10	37 (82%)

Percentiles are reported only for the pooled sample because the individual groups are too small. IQR, interquartile range; SD, standard deviation.

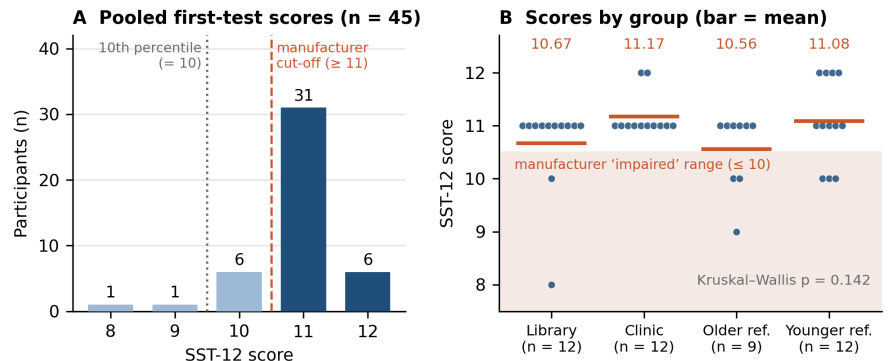


Figure 1. Sniffin' Sticks Screening 12 test (SST-12) scores in healthy Slovenian adults (first test only). (A) Distribution of pooled scores (n = 45); dark bars mark scores classified as normal by the manufacturer (≥ 11). The dotted line marks the 10th percentile of the sample (score 10), the proposed provisional lower limit of normal; the dashed line marks the manufacturer's cut-off (≥ 11). (B) Individual scores by group; horizontal bars show group means and the shaded area the manufacturer's 'impaired' range (≤ 10). The groups did not differ (Kruskal–Wallis $p = 0.142$).

Discussion

This pilot study provides preliminary normative values for the Slovenian version of the SST-12. In healthy Slovenian adults, scores clustered at 11, with a median of 11 and a

10th percentile of 10. Results obtained in a library did not differ significantly from those obtained in a clinic, and scores in both settings were stable on retest after 7 days, supporting pooling the groups and suggesting that the test can be used outside the clinic when testing conditions are controlled.

The mean of our healthy sample (10.89) is close to the 11.0 reported for healthy Danish adults before descriptor revision [5] and higher than the means of population-based samples, which also include people with unrecognized smell loss: 9.1–9.7 in a German cohort [8] and 9.8 in U.S. adults aged 66–89 years [6]. In a German community sample, only 42.5% of participants were classified as normosmic [1], compared with 82% of our healthy participants. Our 10th percentile of 10 indicates that, in healthy Slovenian adults, a score of 10 should not by itself be regarded as abnormal. This agrees with the Danish study, which treated 10 or more as normal [5], and with a German study that classified 10–12 as normal [8], whereas the manufacturer's threshold of 11 would have labelled 18% of our healthy participants as impaired. Because the distribution is narrow and bounded at 12, a single point changes the classification, and a borderline score should prompt fuller olfactory testing rather than be interpreted in isolation [6].

Direct evidence on how the testing environment affects the SST-12 is scarce, and most studies concern the full Sniffin' Sticks battery. Repeated testing of 50 healthy adults in a climate chamber at 20–35 °C and 30–75% relative humidity found no significant change in full-battery results [9]. Non-verbal background noise lowered full-battery performance in experiments with 120 participants [10], and background odours worsened odour detection thresholds in 103 adults, leading the authors to recommend a well-ventilated, odour-free testing room [11]. A home smell test correlated with clinic-based Sniffin' Sticks testing in 200 people, although participants did not take the same test in both places [12]. The closest direct SST-12 comparison changed how odours were presented rather than the room: mean scores were 9.1 with pens and 9.7 with filter paper in different participants tested before and after a pandemic-related interruption [8]. Together with our findings, this evidence supports using the SST-12 in a quiet, ventilated non-clinical room while recording noise and ambient odours, rather than applying a correction to the score.

All participants used the Slovenian descriptor sheets, so the values reported here apply to that version only; changing the wording of the answer options alone altered scores in the Danish and Estonian adaptations [4,5].

This study has several limitations. The sample was small and was a convenience sample of healthy volunteers, weighted towards young adults; only the older reference group included participants over 40 years, so age- and sex-specific norms could not be derived. Earlier studies tested the reference groups, and the groups were not age-matched. Although the four groups did not differ significantly, the difference

between the library and the clinic was close to statistical significance, and a larger sample might reveal a small setting effect. Repeated testing may introduce a learning effect, and the testers were not blinded to the setting. Finally, the SST-12 was not compared against the full Sniffin' Sticks battery or a group with olfactory dysfunction, so the diagnostic accuracy of the provisional lower limit of normal remains to be established.

Conclusion

This pilot study provides preliminary normative values for the Slovenian version of the SST-12. In healthy adults, scores clustered at 11, and a score of 10 fell within the normal distribution, suggesting that the manufacturer's threshold may overestimate impairment in this population. Testing in a library gave results comparable to testing in a clinic. Larger, age- and sex-stratified studies are needed to establish definitive Slovenian norms and to confirm that the test can be used reliably outside the clinical environment.

Ethics, Consent and Funding

Ethical Approval: The study was conducted in accordance with the Declaration of Helsinki.

Informed Consent: Written informed consent was obtained from all participants. No clinical photographs are included.

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Conflict of Interest: The authors declare that they have no conflict of interest.

Use of Artificial Intelligence (AI): Generative AI (Claude, Anthropic) was used to assist with adapting the manuscript. The authors reviewed and edited all content and take full responsibility for the manuscript.

Data Availability: The data supporting the findings of this study are available from the corresponding author on reasonable request.

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Kronični rinosinuzitis z nosnimi polipi: od endotipa do izidov biološkega zdravljenja – izkušnje terciarnega centra

Chronic rhinosinusitis with nasal polyps: from endotype to outcomes of biologic therapy – a tertiary centre experience

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STRUKTURIRANI IZVLEČEK

Uvod: Kronični rinosinuzitis z nosnimi polipi (KRSzNP) je pretežno posledica vnetja tipa 2 in izrazito poslabša kakovost življenja. Delež bolnikov kljub ustreznemu zdravljenju in operaciji ostane neurejen, s tem so kandidati za tarčno biološko zdravljenje. Namen prispevka je predstaviti pot bolnika s KRSzNP v terciarnem centru od epidemiološkega in endotipskega okvira prek dejanskega primarnega zdravljenja do realnih izidov biološke terapije.

Metode: Pregled literature, dopolnjen z retrospektivnimi podatki UKC Ljubljana: multidisciplinarni konzilij za skupno dihalno pot ($n = 99$), register odziva na dupilumab (SNOT-22 in krvni eozinofilci po obiskih), prekinitve zdravljenja ($n = 2$) ter zgodnje izkušnje s tezepelumabom ($n = 2$). Kakovost življenja smo merili z validiranim slovenskim vprašalnikom SNOT-22; uporabljeni so bili parni testi in preizkušnja Mann-Whitney U ($p < 0,05$).

Rezultati: Na konziliju je bilo predstavljenih 99 bolnikov (95 % KRSzNP; astma 58 %, AERD 9 %; mediana krvnih eozinofilcev $450/\mu\text{L}$; povprečni vhodni SNOT-22 60,8); dupilumab je bil odobren pri 58 (59 %). Med dupilumabom se je SNOT-22 izrazito zmanjšal (izhodišče 64,1 $\rightarrow$ 17,6 pri 3. kontroli; parno izboljšanje 29–46 točk; $p < 0,001$), klinično pomemben odziv (≥ 9 točk) je ob približno 120. dnevnu doseglo 85 % bolnikov. Krvni eozinofilci so med zdravljenjem prehodno porasli in niso napovedovali odziva ($p = -0,03$). Obe prekinitvi sta bili zaradi neželenih učinkov, s ponovnim porastom simptomov. Tezepelumab je pri dveh bolnikih izrazil izboljšal SNOT-22 in VAS.

Zaključek: V realni praksi dupilumab pri neurejenem KRSzNP omogoča velik, zgoden in klinično pomemben upad SNOT-22, ki je neodvisen od izhodiščnih eozinofilcev, učinek pa je odvisen od nadaljevanja zdravljenja. Izbor biološke terapije naj bo individualiziran, novejša zdravila kot je tezepelumab glede na prve rezultate ponujajo primerjive izide.

Ključne besede: kronični rinosinuzitis; nosni polipi; dupilumab; SNOT-22; podatki iz realne prakse

ABSTRACT (ENGLISH SUMMARY)

Chronic rhinosinusitis with nasal polyps (CRSwNP) is largely type 2-driven and markedly impairs quality of life; some patients remain uncontrolled despite appropriate non-biologic therapy and surgery and become candidates for targeted biologics. We present the CRSwNP patient pathway at a tertiary centre, from epidemiology and endotype to real-world biologic outcomes, using retrospective aggregate data from University Medical Centre Ljubljana: a Multidisciplinary united-airway board patient pool ($n = 99$), a dupilumab response registry (SNOT-22 and blood eosinophils across visits), treatment discontinuations ($n = 2$) and early tezepelumab experience ($n = 2$). Of 99 patients discussed (95% CRSwNP; asthma 58%; mean baseline SNOT-22 60.8), dupilumab was approved in 58 (59%). On dupilumab, SNOT-22 fell markedly (64.1 at baseline to 17.6 by visit 3; paired improvement 29–46 points, $p < 0.001$), with 85% reaching a clinically important response (≥ 9 points) by ~day 120. Blood eosinophils rose transiently and did not predict response. Both discontinuations were adverse-event related, with symptom rebound. Effects require continued therapy; biologic choice should be individualised and monitored with SNOT-22.

Keywords: chronic rhinosinusitis; nasal polyps; dupilumab; SNOT-22; real-world data

Uvod

Kronični rinosinuzitis (KRS) je pogosta kronična vnetna bolezen, ki jo klinično delimo na obliko z nosnimi polipi (KRSzNP) in brez njih (KRSbNP). KRSzNP je redkejši, a pogosto poteka teže in je pretežno posledica vnetja tipa 2 (eozinofilnega), z izrazitim negativnim vplivom na kakovost življenja [5,9,17].

Fenotip ni enak endotipu. Prisotnost polipov je uporaben klinični marker, a nepopoln. V eni kohorti je vnetje tipa 2 izražalo celo 49 % bolnikov s KRSbNP. Delež tipa 2 pa je močno odvisen od izbranega praga biomarkerjev [10]. Prav endotipska opredelitev je podlaga za tarčno zdravljenje [17].

Temelj obravnave ostaja nebiološko zdravljenje z izpiranjem in intranazalnimi kortikosteroidi (NGK) ter operacija pri vztrajni bolezni [17]. Kljub temu del bolnikov s KRSzNP ostane neurejen, z visokim bremenom simptomov in ponavljajočo se potrebo po sistemskih kortikosteroidih ali ponovnih operacijah; prav ti so kandidati za biološka zdravlila, usmerjena v osrednje molekule vnetja tipa 2 [17]. Namen prispevka je predstaviti celotno pot bolnika s KRSzNP v terciarnem centru — od epidemiološkega in endotipskega okvira prek dejanskega primarnega zdravljenja do realnih izidov biološke terapije (dupilumab; zgodnje izkušnje s tezepelumabom).

Metode

Prispevek je zasnovan pregled značilnosti bolezni s pregledom institucionalnih podatkov. Epidemiološki in endotipski okvir povzemamo iz objavljene literature [1–17]. Izide v slovenskem okolju prikazujemo z retrospektivnimi, anonimiziranimi agregatnimi podatki UKC Ljubljana: (i) presečno študijo kakovosti življenja po tipih KRS (SNOT-22 in objektivne ocene; 412 bolnikov) [19]; (ii) dejansko primarno zdravljenje pred prvim terciarnim pregledom [20] in njegovo primerjavo z britansko epidemiološko študijo CRES [21]; (iii) primerjavo optimalnega in suboptimalnega medikamentoznega zdravljenja [18]; ter (iv) sklop o biološkem zdravljenju — odločitve multidisciplinarnega konzilija za skupno dihalno pot ($n = 99$), register odziva in prekinitvev dupilumaba in zgodnje izkušnje s tezepelumabom.

Kakovost življenja smo merili z validiranim slovenskim vprašalnikom SNOT-22 (0–110; nižje = boljša kakovost življenja; prag klinično pomembne spremembe [MCID] ≈ 9 točk), resnost simptomov pa z lestvico VAS. Odziv na dupilumab smo ovrednotili kot spremembo SNOT-22 po kontrolnih obiskih (parni testi) in kot delež bolnikov, ki so ob veljavni meritvi najbližje 120. dnevu (interval 60–180 dni) dosegli izboljšanje ≥ 9 oziroma ≥ 20 točk. Povezavo izhodiščnih eozinofilcev z odzivom smo ocenili s Spearmanovim koeficientom. Za primerjave skupin smo uporabili preizkušnjo Mann-Whitney U; statistično značilnost smo šteli pri $p < 0,05$. Ker gre za retrospektivno opazovalno analizo, smiselno sledimo priporočilom STROBE; uporabljeni so bili izključno agregirani, anonimizirani podatki.

Rezultati

Epidemiologija in endotip (okvir). Ocene prevalence KRS se med regijami gibljejo približno med 2 % in 28 % ter jih večinoma poganjata definicija primera in metoda, ne prave geografske razlike [1–8]. Vnetje tipa 2 prevladuje pri KRSzNP v vseh regijah (v zahodnih in bližnjevzhodnih kohortah do 84–99,7 %, tudi v azijskih ≥ 50 %), a je delež močno odvisen od izbranega praga biomarkerjev — po poenotenju meril navidezne razlike po regiji večinoma izginejo [9–16]. To utemeljuje endotipsko usmerjeno zdravljenje.

Primarno zdravljenje pred napotitvijo. Ob prvem terciarnem pregledu (412 bolnikov) je bil pomemben delež bolnikov s KRS brez kakršne koli terapije (KRSbNP 28 %, KRSzNP 26,5 %; kontrole 75,9 %), približno 71 % pa je prejelo NGK (kontrole 22,3 %); sistemski kortikosteroid je bil pogostejši pri KRSzNP (10,4 % proti 3,3 %), antibiotik pa pri KRSbNP (14,4 % proti 6,2 %) [20]. V primerjavi z britansko študijo CRES (Philpott in sod.; NGK 12–18 %, izpiranje nosu 1 %) je bila raba NGK pri nas višja, a obe okolji kažeta premajhno uporabo primarnega zdravljenja po smernicah — okolji (populacijsko vs. terciarna napotitev) nista neposredno primerljivi [20,21].

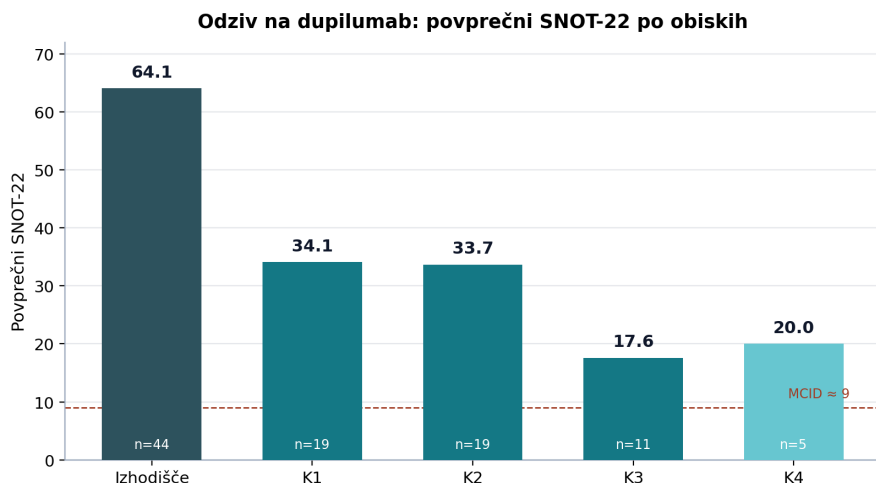
Optimalno vs. suboptimalno nebiološko zdravljenje. Optimalno izvedeno zdravljenje je bilo povezano z boljšo kakovostjo življenja: pri KRSbNP je bil SNOT-22 ob 1. obisku 43,2 proti 54,1 ($p = 0,04$), pri KRSzNP brez reševalnega zdravljenja pa ob 2. obisku 27,4 proti 44,8 ($p = 0,01$; VAS 3,6 proti 6,3; $p = 0,03$). Reševalno zdravljenje samo po sebi ni spremenilo povprečnih izidov [18].

Biološko zdravljenje: izkušnje terciarnega centra

Izbor bolnikov (konzilij). Na multidisciplinarnem konziliju za skupno dihalno pot je bilo predstavljenih 99 bolnikov (95 % KRSzNP; napotitev ORL 55 % / pulmologija 45 %; astma 58 %, AERD 9 %). Mediana krvnih eozinofilcev je bila $450/\mu\text{L}$, tkivnih približno 50/HPF, povprečni vhodni SNOT-22 pa 60,8 (razpon 24–98). Dokazano vnetje tipa 2 (> 10 eoz/HPF) je bilo najpogosteje dokumentirano merilo. Za biološko zdravljenje (dupilumab) je bilo odobrenih 58 bolnikov (59 %), 41 (41 %) je bilo zavrnenih ali odloženih (Tabela 1).

Odziv na dupilumab (SNOT-22). Med zdravljenjem se je SNOT-22 izrazito in zgodaj zmanjšal: s prečiščenega izhodišča 64,1 na 34,1 (K1), 33,7 (K2), 17,6 (K3) in 20,0 (K4) (Slika 1, Tabela 2). Parno (isti bolniki) je izboljšanje znašalo $-31,1$ (K1), $-29,2$ (K2) in $-46,0$ (K3) (vsi $p < 0,001$) ter $-38,0$ pri K4 ($p = 0,063$; $n = 5$). Izboljšanje daleč presega MCID (≈ 9 točk). Ob veljavni meritvi najbližje 120. dnevu ($n = 20$) je bilo povprečno izboljšanje 33,3 (mediana 37); klinično pomemben odziv (≥ 9 točk) je doseglo 85 % (17/20), izboljšanje ≥ 20 točk pa 70 % (14/20). Dva bolnika sta se poslabšala in sta bila obravnavana individualno (adherenca, kortikosteroidi, operacije/okužbe, fenotip).

Slika 1. Odziv na dupilumab — povprečni SNOT-22 po obiskih (UKC Ljubljana). n po obiskih: izhodišče 44, K1 19, K2 19, K3 11, K4 5. Nižji SNOT-22 pomeni boljšo kakovost življenja; MCID ≈ 9 točk.



Eozinofilci. Mediana krvnih eozinofilcev je med zdravljenjem prehodno porasla (izhodišče 440 → 470 → 505 → 880 → 1120/ μ L); parne spremembe niso bile značilne (velika variabilnost, padajoč n). SNOT-22 se je izboljšal, čeprav eozinofilci niso padali.

Prekinitiv zdravljenja. Zabeleženi sta bili dve prekinitvi, obe zaradi neželenih učinkov in ne učinkovitosti: bolnik (M, 62 let) zaradi anafilaksije po 2 mesecih (SNOT-22 64 → 12 med zdravljenjem → 51 po 6 mesecih prekinitve; VAS 9 → 0) in bolnica (Ž, 58 let) zaradi nevzdržnih bolečin v sklepih po 3 mesecih (trajna prekinitiv; SNOT-22 72 → 25 → 80; VAS 8 → 9). Oba sta se med zdravljenjem izrazito izboljšala, po prekinitvi pa so se simptomi ponovno poslabšali, kar govori v prid kronični naravi bolezni in odvisnosti učinka od nadaljevanja zdravljenja.

Zgodnje izkušnje s tezepelumabom. Pri dveh bolnikih s prizadetostjo zgornjih in spodnjih dihal (odrasli in otrok) je tezepelumab (anti-TSLP) izrazito izboljšal izide: SNOT-22 68 → 7 in 76 → 12 ter VAS 9 → 0 in 10 → 3. Ker TSLP deluje nad vnetjem tipa 2 in ne-tip-2, je to obetavna možnost pri skupni dihalni poti, a gre za zgodnje izkušnje pri dveh bolnikih.

Tabela 1. Multidisciplinarni konzilij za skupno dihalno pot (n = 99): značilnosti in odločitve (agregirano, anonimizirano).

Kazalnik	Vrednost
Predstavljenih bolnikov	99
KRSzNP	95 % (94/99)
Komorbidnosti	astma 58 %; AERD 9 %
Napotitev	ORL 55 % / pulmologija 45 %
Krvni / tkivni eozinofilci (mediana)	450/ μ L · $\approx$ 50/HPF
Vhodni SNOT-22 (povpr.; razpon)	60,8 (24–98)
Odobren dupilumab	58 (59 %)
Zavrnjeno / odloženo	41 (41 %)

Tabela 2. Odziv na dupilumab — povprečni SNOT-22 po obiskih in parno izboljšanje glede na izhodišče (isti bolniki).

Obisk	SNOT-22	n	Parno izboljšanje	p
Izhodišče	64,1	44	—	—
K1	34,1	19	–31,1	< 0,001
K2	33,7	19	–29,2	< 0,001
K3	17,6	11	–46,0	< 0,001
K4	20,0	5	–38,0	0,063

Razprava

Realni izidi terciarnega centra kažejo, da dupilumab pri skrbno izbranih bolnikih z neu-rejenim KRSzNP omogoča velik, zgoden in klinično pomemben upad SNOT-22 (parno 29–46 točk), pri čemer je klinično pomemben odziv doseglo približno 85 % bolnikov. Ti izidi so skladni z registracijskimi raziskavami faze 3, v katerih so biološka zdravila proti placebo značilno izboljšala oceno nosnih polipov, SNOT-22 in voh ter zmanjšala potrebo po sistemskih kortikosteroidih in operaciji (dupilumab: SINUS-24/-52 [22]; omalizumab: POLYP 1/-2 [23]; mepolizumab: SYNAPSE [24]). Pomembno pa je, da so naši podatki pravzaprav spremembe pred-med zdravljenjem (brez placebo skupine), zato absolutnih vrednosti ni mogoče neposredno primerjati z od placeba odštetimi razlikami iz randomiziranih raziskav.

Tri opažanja imajo neposreden klinični pomen. Prvič, krvni eozinofili med dupiluma-bom prehodno porastejo, izhodiščna vrednost pa ne napoveduje odziva ($p = -0,03$); krvna eozinofilija torej ni merilo učinkovitosti. Drugič, obe prekinitvi sta bili posledica neželenih učinkov (anafilaksija; nevzdržne bolečine v sklepih), po prekinitvi pa so se simptomi ponovno poslabšali — kar poudarja kronično naravo bolezni in odvisnost učinka od nadaljevanja zdravljenja. Tretjič, zgodnje izkušnje s tezepelumabom (anti-TSLP) pri skupni dihalni poti so obetavne in odpirajo vprašanje izbire med tarčami.

Pot bolnika je treba brati celovito: velik delež bolnikov je ob napotitvi premalo zdra-vljen (pogosto brez NGK ali izpiranja) [20,21], optimalno nebiološko zdravljenje pa iz-boljša izide [18]. Biološka zdravila se umeščajo za ustrezno nebiološko zdravljenje in operacijo, pri endotipsko opredeljenih, neurejenih bolnikih; ob primerljivi uspešnosti različnih tarč (npr. IL-4R α proti IL-5) naj bo izbira individualna glede na komorbidnosti, biomarkerje, način aplikacije, varnost ter dostopnost in ceno.

Omejitve. Gre za retrospektivne, opazovalne podatke enega centra z majhnimi vzorci pri poznih obiskih (n pade na 5 pri K4) in brez kontrolne skupine, zato so ocene občutljive na osip in izbor. Deleži endotipa izhajajo iz raznolikih kohort z različnimi pragovi. Izkušnje s tezepelumabom in podatki o prekinitvah temeljijo na posameznih primerih. Rezultate je zato treba razumeti kot realno prakso terciarnega centra in ne kot nadzo-rovano primerjavo učinkovitosti.

Zaključek

Pri neurejenem KRSzNP z vnetjem tipa 2 dupilumab v realni praksi omogoča velik, zgoden in klinično pomemben upad SNOT-22, neodvisen od izhodiščnih eozinofilcev, učinek pa je odvisen od nadaljevanja zdravljenja. Biološka zdravila se umeščajo za ustrezno nebiološko zdravljenje in operacijo; izbor naj bo individualiziran, izide pa je treba dosledno spremljati z vprašalnikom SNOT-22 (in po potrebi VAS ter oceno poli-pov).

Etika, soglasja in financiranje

Etična odobritev: Institucionalni del temelji na retrospektivnih, anonimiziranih agregatnih podatkih rutinske klinične obravnave in registrov UKC Ljubljana.

Informirano soglasje: Uporabljeni so bili izključno anonimizirani agregirani podatki brez prepoznavnih osebnih podatkov bolnikov; soglasja so bila pridobljena v okviru rutinske obravnave.

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Razpoložljivost podatkov: Agregirani podatki so na voljo pri kontaktnem avtorju na razumno zahtevo; podatki na ravni bolnika zaradi varovanja zasebnosti niso javno dostopni.

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Invertni papilom: strategije za preprečevanje recidivov in maligna transformacija

Inverted papilloma: strategies for preventing recurrence and malignant transformation

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STRUKTURIRANI IZVLEČEK

Uvod: Invertni papilom (IP) je redek benigni, lokalno agresiven tumor nosu in obnosnih votlin, ki ga zaznamujeta nagnjenost k ponovitvam (recidivom) in možnost maligne transformacije. Namen prispevka je predstaviti izkušnje z izključno endoskopskim zdravljenjem IP in jih umestiti v sodobne dokaze o kirurgiji, usmerjeni v narastišče tumorja, ter o maligni transformaciji.

Metode: V retrospektivno opazovalno študijo smo vključili 18 bolnikov, ki so bili zaradi IP endoskopsko operirani na Kliniki za otorinolaringologijo in cervikofacialno kirurgijo UKC Ljubljana med letoma 2010 in 2014. Podatke smo analizirali opisno in jih primerjali s sistematičnimi pregledi, metaanalizami in večjimi kohortnimi študijami.

Rezultati: Vključenih je bilo 9 moških in 9 žensk, povprečne starosti 59 let. Stadij po Krouseju je bil T1 pri 2 (11,1 %), T2 pri 10 (55,6 %) in T3 pri 6 bolnikih (33,3 %); pri treh je šlo za reoperacijo. Narastišče je bilo predoperativno mogoče opredeliti pri 7 bolnikih (38,9 %). Endoskopsko medialno maksilektomijo z »en bloc« anteriornim pristopom smo opravili pri 11 bolnikih (61,1 %). Epifore ni navajal nihče, večje kruste je kot največjo težavo navedlo 14 bolnikov (77,8 %). Ob povprečnem spremljanju $29 \pm 17,5$ meseca ponovitve nismo zaznali. V literaturi je bila po definitivni obdelavi narastišča pogostost ponovitev 5,8 % (14 študij, 585 bolnikov); v kohorti 127 bolnikov je bila 52,2 % po samem luščenju sluznice in 0–4,9 % ob obdelavi kostne podlage.

Zaključek: Popolna odstranitev vseh narastišč s periostom in obdelava kostne podlage je temeljno načelo zmanjševanja ponovitev, izbira pristopa pa določa anatomija narastišča. Endoskopska medialna maksilektomija združuje radikalnost in pooperativno preglednost. Ker se ponovitve in maligna transformacija lahko pojavijo pozno, je potrebno dolgoletno endoskopsko spremljanje.

Ključne besede: invertni papilom; novotvorbe obnosnih votlin; endoskopija; lokalna ponovitve novotvorbe; neoplastična transformacija celic

ABSTRACT (ENGLISH SUMMARY)

Sinonasal inverted papilloma (IP) is a rare, benign but locally aggressive tumour known for its tendency to recur and its potential for malignant transformation. We retrospectively reviewed 18 patients (9 men, 9 women; mean age 59 years; Krouse T1–T3) treated by purely endoscopic resection at the University Medical Centre Ljubljana between 2010 and 2014, and compared our experience with current literature. Endoscopic medial maxillectomy with an en bloc anterior approach was performed in 11 patients (61.1%). No patient reported epiphora; nasal crusting was the most frequent complaint (77.8%). No recurrence was observed during a mean follow-up of 29 ± 17.5 months. Current evidence supports attachment-oriented surgery with removal of the involved mucoperiosteum and treatment of the underlying bone, although no single bone-treatment technique has proven superior. Malignant transformation occurs in approximately 5–15% of cases. Long-term endoscopic surveillance remains essential.

Keywords: Papilloma, Inverted; Paranasal Sinus Neoplasms; Endoscopy; Neoplasm Recurrence, Local; Cell Transformation, Neoplastic

Uvod

Invertni papilom (IP) je redek benigni epitelijski tumor nosu in obnosnih votlin, pri katerem površinske epitelne celice rastejo navznoter v globlje plasti podpornega tkiva. Predstavlja 0,5–4 % vseh primarnih tumorjev nosu [1,2], njegova letna incidenca pa je ocenjena na 0,6–1,5 primera na 100.000 prebivalcev [3]. Najpogosteje se pojavi v petem in šestem desetletju življenja, pogosteje pri moških (razmerje 2–5 : 1) [3]. Etiološko ga povezujejo z okužbo s humanim papiloma virusom (HPV) [4] in virusom Epstein-Barr (EBV) [5], s kajenjem, uživanjem alkohola, poklicno izpostavljenostjo, celo z alergijskim rinitisom in kroničnim rinosinuzitisom z nosno polipozo [6], vendar vzročna vloga večine teh dejavnikov ni dokončno pojasnjena. Njegovi zgodovinski značilnosti sta pogostost ponovitev in maligna transformacija [7].

Klinično se IP kaže kot enostranska polipozna rašča z enostransko zamašenostjo nosu, rinorejo, epistakso, znaki sinuzitisa, obrazno bolečino, hipozmijo ali frontalnim glavobolom; endoskopsko vidimo lobulirano, blede, z žilicami prepleteno maso v nosni votlini ali obnosnih votlinah [3]. Enostranska zamašenost nosu je lahko prisotna več let, zato moramo na IP pomisliti pri vsaki enostranski polipozni rašči. Diagnostika obsega endoskopijo, biopsijo ter računalniško tomografijo (CT) in magnetnoresonančno slikanje (MR) [8]. CT znaki IP so lobulirana masa, žariščna hiperostoza na stiku tumorja s kostjo (narastišču) in hiperdenzni areali v stromi tumorja; MR (sekvenci T1W in T2W) loči tumor od zastoja sekreta v sicer neprizadetih obnosnih votlinah [8]. Histopatološko lahko v IP najdemo atipije in displazijo (histopatološka dejavnika tveganja), karcinom in situ ali ploščatocelični karcinom. Pogostost maligne transformacije se v starejši literaturi giblje med 0 % in 53 %, z razmikom približno 52 mesecev do razvoja

metakronega ploščatoceličnega karcinoma [8]. Analiza zamrznjenega reza (ZR) lahko loči neprizadeto sluznico od IP, teže pa IP od maligne alteracije.

Za opredelitev stadija se najpogosteje uporabljata klasifikaciji po Krouseju [9] in po Cannadyju [10], ki najbolje korelirata s potekom bolezni in prognozo. Klasifikacija po Cannadyju je nastala v obdobju napredne endoskopske kirurgije in razvršča bolnike v tri skupine z različno pogostostjo ponovitev (Tabela 1).

Tabela 1. Klasifikacija IP po Cannadyju in pogostost ponovitev po napredni endoskopski kirurgiji [10].

Skupina	Lokalizacija in razširjenost	Pogostost ponovitev
A	IP omejen na nosno votlino, etmoidni sinus in medialno steno maksilarnega sinusa	3,0 %
B	IP s prizadetostjo lateralne stene maksilarnega sinusa, sfenoidnega ali frontalnega sinusa	19,8 %
C	IP z razraščanjem zunaj obnosnih votlin	35,3 %

IP – invertni papilom.

Zdravljenje IP je kirurško; konzervativno zdravljenje ima omejeno vlogo, mesto radio-terapije pa ostaja odprto vprašanje [11]. Kirurški pristopi so se razvijali od intranazalne polipektomije in odprtih posegov – lateralne rinotomije, transfacialnega pristopa »mid-facial degloving« in kraniofacialne resekcije – do izključno endoskopskih pristopov, kot so različne oblike endoskopske medialne maksilektomije, endoskopska mediana frontotomija tipa III po Drafu in resekcije sprednje lobanjske baze [11]. Obseg posega narekuje razsežnost bolezni: odstraniti je treba celoten IP skupaj s periostom in robom proti zdravi sluznici, stik tumorja s kostjo pa dodatno zbrusiti, če kosti ni mogoče v celoti odstraniti [7,8].

Ponovitve bolezni so v starejših serijah opisovali v do 78 %, predvsem po konzervativnih posegih, kot sta polipektomija in lokalna ekscizija [7]. Posodobljena metaanaliza 96 študij s 4134 bolniki je pokazala pogostost ponovitev 12,8 % po endoskopskih, 16,6 % po zunanjih in 12,6 % po kombiniranih pristopih [12]. Sodobna kirurgija se je zato preusmerila od obsega resekcije k natančni opredelitvi in popolni obdelavi narastišča tumorja (angl. attachment-oriented surgery) [13,14].

Cilj prispevka je predstaviti naše izkušnje z izključno endoskopskim zdravljenjem IP ter jih umestiti v sodobne dokaze o strategijah za preprečevanje ponovitev in o dejavnih tveganja za maligno transformacijo.

Metode

V retrospektivno, opazovalno, nekontrolirano študijo smo zajeli 20 bolnikov z IP, ki jih je starejši avtor endonazalno endoskopsko operiral na Kliniki za otorinolaringologijo in cervikofacialno kirurgijo UKC Ljubljana med januarjem 2010 in decembrom 2014. Iz

analize smo izključili bolnika, pri katerem je razsežnost IP zahtevala kombiniran pristop, in bolnico s predoperativno dokazano maligno alteracijo, pri kateri smo opravili zunanji poseg (razširjeno maksilektomijo). V končno analizo je bilo vključenih 18 bolnikov.

Pri vseh bolnikih smo opravili diagnostiko po priporočilih evropskega stališča za endoskopsko obravnavo tumorjev nosu, obnosnih votlin in lobanjske baze [8], ki je obsegala ambulantno endoskopijo nosu, CT (glede na razširjenost bolezni in klinično vprašanje tudi MR) in biopsijo spremembe. Stadij bolezni smo opredelili po Krouseju [9]. Na podlagi predoperativne slikovne diagnostike smo ocenili, ali je mogoče sklepati na mesto stika IP s kostjo stene sinusa (narastišče).

Vse bolnike smo operirali izključno endoskopsko, dvoročno ali štiriročno, z intraoperativno navigacijo (BrainLAB Kolibri ENT V2.1). Vrsto posega – endoskopsko medialno maksilektomijo z »en bloc« anteriornim pristopom, popolno etmoidektomijo, široko lokalno odstranitev ali lokalno ekscizijo – smo izbrali glede na lokalizacijo in razsežnost bolezni ter predvideno narastišče. Ves odstranjeni biološki material smo poslali na histopatološko preiskavo. Pri odstranitvah »en bloc« z IP v notranjosti preparata robov nismo dodatno pošiljali na ZR, temveč na klasični histopatološki pregled; v ostalih primerih smo robove intraoperativno pregledali z ZR. Po posegu smo v nosno votlino vstavili standardni nosni tampon v rokavici.

Tamponado smo odstranili dan po posegu in bolnika isti dan odpustili v domačo oskrbo. Prva kontrola je bila 10–14 dni po posegu, nadaljnje v prvem letu vsakih 1–2 meseca, v drugem do četrtem letu pa vsakih 6–8 mesecev; ob kontrolah smo endoskopsko spremljali sluznico operiranega področja. Primarni izid je bila ponovitev bolezni. Med pooperativnimi težavami smo bili posebej pozorni na epiforo na strani odstranjenega tumorja in na nastajanje krust po posegih v maksilarnem sinusu oziroma po medialni maksilektomiji.

Podatke smo analizirali opisno (frekvence, deleži, povprečje $\pm$ standardni odklon) s programom IBM SPSS Statistics, različica 20 (IBM Corp., Armonk, NY, ZDA). Pri poročanju smo sledili smernicam STROBE za opazovalne študije.

Za umestitev rezultatov smo opravili ciljani (nesistematični) pregled literature o kirurgiji, usmerjeni v narastišče, obdelavi kostne podlage, predoperativni opredelitvi narastišča, dejavnikov tveganja za ponovitev in maligni transformaciji. Iskali smo v zbirki PubMed in z iskalnikom Consensus (2026); prednost smo dali sistematičnim pregledom, metaanalizam in večjim kohortnim študijam. Ključne številčne podatke smo preverili v izvlečkih oziroma celotnih besedilih izvirnih objav.

Rezultati

Med 18 vključenimi bolniki je bilo 9 moških (50 %) in 9 žensk (50 %), povprečna starost je bila 59 let. Stadij po Krouseju je bil T1 pri 2 (11,1 %), T2 pri 10 (55,6 %) in T3 pri

6 bolnikih (33,3 %). Pri treh bolnikih je šlo za reoperacijo – pri dveh za drugo in pri eni bolnici za tretjo operacijo. Značilnosti bolnikov in posegov so prikazane v Tabeli 2.

Predoperativno je bilo pri 7 bolnikih (38,9 %) mogoče sklepati, kje se nahaja stik IP s kostjo stene sinusa, pri 11 (61,1 %) pa ne. Glede na lokalizacijo in razsežnost bolezni smo 11 bolnikov (61,1 %) operirali dvoročno in 7 (38,9 %) štiriročno. Endoskopsko medialno maksilektomijo z »en bloc« anteriornim pristopom smo opravili pri 11 bolnikih (61,1 %), popolno etmoidektomijo pri 4 (22,2 %), široko lokalno odstranitev pri 2 (11,1 %) in lokalno ekscizijo pri enem bolniku (5,6 %).

Pri bolnikih, ki so bili operirani že prej, je bila pri predhodnem posegu uporabljena tehnika lokalne odstranitve z največ široko meatotomijo; maksilarni sinus zaradi ostanka medialne stene in srednje nosne školjke ni bil pregleden.

Epifore kot pričakovanega zapleta ni navajal noben bolnik (0 %). Največjo pooperativno težavo je predstavljalo nastajanje večjih krust v nosu, ki ga je navedlo 14 bolnikov (77,8 %). Drugi zapleti so bili redki in obvladljivi. V času pooperativnega spremljanja, ki je v povprečju trajalo $29 \pm 17,5$ meseca, ponovitve bolezni nismo zaznali.

Tabela 2. Značilnosti bolnikov in posegov (n = 18).

Značilnost	Vrednost
Spol (moški / ženske)	9 (50 %) / 9 (50 %)
Povprečna starost	59 let
Stadij po Krouseju T1 / T2 / T3	2 (11,1 %) / 10 (55,6 %) / 6 (33,3 %)
Reoperacija	3 (16,7 %)
Predoperativno opredeljeno narastišče	7 (38,9 %)
Tehnika: dvoročna / štiriročna	11 (61,1 %) / 7 (38,9 %)
Endoskopska medialna maksilektomija »en bloc«	11 (61,1 %)
Popolna etmoidektomija	4 (22,2 %)
Široka lokalna odstranitev	2 (11,1 %)
Lokalna ekscizija	1 (5,6 %)
Epifora	0 (0 %)
Večje kruste kot največja težava	14 (77,8 %)
Ponovitev bolezni	0 (0 %)
Trajanje spremljanja (povprečje $\pm$ SD)	$29 \pm 17,5$ meseca

SD – standardni odklon.

Razprava

V naši seriji endoskopsko operiranih bolnikov z IP stadija T1–T3 v povprečno 29 mesecih spremljanja nismo zaznali ponovitve bolezni. Rezultat je skladen z izidi sodobnih

serij kirurgije, usmerjene v narastišče, vendar ga moramo razlagati previdno. Povprečni čas do ponovitve je v večjih kohortah 31 mesecev [15] oziroma 44 mesecev [16], zato lahko naše spremljanje spregleda pozne ponovitve. Tudi v seriji 28 bolnikov z IP maksilarnega sinusa, pri katerih ob povprečnem spremljanju 31,1 meseca niso zaznali ponovitve, avtorji opozarjajo, da takšno spremljanje lahko spregleda pozne recidive in da rezultata ni primerno razlagati kot zagotovilo ozdravitve [17]. Poleg tega smo iz analize izključili bolnika z najobsežnejšo boleznijo in bolnico z maligno alteracijo.

Podatki podpirajo kirurgijo, usmerjeno v narastišče tumorja, dokaz, da je ena tehnika obdelave baze boljša od vseh drugih, pa je omejen. Sistematični pregled 14 študij s 585 bolniki je po definitivni obdelavi narastišča poročal o 5,8 % ponovitev; najpogostejši pristop je bil odstranitev sluznice na narastišču in brušenje spodaj ležeče kosti, nobena posamezna tehnika pa ni zanesljivo napovedovala manj ponovitev [18]. Neposrednejši podatek o pomenu kostne podlage prinaša kohorta 127 bolnikov, v kateri je bila pogostost ponovitev po samem luščenju sluznice 52,2 % (12/23), po brušenju kosti 4,9 % (3/61), po elektrokoagulaciji 4,7 % (1/21) in po popolni odstranitvi kosti 0 % (0/22) [15]. Iz podatkov torej izhaja, da je cilj posega prepoznati vsa narastišča, omogočiti dostop do njih ter odstraniti prizadeto sluznico s periostom in obdelati kostno podlago. Izbira endoskopskega oziroma kombiniranega dostopa je zato odvisna od anatomije narastišča, ne zgolj od razširjenosti vidnega tumorja [14,17].

Naše izkušnje podpirajo endoskopsko medialno maksilektomijo kot poseg izbora pri IP, ki izrašča iz medialne stene maksilarnega sinusa (lateralne stene nosu) in iz etmoida, kjer se IP najpogosteje nahaja. Njene prednosti so dostop do maksilarnega sinusa (z omejitvami pri sprednji, spodnji in lateralni steni), radikalnost odstranitve rašče in kooperativna preglednost operiranega področja, ki omogoča enostavno endoskopsko prepoznavo sumljivih sprememb. Ceno predstavljajo kruste, ki so bile najpogostejša težava naših bolnikov, medtem ko epifore nismo zaznali. V kohorti 127 bolnikov sta bila lokacija v maksilarnem sinusu in endoskopska medialna maksilektomija povezana z večjo pogostostjo ponovitev [15], kar verjetno odraža zahtevnejšo anatomijo in obsežnejšo bolezen pri teh bolnikih, obenem pa poudarja, da širok dostop sam po sebi ne zadošča, če narastišče ni v celoti obdelano. Lokalna ekscizija je po naših izkušnjah smiselna le pri stadiju T1, tudi takrat z izdatno elektrokoagulacijo ležišča in/ali brušenjem kosti na mestu narastišča.

Pri naših reoperiranih bolnikih maksilarni sinus po predhodnih omejenih posegih ni bil pregleden, kar podpira stališče, da je prva operacija najboljša priložnost za popolno odstranitev. V kohorti 210 bolnikov so imeli bolniki, predhodno operirani v drugi ustanovi, 22,3 % ponovitev v primerjavi z 12,4 % po primarnem posegu [19]. Po naših izkušnjah sta za odstranitev IP do stadija T3 uporabni tako dvoročna kot štiriročna tehnika; pri stadiju T4 ter pri uporabi endonazalnega vrtnika ali instrumenta za elektrokoagulacijo brez vgrajene sukcije pa zaradi boljšega prikaza polja (dim in aerosol) priporočamo štiriročno tehniko.

Natančna predoperativna opredelitev narastišča je predpogoj za načrtovanje dostopa. Žariščna hiperostoza na CT se je z dejanskim narastiščem ujemala v 89,1 % [20] oziroma 90 % primerov [21]. V večcentrični kohorti 195 bolnikov je bila hiperostoza vidna pri 65 % bolnikov; kadar se mesto hiperostoze ni ujemalo z medoperativno ugotovljenim narastiščem, se je IP ponovil v 38,5 % (razmerje obetov 6,5) [21]. V naši seriji je bilo narastišče predoperativno mogoče opredeliti le pri 38,9 % bolnikov, kar deloma odraža reoperacije in obsežnejše tumorje ter poudarja pomen medoperativne navigacije in natančne endoskopske opredelitve narastišča med posegom.

Poleg predhodne operacije so s ponovitvijo povezani večžariščno narastišče, displazija in okužba s HPV. Večžariščno narastišče je imela polovica bolnikov v že omenjeni kohorti 210 bolnikov in je bilo povezano s 3,5-krat večjimi obeti za ponovitev [19]. Metaanaliza 13 študij s 1629 bolniki je pokazala, da je displazija povezana z večjimi obeti za ponovitev (združeno razmerje obetov 3,42) [22], pozitivnost za HPV pa se je v finski kohorti izkazala kot neodvisen dejavnik ponovitve [23]. Ti dejavniki zaenkrat še niso vključeni v prospektivno kirurško odločanje, lahko pa pomagajo pri določanju intenzivnosti pooperativnega spremljanja.

Medoperativna analiza ZR je bila v sistematičnem pregledu povezana z manj ponovitvami (3,4 % proti 7,3 %), vendar ta primerjava sama po sebi ne dokazuje vzročnega učinka [18]. V kohorti 199 bolnikov z daljšim spremljanjem se pogostost ponovitev med bolniki z ZR in brez njega ni pomembno razlikovala (20,1 % proti 15,5 %; $p = 0,36$) [16]. ZR tako ostaja koristen predvsem za oceno robov, kadar narastišča ni mogoče odstraniti »en bloc«, kot smo ravnali tudi v naši seriji.

Kot dopolnilo kirurgiji, predvsem kadar narastišča ni mogoče zanesljivo v celoti odstraniti, so preučevali tudi lokalno uporabo 5-fluorouracila (5-FU), ki pa ni uveljavljen kot nadomestilo za popolno resekcijo. V retrospektivni seriji 121 bolnikov (72 reoperacij) so 5 % 5-FU uporabili po 18 posegih pri izbranih zahtevnih ali ponovljenih primerih, tako da so s 5-FU prepojeno tamponado za 7–10 dni namestili ob resecirane površine. Ponovitev se je pojavila pri enem bolniku (5,6 %); opisali so eno prehodno periorbitalno otekline, večjih zapletov ni bilo. Avtorji sami opozarjajo, da je bolnike za zdravljenje izbral kirurg, zato nizke pogostosti ponovitev ni mogoče pripisati 5-FU [24]. V seriji 20 bolnikov z narastiščem v frontalnem sinusu oziroma recesusu pri 8 bolnikih, ki so ob operaciji prejeli 5-FU, ponovitve niso zaznali [25]; ker gre za isto raziskovalno skupino in okolje kot v večji seriji, teh bolnikov ne smemo samodejno šteti za neodvisen dokaz. Retrospektivno poročilo iz leta 2010 je opisalo ponovitev pri 1 od 42 bolnikov s pooperativnimi vlažnimi oblogami s 5-FU v primerjavi z 12 od 33 bolnikov z običajnimi oblogami [26], vendar izvleček navaja za skupini različna obdobja spremljanja, celotne metode pa niso bile dostopne, zato je treba navidezno razliko razlagati posebej previdno. Pregled literature iz leta 2024 je zaključil, da majhni vzorci ne podpirajo rutinske uporabe [27]. Lokalni 5-FU je tako lahko možnost pri izbranih zahtevnih poo-

perativnih primerih, ni pa dokazano standardno dopolnilno zdravljenje niti zdravljenje neodstranjene bolezni [24,27].

Maligna transformacija je ločeno vprašanje. Literatura navaja približno 5–15 % povezanosti s ploščatoceličnim karcinomom, vendar se ocene razlikujejo glede na populacijo in opredelitev sočasnega raka ter poznejše transformacije [3,4]; širši razpon 0–53 % v starejši literaturi odraža predvsem heterogenost serij [8]. Karcinom in situ je bil v eni od večjih serij prisoten pri 17,2 % od 215 bolnikov in je bil povezan z večkratnimi ponovitvami [28]. Novejši sistematični pregled z metaanalizo povezuje HPV z maligno transformacijo; povezava s kajenjem je bila statistično značilna v modelu s fiksnimi učinki, ne pa v modelu z naključnimi učinki [4]. Zato kajenja na podlagi te analize ne moremo predstaviti kot potrjenega neodvisnega napovednika, niti kirurgije narastišča kot dokazanega preprečevanja maligne transformacije. Klinična posledica je, da mora biti ves odstranjeni material histopatološko pregledan, kot smo ravnali v naši seriji, in da IP glede radikalnosti odstranitve in pooperativnega sledenja obravnavamo podobno kot malignom [3].

Ker se ponovitve pojavljajo tudi po petih letih, avtorji večjih kohort priporočajo endoskopske kontrole vsakih šest mesecev prvih pet let in nato vsaj enkrat letno [16]. Naša shema spremljanja v prvih štirih letih je s tem skladna, nadaljevati pa jo je treba z dolgoročnim, vsaj letnim spremljanjem. Ključne ugotovitve iz literature so povzete v Tabeli 3.

Tabela 3. Izbrani podatki iz literature o preprečevanju ponovitev in maligni transformaciji IP.

Vir	Zasnova (n)	Ključna ugotovitev
Peng in sod., 2019 [12]	Metaanaliza, 96 študij (4134)	Ponovitve: endoskopski 12,8 %, zunanji 16,6 %, kombinirani pristopi 12,6 %
Healy in sod., 2016 [15]	Retrospektivna kohorta (127)	Luščenje sluznice 52,2 %; brušenje 4,9 %; elektrokoagulacija 4,7 %; odstranitev kosti 0 %
Trent in sod., 2022 [18]	Sistematični pregled, 14 študij (585)	Ponovitve 5,8 %; ZR 3,4 % proti 7,3 %; nobena tehnika obdelave baze ni zanesljivo boljša
Tong in sod., 2019 [19]	Retrospektivna kohorta (210)	Večžariščno narastišče: RO 3,5; predhodna operacija druge 22,3 % proti 12,4 %
Glikson in sod., 2021 [21]	Večcentrična kohorta (195)	Hiperostoza na CT ustreza narastišču v 90 %; ob neskladju 38,5 % ponovitev (RO 6,5)
Panara in sod., 2025 [16]	Retrospektivna kohorta (199)	Povprečni čas do ponovitve 44,4 meseca; ZR brez razlike (20,1 % proti 15,5 %)
Adriaensen in sod., 2016 [24]	Retrospektivna serija (121; 5-FU po 18 posegih)	Lokalni 5-FU po resekciji: 1/18 ponovitev; izbira bolnikov onemogoča vzročni sklep
Giannaris in sod., 2026 [22]	Metaanaliza, 13 študij (1629)	Displazija: združeno RO 3,42 za ponovitev
Ambrosini-Spaltro in sod., 2025 [4]	Sistematični pregled z metaanalizo	HPV povezan z maligno transformacijo; povezava s kajenjem ni robustna

RO – razmerje obetov; ZR – zamrznjeni rez; 5-FU – 5-fluorouracil.

Glavne omejitve naše študije so majhen vzorec, retrospektivna zasnova brez kontrolne skupine, operacije enega kirurga v enem centru, izključitev najboljšejšega in malignega primera ter razmeroma kratko spremljanje glede na znano pojavljanje poznih ponovitev. Podatkov o displaziji, statusu HPV in večžariščnosti narastišča nismo sistematično beležili. Tudi primerjalni podatki v literaturi so pretežno retrospektivni in obremenjeni z izbiro bolnikov, saj so odprti in kombinirani pristopi praviloma rezervirani za najzahtevnejše primere [12]. Pregled literature ni bil sistematičen; več ključnih kirurških člankov je bilo mogoče preveriti le po izvlečku, zato podrobnih primerjav protokolov ne štejemo za dokončne.

Zaključek

Popolna resekcija vseh narastišč IP s pripadajočim periostom in obdelavo kostne podlage je uveljavljeno kirurško načelo za zmanjševanje ponovitev, dokazi za primerjalno prednost posameznih metod obdelave baze in za preprečevanje maligne transformacije pa ostajajo šibkejši. Kirurški pristop naj določa anatomija narastišča. V naši seriji se je endoskopska medialna maksilektomija izkazala kot varen poseg, ki združuje radikalnost in pooperativno preglednost, zapleti pa so bili redki in obvladljivi; lokalna ekscizija je smiselna le pri stadiju T1 z obdelavo ležišča. Ker se ponovitve in maligna transformacija lahko pojavijo pozno, potrebujejo bolniki z IP dolgoletno endoskopsko spremljanje.

Etika, soglasja in financiranje

Etična odobritev: Raziskava je bila opravljena v okviru ocene kakovosti dela na inicialni seriji bolnikov, operiranih z endoskopsko tehniko, in je temeljila na retrospektivni analizi rutinsko zbranih kliničnih podatkov.

Informirano soglasje: Prispevek ne vsebuje kliničnih fotografij ali podatkov bolnikov

Financiranje: Raziskava ni prejela zunanjega financiranja.

Navzkrižje interesov: Avtorji izjavljamo, da ni navzkrižja interesov.

Uporaba orodij umetne inteligence: Pri iskanju literature je bil uporabljen iskalnik Consensus (Consensus NLP, Inc.). Avtorji smo navedbe preverili v izvirnih virih in prevzemamo polno odgovornost za vsebino.

Razpoložljivost podatkov: Anonimizirani podatki so na voljo pri kontaktnem avtorju na razumno zahtevo.

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Advanced invasive fungal rhinosinusitis with orbital, skull-base and intracranial extension: a two-cohort single-centre experience

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STRUCTURED ABSTRACT

Background: Acute invasive fungal rhinosinusitis (AIFRS) is a rare, rapidly progressive infection of immunocompromised hosts whose prognosis worsens sharply once disease reaches the orbit, skull base or cranial cavity. We describe the experience of a single tertiary centre through two complementary cohorts and place it against published cohorts.

Methods: We retrospectively reviewed (i) consecutive patients treated for AIFRS between 2016 and 2025 (Cohort A, mixed pathogens) and (ii) patients assessed by our Multidisciplinary Skull Base Board between 2023 and 2025 for suspected invasive fungal disease of the head and neck (Cohort B, predominantly *Aspergillus*). Diagnosis rested on histopathological evidence of tissue invasion, supported by computed tomography, magnetic resonance imaging and microbiology. Management combined reversal of host risk factors, systemic mould-active antifungal therapy and endoscopic debridement. Analysis was descriptive.

Results: Cohort A comprised 14 patients; overall survival was 42.8%. All underwent debridement (one to four procedures); orbital exenteration was indicated in one patient and performed in none. Central nervous system involvement with neurological deficit occurred in 64.3%, and survival among patients with dural or intracranial involvement was 16.7%. Every survivor had diabetes mellitus and/or prior COVID-19 and/or systemic corticosteroid exposure. Cohort B comprised eight patients assessed, seven with confirmed *Aspergillus* (predominantly *A. fumigatus*); disease centred on the anterior skull base and paranasal sinuses, and histological proof of invasion was unattainable in two despite unequivocal deep involvement including neurological deficit. Disease-specific survival was highest for *Aspergillus* (59–68%) versus *Mucorales* (39–41%) and mixed infection (below 40%). These figures fall within the range reported by other published cohorts.

Conclusion: Across both cohorts and the wider literature, intracranial extension was the dominant determinant of death and *Aspergillus* carried the most favourable prognosis. When invasion cannot be histologically confirmed but the clinical picture is unequivocal, continued aggressive systemic therapy rather than repeated biopsy appears prudent.

Early diagnosis, reversal of host risk factors and prompt debridement remain central to survival.

Keywords: Invasive Fungal Infections; Mucormycosis; Aspergillosis; Paranasal Sinus Diseases; Immunocompromised Host

Introduction

Acute invasive fungal rhinosinusitis (AIFRS) is among the most lethal conditions in rhinology, with pooled survival of roughly one half and markedly worse outcomes once disease crosses into the orbit, skull base or cranial cavity [1]. Two groups of moulds dominate — the Mucorales and *Aspergillus* species — and outcome differs by organism, *Aspergillus* generally carrying a more favourable prognosis than mucormycosis [2]. The COVID-19 pandemic produced a marked surge in rhino-orbito-cerebral mucormycosis, particularly in patients with diabetes mellitus and corticosteroid exposure [3]. Regardless of organism, spread to the cavernous sinus, cribriform plate or brain marks a steep fall in survival, with intracranial mortality exceeding 80% in most series [1,4].

Management is time-critical and multidisciplinary, resting on reversal of immunosuppression, systemic mould-active antifungal therapy and surgical debridement. Yet the evidence base is small, retrospective and heterogeneous, and single-centre experience remains valuable for calibrating expectations and refining decisions at the orbit, skull-base and cranial interface. We report our institutional experience through two complementary cohorts, set it against the published literature, and derive practical lessons for advanced disease.

Methods

We performed a retrospective review at a tertiary academic centre (University Medical Centre Ljubljana). Cohort A comprised consecutive patients managed for AIFRS between 2016 and 2025 (mixed pathogens). Cohort B comprised patients evaluated by the institutional Multidisciplinary Skull Base Board between 2023 and 2025 for suspected invasive fungal disease of the head and neck, drawn from our recent institutional series [5]; the structure of the board has been described previously [6]. Diagnosis required histopathological evidence of hyphal tissue invasion; computed tomography and magnetic resonance imaging defined disease extent, and microbiology (culture, serum galactomannan and, where available, molecular testing) supported identification. Management followed a common framework: urgent reversal of host risk factors, high-dose systemic mould-active antifungal therapy and endoscopic debridement to viable margins, escalated to open or combined approaches for extensive disease. Recorded outcomes were survival, disease extent (orbital, skull-base, intracranial) and comorbid risk factors. To contextualise our results we summarised

published survival cohorts in invasive fungal rhinosinusitis and rhino-orbito-cerebral mucormycosis. Given the small, heterogeneous samples, analysis was descriptive (counts and percentages); reporting follows the STROBE statement [7].

Results

Cohort A (2016–2025). Fourteen patients were treated over the period, with an overall survival of 42.8%. All patients underwent surgical debridement, repeated one to four times; orbital exenteration was indicated in a single patient and ultimately performed in none, consistent with an organ-preserving approach. Central nervous system involvement manifesting as neurological deficit was present in 64.3% of patients. Survival among those with dural or intracranial involvement fell to 16.7%. Notably, every survivor carried at least one reversible or defining host factor — diabetes mellitus, recent COVID-19, and/or systemic corticosteroid therapy.

Cohort B (2023–2025). Eight patients were assessed for suspected invasive fungal disease of the head and neck, seven with histologically or microbiologically confirmed *Aspergillus* (predominantly *A. fumigatus*; one *A. flavus*). Disease centred on the anterior skull base and paranasal sinuses, with lateral skull-base (temporal bone) involvement in a minority. Underlying conditions spanned the expected immunocompromised spectrum: diabetes mellitus, recent COVID-19, haematological malignancy (B-cell acute lymphoblastic leukaemia) and metastatic solid cancer. In two of the eight patients, unequivocal histological proof of invasion could not be obtained despite a clear clinical picture of deep involvement, including neurological deficits.

Pathogen-specific prognosis. In a parallel synthesis of the literature accompanying Cohort B, disease-specific survival was consistently highest for *Aspergillus* (59–68%), intermediate-to-poor for the Mucorales (39–41%) and lowest for mixed infections (below 40%) [5]. The two cohorts are summarised in Table 1.

Characteristic	Cohort A	Cohort B
Period	2016–2025	2023–2025
Patients (n)	14	8 assessed (7 <i>Aspergillus</i> -confirmed)
Dominant pathogen	Mixed (Mucorales / <i>Aspergillus</i>)	<i>Aspergillus</i> (mostly <i>A. fumigatus</i>)
Principal sites	Sinonasal, orbit, skull base	Anterior skull base, paranasal sinuses
CNS involvement	64.3% (neurological deficit)	Present, incl. deficits; invasion unproven in 2/8
Orbital exenteration	Indicated 1, performed 0	Not performed
Survival	42.8% overall	<i>Aspergillus</i> 59–68% (disease-specific)
Key host factors	DM, COVID-19, corticosteroids	DM, COVID-19, haematologic malignancy, metastatic cancer

Table 1. Characteristics and outcomes of the two single-centre cohorts of advanced invasive fungal rhinosinusitis. DM, diabetes mellitus; CNS, central nervous system.

Discussion

Two lessons stand out. First, intracranial extension dominated outcome: survival with dural or intracranial disease in Cohort A (16.7%) mirrors the mortality above 80% repeatedly reported once fungus reaches the brain or cavernous sinus [4], and the steep anatomic gradient of risk documented in large mucormycosis series [3]. Second, the infecting organism matters: the superior prognosis of *Aspergillus* over the *Mucorales* in Cohort B's synthesis (59–68% versus 39–41%) reproduces the pattern seen in the largest therapeutic review of mucormycosis [2] and underpins pathogen-directed therapy — liposomal amphotericin B anchoring mucormycosis [8], and voriconazole, or isavuconazole with fewer ocular, hepatobiliary and cutaneous adverse events in randomised invasive-mould evidence [9], anchoring aspergillosis, with prolonged, protocol-driven courses at the skull base [10].

Comparison with published cohorts. Set against other published series (Table 2), our institutional survival lies within the reported range. General AIFRS cohorts span roughly one half overall [1], 63% at three months [11], 71% and 52% at one and three months [12], and 39% at six months, falling from 75% to 18% across a clinical-severity staging system [13]. Series enriched for advanced rhino-orbito-cerebral mucormycosis report 60% in sinonasal-limited disease [14], 56.8% hospital survival — only 7.4% with invasive mechanical ventilation [15] — and, in COVID-associated surgically treated cohorts, 73.1% at 24 months [16] and 74.4% at one year [17]. The COVID-associated surgical cohort showed a clear anatomic gradient in disease-specific survival, from about 90% for sinonasal disease to 45% for rhinocerebral disease [16]. Broader data reinforce this pattern: in a 686-patient cohort, orbital and intracranial involvement independently raised mortality roughly two- and 2.6-fold [18]; five of nine patients with orbital involvement died in one AIFRS orbital-infection series [19]; and survival mixing acute with chronic disease was 49% at one year [20]. Because end-points and case-mix differ widely — hospital-discharge versus 3-, 6-, 12- and 24-month survival, and COVID-era versus historic disease — these figures are complementary rather than directly comparable.

Study	Cohort / endpoint	Survival
General AIFRS benchmarks (mixed pathogens)		
Turner et al., 2013	52 studies, 807 patients (historic AIFS)	49.7% overall
Wandell et al., 2018	Multi-institutional, biopsy-proven	63% (3-month)
Gardner et al., 2021	21 pts; 76% haematologic malignancy	71% / 52% (1 & 3-month)
Munyemana et al., 2024	71 pts (1992–2022); severity staging	39% (6-month); stages 75→18%
Advanced rhino-orbito-cerebral (mucormycosis)		

Study	Cohort / endpoint	Survival
Saedi et al., 2011	30 pts, sinonasal-limited; endoscopic + AmB	60% (18/30)
Çağ et al., 2022	74 pts; international ROCM (ID-IRI)	56.8% hosp.; 7.4% if ventilated
Arora et al., 2024	175 COVID-mucor, surgical	73.1% (24-mo); 90→45% by site
Eshraghi et al., 2025	246 COVID-ROCM; 8 centres	74.4% (1-year)
Context — not directly comparable		
Abdulkader et al., 2025	686 hospitalised mucor; India	14.7% 1-yr mortality; orbit/CNS worse
Manaviboon et al., 2026	116 pts; acute + chronic mixed	49.0% (1-year)

Table 2. Reported survival in published cohorts of invasive fungal rhinosinusitis and rhino-orbito-cerebral mucormycosis. Endpoints and case-mix differ; estimates are complementary, not directly comparable. AIFRS, acute invasive fungal rhinosinusitis; ROCM, rhino-orbito-cerebral mucormycosis; AmB, amphotericin B.

A practical message emerges from the two Cohort B patients in whom invasion could not be histologically confirmed despite unequivocal deep involvement: waiting for definitive tissue proof risks fatal delay. Where the clinical and radiological picture is unambiguous, continuing aggressive systemic therapy rather than deferring for repeat biopsy appears the safer course. This aligns with the broader shift toward earlier, source-controlling treatment and maximal safe — rather than maximal radical — surgery, and with observations that conservative resection combined with azole therapy need not worsen outcome in orbitocranial disease [21].

The absence of orbital exenteration across Cohort A, despite advanced disease, supports an organ-preserving stance when the globe remains viable. Coordinated multidisciplinary care — here delivered through a dedicated skull base board [6] — is likely central to these results. This report has clear limitations: both cohorts are small, retrospective and single-centre; pathogens and endpoints are heterogeneous; survival metrics differ (all-cause versus disease-specific); and referral to a tertiary board introduces selection. The descriptive findings, and the published comparators in Table 2, should therefore be read as hypothesis-generating and hypothesis-consistent rather than definitive.

Conclusion

Advanced invasive fungal rhinosinusitis remains highly lethal once it reaches the skull base and cranial cavity, yet outcome depends more on the speed of diagnosis and treatment, the reversibility of host factors and the infecting organism than on the radicality of resection. Prompt mould-active therapy, correction of immunosuppression and organ-preserving debridement — coordinated by a multidisciplinary skull base

team — offer the best prospect of survival, and definitive systemic treatment should not await histological proof when the clinical picture is unequivocal.

Ethics, Consent and Funding

Ethical Approval: This retrospective review was conducted in accordance with the Declaration of Helsinki.

Informed Consent: Written informed consent for the use of clinical data and any images was obtained where required; all clinical images were fully anonymised.

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Use of Artificial Intelligence (AI): A generative AI large-language-model tool was used to assist with summarising previously compiled data and with language editing. The authors reviewed all output and take full responsibility for the content, in line with ICMJE recommendations.

Data Availability: The data supporting the findings are available from the corresponding author on reasonable request.

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Contemporary surgery of the nose, paranasal sinuses and skull base: four myths about surgery for sinonasal tumours

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STRUCTURED ABSTRACT

Surgery for sinonasal and skull-base tumours has shifted markedly towards endoscopic techniques, yet a proportion of physicians still doubt their oncological safety. The lecture aimed to explain this scepticism and to critically examine four common beliefs (myths): that a tumour must always be removed “en bloc”, that “piecemeal” resection carries a higher risk of intraoperative cancer seeding, that a tumour involving the skull base, dura mater or brain is unresectable, and that wide surgical margins must always be secured in cancer. This is a narrative summary of a lecture given at the 1st ILOC Congress, prepared from the lecture slides. It draws on clinical cases from the lecturer's own practice. No systematic literature search or statistical analysis was performed.

Modern surgery for sinonasal and skull-base tumours is based on endoscopic techniques, while open techniques retain a role in selected tumours. The discussed myths do not hold as general rules; the approach and method of resection should be decided case by case, and knowledge of contemporary techniques matters for all surgeons.

Keywords: paranasal sinus neoplasms; skull base neoplasms; endoscopy; margins of excision; neoplasm seeding

Introduction

In terms of tumours, the sinonasal and skull-base region is the most histologically diverse area in the human body. Tumours here lie in direct contact with critical neurovascular structures, the orbit, the face, the oral cavity and the pharynx, which makes their surgical treatment demanding. For decades, open surgery was the only option. Today, modern surgery for sinonasal and skull-base tumours is based on endoscopic resection techniques, made possible by advances in optics, navigation and reconstruction.

Endoscopic and open approaches have different characteristics (Table 1). The endoscopic approach leaves no visible skin incision, magnifies the surgical field, offers better control of bleeding and allows faster recovery, but it is technically more de-

manding and more time-consuming, and the tumour is often removed in pieces ("piecemeal" resection). The open approach allows en bloc resection and is suitable for tumours with skin infiltration, significant orbital infiltration and hard palate involvement, but it requires a facial incision, is performed without magnification of the surgical field and is associated with slower recovery.

Table 1. Comparison of endoscopic and open tumour surgery (summarised from the lecture).

Feature	Endoscopic approach	Open approach
Skin incision	no visible incision	facial incision
Magnification of the surgical field	yes	no
Control of bleeding	better	poorer
Technical difficulty	higher	lower
Operative time	longer	shorter
Recovery	"rapid" (better quality of life)	"slow" (reduced quality of life)
Tumour removal	"piecemeal" resection	en bloc resection
Control of surgical margins	better	poorer
Limitations and indications	not suitable for tumours with skin, orbital or hard palate infiltration	suitable for tumours with skin infiltration, significant orbital infiltration and hard palate involvement

Terms in quotation marks are taken verbatim from the slide.

Despite these advantages, some physicians do not trust endoscopic approaches, and beliefs that the lecture describes as myths persist in tumour management. The aim of this article is to summarise the reasons for doubts about endoscopic approaches to head and neck tumours and to critically present four myths about surgery for sinonasal tumours.

Methods

This article is a narrative summary of the lecture "Contemporary surgery of the nose, paranasal sinuses & skull base", presented at the 1st ILOC Congress in Portorož on 2 October 2026. No systematic literature search was performed. The content is based on the lecture slides, which summarise clinical cases from the lecturer's own practice. The text was prepared from the lecture material with the help of a generative AI tool; no original measurements or statistical analyses were carried out, so the article contains no original statistical data or p-values.

Results

Reasons for doubts about endoscopic approaches

The lecture divided the reasons why some people do not believe in endoscopic approaches to head and neck tumours into two perspectives.

The perspective of non-surgeons:

The historical "gold standard" model: for decades, open surgery was the only option, and the mental model of safety is based on experience gained during specialisation.

Limited exposure to contemporary data: they do not see the functional benefits of minimally invasive approaches and are less familiar with advances in optics, navigation and reconstruction.

Perception of safety and control: open surgery gives an intuitive sense of "greater control", whereas endoscopic approaches may seem abstract or technically demanding.

Fear of incomplete resection: the risk of positive margins in endoscopy is often overestimated; data on comparable radicality in selected tumours are limited.

The perspective of surgeons who operate exclusively openly:

Professional identity and mastery: open surgery is the cornerstone of their careers, and endoscopic approaches can pose a threat to professional identity.

Lack of practical experience: without experience of endoscopic optics, navigation and anatomy "from the inside", it is difficult to have confidence in the technique; they do not see faster recovery or better functional outcomes.

Cognitive bias (status quo bias): "What I know is safe." "What I don't know is risky." "A deeper cut = greater radicality."

Institutional inertia: centres without a tradition of endoscopy train generations of open surgeons, and a lack of equipment, mentors and examples reinforces these doubts.

Hierarchy in surgery: if the lead surgeon does not support endoscopy, it is rarely adopted by the whole department.

The common grounds for doubt are therefore tradition and historical standards, lack of exposure to up-to-date information, mistrust of technology, fear of incomplete resection and institutional culture.

Myth 1: The tumour must be removed "en bloc" to prevent recurrence

Proponents of the open approach argue that it allows better visualisation and prevents seeding of the cancer field, because the cancer is removed in one piece and the incisions are made solely in healthy tissue. The lecture stressed that this is rarely feasible.

ible in the sinonasal region because of the proximity of important neurovascular structures and the orbit. It is often not possible to determine the radiological extent of the tumour or the margins of resection precisely; with the open approach there is no endoscopic magnification, the wound is larger and bleeding may be more severe.

Studies both for and against endoscopic and open resection exist. As presented in the lecture, Kilic et al. [1] performed a retrospective analysis of a national cancer registry of 1,483 patients with squamous cell carcinoma, comparing positive resection margins and overall survival after open and endoscopic procedures; they found no difference between the approaches.

An example of open en bloc resection was an ethmoid adenocarcinoma with invasion of the orbit, the anterior maxillary wall and the skull base, treated with partial maxillectomy and orbital exenteration. A second example was squamous cell carcinoma of the nasal ala (rT3N0M0, after radiotherapy), treated with hemirhinectomy (full thickness of the nasal ala, medial cheek, nasal floor and partial nasal apex). Reconstruction comprised an ipsilateral island nasolabial flap for lining, a concha cartilage graft for framework and an ipsilateral paramedian forehead flap for surface.

The lecturer summarised that the evidence shown consists of retrospective studies, the most recent of which dates from 2017. There is no evidence of poorer survival after “piecemeal” resection compared with en bloc resection. The resection technique may be chosen depending on the size and location of the tumour, the method of resection is decided for each individual tumour separately, and en bloc resection should be attempted whenever this is possible and necessary.

Myth 2: The risk of intraoperative cancer spread is higher with “piecemeal” resection

The assumption is that tumour fragments deposited on healthy tissue during resection may cause field cancerisation. The evidence shown in the lecture is summarised in Table 2 [2]. A systematic review (69 patients with recurrent skull-base lesions attributed to seeding) found that tumour recurrence attributed to seeding after endonasal approaches is rarely reported, and a retrospective cohort of 70 patients with locally advanced sinonasal malignancy likewise found such recurrence to be rare. A retrospective cohort of 38 patients with olfactory neuroblastoma showed that dural recurrence can occur in the absence of local recurrence, and a case report of adenoid cystic carcinoma suggested that distant recurrence after resection may be attributed to intraoperative locoregional seeding (level of evidence 5).

Table 2. Evidence surrounding the risk of tumour seeding (source: Table VI.3 in [2], as shown in the lecture).

Study (year)	LOE	Design	Study group	Clinical end-point	Conclusion
Nguyen et al. (2018)	2	Systematic review	69 patients with recurrent skull-base lesions attributed to seeding	Recurrence attributed to seeding	Tumour recurrence attributed to seeding in endonasal approaches is rarely reported.
Yu et al. (2018)	3	Retrospective cohort	38 patients with olfactory neuroblastoma (ONB)	1. dural recurrence; 2. local recurrence	Dural recurrence can occur in the absence of local recurrence.
Moore et al. (2011)	3	Retrospective cohort	70 patients with locally advanced sinonasal malignancy (SNM)	Recurrence attributed to seeding	Tumour recurrence attributed to seeding is rare.
Miller et al. (2006)	5	Case report	One patient with adenoid cystic carcinoma (ACC) treated with maxillectomy and radiotherapy (RT)	Recurrence at the tracheostoma	Distant recurrence following resection may be attributed to locoregional seeding intraoperatively.

Abbreviations: LOE – level of evidence; SNM – sinonasal malignancy; ONB – olfactory neuroblastoma; ACC – adenoid cystic carcinoma; RT – radiotherapy.

The lecture concluded that the surgical approach and technique can be chosen depending on the risk of cancer recurrence and that there is no evidence that any surgical approach carries a higher risk of intraoperative cancer spread. The material also refers to a video of a “sleeve” resection of a melanoma, the content of which is not captured in this transcript.

Myth 3: A tumour is unresectable if it involves the skull base, the dura mater, the brain, the infratemporal fossa or the pterygopalatine fossa

The lecture defined resectability as the possibility of macroscopic surgical removal of the tumour in an oncologically acceptable manner without causing significant morbidity, a decline in quality of life or mortality. Unresectability is linked to involvement of critical structures. The radicality of removal is described as R0 (cancer removed microscopically into healthy tissue), R1 (tumour removed macroscopically into healthy tissue, gross total resection, GTR) and R2 (macroscopically incompletely resected cancer).

Orbital invasion means stage T4a, and the question of resectability is tied to the impact of exenteration on morbidity and quality of life. Stage T4b (involvement of the dura mater, cavernous sinus, orbital apex, internal carotid artery [ACI], nasopharynx, clivus, middle cranial fossa and cranial nerves except V2) is often considered unresectable, and metastatic cancer is considered unresectable except for adenoid cystic

carcinoma. The lecture treated both simplifications – that T4a is resectable and T4b unresectable – as questionable.

Two stage T4b tumours were shown: cT4bN0M0 with involvement of the bilateral olfactory fossa, falx, frontal lobes, right pterygoid base and periorbit, and rT4bN0M0 with involvement of the bilateral olfactory fossa, falx, frontal lobes, upper nasal septum and periorbit. An endoscopic view at the end of the nasal phase of surgery and a postoperative CT scan were also shown. The lecture material contains no data on the oncological outcome of these cases.

The resectability of a tumour is determined on the basis of its biological potential (malignant or benign), the treatment timeline (before or after non-surgical treatment) and tumour size; unacceptable morbidity means unresectability, which depends on the tumour, on the patient and (to some extent) on the surgeon. Only a pathologist can determine R0 status, by examining the entire continuity of the surgical margins and the base of the cancer resection, which is generally not possible in the sinonasal region. What is usually meant is macroscopically complete removal of the tumour, regardless of the type of surgery (open or endoscopic), and this is taken into account in postoperative treatment. The surgeon may declare an R0 resection following consultation with the pathologist regarding the histopathology results from samples taken from the margins and the tumour bed.

Myth 4: In cases of cancer, wide safety margins must be ensured

The sinonasal and skull-base region is in direct contact with critical neurovascular structures, the oral cavity, the pharynx, the face and the orbit, and three-dimensional spaces are more complex than on body surfaces. The cases of olfactory neuroblastoma and nasopharyngeal cancer shown (MRI with distance measurements drawn in) illustrate the limited space available for wide margins. The material also refers to a video of nasopharyngectomy for adenoid cystic carcinoma, the content of which is not captured in this transcript.

As a solution, the lecture presented intraoperative sampling and pathological examination of frozen sections:

- adequate safety margins can be ensured by intraoperative sampling and frozen-section examination;
- in cases of visible overgrowth of the lamina papyracea, a sample of the periorbital region should be taken;
- in cases of periorbital infiltration, a sample of the intraorbital contents (fat) should be taken;
- in cases of skull-base bone infiltration, a sample of the dura should be taken;
- in the case of dura mater invasion, the brain is not sampled (the best-case scenario is R1 or GTR resection);

- safety margins vary, mostly 0.5–1 cm or depending on the proximity to surgical planes (nasal septum versus orbit).

Discussion

What the four myths discussed have in common is that they treat an absolute rule ("always en bloc", "never piecemeal", "never if the skull base is involved", "always wide margins") as a substitute for individual judgement. According to the lecture material, retrospective data do not show poorer oncological outcomes after endoscopic or piecemeal resection, and tumour seeding is rarely described. Resectability is not a property of the tumour alone but the result of weighing its biological potential, the timing of treatment, the extent of disease and the morbidity acceptable to the individual patient.

Open techniques therefore do not lose their importance: they remain relevant for selected tumours, especially those with skin infiltration, significant orbital infiltration and hard palate involvement, and en bloc resection should be attempted whenever it is possible and necessary. At the same time, the lecturer emphasises that modern surgery for sinonasal and skull-base tumours is based on endoscopic techniques and that knowledge of contemporary approaches is essential regardless of the type of surgery a surgeon performs.

To improve the uptake of endoscopic approaches, the lecture proposes active training by and for the multidisciplinary team (MDT), transparent communication about the limits of the technology, mentoring and observing operations, and the development of centres of excellence.

Limitations. This article is a narrative summary of a lecture, not a systematic review. The evidence shown is retrospective, the most recent study mentioned dates from 2017, and the level of evidence in Table 2 ranges from 2 to 5. Retrospective comparisons of open and endoscopic approaches are limited by the rarity and heterogeneity of sinonasal tumours and by possible patient selection. The text was produced from slides alone and therefore does not capture the spoken explanations; some statements (for example, on comparable radicality in selected tumours) are terse on the slides and would need to be supplemented from the original sources. The article was prepared by AI and must be verified by the author before use.

Conclusion

Modern surgery for sinonasal and skull-base tumours is based on endoscopic resection techniques, while open techniques retain a role in selected tumours. The myths discussed do not hold as general rules, so the approach, the method of resection and the margins should be decided case by case. Because physicians believe in these myths for various reasons, it is essential to keep up to date with modern techniques in

surgery of the nose, paranasal sinuses and skull base, regardless of the type of surgery one performs.

Ethics, Consent and Funding

Ethical approval: not required, as this is a narrative summary of a lecture and of published literature, with no research on human subjects and no new data collection.

Informed consent: not applicable, as the article contains no data or photographs of individual patients. The clinical images from the original lecture (photographs, MRI, CT) are not included in this transcript; their publication would require written patient consent.

Acknowledgements: none.

Conflicts of interest: not relevant.

Use of artificial intelligence tools: A generative AI large-language-model tool was used to assist with summarising previously compiled data and with language editing. The author reviewed all output and takes full responsibility for the content, in line with ICMJE recommendations.

Data availability: all data derive from the lecture slides and the cited literature; there are no original research data.

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EPOS4Patients in informacijske potrebe bolnikov s kroničnim rinosinuzitisom: pregled vodnika in rezultati ankete na terciarni kliniki

EPOS4Patients and the information needs of patients with chronic rhinosinusitis: a review of the guide and survey results at a tertiary clinic

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STRUKTURIRANI IZVLEČEK

Uvod: Kronični rinosinuzitis (KRS) je pogosta, večinoma vseživljenjska bolezen, pri kateri sta uspeh zdravljenja in sodelovanje bolnika odvisna od razumevanja bolezni in možnosti zdravljenja. Evropsko stališče EPOS2020 dopolnjuje vodnik za bolnike EPOS4Patients, pripravljen v sodelovanju z bolniki. Namen raziskave je bil oceniti, kako bolniki s KRS ocenjujejo količino prejetih informacij in potrebo po dodatnih informacijah, ter s tem potrebo po slovenski različici vodnika.

Metode: Pilotno raziskavo smo začeli leta 2023 in jo nadaljevali do leta 2026. Bolnike s KRS, obravnavane na Kliniki za otorinolaringologijo in cervikofacialno kirurgijo UKC Ljubljana, smo povabili k anonimni spletni anketi (Google Forms, dostop prek kode QR) s petimi trditvami, ocenjenimi na lestvici od 1 do 10. Povezane ocene smo primerjali s Wilcoxonovim testom predznačenih rangov, povezanost pa ocenili s Spearmanovim koeficientom korelacije (ρ).

Rezultati: Anketo je izpolnilo 17 bolnikov. Željo po dodatnih informacijah so ocenili z mediano 9 (IQR 8–10), pomen razumevanja zdravljenja za uspeh z mediano 9 (IQR 9–10), zadostnost prejetih informacij z mediano 6 (IQR 2–8) in lastno razumevanje diagnostike in zdravljenja z mediano 5 (IQR 3–7). Želja po informacijah je bila statistično značilno višja od ocene prejetih informacij ($p = 0,002$), pomen razumevanja pa višji od dejanskega razumevanja ($p < 0,001$). Ocena zadostnosti informacij je bila močno povezana z oceno razumevanja ($p = 0,82$; $p < 0,001$). Informacije v spletni ali mobilni obliki si je izrazilo želelo 14 bolnikov (82 %).

Zaključek: Med potrebo bolnikov s KRS po informacijah in informacijami, ki jih prejmejo, obstaja izrazita vrzel. Rezultati utemeljujejo pripravo slovenske različice vodnika EPO-

S4Patients, dostopne tudi v digitalni obliki, ki bi lahko izboljšala razumevanje bolezni in podprla skupno odločanje o zdravljenju.

Ključne besede: sinusitis; izobraževanje bolnikov; zdravstvena pismenost; skupno odločanje; ankete in vprašalniki

ABSTRACT (ENGLISH SUMMARY)

Chronic rhinosinusitis (CRS) is a common, usually lifelong disease in which treatment success depends on patients understanding their condition and participating in their care. EPOS4Patients, a patient-facing supplement to EPOS2020 developed together with patients, explains rhinosinusitis and its management in accessible language. In a pilot study started in 2023 and continued until 2026 at the Department of Otorhinolaryngology and Cervicofacial Surgery, UMC Ljubljana, we assessed the need for a Slovenian version of the guide with an anonymous online survey. Seventeen patients rated five statements on a 1–10 scale. The desire for more information (median 9) exceeded the perceived sufficiency of information received (median 6; $p = 0.002$), and the importance attributed to understanding treatment (median 9) exceeded self-rated understanding (median 5; $p < 0.001$). Sufficiency of information correlated strongly with understanding ($p = 0.82$). Most patients (82%) wanted information in digital form. These findings support a Slovenian version of EPOS4Patients.

Keywords: Sinusitis; Patient Education as Topic; Health Literacy; Decision Making, Shared; Surveys and Questionnaires

Uvod

Rinosinuzitis je vnetje sluznice nosu in obnosnih votlin, ki ga glede na trajanje delimo na akutno (ARS) in kronično obliko (KRS). O KRS govorimo, kadar simptomi trajajo več kot 12 tednov; bolezen prizadene 5–12 % prebivalstva, delimo pa jo na KRS z nosnimi polipi in brez njih [1]. Ker je ozdravitev redka, KRS pri večini bolnikov postane vseživljenjsko stanje.

KRS pomembno znižuje kakovost življenja, kar jasno kažejo vprašalniki, ki jih izpolnjuje bolnik, kot je SNOT-22 (angl. Sino-Nasal Outcome Test) [2,3]. Gliklich in Metson sta pokazala, da KRS nekatera področja splošnega zdravja, zlasti socialno delovanje in telesno bolečino, prizadene bolj kot angina pectoris, kronično srčno popuščanje ali kronična obstruktivna pljučna bolezen [4]. Bolezen je breme tudi za družbo: bolniki s sinuzitisom izgubijo podobno število delovnih dni kot bolniki z akutno astmo, izdatki za njihovo zdravstveno oskrbo pa so višji kot pri peptični razjedi, akutni astmi ali senenem nahodu [5].

Zdravljenje KRS temelji na lokalnih kortikosteroidih in izpiranju nosu s fiziološko raztopino, pri čemer sta pravilna tehnika aplikacije in dosledno jemanje zdravil ključna za uspeh [1]. Evropsko stališče o rinosinuzitisu in nosnih polipih EPOS2020 kot četrta

različica smernic ponuja z dokazi podprta priporočila in integrirane klinične poti za akutni in kronični rinosinuzitis pri odraslih in otrocih, v pripravo pa je prvič enakovredno vključilo tudi bolnike [1].

Vloga bolnika pri obvladovanju KRS je razmeroma slabo raziskana. Sodelovanje bolnika je eden od štirih stebrov t. i. medicine 4P (napovedne, preventivne, personalizirane in participativne), ki naj bi izboljšala sodelovanje pri zdravljenju in zadovoljstvo bolnikov ter zmanjšala stroške [6]. Pri KRS to pomeni vključevanje bolnika v načrtovanje zdravljenja, spremljanje po zdravljenju in odločanje. Pogoji za takšen model je sistematično izobraževanje bolnikov, katerega cilj je t. i. ozaveščen bolnik (angl. smart patient), ki dejavno upravlja svoje zdravje v partnerstvu z zdravnikom [7]. Dobro izobraževanje bolnikov je zato eden ključnih elementov uspešnega obvladovanja simptomov in ponovitev KRS.

Kot dopolnilo EPOS2020 je izšel vodnik EPOS4Patients [8]. Gre za vodnik za bolnike o rinosinuzitisu in ne za samostojno obliko zdravljenja ali klinično raziskavo. Pripravljen je bil v sodelovanju z bolniki in organizacijami bolnikov, njegov namen pa je v razumljivem jeziku pojasniti bolezen in možnosti zdravljenja, odgovoriti na pogosta vprašanja ter bolnikom pomagati, da o zdravljenju odločajo skupaj s svojim zdravnikom [8].

Vodnik zajema akutni in kronični rinosinuzitis, bolezen z nosnimi polipi in brez njih ter rinosinuzitis pri otrocih. Obravnava izpiranje nosu s fiziološko raztopino, kortikosteroidi, antibiotike, biološka zdravila, kirurško zdravljenje, sodelovanje v kliničnih raziskavah, izgubo voha, vire za bolnike in pogosta vprašanja [8]. Iz vsebine vodnika izhajajo tri skupine potreb bolnikov: potreba po jasni razlagi možnosti zdravljenja, priložnost, da z zdravnikom spregovorijo o vplivu bolezni na vsakdanje življenje, ter glas pri določanju prednostnih raziskovalnih vprašanj in zasnovi raziskav. Vodnik izrecno podpira skupno odločanje, predstavlja merjenje simptomov in kakovosti življenja z vprašalniki, ki jih izpolnjuje bolnik (npr. SNOT-22 [3]), ter opisuje vključevanje bolnikov v raziskovanje [8]. Poglavje o izgubi voha opozarja še na potrebe, povezane s prehrano, razpoloženjem in socialno izolacijo [8,9].

Da bi bolnik lahko enakovredno sodeloval pri odločanju, mora informacije najprej prejeti, jih razumeti in uporabiti, kar opisuje pojem zdravstvene pismenosti [10]. Skupno odločanje, pri katerem zdravnik predstavi možnosti ter njihove koristi in tveganja, bolnik pa izrazi svoje vrednote in pričakovanja, je danes priporočen model klinične obravnave [11]. Gradivo, kot je EPOS4Patients, bi lahko slovenskim bolnikom dalo zanesljivo znanje o bolezni in samozavest za pogovor z zdravnikom, hkrati pa bi jih usmerilo stran od nepreverjenih spletnih virov, h katerim se danes pogosto obračajo. Podatkov o tem, koliko informacij o bolezni prejmejo slovenski bolniki s KRS in koliko bi si jih želeli, nismo našli.

Raziskava je izšla iz vprašanja, ali orodja, kot je EPOS4Patients, lahko prek večje vključenosti bolnikov izboljšajo obvladovanje KRS in ali si bolniki takšnih informacij sploh

željivo. Cilji prispevka so bili: (1) povzeti vsebino in namen vodnika EPOS4Patients, (2) oceniti, kako bolniki s KRS na naši kliniki ocenjujejo količino prejetih informacij, lastno razumevanje bolezni in potrebo po dodatnih, tudi digitalnih informacijah, ter (3) na tej podlagi oceniti potrebo po slovenski različici vodnika in predlagati nadaljnje korake. Predpostavili smo, da je potreba bolnikov po informacijah večja od ocene informacij, ki so jih prejeli.

Metode

Zasnova in okolje. Izvedli smo presečno opazovalno raziskavo z anonimno spletno anketo na Kliniki za otorinolaringologijo in cervikofacialno kirurgijo Univerzitetnega kliničnega centra Ljubljana. Raziskavo smo zasnovali leta 2023 kot pilotno študijo v okviru študentskega raziskovalnega dela z namenom oceniti potrebo po slovenski različici vodnika EPOS4Patients; zbiranje odgovorov je nato potekalo do leta 2026. Poročanje smo oblikovali po smernicah STROBE in kontrolnem seznamu za spletne ankete CHERRIES [12].

Preiskovanci. V raziskavo so bili povabljeni odrasli bolniki s KRS, obravnavani na kliniki. Bolnike smo prepoznali v institucionalni bazi bolnikov s KRS in jih povabili k sodelovanju; koda QR za anonimno sodelovanje je bila objavljena tudi na oglasni deski klinike. Po informiranem soglasju so bolniki do vprašalnika dostopali prek kode QR (www.qr-code-generator.com). Sodelovanje je bilo popolnoma prostovoljno in anonimno.

Vprašalnik. Anketo smo pripravili v orodju Google Forms (Google LLC, Mountain View, Kalifornija, ZDA). Vsebovala je pet trditev (T1–T5; Tabela 1), ki so jih bolniki ocenili na lestvici od 1 do 10, pri čemer 1 pomeni »sploh se ne strinjam« in 10 »popolnoma se strinjam« [preverite sidri lestvice]. Trditve so zajemale željo po dodatnih informacijah o bolezni (T1), pomen razumevanja zdravljenja za uspeh (T2), zadostnost informacij, prejetih od zdravnika ali medicinske sestre (T3), lastno razumevanje diagnostike in zdravljenja (T4) ter željo po informacijah v spletni ali mobilni obliki (T5). Ker je šlo za pilotno raziskavo in smo želeli zagotoviti popolno anonimnost, starosti, spola, tipa KRS in stadija bolezni namenoma nismo beležili; zbirali smo le ocene petih trditev. Vprašalnik ni bil predhodno validiran.

Statistična analiza. Ocene smo opisali s povprečjem in standardnim odklonom (SD) ter z mediano in interkvartilnim razponom (IQR). Za opisni prikaz smo ocene razvrstili v tri razrede: 1–4 (nizko), 5–7 (srednje) in 8–10 (visoko strinjanje). Vnaprej smo določili dve primerjavi povezanih ocen z Wilcoxonovim testom predznačenih rangov: T1 proti T3 (razlika med željo po informacijah in prejetimi informacijami) ter T2 proti T4 (razlika med pomenom razumevanja in dejanskim razumevanjem). Povezanost med trditvami smo ocenili s Spearmanovim koeficientom korelacije (ρ); ker smo izračunali deset korelacij, smo jih razen vnaprej zastavljene povezave med T3 in T4 obravnavali kot razi-

skovalne. Za statistično značilne smo šteli dvostranske vrednosti $p < 0,05$. Analizo in slike smo izdelali v programskem jeziku Python 3 s knjižnicami pandas, SciPy (različica 1.17) in Matplotlib.

Rezultati

Anketo je v celoti izpolnilo 17 bolnikov; manjkajočih odgovorov ni bilo. Opisne statistike za posamezne trditve so prikazane v Tabeli 1, porazdelitev odgovorov po razredih na Sliki 1, ocene posameznih bolnikov v parih in povezanost med informiranostjo in razumevanjem pa na Sliki 2.

Tabela 1. Ocene petih trditev ankete na lestvici od 1 do 10 (n = 17).

Trditev	Povprečje ± SD	Mediana (IQR)	Razpon	Ocena 8– 10, n (%)	Ocena 1–4, n (%)
T1 Želel bi si dodatnih informacij glede moje bolezni.	8,8 ± 1,6	9 (8–10)	5–10	14 (82)	0 (0)
T2 Razumevanje načina zdravljenja se mi zdi odločilnega pomena za uspeh.	9,0 ± 1,3	9 (9–10)	6–10	14 (82)	0 (0)
T3 Do tega trenutka sem dobil dovolj informacij s strani svojega zdravnika ali medicinske sestre.	4,8 ± 3,2	6 (2–8)	1–10	5 (29)	8 (47)
T4 Zdi se mi, da razumem način diagnostike in zdravljenja bolezni.	5,5 ± 2,8	5 (3–7)	1–10	4 (24)	6 (35)
T5 Želim si informacije tudi v spletni obliki ali na mobilniku (pametnem telefonu).	8,4 ± 2,8	10 (9–10)	1–10	14 (82)	2 (12)

SD – standardni odklon; IQR – interkvartilni razpon (25.–75. percentil).

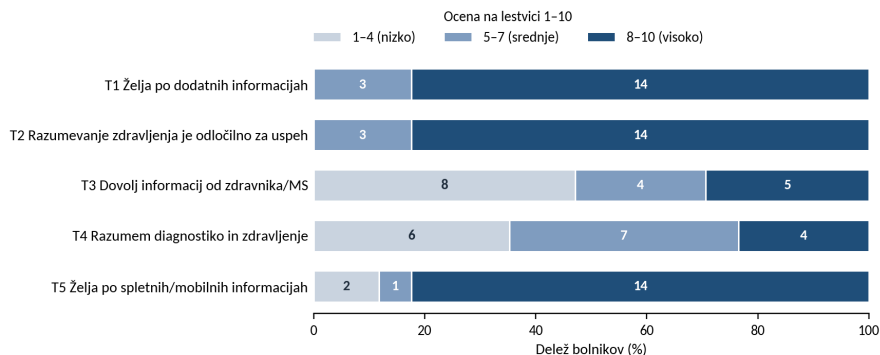
Bolniki so zelo visoko ocenili željo po dodatnih informacijah o bolezni (T1; mediana 9, IQR 8–10) in pomen razumevanja zdravljenja za njegov uspeh (T2; mediana 9, IQR 9–10); pri obeh trditvah je 14 bolnikov (82 %) izbralo oceno 8 ali več, nobeden pa ocene 4 ali manj. Nasprotno je zadostnost informacij, prejetih od zdravnika ali medicinske sestre (T3), dosegla mediano 6 (IQR 2–8); oceno 4 ali manj je izbralo 8 bolnikov (47 %), oceno 8 ali več pa 5 bolnikov (29 %). Lastno razumevanje diagnostike in zdravljenja (T4) so bolniki ocenili z mediano 5 (IQR 3–7), pri čemer so le 4 bolniki (24 %) izbrali oceno 8 ali več.

Želja po dodatnih informacijah je bila statistično značilno višja od ocene prejetih informacij (T1 proti T3; Wilcoxonov test $W = 9,0$; $p = 0,002$). Višjo oceno pri T1 kot pri T3 je dalo 14 bolnikov, nižjo 2, enako pa 1 bolnik; mediana razlike je znašala 4 točke (Slika 2A). Tudi pomen razumevanja zdravljenja je bil statistično značilno višji od ocene lastnega razumevanja (T2 proti T4; $W = 3,5$; $p < 0,001$), in sicer pri 15 bolnikih, z mediano razlike 4 točke (Slika 2B).

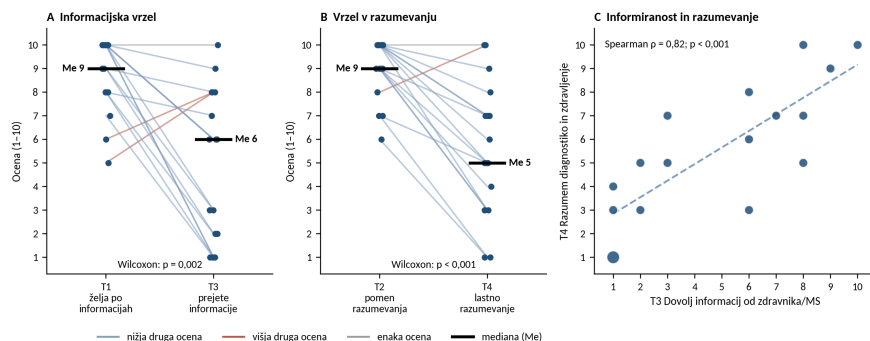
Ocena zadostnosti prejetih informacij (T3) je bila močno pozitivno povezana z oceno lastnega razumevanja (T4; $p = 0,82$; $p < 0,001$; Slika 2C), ni pa bila povezana z željo

po dodatnih informacijah (T1; $p = 0,02$; $p = 0,94$). V raziskovalni analizi je bila ocena razumevanja (T4) zmerno povezana z željo po digitalnih informacijah (T5; $p = 0,54$; $p = 0,026$) in s pomenom razumevanja (T2; $p = 0,50$; $p = 0,043$); ob upoštevanju števila primerjav (Bonferronijev popravek, $\alpha = 0,005$) ti povezavi nista statistično značilni.

Informacije v spletni ali mobilni obliki si je izrazilo želelo 14 bolnikov (82 %; mediana 10, IQR 9–10), medtem ko sta 2 bolnika (12 %) to možnost ocenila z oceno 1 oziroma 2 (Slika 1).



Slika 1. Porazdelitev odgovorov bolnikov ($n = 17$) na pet trditev ankete po razredih ocen. Številke v stolpcih predstavljajo število bolnikov. MS – medicinska sestra.



Slika 2. Ocene posameznih bolnikov ($n = 17$). (A) Želja po dodatnih informacijah (T1) in ocena prejetih informacij (T3). (B) Pomen razumevanja zdravljenja (T2) in lastno razumevanje (T4). Vsaka črta povezuje oceni istega bolnika; debela črna črta označuje mediano. (C) Povezanost med oceno pre-

jetih informacij (T3) in lastnim razumevanjem (T4); velikost točke je sorazmerna s številom bolnikov z enakim parom ocen, črtkana črta prikazuje linearni trend. MS – medicinska sestra.

Razprava

Izhodišče raziskave je bilo, da je KRS večinoma vseživljenjska bolezen, katere obvladovanje je močno odvisno od bolnikovega razumevanja bolezni in doslednega zdravljenja, participativni pristop pa zahteva dobro obveščenega bolnika [1,6,7]. Pilotna raziskava, ki smo jo začeli leta 2023, je dala vpogled v to, kako slovenski bolniki s KRS razumejo svojo bolezen in koliko informacij si želijo. Na izhodiščno vprašanje, ali slovenski bolniki potrebujejo in si želijo več informacij o bolezni, rezultati odgovarjajo pritrdilno.

Glavna ugotovitev raziskave je izrazita vrzel med tem, koliko informacij si bolniki s KRS želijo, in tem, koliko jih po lastni oceni prejmejo. Skoraj vsi sodelujoči menijo, da je razumevanje zdravljenja odločilno za njegov uspeh, a le četrtina meni, da bolezen in njeno zdravljenje dobro razume, skoraj polovica pa ocenjuje, da je dobila premalo informacij. Ker je KRS kronična bolezen, katere obvladovanje je v veliki meri odvisno od vsakodnevne samooskrbe, je takšna vrzel klinično pomembna.

Močna povezava med oceno prejetih informacij in oceno razumevanja bolezni je skladna s predpostavko, da boljša informiranost prispeva k boljšemu razumevanju, čeprav presečna zasnova ne omogoča sklepanja o vzročnosti. Pomembna je tudi ugotovitev, da želja po dodatnih informacijah ni bila povezana s količino že prejetih informacij: tudi bolniki, ki so bili po lastni oceni dobro obveščeni, so si želeli več. Potreba po informacijah je torej splošna in ni omejena na posamezne slabše obveščene bolnike, zato jo je smiselno nasloviti sistematično, s strukturiranim in vsem dostopnim gradivom, ne le z ustno razlago ob pregledu, ki je v ambulantnem delu pogosto časovno omejena.

Vsebina vodnika EPOS4Patients se dobro ujema z ugotovljenimi potrebami. Razlaga možnosti zdravljenja od izpiranja nosu do bioloških zdravil in kirurgije, odgovori na pogosta vprašanja ter poglavje o izgubi voha naslavlja prav področja, na katerih so naši bolniki ocenili svoje razumevanje kot pomanjkljivo [8]. Vodnik izrecno podpira skupno odločanje [8,11], za katero pa je razumevanje bolezni nujen pogoj. Naši rezultati kažejo, da ta pogoj pri pomembnem deležu bolnikov še ni izpolnjen. Slovenska različica vodnika bi bolnike približala vlogi ozaveščenega bolnika, ki je temelj participativne medicine [6,7]. Izguba voha, ki jo vodnik obravnava posebej, vpliva na prehrano, razpoloženje in socialno življenje [9], kar poudarja pomen pogovora o vplivu bolezni na vsakdanje življenje in ne le o objektivnih kliničnih izvidih.

Velika večina bolnikov si je informacije želela tudi v spletni ali mobilni obliki. Rezultat je treba razlagati previdno, saj je bila anketa izvedena digitalno in je zato verjetno pristranska v prid digitalno pismenim bolnikom. Dva bolnika sta digitalno obliko izrazito

zavrnila, zato naj digitalno gradivo dopolnjuje, ne pa nadomešča tiskanih informacij in pogovora z zdravnikom ali medicinsko sestro.

V gradivu, ki smo ga pregledali, nismo našli uradnega, časovno opredeljenega načrta nadaljnega razvoja EPOS4Patients. Na podlagi naših rezultatov predlagamo naslednje korake, ki so naši predlogi in ne napovedane zaveze avtorjev EPOS4Patients: prevod in prilagoditev vodnika za slovenske bolnike v tiskani in digitalni obliki, redno posodabljanje skladno z novimi smernicami (zlasti na področju bioloških zdravil), preverjanje berljivosti in uporabnosti z raznolikimi skupinami bolnikov, pripravo kratkih pripomočkov za posvet in odločanje [13] ter vključevanje bolnikov v izbor vsebin za posodobitve. Učinek takšnega gradiva bi lahko ovrednotili s ponovitvijo iste ankete pred uvedbo in po njej.

Raziskava ima več omejitev. Vzorec je majhen (17 bolnikov v približno treh letih), število povabljenih bolnikov ni znano, zato stopnje odziva ne moremo oceniti, sodelovanje pa je bilo prostovoljno, kar lahko vodi v pristranskost samoizbora. Uporabljeni vprašalniki ni bil validiran in meri subjektivne ocene. Demografskih in kliničnih podatkov (npr. starosti, spola, izobrazbe, fenotipa KRS, predhodnih operacij ali zdravljenja z biološkimi zdravili) v pilotni fazi namenoma nismo zbirali, zato rezultatov ne moremo analizirati po podskupinah. Avtorji se strinjamo, da bi zbiranje teh podatkov v nadaljnji raziskavi omogočilo oceno morebitnih generacijskih razlik v informacijskih potrebah bolnikov s KRS. Raziskava je bila izvedena v enem terciarnem centru, zato rezultatov ni mogoče neposredno posplošiti na vse bolnike s KRS v Sloveniji. Ker odgovori niso vsebovali časovnih žigov, tudi ne moremo oceniti morebitnih sprememb v obdobju zbiranja podatkov.

Zaključek

Potrдили smo, da slovenski bolniki s KRS želijo in pričakujejo podrobnejše informacije o bolezni in njenem zdravljenju. Razumevanju bolezni pripisujejo velik pomen, vendar pogosto menijo, da so prejeli premalo informacij, in svoje razumevanje ocenjujejo kot pomanjkljivo. Potreba po informacijah je splošna in je prisotna tudi pri bolnikih, ki so že dobro obveščeni. Vodnik EPOS4Patients vsebinsko naslavlja te potrebe, zato je priprava njegove slovenske različice v tiskani in digitalni obliki utemeljena in bi lahko podprla skupno odločanje o zdravljenju.

Etika, soglasja in financiranje

Etična odobritev: Etična odobritev ni bila pridobljena. Zaradi narave raziskave – anonimne in prostovoljne ankete, pri kateri nismo zbirali osebnih, demografskih ali kliničnih podatkov – avtorji menimo, da ni bila potrebna.

Informirano soglasje: Bolniki so pred dostopom do vprašalnika dali informirano soglasje; sodelovanje je bilo prostovoljno in anonimno.

Zahvale: Zahvaljujemo se bolnikom, ki so sodelovali v anketi.

Financiranje: Ni financiranja.

Navzkrižje interesov: Avtorji izjavljamo, da ni navzkrižja interesov.

Uporaba orodij umetne inteligence: Pri pripravi vizualne predstavitve je bilo uporabljeno orodje generativne umetne inteligence (Claude, Anthropic). Avtorji smo vsebino, analize in navedbe virov preverili in zanje prevzemamo polno odgovornost.

Razpoložljivost podatkov: Anonimizirani podatki ankete so na voljo pri kontaktnem avtorju na razumno zahtevo.

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04

Avdiologija

Audiology

Kliničnopsihološka obravnava pacienta z avdiovestibulološkimi težavami

Učinkovitost KVT terapije

Clinical psychological treatment of patients with audiovestibular problems: effectiveness of cognitive behavioural therapy

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STRUKTURIRANI IZVLEČEK

Uvod: Kognitivno-vedenjska terapija (KVT) je z dokazi podprta metoda zdravljenja za obvladovanje težav, povezanih s tinitusom, hiperakuzijo in mizofonijo ter težav z Menierovo boleznijo in vestibularnim švanomom. Na Kliniki za ORL in CFK v Ljubljani (klinika) se že od leta 2003 izvaja KVT pacientov s tinitusom, hiperakuzo, mizofonijo, Menierovo boleznijo in vestibularnim švanomom. Paciente, ki imajo tinitus, smo leta 2003 začeli obravnavati skupinsko. V omenjenem članku bi radi predstavili potek in učinkovitost KVT terapije pri pacientih s tinitusom.

Metoda: Predstavili bomo rezultate samoocenjevalnega vprašalnika o obremenjenosti s tinitusom pri 51 pacientih pred KVT terapijo in po zaključeni terapiji. Za merjenje obremenjenosti s tinitusom smo uporabili vprašalnik THI (Tinnitus Handicap Inventory). Za neposredno primerjavo rezultatov pred in po KVT terapiji smo uporabili parni t-test. Za analizo vseh meritev smo uporabili linearni mešani model. Kot dodatno preverbo smo naredili še Wilcoxonov test za meritvi pred in po KVT terapiji ter model, v katerem smo namesto zaporedne številke meritve upoštevali dejanski čas v mesecih od prve meritve.

Rezultati: Razlika med rezultati na vprašalniku pred začetkom terapije in na koncu KVT terapije ni le statistično značilna ($p < 0,001$), temveč je bil učinek KVT izrazito velik (Cohenov $d_z = 0,93$).

Zaključek: Z rezultati naše raziskave potrjujemo visoko učinkovitost KVT terapije tinitusa, ki jo izvajamo na Kliniki za ORL in CFK v Ljubljani. Menimo, da bi bilo smiselno izvajati KVT terapijo v okviru različnih ORL timov v Sloveniji.

Ključne besede: kognitivno-vedenjska terapija, KVT, tinitus, učinkovitost terapije

ABSTRACT

In Ljubljana Clinical Centre CBT has been implemented since 2003 for patients with tinnitus, hyperacusis, misophonia, Meniere's disease, and Vestibular Schwannoma. In 2003, we began treating patients with tinnitus in a group setting. In the aforementioned

article, we would like to present CBT for these issues and diseases, which is highly effective. As evidence of the effectiveness of CBT, we will present the results of a study on the tinnitus distress of patients before CBT therapy and after the completion of therapy. The difference is not only statistically significant ($p < 0.001$), but the effect size of CBT was also remarkably large (Cohen's $d_z = 0.93$).

Keywords: Cognitive Behavioral Therapy, CBT, tinnitus, therapy effectiveness

Uvod

Kognitivno-vedenjska terapija (KVT) je z dokazi podprta metoda zdravljenja za obvladovanje težav, povezanih s tinitusom, hiperakuzijo in mizofonijo (1) ter tudi težav z Menierovo boleznijo (2) in vestibularnim švanomom (3). Tinitus kot simptom je lahko edini simptom, zaradi katerega pacient išče pomoč. Hkrati se lahko tinitus pojavlja tudi kot eden izmed simptomov pri drugih specifičnih avdiovestibuloloških boleznih.

Kognitivno-vedenjska terapija (KVT) pacientov, ki imajo različne avdiovestibulološke težave, ima na Kliniki za ORL in CFK v Ljubljani (klinika) že dolgo zgodovino, vendar ne poteka v okviru Avdiovestibulološkega centra, ampak jo izvaja klinična psihologinja, ki je timsko vpeta v Center za motnje glasu, govora in požiranja. Zaradi omenjenih in dodatno zelo omejenih kadrovskih možnosti so lahko obravnavani le nekateri pacienti in ne vsi, ki bi potrebovali pomoč. Vse bolnike, ki na kliniki potrebujejo psihološko pomoč, tudi bolnike z avdiovestibulološkimi težavami, obravnavamo po principu KVT terapije, saj je klinična psihologinja izobražena iz tovrstnega terapevtskega pristopa. Pacienti s tinitusom so bili od leta 2003 obravnavani tako skupinsko kot individualno, pacienti z drugimi avdiovestibulološkimi težavami ali boleznimi pa so obravnavani le individualno. V zadnjih letih je klinična psihologinja s podporo klinike in Avdiovestibulološkega centra preko Društva za KVT Slovenije organizirala Delavnico za KVT obravnavo tinitusa za že educirane KVT terapevte. Kot kažejo izkušnje, obravnava teh terapevtov izven ORL okolja še nikjer ni zaživela.

Ko pride pacient z avdiovestibulološkimi težavami v kliničnopsihološko obravnavo, naredimo razširjeni kliničnopsihološki intervju ter ocenimo obremenjenost zaradi težav ali bolezni. V primeru skupinske obravnave tinitusa se vsi pacienti predstavijo ter opišejo svoje težave. Tako v okviru individualne kot skupinske obravnave oceno obremenjenosti zaradi tinitusa naredimo z različnimi samoocenjevalnimi vprašalniki. Kot osrednja mera obremenjenosti se uporablja THI – Vprašalnik o obremenjenosti zaradi tinitusa (Tinnitus Handicap Inventory), ki smo ga na kliniki po standardnih pravilih z dovoljenjem avtorjev prevedli leta 2003. Uporabimo tudi druge samoocenjevalne vprašalnike, ki pa jih v tem članku ne bomo izpostavljali. Oceno na vprašalniku THI ponovimo tudi na zaključku redne KVT terapije in na obnovitvenih srečanjih z namenom ocene učinkovitosti pomoči ter daljnoročnosti naučenih strategij za soočanje.

Ko spoznamo paciente, oblikujemo pacientu ali skupini prilagojen načrt obravnave. Obravnavo bi lahko tudi standardizirali, vendar je v kliničnem okolju ključno prilagajanje potrebam pacientov. V začetnih srečanjih posvetimo veliko časa edukaciji. Paciente naučimo razlikovati med vzročnimi dejavniki za nastanek tinitusa ter sprožilci nihanja v okviru doživljanja tinitusa. Naučimo jih, kaj so modulirajoči dejavniki in kaj vzdržujoči dejavniki intenzivnejšega tinitusa. Večina pacientov je v zadnjem času seznanjena s kroničnostjo tinitusa, mnogi še vedno upajo na ozdravitev. Zaradi omenjenega je v okviru obravnave potrebno speljati proces sprejemanja kroničnosti tinitusa. Po sprejemanju tinitusa se usmerimo na kontrolo le tega. Pacientom razložimo, kateri dejavniki predstavljajo razlog za poslabšanje in kateri razlog za izboljšanje tinitusa. Dejavniki, ki poslabšujejo tinitus, so tišina, hrup, usmerjanje pozornosti na tinitus, utrujenost, stres, bolezen. Na drugi strani se tinitus umirja v prijetnem akustičnem okolju, ko preusmerjamo pozornost, ko smo spočiti, ko smo bolj sproščeni oziroma ko bolje obvladujemo stres. V obravnavi se učimo razumeti razliko med maskiranjem tinitusa in preusmerjanjem pozornosti, ki sta dve glavni obliki soočanja. Pacienti se v okviru KVT terapije učijo teh tehnik in so jih dolžni vaditi. Kasneje se ukvarjamo tudi z boljšim obvladovanjem stresa na splošno kot tudi z obvladovanjem stresa zaradi tinitusa. Paciente naučimo različnih vedenjskih tehnik in tehnik sproščanja kot tudi različnih miselnih tehnik. Med miselnimi tehnikami spoznamo osnovni miselni model, na podlagi katerega pacienti prepoznajo svoj avtomatski način razmišljanja na splošno in glede tinitusa. Naučimo jih, kako nerealne in nekoristne misli zamenjati za realne in koristne. Ukvarjamo se tudi z zmanjševanjem skrbi, strahu, anksioznosti na splošno in vezano na tinitus. Mnogi pacienti glede tinitusa premlevajo. Nekateri imajo na tinitus nacepljene panične misli ali panično motnjo, zato v okviru terapije obravnavamo tudi omenjeno težavo, ki za nekatere paciente predstavlja najbolj vznemirjajočo in obremenjujočo vsebino. Seveda se v terapiji ukvarjamo tudi z obvladovanjem nespečnosti.

Obravnavo skušamo zaradi kadrovskih značilnosti čim bolj optimizirati, zato večinoma traja od 3 do 8 srečanj, izjemoma manj ali več. Srečanja poskušamo izvesti tedensko, če ne gre drugače kakšno srečanje izvedemo čez dva tedna. Po potrebi imamo tudi obnovitvena srečanja.

V okviru obravnave z namenom spremljanja učinkovitosti izvajamo redno ocenjevanje obremenjenosti zaradi tinitusa s THI.

Namen naše analize je bil preveriti, ali se rezultati vprašalnika o posledicah tinitusa skozi čas spreminjajo. Višje število točk na THI pomeni večjo obremenjenost s tinitusom oziroma slabšo kakovost življenja, nižji rezultat pri naslednji meritvi pomeni izboljšanje. Posebej nas je zanimalo, ali se razlikujeta rezultata na začetku terapije in na koncu rednega dela terapije, saj je v obdobju med njima potekala terapevtska obravnavo po principu KVT. Poleg tega smo želeli vključiti tudi osebe, ki so izpolnile THI v času obnovitvenih srečanj, ne da bi zaradi nepopolnih podatkov izločili ostale udele-

žence. Nekaj pacientov smo prosili za oceno na THI tudi nekaj let po končanju terapije.

Metoda

V analizo je bilo vključenih 51 oseb z veljavnima meritvama na THI na začetku (1. meritev) in na koncu KVT terapije (2. meritev). V analizo smo vključili 12 oseb, ki je imelo tudi 3. meritev, 6 oseb pa še 4. meritev. V analizo smo torej vključili le paciente, ki so speljali celotno terapijo.

Za neposredno primerjavo prve in druge meritve smo uporabili parni t-test, ker gre za isti vzorec ljudi, izmerjen dvakrat. Za analizo vseh meritev skupaj smo uporabili linearni mešani model. Ta je za te podatke primeren, ker upošteva, da se meritve iste osebe med seboj povezujejo, hkrati pa dovoljuje, da nimajo vsi posamezniki enakega števila meritev. Kot dodatno preverbo smo naredili še Wilcoxonov test za 1. in 2. meritev ter model, v katerem smo namesto zaporedne številke meritve upoštevali dejanski čas v mesecih od prve meritve.

Za merjenje obremenjenosti zaradi tinitusa smo uporabili THI, ki ga sestavlja 25 vprašanj, na katere posameznik odgovarja z da, ne in včasih. Vprašalnik so leta 1996 razvili ameriški strokovnjaki in ga objavili v reviji Archives of Otorinolaringology – Head and Neck Surgery (5). Vprašanja so razdeljena v 3 podlestvice (čustveno, funkcionalno in katastrofično). Seštevek rezultatov predstavlja lestvico 5 stopenj obremenjenosti s tinitusom od komaj prisotne obremenjenosti (0 do 16 točk), preko blage (18 do 36 točk), zmerno obremenjenosti (37 do 57 točk), močne obremenjenosti (58 do 77 točk) in katastrofalne obremenjenosti zaradi tinitusa (78 do 100 točk).

Rezultati

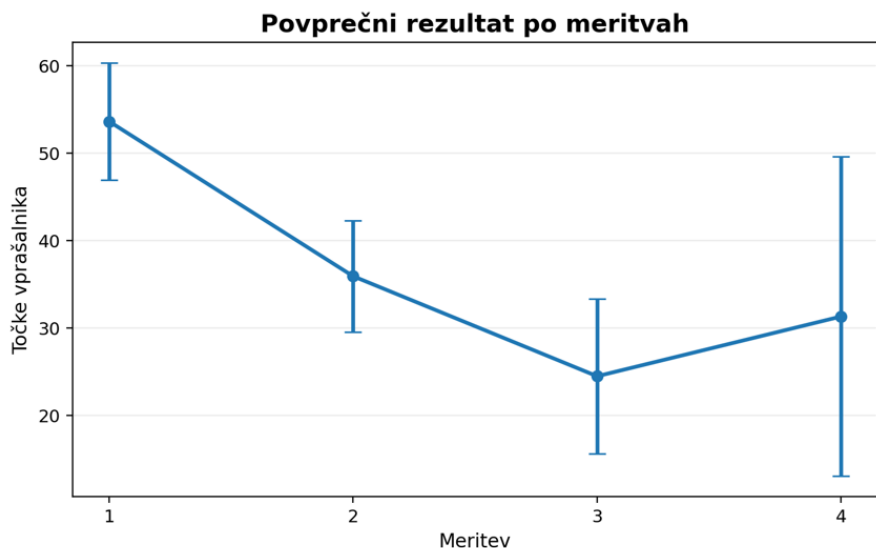
Povprečni rezultat se je med prvo in drugo meritvijo precej zmanjšal. Pri tretji meritvi je bil še nižji, pri četrti meritvi pa se je nekoliko zvišal. Pri zadnjih dveh meritvah je treba upoštevati, da temeljita na precej manjšem številu oseb.

Meritev	N	Povprečje	SD
1. meritev	51	53,6	24,3
2. meritev	51	35,9	23,2
3. meritev	12	24,5	15,6
4. meritev	6	31,3	22,8

Tabela 1: Povprečni rezultati in standardna deviacija na štirih točkah merjenja

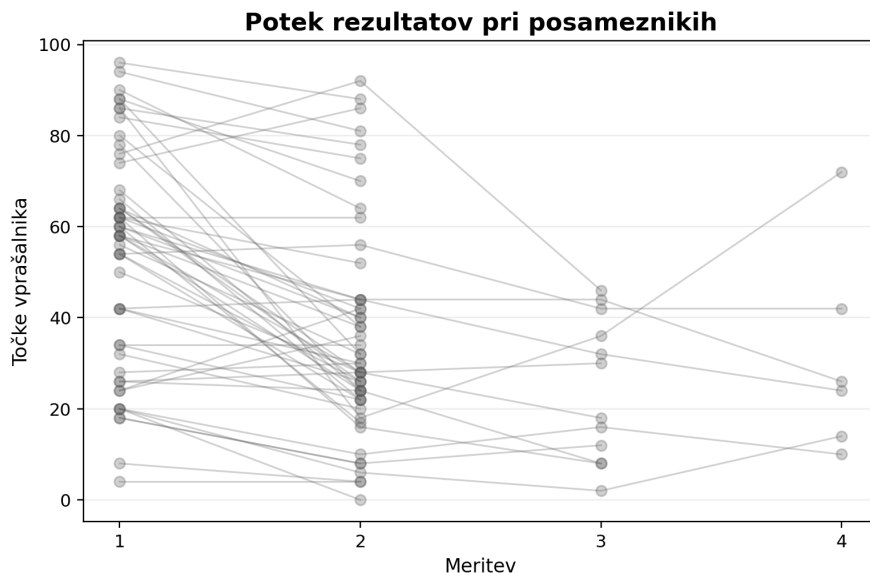
Pri prvi meritvi je bil povprečni rezultat 53,65 točke (zmerna obremenjenost na lestvici obremenjenosti), pri drugi meritvi pa 35,94 točke (stopnja blage obremenjenosti). Rezultat se je torej v povprečju zmanjšal za 17,71 točke. 95-% interval zaupanja za zmanjšanje je znašal od 12,35 do 23,06 točke. Parni t-test je pokazal, da je bila razlika

statistično značilna: $t(50) = 6,64$, $p < 0,001$. Velikost učinka je bila velika (Cohenov $d_z = 0,93$). Tudi Wilcoxonov test je dal enak zaključek ($p < 0,001$). Rezultati kažejo, da razlika ni samo statistično značilna, ampak je glede na velikost učinka celo izrazita.



Slika 1: Povprečni rezultat po posameznih meritvah z okvirnimi 95-% intervali zaupanja.

Na Sliki 1 je viden največji padec med prvo in drugo meritvijo ter nadaljnji nižji rezultati pri osebah z dodatnimi meritvami. Pri četrti meritvi se povprečje nekoliko zviša, vendar je bila ta meritev na voljo samo pri šestih osebah, zato tega ne bi razlagali kot zanesljivo poslabšanje.



Slika 2. Potek rezultatov pri posameznih udeležencih

Ker imajo nekateri udeleženci več kot dve meritvi, smo vse razpoložljive meritve vključili še v linearni mešani model. Prva meritev je bila referenčna točka. Druga meritev je bila v povprečju za 17,71 točke nižja od prve meritve ($p < 0,001$). Tretja meritev je bila glede na model za 26,62 točke nižja od prve meritve ($p < 0,001$). Četrta meritev je bila glede na model za 18,97 točke nižja od prve meritve ($p = 0,004$). Model je tako pokazal, da so bile tudi poznejše meritve v povprečju značilno nižje od začetne meritve.

V okviru obdelave smo pogledali na spremembo tudi glede na dejanski čas od prvega merjenja. Ker časovni razmiki med meritvami niso bili enaki, smo preverili povezavo med številom mesecev od prve meritve in rezultatom. Daljši čas od prve meritve je bil povezan z nižjim rezultatom: rezultat se je v modelu zmanjšal za približno 0,46 točke na mesec ($B = -0,4565$, $p < 0,001$). Tudi ta analiza kaže na trend zmanjševanja obremenjenosti s tinitusom skozi čas. Ta rezultat je dodatna informacija, saj model predpostavlja približno linearno spremembo skozi čas.

Graf posameznikov (Slika 2) pokaže, da se pri večini rezultat med prvo in drugo meritvijo zniža, hkrati pa so med osebami prisotne precejšnje razlike. Rezultati pri nekaterih se izboljšajo zelo izrazito, pri nekaterih je sprememba manjša, pri posameznikih pa se rezultat lahko tudi zviša.

Razprava

Učinkovitost KVT terapije so doslej pokazale mnoge raziskave po svetu (6,7,8,9,10). Različne študije so pokazale, da glasnost in frekvenca tinitusa ne vplivata sami po sebi na funkcioniranje posameznika s tinitusom, ampak na samo funkcioniranje vpliva posameznikovo doživljanje tinitusa (1). To pomeni, da čustveni odziv ni odvisen le od samega zvoka, ampak predvsem od tega, kako posameznik razume svoj tinitus, kako si ga razlaga in kakšne kratkoročne in dolgoročne posledice pričakuje. To je osnova kognitivne teorije znotraj KVT terapije. Pri tinitusu se lahko pojavijo misli, kot so: »Tega ne bom več zmozel prenašati.«, »Zaradi tinitusa se mi bo zmešalo.«, »Moje življenje je uničeno.« Takšne misli predstavljajo nerealen način razmišljanja, in sicer katastrofiziranje, pretirano posploševanje ali razmišljanje po principu vse ali nič. Pacienti s tinitusom prihajajo v obravnavo zelo vznemirjeni, pravzaprav doživljajo skoraj vsa neprijetna čustva, celo do maksimalnega stopnjevanja le teh. Torej ne samo, da so prestrašeni, nekateri so celo panični. Ne samo da so žalostni, nekateri so obupani. Zanimive primerjave, ki jih na koncu KVT terapije povejo pacienti, bi lahko strnili v metaforo, da so na začetku doživljali tinitus kot »najhujšega sovražnika«, na koncu terapije ga doživljajo kot »prijatelja«.

Omenjeno metaforo smo z rezultati naše raziskave potrdili, saj so pacienti na vprašalniku o obremenjenosti s tinitusom THI po začetni meritvi na koncu aktivne KVT terapije dosegali statistično zelo jasno nižje rezultate. Ker ni kontrolne skupine oseb, ki terapije niso prejele, lahko iz omenjenih rezultatov jasno pokažemo le, da so bili rezultati pri pacientih, vključenih v KVT obravnavo, po obdobju terapevtske obravnave izrazito nižji. Obravnavo sicer kolikor je mogoče izvajamo enkrat tedensko, če ni mogoče, je naslednje srečanje čez dva tedna. Aktivna obravnava je večinoma končana v dveh mesecih, kar pomeni, da proces KVT terapije poteka kratek čas. Pacienti že med prvim in drugim srečanjem poročajo o boljšem obvladovanju tinitusa in nam to tudi povejo, v okviru obravnave slišimo, kako jim naučene tehnike in vsebine, edukacija ter motivacija s strani drugih pacientov pomagajo pri veliko boljšem obvladovanju tinitusa. Naučene vsebine jih pripravijo na razumevanje nihanja tinitusa, ki ga normalizirajo, razumejo celo, kateri dejavniki so vplivali na nihanje. Hkrati pa načrtujejo življenje z namenom preventive prevelike stopnje nihanja ali se pripravijo na različne življenjske stresorje, na katere nimajo vpliva in se še dodatno ne vznemirijo zaradi začasnega stopnjevanja tinitusa. Povejo, da spet živijo kvalitetno. Naučijo se ločevati zdrave in nezdrave navade vezane na zvočno okolje. Ne izogibajo se več različnim situacijam. So delovno in splošno bolj učinkoviti.

Zaključek

Z rezultati naše raziskave potrjujemo visoko učinkovitost KVT terapije tinitusa. Verjamemo, da bi lahko podobno učinkovitost potrdili tudi pri ostalih avdiovestibuloloških simptomih ali boleznih. S člankom ne želimo večati števila napotitev v KVT na našo kli-

niko v isti kadrovski zasedbi KVT terapevtov. Menimo, da bi bilo smiselno izvajati KVT terapijo v okviru različnih ORL timov (na primer v sekundarnih ali terciarnih bolnišnicah) v Sloveniji.

Etika, soglasja in financiranje

Navzkrižje interesov: Avtorica izjavljam, da ni navzkrižja interesov.

Razpoložljivost podatkov: Podatki, ki podpirajo ugotovitve ali navedbe, so na voljo pri avtorju na razumno zahtevo.

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Več kot le ravnotežje: celostni pristop k otroku z motnjami vestibularnega sistema

More than just balance: a holistic approach to the child with vestibular disorders

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STRUKTURIRANI IZVLEČEK

Uvod: Vestibularni sistem je pri otroku razvijajoči se multisenzorični sistem, katerega vloga presega vzdrževanje ravnotežja. Vestibularne informacije sodelujejo pri stabilizaciji pogleda in drže, prostorski orientaciji, učenju, branju ter preko širokih centralnih povezav tudi pri kognitivnih, čustvenih in avtonomnih procesih. Vrtoglavica in omotica v otroštvu imata heterogeno etiologijo, klinična slika pa je pogosto starostno odvisna in ob prvem pregledu nepopolno izražena. Namen prispevka je predstaviti celostni, razvojno in longitudinalno usmerjen pristop k otroku z vestibularnimi težavami.

Metode: Pripravili smo narativno sintezo štirih lastnih objav, ki vključujejo kohorto 257 otrok, starih 1–17 let, obravnavanih v terciarnem avdiovestibulološkem centru Klinike za otorinolaringologijo in cervikofacialno kirurgijo Univerzitetnega kliničnega centra Ljubljana, med letoma 2015 in 2020, analizo kazalnikov periferne vestibularne patologije, pregled razvoja in širših funkcij vestibularnega sistema ter ponovno etiološko razvrstitev iste kohorte po podaljšanem spremljanju do leta 2025.

Rezultati: Ob začetni multidisciplinarni obravnavi je bila etiologija centralna pri 19,1 %, periferna vestibularna pri 12,4 %, hemodinamska pri 10,9 % in psihološka pri 5,8 % otrok, 43,6 % primerov pa je ostalo neopredeljenih. Pri periferni etiologiji so bili pomembni klinični kazalniki slabost, bruhanje, horizontalno-rotatorni nistagmus in daljše trajanje simptomov; kombinacija trajanja, slabosti in bruhanja je bila statistično značilno povezana s periferno etiologijo ($\chi^2(3)=10,626$; $p=0,014$). Po podaljšanem spremljanju se je delež neopredeljenih primerov zmanjšal na 10 %. Centralne etiologije so predstavljale 35 %, periferne 18 %, hemodinamske 16 % in psihogene 10 % primerov.

Zaključek: Pediatrična vestibularna obravnava zahteva več kot oceno ravnotežja. Diagnostika naj temelji na natančni anamnezi, usmerjenem otonevrološkem pregledu, starosti prilagojenem vestibularnem testiranju, multidisciplinarnem sodelovanju in strukturiranem spremljanju. Čas je pri otroku pogosto aktivno diagnostično orodje, rehabilitacijski cilj pa mora vključevati ne le zmanjšanje vrtoglavice, temveč tudi optimalen motorični, kognitivni in psihosocialni razvoj.

Ključne besede: vrtoglavica; omotica; vestibularne motnje; otrok; spremljanje

ABSTRACT (ENGLISH SUMMARY)

Pediatric vestibular disorders extend far beyond impaired balance. Vestibular input contributes to gaze and postural stabilization, spatial orientation and motor learning, while its central network is linked to cognition, emotion and autonomic regulation. This narrative synthesis integrates four published studies from our tertiary audiovestibulology center in Otorhinolaryngology clinic UMC Ljubljana, including a cohort of 257 children aged 1–17 years assessed for vertigo and dizziness, an analysis of clinical indicators of peripheral vestibular disease, a review of vestibular development, and longitudinal etiological reassessment. At initial evaluation, 43.6% of cases remained unclassified. Nausea, vomiting, horizontal-rotatory nystagmus and longer symptom duration supported a peripheral origin. Following extended follow-up, the proportion of unclassified cases decreased to 10%, while central, peripheral, hemodynamic and psychogenic diagnoses increased. Pediatric vestibular care should therefore combine developmentally adapted testing, multidisciplinary assessment and longitudinal follow-up. The therapeutic aim is not merely symptom control, but preservation of motor, cognitive and psychosocial development.

Keywords: vertigo; dizziness; vestibular diseases; child; follow-up studies

Uvod

Vestibularni sistem je pogosto predstavljen kot čutilo za ravnotežje, vendar je takšna opredelitev pri otroku preozka. Periferni vestibularni organ zaznava kotne in linearne pospeške ter položaj glave glede na gravitacijo, centralne vestibularne mreže pa te informacije integrirajo z vidnimi, proprioceptivnimi, somatosenzoričnimi in motoričnimi signali. Rezultat te integracije ni le stabilizacija pogleda in drže, temveč tudi oblikovanje notranje predstave telesa in prostora, navigacija, motorično učenje ter prilagajanje vedenja okolju [1,2].

Posebnost pediatrične vestibularne medicine je razvojna dinamika. Strukturni razvoj perifernega dela notranjega ušesa je v veliki meri zaključen že pred rojstvom, medtem ko vestibulo-spinalne, vestibulo-količne in druge centralne povezave dozorevajo skozi otroštvo in vse do adolescence. Razvoj je odvisen od izkušenj in ustrezne senzorične stimulacije. Zmanjšana gibalna dejavnost ali vestibularna okvara v obdobjih visoke nevroplastičnosti lahko zato vplivata na pridobivanje motoričnih spretnosti, orientacijo v prostoru, branje in druge kognitivne funkcije [1,2].

Širše centralne povezave vestibularnega sistema pojasnjujejo, zakaj se otrok z vestibularno motnjo ne predstavi vedno le z jasno opisano vrtoglavico. Vestibularne informacije so povezane z limbičnimi, avtonomnimi in kortikalnimi omrežji, zato lahko težave spremljajo tesnoba, slabša koncentracija, utrudljivost, slabost, avtonomni simptomi,

težave pri športu, učenju ali gibanju v kompleksnem vidnem okolju [1–3]. V populacijski raziskavi ameriških otrok je bila vrtoglavica povezana z večjo verjetnostjo učnih težav, razvojnega zaostanka, težav s pozornostjo ter čustvenih in vedenjskih težav [3]. Pri mlajšem otroku je dodatna težava omejena sposobnost verbalnega opisa občutkov; starši lahko namesto »vrtoglavice« opazijo nenadno ustavljanje, iskanje opore, padec, bledico, bruhanje, zavračanje gibanja ali ponavljajoče se epizode nestabilnosti [4,5].

Etiološki spekter vrtoglavice in omotice v otroštvu je širok. Poleg perifernih vestibularnih motenj vključuje migrensko povezane in druge centralne vzroke, hemodinamske motnje, psihološke oziroma psihogene dejavnike, infekcijske, nevrološke in redkejša sistemska vzroke [6–8]. Zato izoliran organski pristop pogosto ne zadostuje. V naši začetni analizi 257 otrok je po obsežni multidisciplinarni obravnavi kar 43,6 % primerov ostalo etiološko neopredeljenih [4]. Kasnejša revizija iste kohorte po podaljšanem spremljanju je pokazala, da se je neopredeljeni delež zmanjšal na 10 %, kar spreminja razumevanje diagnostične negotovosti: ta pri otroku pogosto ni znak odsotnosti bolezni, temveč odraz še neizoblikovanega kliničnega fenotipa [9].

Namen prispevka je na podlagi naših kliničnih raziskav in razvojnega pregleda vestibularnega sistema predstaviti celostni model obravnave otroka z vrtoglavico, omotico ali motnjo ravnotežja. Poudarjamo več medsebojno povezanih elementov: pomen anamneze in kliničnih znakov, racionalno in starosti prilagojeno vestibularno testiranje, multidisciplinarno diagnostiko ter longitudinalno spremljanje kot aktivni del diagnostičnega procesa.

Metode

Prispevek je narativna, klinično usmerjena sinteza štirih lastnih objav, ki obravnavajo pediatrične vestibularne motnje z različnih vidikov [1,4,5,9]. Vključeni so bili: (1) pregledni članek o prenatalnem in postnatalnem razvoju vestibularnega sistema ter njegovih povezavah z motoriko, kognicijo, čustvovanjem, avtonomnim in endokrinim sistemom [1]; (2) retrospektivna analiza etiologije vrtoglavice in omotice pri 257 zaporednih otrocih v terciarnem centru [4]; (3) retrospektivna analiza kliničnih kazalnikov periferne vestibularne etiologije in izvedljivosti vestibularnih preiskav v isti populaciji [5]; ter (4) longitudinalna revizija etiološke razvrstitve iste kohorte po podaljšanem spremljanju do leta 2025 [9]. V izhodiščno kohorto so bili vključeni otroci in mladostniki, stari 1–17 let, ki so bili zaradi vrtoglavice in/ali omotice napoteni v terciarni avdiovestibulološki center med januarjem 2015 in novembrom 2020. Diagnostični postopek se je začel z natančno anamnezo otroka in staršev, z oceno trajanja in okoliščin epizod, ravnotežnih težav, slabosti, bruhanja, glavobola, poškodb, predhodnih bolezni ter drugih možnih nevroloških, infekcijskih, hemodinamskih in psiholoških dejavnikov [4,5].

Otonevrološki pregled je obsegal otoskopijo oziroma otomikroskopijo, orientacijsko oceno možganskih živcev, oceno spontanega in položajnega nistagmusa z video Frenzllovimi očali, Rombergov preizkus ter tandem hojo z odprtimi in zaprtimi očmi. Dix-Hallpikev manever je bil izveden ob kliničnem sumu na benigni paroksizmalni pozicijski vertigo. Sledila sta avdiološka in vestibularna diagnostika, prilagojena starosti, razvojni stopnji in sodelovanju otroka [4,5].

Vestibularna diagnostika je glede na izvedljivost vključevala rotacijski stol, kalorično testiranje, video head impulse test (vHIT), subjektivno vidno vertikalno (SVV) in cervikalne vestibularno evocirane miogene potenciale (cVEMP). Pri mlajših otrocih so bile preiskave prilagojene sodelovanju, pri vHIT pa so bile za fiksacijo uporabljene slike oziroma nalepke. Instrumentalne preiskave niso bile obravnavane kot medsebojno zamenljive, temveč kot komplementaren nabor testov različnih delov vestibularnega organa in različnih frekvenčnih območij vestibulo-okularnega refleksa [5,10–13]. Kadar periferna vestibularna patologija ni pojasnila simptomov ali je klinična slika usmerjala drugam, so bili otroci napoteni k ustreznim specialistom, zlasti pediatričnemu nevrologu, kardiologu, psihologu oziroma psihiatru, oftalmologu, infektologu ali radiologu. Spremljanje je bilo klinično prilagojeno; v longitudinalni reviziji so bili podatki ponovno ocenjeni, kadar so se pojavili novi simptomi, rezultati preiskav ali specialistično potrjene diagnoze. Etiološke kategorije so ostale primerljive z izhodiščno analizo [9].

Za izhodiščne raziskave je bila uporabljena opisna statistika in, kjer je bilo relevantno, inferenčna analiza povezave kliničnih znakov s periferno etiologijo. V analizi kazalnikov periferne vestibularne motnje je bila uporabljena binarna logistična regresija za oceno vpliva trajanja simptomov, slabosti in bruhanja [5]. Longitudinalna revizija je primerjala deleže etioloških skupin ob začetni obravnavi in po podaljšanem spremljanju [9].

Rezultati

V izhodiščno kohorto je bilo vključenih 257 otrok, starih 1–17 let (povprečno $10,9 \pm 4,3$ leta); 42 % je bilo dečkov in 58 % deklic [4,5,9]. Ob začetni multidisciplinarni obravnavi je bila etiologija opredeljena kot centralna pri 19,1 %, periferna vestibularna pri 12,4 %, hemodinamska pri 10,9 % in psihološka pri 5,8 % otrok. Pri 43,6 % otrok etiologije ob začetni analizi ni bilo mogoče dokončno opredeliti [4].

Tabela 1. Etiološka razvrstitev vrtoglavice in omotice ob začetni analizi in po podaljšanem spremljanju [4,9].

Etiološka skupina	Začetna analiza (2021)	Po reviziji spremljanja (2025)
Centralna	19,1 %	35 % (91/257)
Periferna vestibularna	12,4 %	18 % (45/257)
Hemodinamska	10,9 %	16 % (41/257)
Psihološka/psihogena	5,8 %	10 % (26/257)

Etiološka skupina	Začetna analiza (2021)	Po reviziji spremljanja (2025)
Drugi opredeljeni vzroki	—	7 % (19/257)
Neopredeljena	43,6 %	10 % (26/257)

Opomba: kategorije iz obeh analiz niso povsem identične glede vseh podskupin; tabela prikazuje glavne skupine, uporabljene pri longitudinalni primerjavi. Podatki izhajajo iz iste osnovne kohorte 257 otrok [4,9].

Pri ocenjevanju periferne vestibularne etiologije so se kot uporabni izkazali nekateri preprosti klinični kazalniki. Med otroki s periferno vrtoglavico oziroma omotico je 60 % bruhalo, 55,6 % pa jih je navajalo slabost. Tip nistagmusa je bil povezan z razlikovanjem med centralno in periferno etiologijo (Goodman-Kruskal $\lambda = 0,481$; $p = 0,001$). Bruhanje je bilo prisotno pri 60 % otrok s periferno etiologijo in pri približno 30 % otrok brez nje; razlika je bila statistično značilna ($p = 0,024$). Model z vključitvijo trajanja simptomov, slabosti in bruhanja je bil statistično značilen za napoved periferne etiologije ($\chi^2(3) = 10,626$; $p = 0,014$) [5].

Instrumentalno vestibularno testiranje je bilo izvedljivo pri številnih otrocih, vendar ne pri vseh in ne vedno v celotnem obsegu. Starost, sodelovanje, utrujenost in nelagodje so pomembno vplivali na izbor testa. Rotacijski stol je bil posebej uporaben pri mlajših otrocih, vHIT pa je omogočal hitro oceno polkrožnih kanalov pri sodelujočih otrocih. Kalorično testiranje, cVEMP in SVV so dopolnjevali oceno z informacijami o različnih delih vestibularnega sistema. Izsledki so podprli pristop, pri katerem se testni nabor prilagodi kliničnemu vprašanju in otroku, namesto da bi se uporabljal enoten protokol za vse starostne skupine [5].

Podaljšano spremljanje je bistveno spremenilo etiološko sliko. Po reviziji podatkov leta 2025 je bilo neopredeljenih le še 10 % primerov. Centralne etiologije so predstavljale 35 %, periferne vestibularne 18 %, hemodinamske 16 %, psihogene 10 % in drugi specifični vzroki 7 % primerov [9]. Največ ponovnih razvrstitev je bilo opravljenih v prvih dveh kontrolnih pregledih. Trajanje spremljanja je bilo od 0 do 132 mesecev, povprečno 17,6 meseca in mediano 4,5 meseca. Podatki o spremljanju so bili na voljo za 256 otrok; 20 % otrok ni bilo naročenih na kontrolni pregled, 11 % pa se načrtovanega pregleda ni udeležilo [9].

Razvojni pregled je pokazal, da je razumevanje pediatričnih vestibularnih motenj širše od samega simptoma vrtoglavice. Centralne vestibularne poti dozorevajo do adolescence, vestibularne informacije pa sodelujejo z vidnim, proprioceptivnim, somato-senzoričnim, limbičnim in avtonomnim sistemom. Vestibularna okvara ali pomanjkljiva stimulacija v razvojno občutljivih obdobjih je zato lahko povezana z motoričnimi, kognitivnimi in čustvenimi posledicami [1].

Tabela 2. Klinično usmerjen celostni pristop k otroku z vrtoglavico ali omotico.

Klinično vprašanje	Kaj ocenimo	Možni namigi	Naslednji korak
Ali gre za akutni periferni vestibularni sindrom?	trajanje; slabost/bruhanje; spontani nistagmus; sluh	daljše trajanje, slabost, bruhanje in horizontalno-rotatorni nistagmus podpirajo periferno etiologijo [5]	ORL/avdiovestibulološka ocena; starosti prilagojeni vHIT, kalorika, rotacijski stol, VEMP
Ali so prisotni centralni ali migrenski znaki?	glavobol; nevrološki izpad; okulomotorika; ponavljajoče epizode; družinska anamneza	migrensko povezani sindromi so pogosti; fenotip se lahko razvije skozi čas [4,9]	pediatrični nevrolog; ciljna slikovna diagnostika le ob indikaciji; spremljanje
Ali je težava hemodinamska?	povezava z vstajanjem; presinkopa; palpacije; hidracija	zlasti pri mladostnikih so možni ortostatski/refleksni mehanizmi [4,9]	meritve krvnega tlaka in pulza; kardiološka/avtonomna obravnava po indikaciji
Ali so prisotni psihološki in funkcionalni dejavniki?	anksioznost; šolsko funkcioniranje; izogibanje gibanju; stres	vestibularni in čustveni sistemi so funkcionalno povezani [1]	izključitev organske patologije; po potrebi psihološka/psihiatrična ocena
Ali motnja vpliva na razvoj?	groba motorika; šport; branje; koncentracija; vidno-gibalne naloge	centralne vestibularne povezave dozorevajo do adolescence [1]	rehabilitacija, telesna dejavnost, vestibularna stimulacija, razvojna podpora
Je diagnoza še vedno nejasna?	potek simptomov; novi znaki; odziv na ukrepe	neopredeljen fenotip ob prvem pregledu je pogost [9]	strukturiran kontrolni pregled; ponovna etiološka presoja

Razprava

Od simptoma k razvojnemu fenotipu

Najpomembnejši premik pri obravnavi otroka z vestibularno motnjo je prehod od vprašanja »ali ima otrok motnjo ravnotežja?« k vprašanju »kako vestibularna težava vpliva na njegovo delovanje in razvoj?«. Pri odraslem je mogoče vestibularni sindrom pogosto strukturirati na podlagi natančnega opisa kvalitete in časovnega poteka simptoma. Pri otroku je ta opis lahko nezanesljiv, posebej v predšolskem obdobju. Zato moramo večjo težo pripisati vedenjskim znakom, opazovanju gibanja, podatkom staršev in po možnosti video posnetkom epizod [4,5].

Razvojni vidik je pomemben tudi pri interpretaciji testov. Vestibulo-okularni refleks dozoreva drugače kot vestibulo-spinalne in vestibulo-količne poti, centralne povezave pa se spreminjajo vse do adolescence [1]. Pediatričnega izvida zato ni smiselno nekritično interpretirati po odraslih normah. Enako pomembna je izvedljivost: popoln testni protokol, ki ga otrok ne zmore izvesti zanesljivo, ima manjšo diagnostično vrednost kot krajši in ciljno izbran nabor kakovostno opravljenih testov.

Anamneza in klinični pregled ostajata temelj

Naši podatki podpirajo klinični pristop, pri katerem preiskave sledijo hipotezi in ne obratno. Slabost, bruhanje, horizontalno-rotatorni nistagmus ter daljše trajanje simptomov so bili povezani s periferno etiologijo [5]. Noben posamezen simptom seveda ni dovolj specifičen za dokončno diagnozo, toda njihova kombinacija lahko že ob prvem stiku usmeri otroka k avdiovestibulološki obravnavi. Nasprotno pa nevrološki izpadi, atipični očesni gibi, hud ali nov glavobol, motnja zavesti, progresiven potek ali drugi opozorilni znaki zahtevajo širšo oziroma urgentno nevrološko obravnavo.

Posebno previdnost zahteva slikovna diagnostika. V prvotni kohorti je bila klinično relevantna patologija pri slikanju glave ugotovljena razmeroma redko, zato rutinsko slikanje vseh otrok z vrtoglavico ni utemeljeno. Pri mlajšem otroku je treba dodatno upoštevati potrebo po sedaciji pri magnetnoresonančnem slikanju in ionizirajoče sevanje pri računalniški tomografiji [4]. Slikovne preiskave morajo biti usmerjene, ne pa uporabljene kot nadomestilo za anamnezo in pregled.

Vestibularno testiranje kot mozaik, ne kot en sam »zlati standard«

Vestibularni organ sestavljajo različne senzorične strukture, preiskave pa ocenjujejo različne funkcionalne komponente in frekvenčna območja. Kalorično testiranje, rotacijski stol in vHIT zato ne merijo istega pojava. Podobno VEMP dopolnjujejo oceno otolitnih organov, SVV pa prispeva informacijo o zaznavi vertikale. Pri otroku je smiselno razmišljati o »mozaiku« rezultatov, v katerem je vsak test interpretiran v kontekstu klinične slike [5,10–13]. Pediatrične raziskave potrjujejo izvedljivost vHIT, SVV in cVEMP ter hkrati opozarjajo, da je tolerabilnost posameznih komponent testiranja starostno odvisna [10–13].

Praktično to pomeni, da je izbira preiskave odvisna od starosti, sodelovanja in diagnostičnega vprašanja. Rotacijski stol je lahko primernejši za mlajšega otroka, vHIT je hiter in dobro toleriran pri sodelujočih otrocih, kalorična preiskava pa ostaja uporabna, kadar želimo nizkofrekvenčno oceno lateralnih polkrožnih kanalov in jo otrok tolerira [5,10,13]. Pri klinično stabilnem otroku ni vedno potrebno opraviti vseh testov v enem obisku; postopno testiranje lahko zmanjša utrujenost in poveča zanesljivost rezultatov [13].

Multidisciplinarnost ni dodatek, temveč diagnostična strategija

Začetna etiološka porazdelitev naše kohorte jasno pokaže, da vrtoglavica pri otroku ni izključno otorinolaringološki problem. Centralni, hemodinamski in psihološki vzroki so skupaj predstavljali pomemben delež primerov [4]. Otolog oziroma avdiovestibulolog ima ključno vlogo pri prepoznavi in izključevanju periferne vestibularne patologije, vendar mora biti diagnostična pot povezana z nevrologijo, pediatrijo, kardiologijo, psi-

hologijo oziroma psihiatrijo, oftalmologijo, infektologijo in radiologijo glede na klinični fenotip.

Vestibularni in čustveni sistemi so anatomsko in funkcionalno povezani, zato sta lahko organska in psihološka komponenta prisotni hkrati [1]. Psihogeno oziroma funkcionalna razlaga mora temeljiti na pozitivnih kliničnih značilnostih in ustrezni izključitvi pomembnih organskih vzrokov, ne le na odsotnosti laboratorijske potrditve.

Čas kot diagnostično orodje

Najizrazitejši rezultat longitudinalne analize je zmanjšanje deleža etiološko neopredeljenih otrok s približno 44 % na 10 % [9]. To potrjuje, da je pediatrični vestibularni fenotip dinamičen. Pri nekaterih otrocih se migrenski vzorec, ortostatski simptomi, psihološki dejavniki ali periferna vestibularna motnja (predvsem benigni pozicijski paroksizmalni vertigo) ob prvem obisku še ne izrazijo dovolj značilno, da bi izpolnili diagnostična merila. Pri migrenskih sindromih so sodobna merila Bárány Society in International Headache Society pomembno izboljšala opredelitev vestibularne migrene otroštva in ponavljajoče se vrtoglavice otroštva [14,15]. V takšnih primerih je kontrolni pregled diagnostični postopek, ne znak diagnostičnega neuspeha.

Strukturirano spremljanje naj bo zato aktivno načrtovano predvsem pri ponavljajočih se ali trajajočih simptomih, neopredeljeni etiologiji, sumu na migrenski fenotip ter ne-normalnih nevroloških ali vestibularnih najdbah [9,14,15]. Na kontrolnem pregledu ne ponavljamo le istih vprašanj, temveč ocenimo, ali se je spremenila časovna struktura napadov, ali so se pojavili glavobol, slušni simptomi, presinkopa, novi nevrološki znaki, anksioznost ali izogibanje gibanju, ter ali je mogoče opraviti dodatne vestibularne teste, ki ob prvem obisku zaradi starosti ali sodelovanja niso bili izvedljivi.

Več kot zdravljenje vrtoglavice: razvoj, gibanje in rehabilitacija

Vestibularni sistem je potrebno obravnavati kot razvojno senzorično mrežo. Cilj terapije ni samo odsotnost vrtoglavice. Pomembni izidi so varna in samozavestna hoja, vrnitev k igri in športu, dobra stabilizacija pogleda, sposobnost delovanja v vidno kompleksnem okolju, šolska udeležba ter zmanjšanje sekundarne anksioznosti in izogibanja. Pri vestibularni hipofunkciji je zato smiselna zgodnja, starosti prilagojena vestibularna in motorična rehabilitacija.

Pregled razvoja vestibularnega sistema opozarja, da se centralne vestibularne povezave oblikujejo v obdobju, ko otrok pridobiva osnovne gibalne in kognitivne veščine [1,2]. Prosta igra, hoja, tek, plezanje, vrtenje, skakanje in druge raznolike gibalne izkušnje zagotavljajo naravno vestibularno stimulacijo. Dolgotrajna telesna neaktivnost in dejavnosti pred zaslonom te izkušnje zmanjšujeta [1]. Zato je pomembno, da pri otroku ohranjamo raznolike senzorično-motorične izkušnje in čim prej rehabilitiramo ugotovljeno vestibularno okvaro.

Predlagani klinični model

Celostni model je mogoče povzeti v šest zaporednih korakov (slika 1). Tak model zmanjšuje tveganje za dve skrajnosti: pretirano diagnostiko z velikim številom slabo indiciranih preiskav in prehitro zaključevanje diagnostike po normalnem prvem izvidu. Namen ni opraviti čim več testov, temveč pridobiti dovolj kakovostnih informacij, da lahko otroka varno razvrstimo, spremljamo in usmerimo v ustrezno zdravljenje ali rehabilitacijo.

Slika 1. Predlagan klinični model pri obravnavi otroka z vrtoglavico ali omotico.



Omejitve

Predstavljena sinteza temelji pretežno na podatkih iz enega terciarnega centra, zato lahko napotitveni vzorec vpliva na etiološko porazdelitev. Izhodiščni klinični raziskavi sta bili retrospektivni, pri vseh otrocih pa zaradi starosti, sodelovanja in časovne dostopnosti posameznih metod ni bilo mogoče izvesti enakega nabora vestibularnih testov [4,5]. Longitudinalna revizija je uporabljala različno dolga obdobja spremljanja; 32 % otrok ni imelo zaključenega kontrolnega pregleda, zato pri delu kohorte morebitna kasnejša etiološka sprememba ni bila dokumentirana [9]. Prav tako ta prispevek ni sistematični pregled literature in ne omogoča neposrednega kvantitativnega primerjanja vseh objavljenih etioloških serij.

Zaključek

Motnje vestibularnega sistema pri otroku so več kot motnje ravnotežja. Vestibularni sistem je del razvijajoče se multisenzorične mreže, ki podpira stabilizacijo pogleda in drže, gibanje, prostorsko orientacijo ter sodeluje pri kognitivnem, čustvenem in avtonomnem delovanju. Največjo diagnostično vrednost ima kombinacija natančne razvojno usmerjene anamneze, otonevrološkega pregleda, premišljeno izbranih starosti prilagojenih vestibularnih testov ter multidisciplinarne presoje. Kadar diagnoza ob prvem pregledu ni jasna, je načrtovano spremljanje del diagnostike. Klinični fenotip se lahko razvije skozi čas, kar omogoči natančnejšo etiološko razvrstitev in prepreči prezgodnje diagnostično zaključevanje.

Končni cilj pediatrične vestibularne medicine ni le odpraviti vrtoglavico, temveč otroku omogočiti optimalen motorični, kognitivni, čustveni in socialni razvoj. Celostni pristop zato združuje diagnostiko, spremljanje, rehabilitacijo in spodbujanje primerne gibalne oziroma vestibularne izkušnje v vsakdanjem življenju.

Etika, soglasja in financiranje

Etična odobritev: Prispevek je narativna sinteza že objavljenih podatkov in ne vključuje novega zbiranja podatkov. Izhodiščna klinična raziskava je bila odobrena s strani Komisije Republike Slovenije za medicinsko etiko (št. 0120-34/2018/16, 13. 12. 2018) [5].

Informirano soglasje: V izhodiščni klinični raziskavi so otroci in njihovi starši oziroma skrbniki podali pisno informirano soglasje [5]. Ta prispevek ne vključuje novih kliničnih fotografij ali individualno prepoznavnih podatkov.

Financiranje: Obravnavane raziskave niso prejele finančne podpore.

Navzkrižje interesov: Avtorji izjavljajo, da ni navzkrižja interesov.

Uporaba orodij umetne inteligence: Pri izdelavi tabel je bilo uporabljeno generativno orodje ChatGPT (OpenAI). Avtorji so vsebino strokovno pregledali, preverili navedbe ter prevzemajo polno odgovornost za končno različico prispevka.

Razpoložljivost podatkov: Prispevek temelji na že objavljenih podatkih. Podatki iz izvornih raziskav so dostopni skladno z izjavami o razpoložljivosti podatkov v posameznih objavah oziroma pri kontaktnem avtorju na razumno zahtevo, kjer je to dopustno.

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Funkcionalna vrtoglavica: diagnostična slepa pega ali nova klinična entiteta?

Functional dizziness: a diagnostic blind spot or a new clinical entity?

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POVZETEK

Uvod: Funkcionalna vrtoglavica predstavlja pomemben diagnostični izziv, zlasti pri pacientih in pacientkah s persistentnim občutkom vrtoglavice ali nestabilnosti, pri katerih standardna vestibularna in nevrološka diagnostika ne pojasni stopnje subjektivne prizadetosti. Uvedba diagnostičnih kriterijev za persistentno posturalno-perceptivno vrtoglavico (persistent postural-perceptual dizziness, PPPD) je omogočila odmik od koncepta diagnoze izključevanja in tradicionalne delitve med »organsko« in »psihogeno« vrtoglavico.

Pristop: Prispevek je zasnovan kot narativni pregled literature, dopolnjen s klinično perspektivo obravnave funkcionalne vrtoglavice. Pregledani so bili zgodovinski opisi funkcionalnih vestibularnih sindromov, diagnostični kriteriji PPPD ter literatura s področja vestibularne fiziologije, multisenzorične integracije, senzorično-motoričnega in prediktivnega procesiranja. Upoštewane so bile tudi klinične izkušnje multidisciplinarne obravnave pacientov in pacientk s funkcionalno vrtoglavico v Avdiovestibulološkem centru Klinike za ORL in CFK ter Nevrološke klinike, UKC Ljubljana.

Ključne ugotovitve: Razvoj od zgodnejših konceptov phobic postural vertigo, visual vertigo in chronic subjective dizziness do PPPD kaže, da funkcionalna vrtoglavica ni nov klinični pojav. Sodobni diagnostični kriteriji omogočajo njeno prepoznavanje na podlagi značilnega kliničnega fenotipa, pri čemer normalni vestibularni izvidi diagnoze ne izključujejo, prav tako pa lahko PPPD obstaja sočasno z vestibularno boleznijo. Eksperimentalne raziskave kažejo na možne spremembe senzorično-motoričnega procesiranja in uporabe notranjih modelov gibanja. Sodobni patofiziološki modeli vključujejo spremenjeno multisenzorično integracijo, vizualno odvisnost, senzorično vrednotenje, pozornost in prediktivno procesiranje, vendar enoten patofiziološki mehanizem ali diagnostični biomarker za zdaj ni opredeljen.

Zaključek: Funkcionalna vrtoglavica ni nova klinična entiteta v smislu novega pojava, temveč sodobneje opredeljen funkcionalni vestibularni sindrom. Ključno je njeno prepoznavanje kot pozitivne klinične diagnoze ter celovita obravnava, ki povezuje avdiovesti-

bulološko in nevrološko diagnostiko z individualno usmerjeno multidisciplinarno rehabilitacijo.

Ključne besede: persistentna posturalno-perceptivna vrtoglavica; funkcionalna vrtoglavica; vestibularne motnje; multisenzorična integracija; senzorično-motorično procesiranje.

ABSTRACT

Background: Functional dizziness represents an important diagnostic challenge, particularly in patients with persistent dizziness or unsteadiness in whom standard vestibular and neurological assessment does not explain the degree of subjective impairment. The introduction of diagnostic criteria for persistent postural-perceptual dizziness (PPPD) has enabled a shift away from the concept of a diagnosis of exclusion and from the traditional distinction between “organic” and “psychogenic” dizziness.

Approach: This article is a narrative review of the literature complemented by a clinical perspective on the management of functional dizziness. Historical descriptions of functional vestibular syndromes, the diagnostic criteria for PPPD, and literature on vestibular physiology, multisensory integration, sensorimotor processing, and predictive processing were reviewed. Clinical experience with the multidisciplinary management of patients with functional dizziness at the Audiovestibulology Centre of the Department of Otorhinolaryngology and Cervicofacial Surgery and the Department of Neurology, University Medical Centre Ljubljana, was also considered.

Key findings: The evolution from earlier concepts such as phobic postural vertigo, visual vertigo, and chronic subjective dizziness to PPPD indicates that functional dizziness is not a new clinical phenomenon. Contemporary diagnostic criteria allow it to be identified on the basis of a characteristic clinical phenotype; normal vestibular test results do not exclude the diagnosis, and PPPD may coexist with vestibular disease. Experimental studies suggest possible alterations in sensorimotor processing and the use of internal models of movement. Contemporary pathophysiological models include altered multisensory integration, visual dependence, sensory weighting, attention, and predictive processing, although no single pathophysiological mechanism or diagnostic biomarker has yet been established.

Conclusion: Functional dizziness is not a new clinical entity in the sense of a newly emerging phenomenon, but rather a functional vestibular syndrome that is now more clearly defined. Its recognition as a positive clinical diagnosis is essential, as is comprehensive management integrating audiovestibular and neurological assessment with individually tailored, multidisciplinary rehabilitation.

Keywords: persistent postural-perceptual dizziness; functional dizziness; vestibular disorders; multisensory integration; sensorimotor processing.

Uvod

Vrtoglavica, omotica in nestabilnost sodijo med pogoste simptome v klinični praksi ter predstavljajo diagnostični izziv tako v primarnem zdravstvu kot v specialistični otorinolaringološki in nevrološki obravnavi. Poseben diagnostični izziv predstavljajo pacienti in pacientke s persistentno vrtoglavico, nestabilnostjo ali občutkom zibanja, pri katerih standardna vestibularna in nevrološka diagnostika ne pojasni pomembne subjektivne prizadetosti. Takšne klinične slike so bile v preteklosti pogosto uvrščene med psihogene ali nespecifične vrtoglavice, čeprav so bili značilni klinični fenotipi, kot sta phobic postural vertigo in visual vertigo, opisani že desetletja pred uvedbo sodobne klasifikacije [1,2].

Pomemben premik je predstavljala uvedba diagnoze persistentne posturalno-perceptivne vrtoglavice (persistent postural-perceptual dizziness, PPPD). Bárány Society jo je leta 2017 opredelila kot kronično funkcionalno vestibularno motnjo s pozitivnimi diagnostičnimi kriteriji [3]. S tem se je koncept funkcionalne vrtoglavice začel premikati od diagnoze izključevanja in dihotomije med »organskim« in »psihogenim« proti sodobnejšemu razumevanju motenj vestibularnega zaznavanja, multisenzorične integracije in senzorično-motoričnega procesiranja.

Kljub standardiziranim diagnostičnim kriterijem ostajajo funkcionalne vestibularne motnje v vsakodnevni klinični praksi pogosto težko prepoznane, njihova patofiziologija pa ni dokončno pojasnjena. Namen prispevka je predstaviti razvoj koncepta funkcionalne vrtoglavice, sodobno razumevanje PPPD in možne patofiziološke mehanizme ter osvetliti pomen multidisciplinarnega pristopa pri diagnostiki in rehabilitaciji oseb s funkcionalno vrtoglavico. Ob tem se postavlja osrednje vprašanje: Ali funkcionalna vrtoglavica predstavlja novo klinično entiteto ali predvsem diagnostično slepo pego tradicionalnega vestibularnega pristopa?

Narativni pregled in klinična perspektiva

Prispevek je zasnovan kot narativni pregled literature, dopolnjen s klinično perspektivo obravnave pacientov in pacientk s funkcionalno vrtoglavico. Pregledani so bili ključni zgodovinski opisi funkcionalnih vestibularnih sindromov, sodobni diagnostični kriteriji persistentne posturalno-perceptivne vrtoglavice (persistent postural-perceptual dizziness, PPPD) ter novejša literatura s področja vestibularne fiziologije, multisenzorične integracije, senzorično-motoričnega procesiranja in sodobnih modelov prediktivnega procesiranja. Posebna pozornost je bila namenjena raziskavam, ki obravnavajo razmerje med objektivno izmerjeno vestibularno oziroma senzorično-motorično funkcijo in subjektivno zaznavo simptomov. Zaradi narativne zasnove prispevka sistematični protokol izbora literature in metaanalitična obdelava podatkov nista bila izvedena.

Prispevek vključuje tudi klinične izkušnje Avdi vestibulološkega centra Klinike za otorinolaringologijo in cervikofacialno kirurgijo UKC Ljubljana, kjer spremljamo in obrav-

navamo tudi paciente in pacientke s funkcionalno vrtoglavico. V zadnjem obdobju njihova obravnava poteka tudi v sklopu multidisciplinarnega tima za funkcionalne nevrološke motnje (FNM) Nevrološke klinike UKC Ljubljana, v katerem sodelujejo strokovnjaki in strokovnjakinje s področij otorinolaringologije, nevrologije, otroške in adolescentne ter odrasle psihiatrije, klinične psihologije in fizioterapije. Takšen pristop omogoča povezovanje avdiovestibulološke in nevrološke diagnostike z oceno psiholoških in psihiatričnih dejavnikov ter individualnega funkcionalnega stanja.

Po diagnostični opredelitvi nadaljnjo obravnavo prilagodimo kliničnemu fenotipu in individualnim potrebam ter vključujemo ustrezne oblike rehabilitacije. Te vključujejo psihoterapevtsko obravnavo, vestibularno in drugo usmerjeno fizioterapijo ter delovno terapijo.

Od zgodnjih opisov funkcionalne vrtoglavice do PPPD

Funkcionalna vrtoglavica ni nov klinični pojav. Klinične slike persistentne vrtoglavice in nestabilnosti, pri katerih stopnja simptomov ni bila zadovoljivo pojasnjena z ugotovljeno vestibularno okvaro, so bile v preteklosti opisovane z različnimi izrazi. Med pomembnejšimi predhodniki današnjega koncepta persistentne posturalno-perceptivne vrtoglavice (PPPD) so phobic postural vertigo, space-motion discomfort, visual vertigo in chronic subjective dizziness [1–4].

Brandt je podrobneje opredelil phobic postural vertigo, za katerega sta bili značilni subjektivna posturalna nestabilnost in vrtoglavica, pogosto izrazitejši v specifičnih situacijah [1]. Bronstein je opisal visual vertigo, pri katerem se simptomi vrtoglavice in nestabilnosti pojavljajo oziroma stopnjujejo ob izpostavljenosti kompleksnim ali gibajočim se vizualnim dražljajem [2]. Koncept se je pozneje nadalje razvijal z opisom chronic subjective dizziness, pri katerem so v ospredju persistentna nevrtiča vrtoglavica oziroma nestabilnost, povečana občutljivost na gibanje ter težave v vizualno zahtevnih okoljih [4].

Pomemben korak k poenotenju teh delno prekrivajočih se kliničnih konceptov je predstavljala uvedba diagnostičnih kriterijev za PPPD, ki jih je Bárány Society objavila leta 2017 [3]. PPPD je bila opredeljena kot kronična funkcionalna vestibularna motnja, za katero so značilni vrtoglavica, nestabilnost in/ali občutki nevrtičega gibanja, prisotni večino dni najmanj tri mesece. Simptomi se značilno stopnjujejo v pokončnem položaju, med aktivnim ali pasivnim gibanjem ter ob izpostavljenosti gibajočim se ali kompleksnim vizualnim dražljajem [3].

PPPD lahko sprožijo periferne ali centralne vestibularne motnje, druge nevrološke ali somatske bolezni ter psihološki distress. Pomembno je, da lahko PPPD obstaja samostojno ali sočasno z drugo vestibularno boleznijo [3]. Prisotnost objektivno ugotovljene vestibularne disfunkcije zato diagnoze PPPD ne izključuje, prav tako normalni izvidi vestibularnih preiskav niso pogoj za njeno postavitev.

Sodobna opredelitev PPPD je s tem pomembno spremenila diagnostični pristop k funkcionalni vrtoglavici. Diagnoza ne temelji na izključevanju vseh organskih vzrokov vrtoglavice, temveč na prepoznavanju značilnega kliničnega fenotipa in izpolnjevanju pozitivnih diagnostičnih kriterijev [3]. Vestibularne preiskave imajo pri tem pomembno vlogo pri opredelitvi periferne in centralne vestibularne funkcije ter prepoznavanju morebitnih sočasnih vestibularnih motenj, vendar same po sebi PPPD ne potrjujejo ali izključujejo. Tako lahko diagnosticiramo PPPD ne samo pri pacientih in pacientkah z neopredeljeno motnjo v delovanju ravnotežnega sistema, temveč tudi pri pacientih in pacientkah, ki imajo opredeljeno okvaro ravnotežnega organa, ki pa ni sorazmerna z njihovimi subjektivnimi težavami.

Od periferne vestibularne okvare do centralne kompenzacije

Klinična slika po vestibularni okvari ni odvisna zgolj od obsega perifernega vestibularnega deficita, temveč tudi od učinkovitosti centralne kompenzacije in senzorično-motorične prilagoditve. Po spremembi vestibularnega priliva se osrednje živčevje prilagaja z različnimi mehanizmi nevropastičnosti, senzoričnega vrednotenja in spremembami strategij nadzora pogleda ter ravnotežja [5]. Ti procesi omogočajo delno funkcionalno okrevanje tudi takrat, ko periferna vestibularna funkcija ostaja okvarjena.

Pomen senzorično-motorične prilagodljivosti so pokazali Lehnen in sodelavci pri osebah z bilateralno vestibulopatijo [6]. V raziskavi z navzkrižno zasnovo sta dve osebi s kronično bilateralno vestibularno hipofunkcijo opravili štiritedensko rehabilitacijo s poudarkom na aktivnih gibih glave ter kontrolno vadbo, ki je vključevala le gibe oči. Po rehabilitaciji z gibi glave se je izboljšal dinamični vid, izboljšanje pa je bilo povezano tako s povečanjem vestibulo-okularnega refleksa (VOR) kot z učinkovitejšimi kompenzacijskimi sakadami [6]. Zaradi zelo majhnega vzorca rezultatov ni mogoče posploševati, vendar raziskava nazorno prikazuje, da funkcionalni izid vestibularne okvare ni določen zgolj s stanjem perifernega vestibularnega aparata, temveč tudi s sposobnostjo centralnega senzorično-motoričnega sistema za prilagajanje.

Funkcionalna vrtoglavica kot motnja senzorično-motoričnega procesiranja

Možnost objektivno merljivih sprememb senzorično-motoričnega procesiranja pri funkcionalni vrtoglavici so raziskovali Schröder in sodelavci [7]. Pri osmih osebah s funkcionalno vrtoglavico, ki so izpolnjevale diagnostične kriterije za PPPD, in enajstih zdravih kontrolah so analizirali stabilizacijo pogleda med velikimi usklajenimi gibi oči in glave. Eksperimentalna zasnova je omogočila primerjavo dveh različnih mehanizmov stabilizacije pogleda: faze, v kateri lahko osrednje živčevje pri načrtovanju gibanja uporablja notranje modele in pričakovane senzorične posledice lastnega gibanja, ter faze, v kateri stabilizacija temelji predvsem na dejanskem senzoričnem prilivu [7].

Pri osebah s funkcionalno vrtoglavico je bila stabilizacija pogleda zmanjšana le v fazi, v kateri so bile vključene notranje napovedi gibanja, medtem ko se senzorično vodena stabilizacija pogleda ni razlikovala od zdravih kontrol [7]. Pomembno je, da vključene osebe niso imele dokazljive periferne ali centralne vestibularne okvare, kar je bilo preverjeno z obsežno nevrototološko diagnostiko. Avtorji so ugotovitve interpretirali kot možen pokazatelj neskladja med notranjimi pričakovanji o posledicah lastnega gibanja in dejanskim senzoričnim prilivom ter jih umestili v model prediktivnega procesiranja (predictive processing) [7].

Podobno eksperimentalno paradigmo so Regnath in sodelavci pozneje uporabili pri osebah s funkcionalno vrtoglavico in funkcionalno motnjo gibanja [8]. Med izvajanjem velikih premikov pogleda so analizirali gibanje glave pri desetih osebah s funkcionalno vrtoglavico, desetih s funkcionalno motnjo gibanja in ustreznih zdravih kontrolah. V obeh skupinah s funkcionalno motnjo so ugotovili povečane oscilacije glave ob zaključku premika pogleda, kar kaže na spremenjeno načrtovanje in izvedbo senzorično-motoričnega odziva [8].

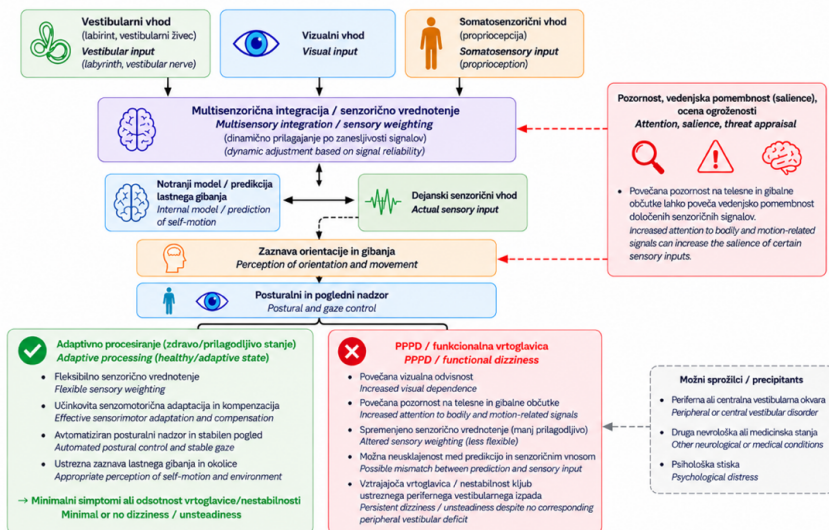
Ugotovitve obeh raziskav podpirajo možnost, da je pri funkcionalni vrtoglavici spremenjeno predvsem procesiranje in uporaba senzorično-motoričnih informacij, ne pa nujno sam periferni senzorični priliv [7,8]. Podoben vzorec pri funkcionalni motnji gibanja dodatno odpira možnost, da nekateri mehanizmi senzorično-motoričnega procesiranja niso specifični samo za vrtoglavico, temveč bi lahko predstavljali širši, transdiagnostični pojav pri funkcionalnih motnjah [8]. Zaradi majhnih vzorcev in eksperimentalne narave obeh raziskav teh ugotovitev za zdaj ni mogoče obravnavati kot validiran diagnostični biomarker.

Sodobni patofiziološki modeli: multisenzorična integracija in prediktivno procesiranje

Sodobni modeli PPPD presegajo razlago, ki bi simptome pripisovala zgolj periferni vestibularni okvari. V ospredje postavljajo spremenjeno multisenzorično integracijo, povečano vizualno odvisnost, spremembe senzoričnega vrednotenja (sensory reweighting), povečano usmerjanje pozornosti na telesne in gibalne zaznave ter spremenjeno uporabo notranjih modelov lastnega gibanja. V takšnem okviru lahko vztrajajo izraziti simptomi tudi takrat, ko je začetna vestibularna okvara že kompenzirana oziroma ko standardne vestibularne preiskave ne pokažejo pomembne periferne disfunkcije [9].

Model prediktivnega procesiranja predpostavlja, da zaznava ni zgolj pasivna registracija senzoričnega priliva, temveč rezultat stalnega usklajevanja med prihajajočimi senzoričnimi informacijami in pričakovanji osrednjega živčevja o njihovem pomenu. Pri funkcionalni vrtoglavici bi lahko prišlo do neustreznega vrednotenja teh dveh virov informacij, pri čemer bi notranja pričakovanja, povečana pozornost na gibanje oziroma nestabilnost in povečana pomembnost posameznih senzoričnih signalov lahko prido-

bili nesorazmerno težo. Eksperimentalne ugotovitve Schröderja in sodelavcev ter Regnatha in sodelavcev so s takšnim modelom skladne [7,8].



Slika 1. Predlagani model spremenjene multisenzorične integracije in senzorično-motoričnega procesiranja pri funkcionalni vrtoglavici/PPPD. Shema prikazuje interakcijo treh senzoričnih vhodov, vloge pozornosti, vedenjske pomembnosti (salience) in ocene ogroženosti ter posledice za zaznavo orientacije, gibanja in posturalni nadzor.

Figure 1. Proposed model of altered multisensory integration and sensorimotor processing in functional dizziness/PPPD. The diagram illustrates the interaction of three sensory inputs, the role of attention, salience and threat appraisal, and possible consequences for perception of orientation, movement and postural control.

(izdelano z uporabo umetne inteligence / created using artificial intelligence)

Pri PPPD so bile opisane tudi spremembe v procesiranju vizualnih in vestibularnih informacij ter v funkcionalni povezanosti možganskih omrežij, ki sodelujejo pri multisenzorični integraciji, prostorski orientaciji, posturalnem nadzoru, pozornosti in čustvenem vrednotenju dražljajev [9,10]. Med pogosto omenjenimi področji so posteriorna insula in parietalni operkulum, vizualna in posteriorna parietalna omrežja, anteriorna insula, cingularna skorja, prefrontalna področja ter hipokampalno-parahipokampalni sistem. Te ugotovitve so na ravni skupin heterogene in jih trenutno ni mogoče uporabljati kot individualne diagnostične biomarkerje.

V takšnem okviru je posebej zanimivo vprašanje vedenjske pomembnosti (salience) telesnih signalov. Če določeni senzorični signali, povezani z ravnotežjem, gibanjem ali notranjim stanjem telesa, pridobijo povečano vedenjsko pomembnost, lahko postanejo predmet trajnejše pozornosti in nadzora. To lahko prispeva k vzdrževanju simptomov, povečani vizualni odvisnosti in manj avtomatiziranemu posturalnemu nadzoru. Sodobne ugotovitve tako podpirajo razumevanje funkcionalne vrtoglavice kot motnje dinamičnega sodelovanja več senzoričnih, senzorično-motoričnih in kognitivnih omrežij, ne pa kot posledice okvare ene same anatomske strukture.

Transdiagnostični pogled na funkcionalne simptome

Možnost, da podobni mehanizmi niso omejeni zgolj na vestibularni sistem, podpirajo tudi raziskave drugih funkcionalnih simptomov. Von Werder in sodelavci so pri osebah s post-COVID sindromom med standardiziranim izzivom dihanja ugotovili izrazitejši občutek dispneje kljub primerljivim fiziološkim vzorcem dihanja in brez razlik, ki bi zadovoljivo pojasnile stopnjo zaznanega simptoma. Avtorji so rezultate interpretirali v okviru modela notranjih pričakovanj in prediktivnega procesiranja [11].

Čeprav ta raziskava ni bila izvedena pri osebah z vrtoglavico in ne predstavlja dokaza za patofiziologijo PPPD, je konceptualno pomembna. Prikazuje namreč, da lahko tudi v drugih telesnih sistemih obstaja neskladje med intenzivnostjo subjektivnega simptoma in objektivno merjeno fiziološko funkcijo, pri čemer se kot možna razlaga raziskuje spremenjeno procesiranje senzoričnih informacij in notranjih modelov [11]. Takšen transdiagnostični pogled je skladen tudi z ugotovitvami Regnatha in sodelavcev, ki so podobne senzorično-motorične nepravilnosti opisali pri funkcionalni vrtoglavici in funkcionalni motnji gibanja [8].

Razprava

Razvoj koncepta funkcionalne vrtoglavice kaže, da PPPD ni povsem nov klinični pojav, temveč sodobna opredelitev fenotipa, ki je bil pod različnimi imeni prepoznan že desetletja [1–4]. Pomembna novost je predvsem uvedba enotnih pozitivnih diagnostičnih kriterijev in opredelitev PPPD kot funkcionalne vestibularne motnje [3]. S tem se diagnostični pristop odmika od tradicionalne delitve na »organsko« in »psihogeno« vrtoglavico.

Prav takšna tradicionalna delitev lahko predstavlja diagnostično slepo pego. Pri pacientih in pacientkah z izrazito vrtoglavico ali nestabilnostjo, pri katerih standardne vestibularne preiskave ne pokažejo okvare, ki bi zadovoljivo pojasnila simptome, lahko odsotnost objektivnega perifernega vestibularnega deficita vodi v sklep, da vestibularna oziroma nevrotološka obravnava ne more več ponuditi razlage težav. Sodobni koncept PPPD takšno razmišljanje presega: normalni vestibularni izvidi niso dokaz odsotnosti motnje, prav tako pa prisotnost periferne vestibularne bolezni ne izključuje sočasne PPPD [3].

Eksperimentalne ugotovitve zadnjih let kažejo, da so pri funkcionalni vrtoglavici lahko prisotne merljive spremembe senzorično-motoričnega procesiranja tudi ob ohranjeni osnovni senzorični funkciji [7,8]. To je pomembno tudi za razumevanje izraza funkcionalna. Ta ne pomeni, da so simptomi namišljeni ali zgolj posledica psihiatrične motnje, temveč usmerja pozornost na spremenjeno delovanje sistemov, ki sodelujejo pri zaznavanju, integraciji ter nadzoru gibanja in ravnotežja.

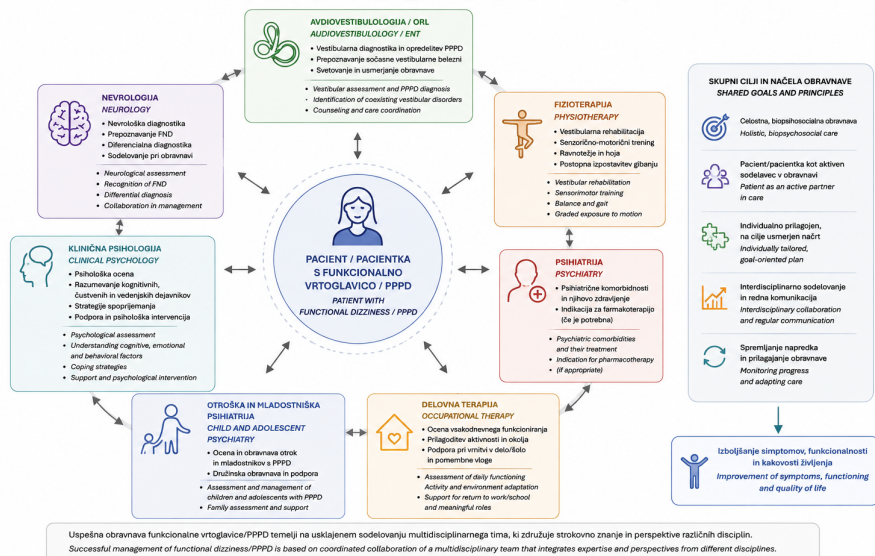
Trenutni dokazi kljub temu še ne omogočajo opredelitve enega samega patofiziološkega mehanizma PPPD. Spremenjena multisenzorična integracija, vizualna odvisnost,

senzorično vrednotenje, pozornost, procesiranje pomembnosti dražljajev ter prediktivno procesiranje predstavljajo medsebojno povezane modele, ki lahko pojasnijo posamezne značilnosti motnje [7–10]. Nevrofiziološke in nevroslikovne ugotovitve so predvsem skupinske in za zdaj nimajo vloge diagnostičnih biomarkerjev. Sodobno razumevanje PPPD zato bolj podpira koncept funkcionalne nevrotološke motnje z več verjetnimi in medsebojno povezanimi mehanizmi kot pa model ene same anatomske ali funkcionalne okvare.

Klinični pomen multidisciplinarnega pristopa

Celostno razumevanje težav pacientov in pacientk s funkcionalno vrtoglavico ima neposredne posledice za klinično obravnavo in poudarja pomen multidisciplinarnega pristopa. Cilj diagnostike ni zgolj izključiti periferno vestibularno bolezen, temveč prepoznati značilen fenotip funkcionalne vrtoglavice, opredeliti morebitno sočasno vestibularno ali nevrološko motnjo ter prepoznati dejavnike, ki lahko prispevajo k vztrajanju simptomov. Pomemben del obravnave je tudi jasna razlaga diagnoze pacientom in pacientkam ter predstavitev funkcionalne motnje kot pozitivne diagnoze, ne kot diagnoze, postavljene zato, ker diagnostične preiskave niso pokazale drugega vzroka. Prav zaradi prepletanja vestibularnih, senzorično-motoričnih, perceptivnih, psiholoških in funkcionalnih dejavnikov je smiseln multidisciplinarni pristop. V našem kliničnem okolju sodelovanje Avdi vestibulološkega centra Klinike za otorinolaringologijo in cervikofacialno kirurgijo UKC Ljubljana z multidisciplinarnim timom za funkcionalne nevrološke motnje Nevrološke klinike UKC Ljubljana omogoča povezovanje različnih strokovnih perspektiv ter individualno načrtovanje nadaljnje obravnave in rehabilitacije.

Slika 2. Multidisciplinarni pristop k obravnavi pacientov in pacient s funkcionalno vrtoglavico/PPPD
Figure 2. Multidisciplinary approach to the management of patients with functional dizziness/PPPD
 (izdelano z uporabo umetne inteligence / created using artificial intelligence)



Rehabilitacijo prilagajamo kliničnemu fenotipu in individualnim potrebam, vključuje pa lahko vestibularno in drugo usmerjeno fizioterapijo, psihoterapevtsko obravnavo ter delovno terapijo. Namen takšnega pristopa ni »dokazovati«, ali je simptom organskega ali psihogenega izvora, temveč prepoznati potencialno spremenljive dejavnike, ki lahko prispevajo k vztrajanju simptomov, ter spodbujati ponovno vzpostavljjanje bolj avtomatiziranih in prilagodljivih strategij zaznavanja, gibanja in posturalnega nadzora.

Omejitve

Pri interpretaciji predstavljenih ugotovitev je treba upoštevati več omejitev. Prispevek je zasnovan kot narativni in ne sistematični pregled literature, zato ne vključuje sistematične ocene kakovosti dokazov. Raziskave patofizioloških mehanizmov funkcionalne vrtoglavice so heterogene in pogosto vključujejo majhne vzorce, zlasti eksperimentalne nevrofiziološke in nevroslikovne študije. Trenutne ugotovitve zato omogočajo oblikovanje verjetnih modelov spremenjene multisenzorične in senzorično-motorične obdelave, vendar še ne omogočajo opredelitve enotnega patofiziološkega mehanizma ali klinično uporabnega biomarkerja za PPPD [7–10].

Zaključek

Funkcionalna vrtoglavica ne predstavlja povsem novega kliničnega pojava, vendar je sodobna opredelitev PPPD pomembno spremenila način njenega prepoznavanja in razumevanja. Uvedba pozitivnih diagnostičnih kriterijev omogoča odmak od koncepta di-

agnoze izključevanja in tradicionalne delitve med »organsko« in »psihogeno« vrtoglavico [3].

Sodobne raziskave kažejo, da simptomov funkcionalne vrtoglavice ni mogoče zadovoljivo pojasniti zgolj s stanjem perifernega vestibularnega sistema. Spremenjena multisenzorična in senzorično-motorična obdelava, vizualna odvisnost ter procesi, povezani z notranjimi modeli in prediktivnim procesiranjem, predstavljajo možne mehanizme vztrajanja simptomov, vendar njihova natančna vloga še ni dokončno pojasnjena [7–10].

Za klinično prakso je zato ključno prepoznavanje funkcionalne vrtoglavice na podlagi značilnega kliničnega fenotipa ter razumevanje, da normalni vestibularni izvidi ne pomenijo odsotnosti motnje, prav tako pa ugotovljena vestibularna patologija ne izključuje sočasne PPPD [3]. Multidisciplinarni pristop, ki povezuje avdiovestibulološko in nevrološko diagnostiko z individualno usmerjeno rehabilitacijo, omogoča celovitejšo obravnavo pacientov in pacientk s funkcionalno vrtoglavico.

Funkcionalna vrtoglavica torej ni nov klinični pojav; nov je predvsem način njenega razumevanja in diagnostičnega opredeljevanja. Diagnostična slepa pega ostaja predvsem v nezadostnem prepoznavanju funkcionalne vrtoglavice kot pozitivne klinične diagnoze.

Etika, soglasja in financiranje

Etična odobritev in soglasje: Prispevek je narativni pregled literature s klinično perspektivo in ne vključuje raziskave na pacientih in pacientkah ali analize individualnih podatkov pacientov, zato odobritev komisije za medicinsko etiko in pridobitev informiranega soglasja nista bili potrebni.

Financiranje: Prispevek ni prejel posebnega financiranja.

Nasprotje interesov: Avtorji in avtorice izjavljajo, da nimajo nasprotij interesov, povezanih s tem prispevkom.

Uporaba umetne inteligence: Pri pripravi prispevka je bilo uporabljeno orodje generativne umetne inteligence za jezikovno in slogovno podporo, pomoč pri strukturiranju besedila ter izdelavo shem. Avtorji in avtorice so vsebino strokovno pregledali in prevzemajo odgovornost za končno besedilo.

Dostopnost podatkov: Prispevek ne vključuje novih raziskovalnih podatkov.

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05

Kirurgija glave in vratu

Head and Neck Surgery

Endoscopic Surgery of the Laryngeal and Pharyngeal Cancer with Special Regard to Combined Modality Endoscopic Surgery for T2 and T3 Supraglottic and Hypopharyngeal Cancer in Ljubljana, Slovenia

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ABSTRACT

Endoscopic surgery allows many patients with laryngeal and pharyngeal cancer to maintain natural speech, breathing and swallowing. The method has existed for more than 100 years, and as a modern microsurgical technique in otorhinolaryngology, it has been present since the 1960s. After a period of open surgery and radiotherapy domination, due to the introduction of new technologies, especially laser, we are witnessing a method's new impetus. With all this technological advancement, we ask ourselves what its efficiency is compared to the classical endoscopic technique of cold steel, classical open surgery and radiotherapy? My wish is to present endoscopic microsurgery and newer endoscopic modalities (laser and hybrid 3D / harmonic / bipolar) in the treatment of laryngopharyngeal cancer, especially supraglottic and hypopharyngeal cancer at the Department of Otorhinolaryngology and Cervicofacial Surgery in Ljubljana. In the last-mentioned subset, the overall local recurrence rate was 14% and the regional 3.6% after the average duration of follow up lasting four years.

I will also present foreign experience with robotic surgery of the same anatomic region, since in the near future we are intending to introduce this modern therapeutic option. We expect that systematic re-education of patients would further improve long-term results after endoscopic laryngeal and pharyngeal cancer resections.

Keywords: [larynx; pharynx; cancer; endoscopic surgery; laser microsurgery; transoral surgery]

Introduction

Lynch pioneered endoscopic surgery for laryngeal cancer as early as 1915 (1), although the method only began to evolve in the 1960s thanks to Kleinsasser (2) and, notably, Professor Kambič (3). The 1970s saw the publication of initial experiences with transoral laser surgery for the larynx (4); following the year 2000, this technique became the gold standard for laryngeal surgery at most centers, including the one in

Ljubljana (5). The development of laser surgery also spurred the use of other instrumentation in endoscopic laryngeal cancer surgery—such as coblation (6) or microdebrider methods (7)—and ultimately gave fresh impetus to the traditional "cold steel" phonosurgical technique (8, 9). Nowadays, numerous centers perform endoscopic surgery of the larynx and pharynx; this approach addresses similar issues to open surgery, covering nearly the entire spectrum of potential partial-preservation procedures, including even total laryngectomy. A full range of instrumentation is utilized in these procedures (10, 11).

The principles of endoscopic laryngeal surgery—particularly regarding the vocal cords—differ somewhat from the classic tenets of oncological surgery; for instance, removing the tumor in fragments rather than »en bloc« does not compromise disease control or survival, and some surgeons even advocate transecting the affected vocal cord to precisely determine the depth of tumor invasion (12–14). In endoscopic surgery for laryngeal cancer (particularly of the vocal cords), the resection is considered sufficiently radical if the tumor is removed in its entirety along with 2–3 mm of surrounding healthy tissue (exceeding 1 mm); naturally, the resection margin must be verified intraoperatively using the frozen section method. A slightly wider safety margin is required for the resection of malignant tumors of the supraglottic larynx and hypopharynx (greater than 5 mm) (15).

The aim of endoscopic surgery for laryngeal and pharyngeal cancer is to achieve oncological goals while preserving natural speech, breathing, and swallowing functions. What are the advantages of endoscopic surgery for these cancers compared to other organ-preserving treatment options? Endoscopic procedures preserve the laryngeal anatomical suspension and innervation, ensuring that swallowing remains unimpaired; furthermore, the need for a temporary tracheostomy can be avoided in a high percentage of cases, resulting in a shorter hospital stay and improved patient well-being. Should the disease recur, all treatment options for laryngeal carcinoma remain available. The only drawback of endoscopic surgery is the lack of a strong deterrent effect—stemming from the significantly lower postoperative morbidity compared to traditional open surgery—which leads many patients to continue with harmful habits. Based on published results regarding the treatment of laryngeal cancer, primary laser surgery can achieve local disease control while preserving organ function in 70–80% of cases (16); some sources even report a local disease control rate exceeding 90% five years after laser treatment for patients with early-stage laryngeal cancer (17). Since 2009, the Department of Otorhinolaryngology and Cervicofacial Surgery in Ljubljana has treated the majority of patients with laryngeal cancer and selected patients with pharyngeal cancer (stages T1 and T2) using endoscopic surgery—employing cold micro-instruments, lasers, and hybrid harmonic/bipolar devices, alongside operating microscopes or 3D technology. We will present not only our own experience

with endoscopic surgery for laryngeal and hypopharyngeal cancer but also international experience with robotic surgery for cancer in the same anatomical regions.

Cold-steel endoscopic microsurgery for laryngeal and pharyngeal cancer

Endoscopic excisions of primary tumors were performed according to the "en bloc" resection principle—that is, with the aim of complete removal including a margin of adjacent, apparently uninvolved tissue. The excised tumor specimen, as well as the margins and base of the resulting defect, underwent histological examination. Although cold-steel endoscopic surgery is recognized in modern monographs as an established method for treating laryngeal cancer (18, 19), few authors have recently reported on their experiences in this field. In our study (20), 30% of patients presented with T2 or T3 stage tumors, and the overall local recurrence rate was 21%; thus, our endoscopic surgical results regarding local control of laryngeal and pharyngeal cancer are comparable to those of other organ-preserving therapeutic options. We believe that endoscopic "cold-steel" microsurgery—particularly when combined with modern visualization techniques (such as 3D imaging)—still holds a place in the treatment of laryngeal and pharyngeal cancer.

Laser Microsurgery for Laryngeal and Pharyngeal Cancer

At the Department of Otorhinolaryngology and Cervicofacial Surgery, we have been using the CO2 laser in endolaryngeal surgery for over 30 years. Our oncological outcomes for laser microsurgery of laryngeal and pharyngeal cancer are comparable to those of open surgery and radiotherapy, while long-term voice quality following endoscopic laryngeal surgery is actually superior.

Based on our experience, we believe that—compared to conventional endoscopic surgery—laser use can compromise voice quality, particularly in the treatment of early-stage cancer. Thermal injury causes more pronounced scarring, leading to the formation of synechiae and granulomas in the larynx, which often necessitates further intervention to improve voice quality. In such cases, we can often successfully improve voice quality through medialization of the vocal cord. At the same time, thermally altered margins present challenges for histopathological examination. The laser is undoubtedly indispensable for endoscopic supraglottic laryngectomy, as recovery and the restoration of swallowing function are faster than with conventional supraglottic laryngectomy. Furthermore, the use of the laser reduces bleeding, thereby enabling safe tumor removal (5).

Endoscopic surgery for laryngeal and pharyngeal cancer using harmonic/bipolar instruments and 3D technology

A new chapter in endoscopic laryngeal and pharyngeal surgery has been opened by 3D technology, which utilizes a system camera that delivers a separate image to each

eye, creating a sense of spatial perception in the brain. While the use of modern harmonic or hybrid harmonic-bipolar instruments originated in laparoscopic surgery, it has recently found its place in the surgical treatment of pharyngeal and laryngeal cancer. When combined—and used alongside modern endoscopic retractors—these tools enable precise, synchronized teamwork between two surgeons (so-called "four-handed surgery") during the resection of pharyngeal and laryngeal tumors. Authors from Madrid were the first to publish work on this approach, describing 11 operations for supraglottic and pharyngeal cancer in 2015, reporting excellent intraoperative conditions and functional outcomes. They named the method TOUSS (Transoral Ultrasonic Surgery) (21) and consider it a viable alternative to robotic surgery.

Robotic Surgery for Laryngeal and Pharyngeal Cancer

Transoral robotic surgery (TORS) has advanced significantly since its inception in 2007. Initially used only for oropharyngeal carcinoma, the subsequent development of necessary instruments has enabled robotic surgery for laryngeal, especially supraglottic cancer as well. Numerous authors have reported positive experiences with TORS supraglottic laryngectomy, noting good oncological and functional outcomes, and the use of TORS for total laryngectomy is also increasing. In the surgical treatment of early-stage vocal cord cancer, TORS is still in its infancy; although results from robotic cordectomies have been encouraging so far, further development of robotic technology will be required for the method to see widespread adoption (22). Robotic surgery represents the next stage in the evolution of endoscopic surgery—a path we certainly intend to follow.

Combined modality endoscopic surgery for T2 and T3 tumors of supraglottic and hypopharyngeal cancer in Ljubljana, Slovenia

In 2018, at the Department of Otorhinolaryngology and Cervicofacial Surgery in Ljubljana, we started performing endoscopic surgery as a combination of laser, cold steel and hybrid harmonic-bipolar instruments on six patients with supraglottic and hypopharyngeal cancer, achieving good results (Grošelj, Pukl, Šifrer, Aničin). For the exact execution of these endoscopic procedures, we used special retractors (Feyh-Kastenbauer retractor) or laryngoscopes (Weerda distending laryngoscope and others). Later, till September 2026, we continued to perform this type of endoscopic surgery for T2 and even T3 tumors of supraglottic larynx and hypopharynx in 22 more successive cases. We believe this method offers excellent conditions for performing endoscopic surgeries in the supraglottic and hypopharyngeal regions, thanks to the three-dimensional image, the four-handed approach, and the virtually bloodless nature of the procedure, as harmonic bipolar graspers allow for simultaneous cutting and electrocoagulation. The issue of treating regional disease is of great importance in the mentioned patients as the incidence of both clinically evident and occult region-

al metastases is very high in the patients with supraglottic and hypopharyngeal cancer. So, in all patients with supraglottic cancer graded T2 or more a bilateral neck dissection was performed, while for hypopharyngeal cancers graded more than T1 an ipsilateral dissection was indicated. Postoperative radiotherapy was added in all cases with hypopharyngeal cancer and supraglottic cancer patients with non-radical or questionable primary resection and / or positive regional metastases. The overall local recurrence rate was 14% and the regional 3.6% after the average duration of follow up lasting four years.

Postoperative voice quality

Voice quality corresponded to the extent of the excision, with long-term outcomes rated as very satisfactory or satisfactory in all but six cases in glottic resections. With laser and cold steel procedures, additional interventions are sometimes required to remove extensive granulation tissue, reduce glottic insufficiency, or improve voice quality. The method we used most often to reduce glottic insufficiency following endoscopic resections of laryngeal cancer was autologous fat injection laryngoplasty. We also used a novel method to reduce glottic insufficiency: inserting an auricular cartilage graft beneath the inner perichondrium of the anterior thyroid cartilage plate, achieving significant improvement in voice quality.

Discussion

A comparison of endolaryngeal surgery (with or without laser) versus radiotherapy for the treatment of early-stage glottic cancer—based on an analysis of relevant studies from the MEDLINE, Embase, and Cochrane Library databases covering the period from 1995 to 2011—revealed no significant differences in outcomes. A large US-based meta-analysis of 5,499 patients treated via various laryngeal-preservation approaches found that, while oncological and functional outcomes were similar, the use of endoscopic surgery could reduce the financial burden and length of hospital stay compared to open surgery and (chemo) radiotherapy (23). Among endoscopic approaches, "cold-steel" microsurgery is significantly more cost-effective than all other therapeutic options, as it requires neither expensive equipment nor disposable instruments, and remains a viable alternative should other technologies fail. Authors from the UK and Canada concluded that the decision regarding the treatment method for early-stage vocal cord cancer depends on the preferences of the physician and the patient, as well as the patient's general condition (24).

Available literature indicates that voice quality following endoscopic surgery and radiotherapy for early-stage vocal cord carcinoma is comparable (25). Based on our experience, we believe that the use of a laser—compared to conventional endoscopic surgery—may initially compromise voice quality due to thermal injury, although long-term results remain comparable. When comparing these endoscopic approaches with

radiotherapy, the latter yields better voice quality initially but poorer quality in the long term due to accelerated laryngeal aging caused by ionizing radiation. Authors from New York found a high incidence of incomplete glottic closure in patients successfully treated with radiotherapy for early-stage vocal cord cancer; this condition is characteristic of the aging larynx but is a significantly rarer phenomenon in the general population (26).

Thermal devices (such as lasers) enable bloodless surgery within organs, but a challenge arises when assessing the completeness of the resection. Consequently, some authors often forgo intraoperative histological margin assessment, relying instead on clinical judgment, the laser's thermal effect, and postoperative patient monitoring. Although thermally altered margins no longer pose difficulties for skilled pathologists during examination, assessing resection margins remains easier with conventional endoscopic surgery (27).

Following the excision of larger primary laryngeal or pharyngeal tumors (e.g., at stage T2)—particularly when thermal techniques are employed—significant scarring may occur, leading to the formation of synechiae and granulomas; this often necessitates a secondary procedure to improve voice quality. Large granulomas are most frequently removed, a step that is also crucial for ruling out potential disease recurrence. In cases where the operated vocal fold fails to make complete contact with the healthy one, we sometimes perform a surgical correction involving medialization of the affected side, for instance, using a cartilage graft. We believe that decisions regarding the method and extent of surgical correction following cordectomy should be guided by the functional state of the larynx—specifically, compensatory mechanisms such as voice production via the false vocal fold or the development of pronounced Reinke's edema on the healthy vocal fold.

One of the numerous advantages of endoscopic surgery for laryngeal cancer is undoubtedly the patients' improved well-being compared to those treated via other therapeutic options. It appears that this very low postoperative morbidity and sense of well-being contribute to the procedure's sole drawback—its lack of a significant "wake-up call" effect; consequently, most patients continue smoking or maintaining other harmful habits, which may contribute to disease recurrence or the development of a new cancer in the upper aerodigestive tract. We believe that implementing a systematic patient re-education program involving a clinical psychologist and a speech therapist would further improve long-term outcomes following the endoscopic resection of laryngeal and pharyngeal cancer.

And finally, endoscopic procedures should by no means be approached dogmatically; rather, the various available tools are complementary, and it is desirable for the surgeon to master as many endoscopic techniques as possible.

Conclusions

At the Department of Otorhinolaryngology and Cervicofacial Surgery in Ljubljana, in the endoscopically operated patients with supraglottic and hypopharyngeal cancer, the overall local recurrence rate was 14% and the regional 3.6% after a four-year average follow up. Endoscopic surgery for laryngeal and pharyngeal cancer yields functional and oncological results comparable to those of other organ-preserving treatment options. However, it offers distinct advantages, such as reduced postoperative morbidity, improved patient well-being during recovery, a lower financial burden, and shorter hospital stays. We anticipate that systematic patient rehabilitation would further enhance long-term outcomes following the endoscopic resection of laryngeal and pharyngeal cancer.

Ethics, Consent and Funding

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Poročilo »Make Sense Campaign« v Sloveniji za leto 2026

Report on the Make Sense Campaign in Slovenia for 2026

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STRUKTURIRANI IZVLEČEK

Med rak glave in vratu (RGV) štejemo rak ustnic, ustne votline, žrela, grla, žlez slinavk, nosu in obnosnih votlin, sluznični melanom tega področja ter rak neznanega izvora z zavsevkami na vratu.

Odkrivanje RGV temelji na otorinolaringološkem (ORL) kliničnem pregledu, endoskopskih in slikovnih, cito- in histopatoloških preiskavah. Posebno pozornost namenjamo pacientom, ki imajo tri tedne ali več opozorilne simptome, kot so: hripavost, težko ali boleče požiranje, bolečine v ustih in žrelu, spremembe na ustni sluznici, občutek cmoka v žrelu ter otekline na vratu. Zgodnejše odkrivanje RGV ima ugodnejšo prognozo in izid zdravljenja.

Leta 2024 se je Slovenija pridružila evropski pobudi »Make Sense Campaign« (MSC), ki ozavešča javnost o RGV in spodbuja zgodnejše odkrivanje le-tega. V prvih devetih mesecih projekta smo pri 193 simptomatskih pacientih opravili otorinolaringološki pregled. Maligno bolezen ali predrakavo spremembo smo odkrili pri 16 osebah (8,2 %).

Ključne besede: Rak glave in vratu; Zgodnje odkrivanje raka; Presejanje za raka

ABSTRACT (ENGLISH SUMMARY)

Head and neck cancers (HNC) encompass malignancies of the lips, oral cavity, pharynx, larynx, salivary glands, nasal cavity and paranasal sinuses, as well as mucosal melanoma in this anatomical region and cervical lymph node metastases of unknown primary origin.

The diagnosis of HNC is based on a comprehensive clinical otorhinolaryngological (ENT) examination, endoscopic evaluation, imaging, cytological and histopathological assessment. Particular emphasis is paid to symptoms persisting for three weeks or longer, including hoarseness, dysphagia, odynophagia, pharyngeal pain, mucosal changes of the oral cavity, globus sensation, and cervical masses. Early detection is associated with improved treatment outcomes.

In 2024, Slovenia joined the Make Sense Campaign (MSC), which aims to increase awareness and facilitate the early detection of HNC. During the first nine months of the

campaign, 193 symptomatic patients underwent ENT assessment. Malignancy or precancerous lesion was diagnosed in 16 patients (8.2 %).

Keywords: Head and Neck Neoplasms; Early Detection of Cancer; Cancer screening

Uvod

Definicija raka glave in vratu, etiologija, diagnostika, zdravljenje

NCCN (angl. National Comprehensive Cancer Network) med rak glave in vratu (RGV) vključuje rak ustnic, ustne votline, žrela, grla, žlez slinavk, nosu in obnosnih votlin, sluznični melanom tega področja in rak neznanega izvora z zasevki na vratu [1]. Rak kože tega področja med RGV štejemo le v širšem anatomskem smislu.

V Evropi ga uvrščamo na sedmo mesto po pogostnosti [2]. Po zadnjih podatkih Slovenskega registra raka (v obdobju 2019–2023) pade na šesto mesto po pogostnosti med vsemi raki pri moških in na štirinajsto pri ženskah. Pri obeh spolih pa na deveto mesto. V prej omenjenem obdobju smo letno povprečno odkrili 481 novih primerov bolnikov z RGV [3].

Najpomembnejša etiološka dejavnika sta **kajenje** in **uživanje alkoholnih pijač**, še posebej v kombinaciji. Okužba s **Humanim papiloma virusom** (HPV) in z njim povezane spolne navade pa imajo vse pomembnejšo vlogo v etiopatogenezi raka orofarinksa [2, 4]. Obstajajo še drugi dejavniki tveganja, vendar so manj značilni.

Postavitev diagnoze RGV je zahtevna in se začne z **anamnezo** in **kliničnim ORL pregledom**, lahko se nadaljuje z endoskopsko diagnostiko v lokalni in splošni anesteziji. Pregled dopolnimo s slikovno diagnostiko, citopatološko in histopatološko analizo odvzetih vzorcev ter po potrebi z mnenji specialistov drugih specialnosti [2, 5].

Povedati je treba, da se simptomi, značilni za RGV, lahko pojavljajo tudi pri nenevarnih boleznih ali prestopnih rakavih boleznih. Ločnico oziroma večjo verjetnost za maligno bolezen tako predstavlja časovna komponenta, in sicer trajanje simptomov **tri tedne in več** [2, 6].

Na sluznici glave in vratu lahko vzniknejo predrakave spremembe bele (levkoplakija) in rdeče barve (eritroplakija) [7, 8]. Pri odkrivanju sumljivih sprememb na sluznicah glave in vratu in napovedi njihovega malignega potenciala si pomagamo z endoskopijo z ozkospektralno osvetlitvijo (angl. narrow-band imaging, NBI), s katero razpolagamo na ORL klinikah v Ljubljani in Mariboru [2, 9, 10].

Pri odločanju o načinu zdravljenja RGV sledimo mednarodno veljavnim in zaupanja vrednim smernicam NCCN [11] in Smernicam za obravnavo rakov glave in vratu v Sloveniji [2, 12, 13].

Rezultati zdravljenja so dokazljivo boljši, če je RGV diagnosticiran v zgodnjih fazah, med katerimi preživi kar 80–90% bolnikov [2, 4, 14]. Paciente z RGV v zgodnjih fazah

se zdravi unimodalno - operacijsko ali z obsevanjem. Razumljivo, operacije in obsevalna polja so po obsegu pri pacientih v zgodnjih fazah RGV manjši, zato je tudi posledic zdravljenja manj. Poleg tega se kemo- ter imunoterapiji in tarčnim zdravilom, ki pridejo v poštev pri lokoregionalno napredovalih, metastatskih in ponovljenih RGV, in posledicam takšnega zdravljenja izognemo. S tem se izboljša kvaliteta življenja in dodatno zmanjšajo stroški zdravljenja [2]. Nenazadnje so rezultati zdravljenja zgodnjega RGV v primerjavi z napredovalim dokazljivo boljši [15]. Pri približno 60% bolnikov je RGV diagnosticiran v lokoregionalno napredovalih stanjih [16]. Med njimi jih 66% ne bo preživel petih let [17].

Make Sense Campaign

Make Sense Campaign (MSC) je pobuda, ki zajema tri ključne cilje: povečati ozaveščenost in znanje o raku glave in vratu, doseči zgodnejše odkritje pacientov z RGV ter izboljšati njihov izid zdravljenja. Deluje v prostovoljno pridruženih evropskih in nekaterih izvenevropskih pridruženih članicah (Brazilija, Južna Koreja) od leta 2006. Vsako leto v mesecu septembru, tokrat med 21. in 26. 9. MSC obeleži svoj obstoj z »Awareness week« oz. tednom ozaveščanja, ko potekajo dodatne aktivnosti z zgoraj omenjenimi cilji.

Temeljno delo MSC je organizacija preventivnih pregledov oseb s simptomi, sumljivimi za zgodnji RGV. V letu 2024 so v Evropi opravili 33.501 preventivni pregled, od katerih so 841 oseb (2,5 %) napotili na nadaljnjo specialistično obravnavo zaradi suma na RGV. V letu 2025 je bilo izvedenih 13.146 pregledov, od katerih so 1.209 oseb (9,2 %) napotili na nadaljnjo specialistično obravnavo.

Eden izmed sloganov MSC je »1 for 3«, kar pomeni, da ima bolnik enega (ali več) od spodaj navedenih simptomov, ki traja(jo) vsaj tri tedne (angl. 1 symptom for 3 weeks). Takega bolnika se napoti na preventivni pregled k otorinolaringologu. Ti simptomi so:

- bolečine v ustni votlini,
- razjede, bele in rdeče spremembe na sluznici ustne votline in ostalih sluznicah glave in vratu,
- bolečine v žrelu, ki se lahko širijo v uho,
- hripavost,
- težko požiranje,
- boleče požiranje,
- občutek cmoka v žrelu,
- zaprt nos s krvavkastim izcedkom na isti strani,
- oteklina na vratu [2, 4].

Leta 2024 je Klinika za ORL in CFK UKC Ljubljana s strani krovne organizacije MSC prejela uradno vabilo za vzpostavitev MSC v Sloveniji in pridružitve MSC v Evropi.

Cilji MSC v Sloveniji so enaki ciljem MSC v Evropi in so navedeni zgoraj. Z uresničitev le-teh so potrebne naslednje aktivnosti:

1. Ozaveščanje ljudi o prvih znakih RGV in seznanitev z možnostjo preventivnega pregleda.
2. Izobraževanje družinskih zdravnikov in medicinskih sester referenčnih ambulant o prepoznavanju zgodnjih simptomov RGV.
3. Izvajanje preventivnih pregledov sprva simptomatskih oseb in v kasnejših fazah tudi asimptomatskih oseb, ki ustrezajo populaciji z visokim tveganjem za RGV (kadilci, pivci alkoholnih pijač in starejši od 60 let).
4. Izobraževanje preventivno obravnavanih oseb o dejavnikih tveganja za RGV [2].

Klinična pot

Pred začetkom delovanja MSC je bila na temeljih aktivnosti MSC izdelana klinična pot z namenom: boljše komunikacije in koordinacije med napotnimi zdravniki (zaenkrat ZD Ljubljana) ter Kliniko za ORL in CFK Ljubljana, olajšanja odločitev glede stopnje nujnosti ter s tem negotovosti pacientov o zdravstvenem stanju ter razbremenitve naših urgentnih ORL ambulant. Končni cilj pa je skrajšanje čakalnega časa pacientov in s tem zgodnejše odkrivanje RGV.

1. Obravnava se začne na primarnem nivoju. Družinski, urgentni zdravnik ali zobozdravnik opravi osnovno anamnezo in pregled ter na podlagi trajanja (3 tedne ali več) in značilnosti simptomov presodi, ali je smiselna napotitev. Poleg zgoraj navedenih simptomov smo v dogovoru z ZD Ljubljana dodali še sledeče simptome in/ali znake:

- oteklina na vratu z izvidom slikovnih ali drugih preiskav (npr. UZ vratu, citopatološka punkcija), ki kaže na možnost resnejše bolezni ali ki zaradi nejasnosti zahteva dodatne preiskave,
- krvavitev iz ust in/ali žrela,
- nepojasnjeno hujšanje ob zgoraj navedeni simptomatiki,
- okužba s HPV ob zgoraj navedeni simptomatiki.

Ciljna populacija so odrasli nad 20 let.

2. V kolikor pacient ustreza časovnim in starostnim kriterijem ter ima za RGV značilne simptome, zdravnik izda napotnico za 1035P Otorinolaringološki pregled - prvi, stopnja nujnosti ZELO HITRO. V rubriki "anamneza" je potrebno označiti "Make Sense Campaign" oz. MSC.

3. Bolnik se mora po prejetju napotnice sam naročiti.

4. Naš cilj je, da pregledamo pacienta znotraj 14 dni od oddaje napotnice. Preglede izvajamo ob ponedeljkih med 14.00—19.00.

5. Med pregledom otorinolaringolog prebere izpolnjen MSC vprašalnik (pacient ga dobi s strani napotnega zdravnika ali na Kliniki za ORL in CFK), opravi ciljano anamnezo in klinični otorinolaringološki pregled, ki ga po presoji dopolni z ambulantno endoskopijo. Po potrebi odredi dodatne preiskave.

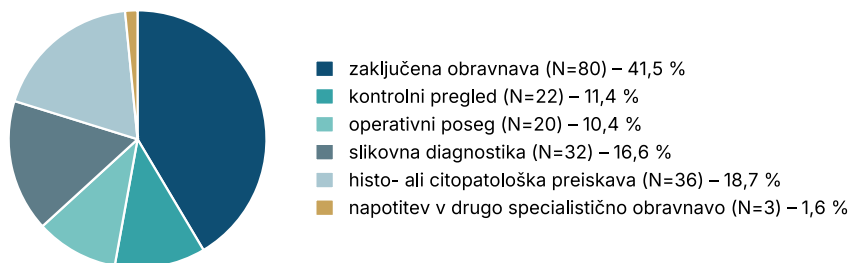
6. Pri odločanju o ukrepih otorinolaringolog v MSC ambulantni upošteva sledeče principe:

1. V kolikor ne obstaja sum na rakave in predrakave spremembe, pacient prejme izvid, pojasnila ter svetovanje glede zmanjšanja dejavnikov tveganja za RGV. Napoten je nazaj na primarni nivo.
2. V kolikor so spremembe sumljive za RGV, se pacienta napoti na dodatne preiskave, v naknadno ambulantno in/ali hospitalno obravnavo ter na multidisciplinarni konzilij, v skladu s časovnim okvirjem Klinike.
3. V kolikor gre za nemaligne bolezni, ki zahtevajo ORL obravnavo, bolnika ravno tako prevzamemo in vodimo ambulantno ali hospitalno.

Rezultati

Od 5. 1. 2026 do 30. 9. 2026 je bilo v MSC ambulantni Klinike za ORL in CFK Ljubljana pregledanih 193 pacientov, od tega 91 moških in 102 ženski. Povprečna starost obravnavanih bolnikov je bila 58 let (razpon 18—94 let).

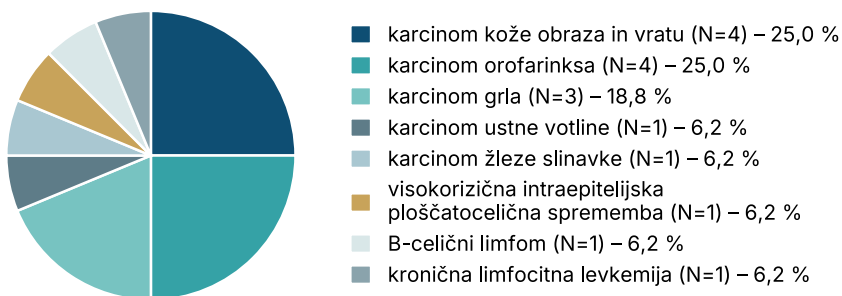
Najpogostejša simptoma sta bila cmok v žrelu (N=49, 25,3%) ter hripavost (N=43, 22,3 %).



Tortni grafikon 1: Potek obravnave pacientov v MSC po opravljenem prvem pregledu

Skupno je bilo v preiskovanem obdobju v okviru MSC ambulantne odkritih 16 malignomov in predrakavih sprememb (8,2 % pregledanih). Natančneje, RGV po definiciji

NCCN smo odkrili pri 9 pregledanih oziroma 4,7 %. Prevladovali so moški – 55,6 % (N = 5).



Tortni grafikon 2: Vrste odkritih novotvorb v okviru MSC ambulantne

Iz poročila evropske MSC je razvidno, da so k specialistom usmerili 2,5 do 9,2 % bolnikov. Evropske rezultate težko primerjamo z našimi, saj so v evropski MSC pregledovali asimptomatske bolnike, pri nas pa simptomatske. Med pregledanimi se je 44 oseb opredelilo kot aktivni kadilci (22,8 %), 44 oseb pa kot nekdanji kadilci (22,8 %). Alkohol je redno uživalo 7,3 % pregledanih (N=14), 42,5 % pa je bilo občasnih pivcev alkoholnih pijač (N=82).

Pri potrjenih RGv (N=9) je bilo 22,2 % aktivnih kadilcev (N=2) in 22,2 % nekdanjih kadilcev (N=2). Kot reden uživalec alkohola se je opredelil 1 bolnik (11,1 %).

Razprava

Rezultati MSC so dobri, saj smo kar 8,3 % pregledanim bolnikom z malignomom ali prekancerozo (16/193) omogočili hitrejši dostop do otorinolaringologa oz. ustreznega specialista in s tem zgodnejšo diagnostiko in zdravljenje bolezni.

Glede na dobre rezultate do sedaj vzpostavljenega programa bomo z njim nadaljevali ter ga razširili in omogočili več napotitev iz ZD Ljubljana kakor tudi napotitve drugim primarnim ustanovam v Sloveniji. Trenutno so v kampanjo vključeni le simptomatski pacienti, saj je financiranje teh pregledov krito s strani ZZS. Smiselno bi bilo presejati tudi asimptomatske osebe, ki so dovzetne za RGv. To so moški, starejši od 60 let, kadilci in redni uživalci alkoholnih pijač. Žal za RGv zaenkrat ne obstajajo specifični zanesljivi in s smernicami podprti tumorski markerji, ki bi jih lahko uporabili pri presejalnem odkrivanju bolnikov [2] in bi omogočili lažjo izbiro oseb s tveganjem za RGv. Biološki tumorski markerji bi lahko olajšali in pospešili obravnavo. Tako pa je na voljo samo klinični otorinolaringološki pregled. V prihodnosti bomo iskali organizacijske in finančne možnosti, ki bi omogočale preventivni pregled asimptomatskim pacientom z

dejavniki tveganja. V tem oziru smo v stiku s Koordinatorjem Državnega programa za obvladovanje raka. Pobudo MSC bomo poskusili predstaviti širši javnosti in s tem krepi ozaveščanje o preventivi in zgodnjem odkrivanju RGV.

Zaključek

Zgodnje odkrivanje RGV in predrakavih sprememb pomembno pripomore k boljšemu rezultatu zdravljenja ter zmanjša stroške le-tega. Prepoznati moramo simptome, značilne za RGV, ki trajajo več kot tri tedne in pacienta napotiti na ORL pregled. Sem štejejo bolečine v ustni votlini ali žrelu, ki se lahko širijo v uho, razjede, bele in rdeče spremembe na sluznici, hripavost, boleče in/ali težko požiranje, občutek cmoka v žrelu, zaprt nos s krvavim izcedkom na isti strani, oteklina na vratu.

Dodatne informacije o MSC so dostopne na spletni strani MSC (<https://makesense-campaign.eu>), kjer so na voljo informacije o RGV za splošno in strokovno javnost, napotki za bolnike z RGV, predstavitev dogodkov, povezanih s preventivo RGV v Evropi in propagandni material, s katerim MSC ozavešča prebivalstvo.

Etika, soglasja in financiranje

Etična odobritev: Etična odobritev ni bila potrebna.

Informirano soglasje: Za tovrstne prispevke informirano soglasje ni potrebno.

Zahvale: Zahvaljujemo se vsem sodelujočim pri projektu MSC, tako ORL specialistom, ki so pregledovali paciente v MSC ambulantni kot družinskim zdravnikom ZD Ljubljana, ki so paciente napotovali v MSC ambulantno.

Financiranje: Raziskavo je financirala Javna agencija za raziskovalno dejavnost Republike Slovenije (ARRS), št. projekta P3-0307.

Navzkrižje interesov: Avtorja izjavljata, da ni navzkrižja interesov.

Uporaba orodij umetne inteligence: Orodja generativne UI niso bila uporabljena.

Razpoložljivost podatkov: Podatki so na voljo pri kontaktnem avtorju na razumno zahtevo.

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Preprečevanje faringokutane fistule po laringektomiji s pektoralis major režnjem

Prevention of pharyngocutaneous fistula after laryngectomy with a pectoralis major flap

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STRUKTURIRANI IZVLEČEK

Uvod: Pojav faringokutane fistule (FCF) po laringektomiji je relativno pogost zaplet, še bolj pogost pa je pri pacientih, ki so bili predhodno zdravljeni z obsevanjem (RT), ali pa s kombinacijo obsevanja in kemoterapije (RT/KT) – takrat govorimo o rešilni laringektomiji (RLE). Uporaba režnja velike prsne mišice (PMR) naj bi po do sedaj objavljeni literaturi doprinesla k zmanjšanju pojavnosti FCF. Namen te študije je opredeliti vpliv uporabe režnja na pojavnost FCF.

Metode: Retrospektivno smo analizirali dokumentacijo 158 bolnikov po RLE v obdobju od 2004 do 2024 in določili incidenco pojava FCF. Opredelili smo tudi različne indikacije za uporabo PMR in ocenili njegovo preventivno vrednost.

Rezultati: Incidenca FCF po RLE je znašala 39,5 %, po uporabi PMR za namen rekonstrukcije 46,9 % in za namen preventive FCF 12,5 %. V raziskavi smo na vzorcu opazili zmanjšanje pojavnosti FCF po preventivni uporabi PMR, vendar to zmanjšanje ni bilo statistično značilno. To je lahko posledica relativno majhnega števila bolnikov, kjer je bil režnj uporabljen zgolj v preventivni namen.

Zaključek: Rezultati raziskave za razliko od do sedaj objavljene literature niso podprli dobrobiti uporabe PMR po RLE, ugotovili smo tudi dokaj visoko stopnjo FCF glede na ostalo objavljeno literaturo. Ne glede na izsledke objavljene raziskave smo mnenja, da je uporaba svežega, dobro vaskulariziranega tkiva smotrna pri RLE.

Ključne besede: laringektomija; reženj velike prsne mišice; faringokutana fistula; obsevanje; radiokemoterapija; rešilna laringektomija

ABSTRACT (ENGLISH SUMMARY)

Pharyngocutaneous fistula (FCF) is a relatively common complication of total laryngectomy (LE), even more so in salvage laryngectomy (RLE) after previous radiotherapy or chemoradiotherapy. We conducted a retrospective analysis of 158 patients after RLE and determined the incidence of FCF development. We further divided the patients into different groups depending on the use case of the pectoralis major flap (PMR). The incidence of FCF was 39,5%, 46,9% after PMR was used as a reconstructive flap and 12,5%

when used as a preventive measure. The study therefore did not confirm a significant effect of PMR usage on the incidence of FCF, but that might have been caused by the relatively low number of patients where PMR was used purely as a preventative measure.

Keywords: laryngectomy; pectoralis major flap; pharyngocutaneous fistula; salvage laryngectomy; radiotherapy, chemoradiotherapy

Uvod

Od začetka devetdesetih let prejšnjega stoletja se je po objavljenih študijah Veteran Affairs [1] in RTOG 91-11 [2] zdravljenje lokoregionalno napredovalega raka grla in spodnjega žrela prevesilo v t.i. organ ohranitveno konkomitantno radiokemoterapijo (RT/KT). Ta je delež LE v ZDA zmanjšala za 48% [3,4]. Tako zdravljenje ima svoje omejitve in omogoča ohranitev grla v 70-78% [2,5]. Preostalih 22-30% bolnikov tako potrebuje t.i. "rešilno" laringektomijo (RLE) iz različnih razlogov: ostanek ali ponovitev raka, drugi primarni rak, nefunkcionalno grlo in radionekroza [5,6].

Patološko povezavo med na novo ustvarjenim faringoezofagealnim kanalom in kožo na vratu imenujemo faringokutana fistula. Le ta je pogosta že brez predhodnega zdravljenja, t.j. po primarni LE, kjer je incidenca 9-25%, še bolj pogosta pa je po RLE, 14-57% [7]. Incidenca se spreminja tudi z leti in med različnimi centri [8]. Po analizi bolnikov operiranih na Kliniki za ORL in CFK Ljubljana med leti 2007 in 2020 pa znaša incidenca po LE 20,8% in po RLE 32,7% [9].

Pojav faringokutane fistule podaljša celjenje in s tem hospitalizacijo, vodi pa lahko tudi v nadaljnje zaplete. Iz tega razloga je eden izmed bolj raziskovanih zapletov v kirurgiji glave in vratu. Svetovani so številni ukrepi, z namenom zmanjšanja incidence: dobra anesteziološka, internistična in prehranska priprava bolnika, ustrezna kirurška antibiotična profilaksa, skrb za primerne kirurške tehnike in krajši čas operativnega posega. V literaturi svetujejo tudi uporabo posebnih opornic za obvod slin (angl. Salivary bypass tube), posebnih tehnik šivanja, odloženo traheoezofagealno punkcijo za vstavitve govorne proteze [10,11]. V naši raziskavi pa smo posebno pozornost namenili uporabi oddaljenega, dobro vaskulariziranega tkiva v namen zmanjšanja incidence FCF. V ta namen se v kirurgiji glave in vratu najpogosteje uporablja reženj velike prsne mišice (PMR).

Za rekonstrukcijo je uporaben v različnih situacijah:

- Delna odstranitev oboda žrela – uporaba kožnega otoka PMR za vsitje v defekt, torej vsiti reženj (VR; angl. patch flap)
- Odstranitev celotnega oboda žrela – uporaba kožnega otoka PMR kot tubuliranega režnja (angl. tubular flap)

- Odstranitev infiltriranega kožnega pokrova – uporaba kožnega otoka za rekonstrukcijo defekta kože vratu

V omenjenih primerih gre za uporabo v namen rekonstrukcije nastale vrzeli. PMR pa lahko uporabimo tudi ob zadostni količini žrela, ki ga lahko zapremo primarno. Takrat ga lahko s kožnim otokom všijemo v žrelo (VR), ali pa uporabimo le mišično-fascialni reženj, ki ga položimo preko šivne linije žrela (prekrivajoči reženj – PR, angl. onlay flap). Namen je prenos dobro vaskulariziranega tkiva v območje predhodno nekirurško zdravljenega tkiva, kjer poveča oksigenacijo in s tem izboljša celjenje.

Namen raziskave je torej opredeliti incidenco FCF po RLE ter smiselnost uporabe PMR pri RLE zgolj kot preventivno metodo.

Metode

Opravili smo pregled elektronske in papirnat zdravstvene dokumentacije bolnikov operiranih s totalno laringektomijo zaradi raka grla in spodnjega žrela na Kliniki za otorinolaringologijo in cervikofacialno kirurgijo Ljubljana med 1.1.2004 in 31.12.2024. Iz operiranih bolnikov smo izbrali tiste, ki so bili predhodno zdravljeni bodisi z RT ali RT/KT. Le-te smo razdelili v skupino s FCF in brez nje. Določili smo incidenco ter jo primerjali glede na različen način uporabe PMR. Pri statistični primerjavi smo uporabili hi-kvadrat test. Za statistično značilne smo šteli razlike pri $p < 0,05$.

Rezultati

Demografski podatki

V obdobju od 2004 do 2024 smo napravili LE pri 594 bolnikih. Predhodno so 104 bolniki prejeli RT in 54 RTKT, torej je RLE predstavljala 26,6 % vseh LE.

Povprečna starost bolnikov z RLE je znašala 63,4 let (razpon 33-86 let), med njimi je bilo 148 (93,7 %) moških in 10 žensk (6,3 %). Osnovna bolezen je bila rak grla pri 117 (74,1 %), rak hipofarinksa pri 32 (20,3 %) in rak orofarinksa pri 9 (5,7 %) bolnikih. Histološko je šlo za ploščatocelični karcinom pri 149 bolnikih (94,3 %). Pri dveh bolnikih je šlo za sarkom, pri preostalih pa za kombinacijo klasičnega ploščatoceličnega karcinoma z vretenastoceličnim (5 bolnikov), verukoznim (1 bolnik) in bazaloidnim karcinomom (1 bolnik). TNM stadij je bil določen na osnovi osme TNM klasifikacije malignih tumorjev [12]. Primarni tumorji so bili razvrščeni: pT1 pri 16 (10,3 %), pT2 pri 44 (28,4 %), pT3 pri 59 (38,1 %) in pT4a pri 36 (23,2 %) bolnikov. Regionalna razširjenost je bila opredeljena: N0 pri 124 (78,5 %), N1 pri 7 (4,4 %), N2a pri 5 (3,2 %), N2b pri 7 (4,4 %), N2c pri 4 (2,5 %) in N3b pri 10 (6,3 %) bolnikih. Pri treh bolnikih podatke o T in pri enem o N stadiju ni bil dosegljiv. Vsega skupaj je bolnike v študiji operiralo 13 kirurgov, ki so operirali od enega (0,6 %) do 26 (16,5 %) bolnikov.

Med 158 bolniki, ki smo jih po neuspešni RT ali RTKT zdravili kirurško z RLE, smo žrelni kanal zaprli primarno pri 117 bolnikih (74,1 %). Pri ostalih 41 bolnikih (25,9 %) smo izvedli rekonstrukcijo, pri čemer smo v 40 primerih (97,6 %) naredili PMR, v enem pa otočni reženj supraklavikularne arterije. Slednjega smo iz nadaljnje analize izločili. Demografski podatki so podrobneje prikazani v tabeli 1.

	Vsi pacienti	PMR za rekonstrukcijo	PMR za preventivo FCF	Brez PMR
N	158	33	8	117
starost v letih (razpon)	63,4 let (33-86)	64 let (46-85)	62 let (56-70)	63 let (33-86)
moški spol (delež)	148 (93,7 %)	30 (90,9 %)	8 (100 %)	110 (94 %)
Lokaliz. PTU: larinks	117 (74,1 %)	10 (30,3 %)	5 (62,5 %)	102 (87,2 %)
Lokaliz. PTU: hipofarinks	32 (20,3 %)	18 (54,5 %)	2 (25 %)	12 (10,3 %)
Lokaliz. PTU: orofarinks	9 (5,7 %)	5 (15,2 %)	1 (12,5 %)	3 (2,6 %)
HI: Ploščatocelični rak	149 (94,3 %)	32 (97 %)	7 (87,5 %)	110 (94 %)
Stadij T1	16 (10,3 %)	2 (6,1 %)	1 (12,5 %)	13 (11,4 %)
Stadij T2	44 (28,4 %)	9 (27,3 %)	4 (50 %)	31 (27,2 %)
Stadij T3	59 (38,1 %)	8 (24,2 %)	3 (37,5 %)	48 (42,1 %)
Stadij T4a	36 (23,2 %)	14 (42,4 %)	0 (0)	22 (19,3 %)
Stadij N0	124 (78,5 %)	27 (81 %)	6 (75 %)	91 (77,8 %)
Stadij N1	7 (4,4 %)	0 (0)	0 (0)	7 (6 %)
Stadij N2a	5 (3,2 %)	2 (6,1 %)	0 (0)	3 (2,6 %)
Stadij N2b	7 (4,4 %)	2 (6,1 %)	0 (0)	5 (4,3 %)
Stadij N2c	4 (2,5 %)	0 (0)	1 (12,5 %)	3 (2,6 %)
Stadij N3b	10 (6,3 %)	2 (6,1 %)	1 (12,5 %)	7 (6 %)

Tabela 1: Prikaz demografskih podatkov in podatkih o bolezni. PTU = primarni tumor, HI = histološki izvid primarnega tumorja.

Faringokutana fistula in povezanost njene pojavnosti s pektoralis major režnjem

FCF se je pojavila mediano 12 dni po operaciji (interkvartilni razpon 7–18 dni) in trajala mediano 39 dni (interkvartilni razpon 14–106 dni).

Primerjavo pacientov, pri katerih smo uporabili rekonstrukcijski reženj PMR za katerikoli namen s tistimi, kjer ga nismo, prikazujemo v tabeli 2.

Rekonstrukcija	Vsi	FCF	Brez FCF	p
vsi pacienti	157 (100 %)	62 (39,5 %)	95 (60,5 %)	

Rekonstrukcija	Vsi	FCF	Brez FCF	p
PMR	40 (100 %)	16 (40 %)	24 (60 %)	0,939
Brez PMR	117 (100 %)	46 (39,3 %)	71 (60,7 %)	

Tabela 2: Primerjava skupine bolnikov z in brez FCF po RLE glede na rekonstrukcijo s PMR ali brez nje. PMR = pektoralis major reženj, FCF = faringokutana fistula

Statistično značilnega znižanja incidence FCF po uporabi PMR režnja iz katerega koli razloga (namen rekonstrukcije ali preventive) nismo dokazali ($p=0,939$).

V tabeli 3 prikazujemo posamezne indikacije za PMR reženj, ki zajemajo tako indikacije v okviru rekonstrukcije defektov po operaciji raka in indikacije v luči preprečevanja FCF pri bolnikih, kjer je bilo dovolj tkiva za primarno zaporo žrela po RLE.

Rekonstrukcija	Vsi	FCF	Brez FCF	p
vsi pacienti	157 (100 %)	62 (39,5 %)	95 (60,5 %)	
rekonstrukcija kožnega pokrova	6 (100 %)	3 (50 %)	3 (50 %)	
rekonstrukcija dela stene žrelnega kanala	21 (100 %)	8 (38,1 %)	13 (61,9 %)	
cirukumferentna rekonstrukcija žrelnega kanala	5 (100 %)	4 (80 %)	1 (20 %)	0,177
preventiva FCF z všitjem kože PMR v žrelni kanal	6 (100 %)	1 (16,7 %)	5 (83,3 %)	
preventiva FCF z všitjem mišice PMR preko žrelnega kanala	2 (100 %)	0 (0)	2 (100 %)	
Brez PMR	117 (100 %)	46 (39,3 %)	71 (60,7 %)	

Tabela 3: Primerjava skupine bolnikov z in brez FCF po RLE glede na indikacijo za PMR. PMR = pektoralis major reženj, FCF = faringokutana fistula.

Rezultati niso prikazali statistične razlike v incidenci FCF glede na različne indikacije uporabe PMR ($p=0,177$), čeprav je opazen trend k manj FCF pri bolnikih z aplikacijo PMR za preventivni namen.

Tabela 4 prikazuje pregled celotne kohorte upošteva indikacijo PMR za rekonstrukcijo defekta po RLE in preventivno uporabo PMR za zmanjšanje incidence FCF.

Rekonstrukcija	Vsi	FCF	Brez FCF	p
vsi pacienti	157 (100 %)	62 (39,5 %)	95 (60,5 %)	
PMR za rekonstrukcijo defekta	32 (100 %)	15 (46,9 %)	17 (53,1 %)	0,205

Rekonstrukcija	Vsi	FCF	Brez FCF	p
PMR za preventivo FCF	8 (100 %)	1 (12,5 %)	7 (87,5 %)	

Tabela 4: Primerjava skupine bolnikov z in brez FCF po RLE glede na aplikacijo PMR za namen rekonstrukcije in namen preventive FCF. PMR = pektoralis major režen, FCF = faringokutana fistula.

Tudi v tabeli 4 ni statistično značilnih razlik pri aplikaciji PMR za rekonstruktivni ali preventivni namen ($p=0,205$). Čeprav rezultati iz tabel 3 in 4 niso prikazali statistično pomembnih razlik v incidenci FCF glede na različne indikacije uporabe PMR, je opazen trend k manj FCF pri bolnikih z narejenim PMR za preventivni namen.

Razprava

Uporaba PMR v namen preprečevanja FCF je v literaturi dobro opisana tehnika. Righini je leta 2005 z uporabo PMR zmanjšal incidenco iz 50% na 23% [13]. Kasnejše študije so ravno tako opredelile pozitiven vpliv PMR. Patel je v skupini bolnikov s primarno zaporo žrela ugotovil 57% pojavnost FCF, medtem ko FCF po preventivni uporabi PMR sploh ni bilo. [10] Do podobne ugotovitve je prišel tudi Anschütz, ki ravno tako v skupini s preventivnim PMR ni zaznal nobene FCF [14]. Raziskava s podobnim številom vključenih bolnikov je bila študija Gendreau-Lefèvre, ki se okvirno ujema tudi glede deleža FCF; pri preventivni uporabi PMR 14% (v naši 12,5%), brez uporabe PMR 36% (39,3%). Se pa je v tej študiji za razliko od naše izkazalo, da gre za statistično pomembno razliko [15].

V literaturi pa je moč najti tudi študije, ki pozitivnega vpliva PMR ne kažejo. Gil in sodelavci niso ugotovili statistično pomembne razlike med preventivno uporabo PMR in primarno zaporo po RLE. [16]

Metaanalize v veliki meri potrjujejo dobrobit uporabe PMR v namen preprečevanja FCF. Analizo sedmih študij s skupno 591 bolniki je opravil Paleri, ki poroča o incidenci 31,2% pri primarni zapori, ter 22,2% pri rekonstrukciji z režnji. Tu so bili vključeni tako prosti mikrovaskularni režnji kot tudi PMR, in to v vlogah tako všitih kot tudi prekrivnih režnjev [6].

Guimarães je opravil analizo le v primeru, ko je bil uporabljen preventivni PMR preko primarno zaprtega žrela in ugotovil statistično značilno zmanjšanje incidence iz 37,0% na 19,4% ($p<0,001$) [18].

Do podobnih rezultatov sta prišla tudi de Virgilio in Williamson, ki sta ravno tako za vse različne načine uporabe različnih režnjev (VR, PR, vezani in mikrovaskularni režnji) ugotovila manjšo incidenco FCF [4,17]. Piazza je v objavljenem preglednem prispevku ravno tako poudaril pomembnost uporabe režnjev kot uveljavljen pristop k zmanjšanju incidence FCF [11].

Ker se zaključek našega prispevka razlikuje od sicer že večkrat potrjenega pozitivnega učinka PMR na pojavnost FCF, smo poizkušali razjasniti, kje bi lahko prišlo do razlik.

Glede na to, da smo pri le 8 bolnikih od 157 reženj uporabili preventivno, je tu lahko eden od razlogov, saj sicer trend kaže k manjši pojavnosti FCF (12,5%), a zaradi majhnega vzorca razlika statistično ni značilna. Na tem mestu je tudi smiselno navesti omejitve retrospektivnega pregleda dokumentacije. Ravno tu se je namreč pogosto pojavil problem interpretacije ali je bil reženj vшит v vrzel z namenom preprečitve FCF, ali zaradi manjka tkiva. Ravno po metaanalizi de Virgilia je v primeru vшитja PMR v defekt (VR) pričakovati višjo stopnjo FCF kot pri preventivni, prekrivni uporabi (25% napram 17%). Lahko da je bil namreč PMR zaradi retrakcije sluznice po predhodnem nekirurškem zdravljenju uporabljen kot VR, vendar z izključno preventivnim namenom.

Zaključek

Navkljub temu, da nismo ugotovili statistično pomembne razlike v pojavnosti FCF po uporabi PMR v preventivni namen, smo mnenja, da vseeno obstaja trend k manjši pojavnosti in je zato uporaba tako PMR, kot tudi drugih vrst reženjev smiselna. Glede na nizko število bolnikov, kjer se je reženj uporabil izključno kot preventivni, prekrivni reženj, bi bilo morda smiselno na tak način, seveda ob ustrezni indikaciji, rekonstruirati več defektov. Poleg tega pa tudi uporaba reženjev ne prepreči pojava vseh FCF, tako da še vedno menimo, da je pomembno spremljati in obvladovati tudi druge dejavnike tveganja, ter jih sproti prepoznavati, saj se lahko skozi leta tudi spreminjajo.

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KIRURGIJA GLAVE IN VRATU · HEAD AND NECK SURGERY

The Impact of Pharyngocutaneous Fistula after Laryngectomy as a Risk Factor on Patient Survival – Preliminary Results

Vpliv faringokutane fistule po laringektomiji kot dejavnika tveganja na preživetje bolnikov – preliminarni rezultati

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STRUKTURIRANI IZVLEČEK

Uvod: Faringokutana fistula (FKF) je eden najpogostejših zapletov po totalni laringektomiji (TLE). Povezava med tem zapletom in onkološkimi izidi ni povsem jasna. Raziskali smo povezavo med FKF in tveganjem za ponovitev tumorja po TLE.

Metode: Izvedli smo retrospektivno kohortno študijo bolnikov z rakom grla, hipofarinksa in orofarinksa, ki so bili med julijem 2010 in decembrom 2024 na Kliniki za otorinolaringologijo in cervikofacialno kirurgijo v Ljubljani operirani s TLE. Bolnike smo razdelili glede na pojav FKF po TLE v dve skupini. Opravili smo predhodno analizo na vzorcu 250 naključno izbranih bolnikov iz celotne kohorte. Ocenjevali in analizirali smo lokalne, regionalne, peristomalne, lokoregionalne in oddaljene ponovitve bolezni z uporabo Kaplan-Meierjeve metode, morebitne prognostične dejavnike pa smo ovrednotili z multivariatno Coxovo regresijsko analizo.

Rezultati: FKF se je razvila pri 26,4 % bolnikov (66/250). Triletno preživetje brez lokalne ponovitve (LRFS) je pri bolnikih s FKF znašalo 77,8 %, pri tistih brez FKF pa 92,2 %; ustrezna deleža za petletno LRFS sta bila 75,0 % oziroma 90,4 % (log-rank test: $p = 0,001$). Statistično značilnih razlik nismo zabeležili pri preživetju brez regionalne ($p = 0,314$), peristomalne ($p = 0,754$), lokoregionalne ($p = 0,112$) ali oddaljene ponovitve bolezni ($p = 0,847$). V multivariatni Coxovi regresijski analizi se je FKF izkazala za neodvisno povezano s povečanim tveganjem za lokalno ponovitev (HR 2,70; $p = 0,016$), prav tako pa tudi rešilna (salvage) TLE in kompleksna rekonstrukcija.

Zaključek: V preliminarni analizi je bila prisotnost FKF po TLE neodvisno povezana s slabšim lokalnim nadzorom bolezni in 2,7-krat večjim tveganjem za lokalno ponovitev bolezni. Ti rezultati kažejo, da FKF morda ni zgolj kratkotrajni kirurški zaplet, temveč ima lahko tudi prognostični pomen pri bolnikih, zdravljenih s TLE. Mehanizmi, ki so podlaga za to povezavo, ostajajo nejasni in jih bo treba dodatno raziskati v prihodnjih raziskavah.

Ključne besede: faringokutana fistula, totalna laringektomija, prognoza, preživetje brez lokalne ponovitve bolezni

ABSTRACT (ENGLISH SUMMARY)

Pharyngocutaneous fistula (PCF) is a frequent complication following total laryngectomy (TLE), but its association with oncological outcomes remains unclear. We investigated the association between PCF and tumour recurrence in patients undergoing TLE. A retrospective cohort study included patients with laryngeal, hypopharyngeal and oropharyngeal cancer treated at the Department of Otorhinolaryngology and Cervicofacial Surgery, University Medical Centre Ljubljana, between July 2010 and December 2024. Preliminary analysis included 250 randomly selected patients, of whom 66 (26.4%) developed PCF. Three- and five-year local recurrence-free survival was significantly lower in patients with PCF than in those without PCF (77.8% vs. 92.2% and 75.0% vs. 90.4%, respectively; log-rank $p=0.001$). No significant differences were observed in regional, peristomal, locoregional or distant recurrence-free survival. In multivariable Cox regression analysis, PCF was independently associated with local recurrence (HR 2.70, $p=0.016$). PCF may represent more than a short-term surgical complication and may have prognostic implications for local tumour control.

Keywords: pharyngocutaneous fistula, total laryngectomy; prognosis, local recurrence-free survival

Uvod

Kljub temu, da so incidenca in dejavniki tveganja za razvoj faringokutane fistule (FKF) po totalni laringektomiji (TLE) v literaturi dobro raziskani, so podatki o tem zelo različni. Incidenca FKF se giblje med 0 in 80%. Višja je po rešilni TLE (14–57%) v primerjavi s primarno TLE (8–25%). Glede na rezultate nedavnih meta-analiz, so glavni dejavniki tveganja starost nad 60 let, kajenje, kronična obstruktivna pljučna bolezen, koronarna srčna bolezen, sladkorna bolezen, predhodno obsevanje (ali radioterapija, RT), predhodna traheotomija, nizke vrednosti albumina in hemoglobina pred in po operaciji, stadij T3–4, supraglotična lokacija tumorja, dodatna faringektomija, rešilna TLE [1]. Rezultati predhodnih raziskav Klinike za ORL in CFK Ljubljana so pokazali incidenco FKF 23,9% in okužbo kirurške rane, invazijo piriformnega žepa, rešilno TLE in dozo prejete RT kot neodvisne dejavnike tveganja za razvoj FKF [2]. Incidenca in dejavniki tveganja se lahko znotraj istega oddelka v različnih obdobjih spreminjajo.

Posledice FKF so podaljšanje celjenja kirurške rane, zakasnitev rehabilitacije požiranja in govora ter uvedbe adjuvantnega zdravljenja, daljša hospitalizacija, dodatna operacija (pogosto z uporabo kompleksne rekonstrukcije), aspiracijska pljučnica, faringoezofagealna stenoza, povišani stroški zdravljenja in razpoka karotidne arterije. Slednja lahko povzroči izkrvavitev.

Posledica FKF, opisana v nedavni literaturi, je slabša prognoza. Eden od vzrokov je odpoved adjuvantnega zdravljenja. V kanadski multicentrični študiji [3] so dokazali, da imajo bolniki s FKF po rešilni TLE več distalnih recidivov bolezni, torej več oddaljenih zasevkov. Na drugi strani so v ameriški študiji [4] ugotovili, da je bil delež fistul, ki so zahtevale ponovno operacijo, 33 % (20/61) pri bolnikih, ki so umrli v prvem letu, v primerjavi z 20 % (68/342) pri bolnikih, ki v prvem letu niso umrli. Pojav fistule, ki je zahtevala ponovno operacijo, je bil 2,2-krat pogostejše povezan s smrtjo v prvem letu (95 % IZ 1,2–4,4; $P = 0,01$).

Namen študije je ugotoviti vpliv FKF na razvoj lokalnega, regionalnega, peristomalnega in distalnega recidiva raka glave in vratu pri bolnikih s FKF po TLE.

Metode

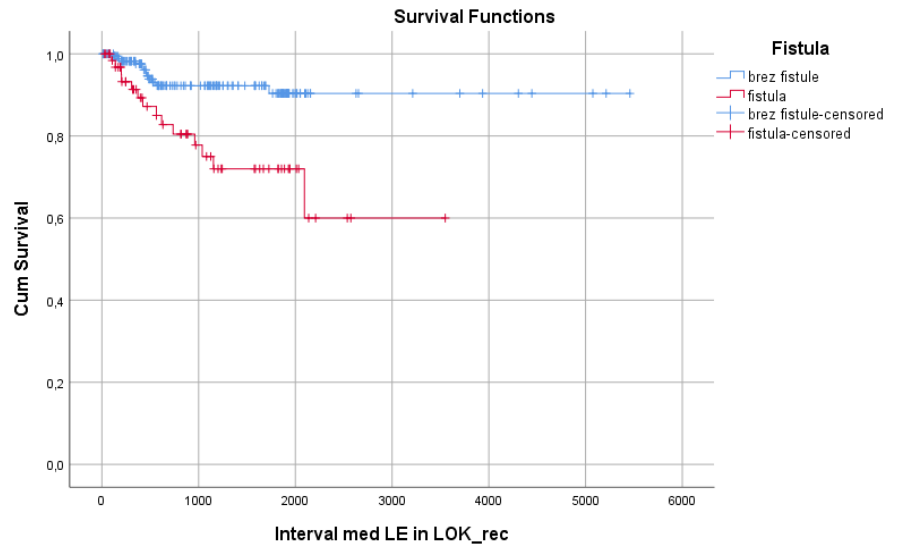
V retrospektivni raziskavi smo zbrali podatke bolnikov z rakom grla in žrela, ki so bili na Kliniki za ORL in CFK v Ljubljani med julijem 2010 in decembrom 2024 operirani s TLE. Zbrali smo celovite klinično-patološke podatke za bolnike, vključno z dejavniki tveganja za nastanek FKF. Razvrstili smo jih v skupino, pri kateri je prišlo do nastanka FKF (študijska skupina), in skupino brez FKF (kontrolna skupina). Izvajanje študije in zbiranje podatkov še traja. Predvidevamo, da bomo v študijo zajeli okrog 420 bolnikov. Predstavljamo podatke naključno izbranih bolnikov, na podlagi katerih smo izpejlali preliminarno analizo glede lokalnih, regionalnih, peristomalnih, lokalno-regionalnih in oddaljenih ponovitev bolezni. Izvedli smo univariatno Kaplan-Meierjevo analizo preživetja in multivariatno Coxovo regresijsko analizo.

Rezultati

V preliminarno analizo smo vključili 250 bolnikov, od tega 222 moških in 28 žensk. Primarni tumorji so se nahajali v grlu pri 157 (62,8%), ustnem žrelu pri 6 (2,4%) in spodnjem žrelu pri 86 bolnikih (34,4%). Povprečna starost bolnikov je znašala 65,6 let (razpon 43–87 let). Stadiji bolezni so bili porazdeljeni sledeče: pT1 pri 6 (2,4%), pT2 pri 38 (15,2%), pT3 pri 105 (42%) in pT4 pri 99 bolnikih (39,6%), N0 pri 131 (52,4%), N1 pri 17 (6,8%), N2a pri 8 (3,2%), N2b pri 23 (9,2%), N2c pri 9 (3,6%), N3 pri enem (0,4%) in N3b pri 59 bolnikih (23,4%). Pri dveh bolnikih T in pri enem bolniku N stadij ni bil znan. Najpogostejša histološka entiteta je bil ploščatocelični rak pri 228 bolnikih (91,2%), pri ostalih 22 bolnikih (8,8%) je šlo za hondrosarkom, verukozni, papilarni, vretenastocelični, mukoeptidermoidni, adenoidnocistični, bazaloidni in papilarni ploščatocelični karcinom, ter maligni melanom. Vrzeli po TLE smo zaprli primarno pri 197 bolnikih (78,8%) in z rekonstrukcijskim režnjem pri 53 bolnikih (21,2%). Vratna disekcija je bila opravljena pri 199 bolnikih (79,6%). Parcialna faringeotomija je bila opravljena pri 103 (41,2%), pri ostalih 147 bolnikih (58,8%) je bila izvedena samo TLE. Predhodno se je 42 bolnikov (16,8%) zdravilo z RT in 26 (10,4%) z radiokemoterapijo.

Incidenca FKF po TLE pri naključno zbranih bolnikih operiranih med julijem 2010 in decembrom 2024 znaša 26,4 % (66/250; 95-% IZ: 21,2–32,2 %).

Stopnji preživetja brez lokalne ponovitve bolezni (angl. local recurrence-free survival, LRFS) po 3 in 5 letih sta pri bolnikih brez FKF znašali 92,2 % in 90,4 %, pri bolnikih s FKF pa 77,8 % oziroma 75,0 % (slika 1). Razliki sta bili statistično značilni (log-rank $p = 0,001$).



Slika 1. Preživetja brez lokalne ponovitve bolezni (modra = brez faringokutane fistule, rdeča = farin-gokutana fistula).

Preživetje brez regionalnega ($p=0,314$), peristomalnega ($p=0,754$), lokalno-regional-nega ($p= 0,112$) in distalnega recidiva ($p=0,847$) se med skupinama s FKF in brez nje niso statistično značilno razlikovali.

V multivariatni analizi smo preverili vpliv različnih potencialnih dejavnikov tveganja na LRFS in sicer starost bolnika ob TLE, rešilno TLE, število regionalnih metastaz, ekstra-kapsularni preboj v metastazi na vratu, T stadij, kompleksno rekonstrukcijo in pojav FKF.

V Coxovi regresijski analizi je bila prisotnost FKF statistično značilno povezana z 2,7-krat večjim tveganjem za lokalno ponovitev bolezni ($HR = 2,702$; $p = 0,016$). Poleg FKF sta bila z znatno povečanim tveganjem za lokalno ponovitev bolezni povezana še rešilna TLE in kompleksna rekonstrukcija. Rezultat prikazujemo v tabeli 1.

p vrednost	HR (Hazard ratio)
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Starost ob TLE	0,697	1,011
rešilna TLE (po RT/RTKT/OP)	0,001	5,572
število metastaz	0,306	1,099
ekstakapsularni preboj	0,784	0,810
T stadij	0,518	0,846
velika rekonstrukcija	0,001	4,351
Fistula	0,016	2,702

Tabela 1. Multivariatna Coxova regresijska analiza (TLE = totalan laringektomija, RT = radioterapija, RTKT = radiokemoterapija, OP = operacija)

Razprava

V naši raziskavi je bila incidenca FKF po TLE 26,4 %. Bolniki s FKF so imeli slabši LRFS kot bolniki brez FKF; 3-letni LRFS je znašal 77,8 % v primerjavi z 92,2 %, 5-letni pa 75,0 % v primerjavi z 90,4 %. Razlika je bila statistično značilna tudi v multivariatni Coxovi regresiji, v kateri je bila prisotnost FKF neodvisno povezana s slabšim LRFS. Prisotnost FKF je bila povezana z 2,7-krat večjim hazardom lokalne ponovitve bolezni (HR = 2,702; $p = 0,016$).

FKF poskušamo najprej pozdraviti s konservativnimi ukrepi, ki jim po potrebi sledijo kirurški. Praviloma to pomeni obsežno operacijo z uporabo rekonstrukcijskega režnja. Adjuvantno zdravljenje smo zaradi vztrajanja FKF, načrtovanja in izvedbe operacije ter postoperacijske rehabilitacije večkrat primorani prestaviti, včasih pa celo odpovedati. Vzrok za odpoved adjuvantnega zdravljenja je interval med TLE in RT (ali RTKT) daljši od 6 tednov, ki lahko poslabša prognozo [5]. Zato vztrajanje pri intervalu manj kot 6 tednov zagovarjajo tudi NCCN smernice [6]. Vendar pa v naši študiji tega problema nismo raziskovali.

Preko FKF bakterije iz žrela skupaj s slino iztekajo na vrat in povzročijo ali poslabšajo lokalno vnetje na svoji poti, vključno tik ob žrelu. Povezava med vnetjem in progresom maligne bolezni je že znana, saj vnetje preko citokinov in rastnih faktorjev spodbuja rast in migracijo malignih celic [7]. S tem lahko razložimo porast lokalnih recidivov pri bolnikih s FKF. Sklepamo, da je zaradi FKF prišlo do intenzifikacije lokalnega vnetja ob žrelu, ki je povzročilo dvig omenjenih rastnih faktorjev, ti pa so spodbudili rast (tudi) malignih celic, ki so kasneje vodile v lokalni recidiv. S podobno hipotezo o lokalnem vnetju so pojasnili tudi pospešeno rast malignih celic pri raku dojke [8] in pri raku požiralnika, kjer so recidive raka pojasnili z vlogo vnetnih mediatorjev, kot so C-reaktivni protein, in razmerjem med nevtrofilci in limfociti [9].

Tudi bakterije same morda igrajo vlogo pri lokalnem recidivu. Ugotovljeno je bilo, da bakterijski endotoksini prek različnih mehanizmov spodbujajo sproščanje provnetnih citokinov, ki lahko vplivajo na nastanek oddaljenih zasevkov [10]. Tako se postavlja zanimivo vprašanje, zakaj v nasprotju z ugotovitvami Daviesa [3] pri naših bolnikih s FKF nismo ugotovili večjega števila oddaljenih zasevkov. Ena od razlag bi lahko bila, da vnetni mediatorji iz vnetnega žarišča ob FKF učinkujejo najbolj intenzivno v njegovi neposredni bližini. Posledično bi lahko spodbujali rast in proliferacijo tumorskih celic v okolici žrelnega kanala, njihov učinek pa bi se z oddaljevanjem od vnetnega žarišča zmanjševal. Takšen mehanizem bi lahko pojasnil slabši LRFS pri bolnikih s FKF ob hkratni odsotnosti razlik v pojavnosti regionalnih in oddaljenih ponovitev bolezni v naši raziskavi.

Ameriška študija ugotavlja podobno. In sicer, pojav fistule, ki je zahtevala ponovno operacijo, je bil 2,2-krat pogostejše povezan s smrtjo v prvem letu. Vendar pa avtorji raziskave vzorčne povezanosti med fistulo, ki zahteva kirurško zdravljenje, in višjo verjetnostjo za smrt v prvem letu po TLE niso razložili. Zaključili so, da mora operater narediti vse, kar je možno (npr. uporabiti rekonstruktivni reženj), da bi preprečil pojav FKF, ki po njihovem mnenju poslabšuje prognozo v smislu več smrti v prvem letu po TLE. S trditvijo, da je treba aktivno delati v smeri preprečevanja FKF, se seveda strinjamo [4].

Menimo, da je treba incidenco in dejavnike tveganja za FKF sproti spremljati, saj s tem ne povzročamo le krajše hospitalizacije, hitrejšre rehabilitacije, višje kvalitete življenja in znižanja stroškov [11], ampak, še pomembneje, preko znižanja incidence FKF znižamo lokalne recidive in s tem pozitivno vplivamo na prognozo.

Zaključek

Dosedanji preliminarni rezultati retrospektivne kohortne raziskave Klinike za ORL in CFK Ljubljana na 250 bolnikih po TLE potrjujejo, da pojav FKF pomembno in neugodno vpliva na onkološke izide ter preživetje. Bolniki, ki so razvili FKF, imajo pomembno krajši čas do pojava lokalnega recidiva ter opazno nižjo stopnjo LRFS v primerjavi z bolniki brez fistule. V tem oziru je prisotnost FKF neodvisni dejavnik tveganja za razvoj lokalnega recidiva ($HR = 2,7$; $p=0,016$). Bolniki s FKF imajo 2,7-krat višje tveganje za pojav lokalnega recidiva. Nastanka FKF zato ne moremo obravnavati samo kot kratkotrajen kirurški zaplet, temveč kot neposreden neodvisni prognostični kazalec za slabšo lokalno kontrolo bolezni. To bi bilo treba seveda dokazati v dokončni študiji, ki je še v teku, kakor tudi v študijah drugih centrov. Enako pomembno je razjasniti patofiziološke mehanizme, ki vzročno povezujejo pojav FKF z lokalno ponovitvijo raka. Kakor koli že, rezultati študije dajejo dodatni vzrok, da je treba še aktivno, natančno in dosledno skrbeti za preprečevanje tega resnega zapleta.

Etika, soglasja in financiranje

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Naraščajoča vloga imunoterapije pri zdravljenju raka glave in vratu

The growing role of immunotherapy in the treatment of head and neck cancer

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STRUKTURIRANI IZVLEČEK

Navodilo: Obseg naj bo med 250 in 300 besed. Ohranite spodnje podnaslove.

- Rak glave in vratu (RGV) predstavlja heterogeno skupino malignih bolezni, med katerimi prevladuje ploščatocelični rak. Zdravljenje lokalno-regionalno napredovelega RGV je multimodalno in vključuje kirurgijo, radioterapijo ter sistemsko zdravljenje. Zdravljenje ponovljenega ali metastatskega RGV (p/m RGV) je sistemsko in je dolgo temeljilo na kemoterapiji in tarčnem zdravljenju, v zadnjem desetletju pa je imunoterapija (IMT) pomembno spremenila zdravljenje p/m RGV. Namen prispevka je predstaviti razvoj in mejnike IMT ter njihov pomen za otorinolaringologa in kirurga glave in vratu. Študija EXTREME je uveljavila kombinacijo platine, 5-fluorouracila in cetuksimaba kot standard prvega reda zdravljenja p/m RGV. Študiji KEYNOTE-012 in CheckMate 141 sta ponudili prve pomembne dokaze o učinkovitosti pembrolizumaba (PEMBRO) in nivolumaba, KEYNOTE-040 pa je potrdila učinkovitost PEMBRO po odpovedi platinske terapije. KEYNOTE-048 je nato razširila vlogo PEMBRO v prvi red zdravljenja p/m RGV, bodisi kot monoterapijo pri bolnikih z visokim izražanjem PD-L1 bodisi v kombinaciji s kemoterapijo pri nizkem. Najnovejši raziskavi KEYNOTE-689 in NIVOPOST-OP nakazujejo nadaljnji premik IMT iz zdravljenja p/m RGV v perioperativno oziroma pooperativno zdravljenje lokalno napredovelega RGV. IMT tako postaja pomemben sestavni del specifičnega onkološkega zdravljenja RGV. Njen vse večji pomen prinaša nove izzive za kirurga glave in vratu, ki se vse bolj vključuje v celostno načrtovanje zdravljenja, izbiro bolnikov in obravnavo bolnikov, zdravljenih z IMT.
- **Ključne besede:** ponovljeni in metastatski rak glave in vratu; imunoterapija; pembrolizumab; nivolumab

ABSTRACT (ENGLISH SUMMARY)

- Head and neck cancer (HNC) represents a heterogeneous group of malignant diseases, among which squamous cell carcinoma predominates. Treatment of locally

advanced HNC is multimodal and includes surgery, radiotherapy, and systemic therapy. Treatment of recurrent or metastatic HNC (r/m HNC) is systemic and has long been based on chemotherapy and targeted therapy; however, over the past decade, immunotherapy (IMT) has substantially changed the treatment of r/m HNC. The aim of this paper is to present the development and key milestones of IMT and their relevance to otorhinolaryngologists and head and neck surgeons. The EXTREME study established the combination of platinum, 5-fluorouracil, and cetuximab as the standard first-line treatment for r/m HNC. The KEYNOTE-012 and CheckMate 141 studies provided the first important evidence of the efficacy of pembrolizumab (PEMBRO) and nivolumab, respectively, while KEYNOTE-040 confirmed the efficacy of PEMBRO following failure of platinum-based therapy. KEYNOTE-048 subsequently expanded the role of PEMBRO into first-line treatment of r/m HNC, either as monotherapy in patients with high PD-L1 expression or in combination with chemotherapy in patients with low PD-L1 expression. The most recent KEYNOTE-689 and NIVOPOST-OP studies suggest a further shift of IMT from the treatment of r/m HNC towards perioperative and postoperative treatment of locally advanced HNC, respectively. IMT is thus becoming an increasingly important component of the oncological treatment of HNC. Its growing role poses new challenges for head and neck surgeons, who are increasingly involved in multidisciplinary treatment planning, patient selection, and the management of patients receiving IMT.

- **Keywords:** recurrent and metastatic head and neck cancer; immunotherapy; pembrolizumab; nivolumab

Uvod

Diagnostična in terapevtska obravnava bolnikov z rakom glave in vratu (RGV) je kompleksna in zahteva usklajeno delovanje strokovnjakov različnih strok [1]. Prispevek se nanaša na ploščatocelični rak ustne votline, ustnega žrela, spodnjega žrela in grla, kar za namen prispevka označujemo s skupnim terminom RGV (ki sicer zajema tudi rake nekaterih drugih področij). RGV zdravimo na različne načine, med katerimi biološko zdravljenje predstavlja najmlajšo obliko zdravljenja. Vključuje zdravljenje s tarčnimi zdravili in imunoterapijo (IMT).

Principi sistemskega zdravljenja raka glave in vratu

Sistemsko zdravljenje pomeni zdravljenje z zdravili, ki po vnosu v telo delujejo na rakave celice povsod po telesu. Med sistemsko zdravljenje raka štejemo kemoterapijo (KT), tarčno terapijo, IMT in hormonsko terapijo. V primerjavi s prvimi tremi se pri RGV slednjo možnost uporablja zelo redko.

KT pomeni zdravljenje s citostatiki in temelji na poškodbi in uničevanju hitro delečih se celic. V tem oziru deluje najbolj na maligne celice, vendar pa je treba vedeti, da pravzaprav deluje na vse celice, vključno z zdravimi. Od tod temeljijo resni in pogosti

stranski učinki KT. Delovanje KT je hitro in traja, dokler apliciramo citostatik. Najpogostejše uporabljeni in najbolj znan citostatik za zdravljenje RGV je cisplatin.

Tarčna zdravila delujejo na signalne poti v tumorski celici. Na ta način zavirajo rast in razvoj tumorja. Primer tarčnega zdravila pri RGV je monoklonsko protitelo cetuksimab (CTX), ki kompetitivno inhibira receptor epidermalnega rastnega faktorja (angl. epidermal growth factor receptor, EGFR) [2].

IMT deluje na kontrolne točke imunskega sistema tako, da odstrani zaviralni signal za limfocite. Tako imunskemu sistemu omogoči, da tumorske celice ponovno prepozna in ga spodbudi k (ponovnemu) uničevanju tumorskih celic. Za razliko od KT deluje počasi in dlje časa – tudi po prenehanju aplikacije zdravila. Stranski učinki so imunsko pogojeni – podobni avtoimunim vnetjem. Kot primera navajamo pembrolizumab (PEMBRO) in nivolumab (NIVO) [2].

Celica je v procesu maligne transformacije podvržena številnim genetskim in epigenetskim spremembam, zato na svoji površini izraža vedno več tumorskih antigenov. Upravičeno bi pričakovali, da bi imunski sistem te antigene prepoznal, ustrezno reagiral in prizadete celice izločil. Vendar temu ni vedno tako. Tumorske celice namreč izražajo ligande PD-L1 (angl. programmed death ligand 1), s katerimi se vežejo na receptor PD-1 (angl. programmed death 1) na limfocitih. Vezava PD-L1 na PD-1 pomeni zaviralni signal za limfocit, ki se posledično ne odzove na prepoznani tumorski antigen. Na ta način se tumorske celice izognejo imunskemu nadzoru in preživijo. Pri tem izkoriščajo vezavo PD-L1 in PD-1, ki je sicer fiziološko pomembna za zaviranje premočnega imunskega odgovora, npr. za zaviranje avtoimunih vnetij.

To nas pripelje do temelja delovanja IMT pri RGV. Monoklonski protitelesi PEMBRO in NIVO blokirata povezavo PD-L1 in PD-1, preprečita zaviranje limfocitov in omogočata njihovo nadaljnjo proliferacijo in aktivacijo [2].

Ploščatocelični rak glave in vratu

Približno 60 % bolnikov z RGV je diagnosticiranih v loko-regionalno napredovalih stadijih [3] in jih lahko zdravimo multimodalno na več načinov. Kirurška možnost zajema operacijo, ki ji sledi adjuvantno obsevanje (ali radioterapija, RT) ali radiokemoterapija (RTKT). Druga možnost je nekirurška, ki jo predstavljata konkomitantna RTKT in indukcijska KT, ki ji v primeru dobrega odgovora na neoadjuvantno KT sledi RTKT [4].

Med bolniki z lokalno-regionalno napredovalim RGV jih 66 % ne bo preživel petih let [5]. V primeru neuspeha zdravljenja ali ponovitve RGV ti bolniki nimajo dobrih možnosti za preživetje. Edini kurativni opciji sta rešilna kirurgija in reRT.

Med bolniki z RGV imajo bolniki s ponovljenim in metastatskim RGV (p/m RGV) najslabšo prognozo. Če za ponovljene RGV ni možno niti kirurško zdravljenje niti zdravljenje z RT, so na razpolago paliativni ukrepi, kar velja za primarno metastatske RGV. Go-

vorimo o KT, tarčnih zdravilih, različnih kombinacijah teh zdravil in podpornih ukrepih. V zadnjih letih je na to področje prodrla tudi IMT z zdraviloma PEMBRO in NIVO. Začelo se je z indikacijami za p/m RGV, v zadnjem letu pa je IMT možno izbrati tudi kot primarno specifično onkološko zdravljenje.

Razvoj imunoterapije pri zdravljenju raka glave in vratu

Predstavljamo klinične raziskave, ki so pomembni mejniki razvoja IMT pri RGV. Menimo, da je poznavanje teh raziskav koristno za otorinolaringologe in kirurge glave in vratu pri razumevanju indikacij IMT. Večina jih temelji na bolnikih s p/m RGV.

EXTREME

Vermorken s sod. je v randomizirani študiji na 424 pacientih s p/m RGV ugotovil boljše mediano skupno preživetje bolnikov pri kombinaciji platine, 5-fluorouracila (5-FU) in CTX v primerjavi s platino in 5-FU. Srednje mediano preživetje se je podaljšalo iz 7,5 na 10,1 mesec [6]. Takrat je protokol EXTREME (kombinacija platine, 5-FU in CTX) postal novi standardni prvi red zdravljenja p/m RGV. Kljub temu je ostala težnja k iskanju bolj učinkovite in hkrati manj toksične kombinacije zdravil za zdravljenje p/m RGV.

KEYNOTE-012

Seiwert s sod. je izvedel multicentrično multikohortno študijo faze 1b, pri kateri so 60 bolnikov s PD-L1 pozitivnimi p/m RGV zdravili s PEMBRO. Določali so objektivni odgovor tumorja po metodologiji RECIST in varnost zdravljenja. Objektivni odgovor tumorja je znašal 18 % (6/45) do 21 % (12/56). Razlika je temeljila na različni interpretaciji odgovora v odvisnosti od centralnega ali individualnega radiološkega pregleda. Pri 17 % (10/60) bolnikov so se pojavili z zdravilom povezani neželeni učinki stopnje 3–4, zato raziskovalci zaključujejo, da so bolniki PEMBRO dobro prenašali [7]. KEYNOTE-012 pomeni prvi pomemben dokaz učinkovitosti PEMBRO pri p/m RGV.

CheckMate 141

Ferris s sod. je izvedel randomizirano študijo na 361 pacientih s p/m RGV, pri katerih je prišlo do progressa ali ponovitve znotraj 6 mesecev od zdravljenja s platino. Primerjali so uspešnost NIVO proti monoKT in dokazali boljše 1-letno skupno preživetje (36 % proti 16 %). Razlika ni bila odvisna od PD-L1 statusa tumorja. CheckMate 141 dokazuje učinkovitost NIVO po odpovedi platine. Tako KEYNOTE-012 kot CheckMate 141 sta vodila v odobritev PEMBRO in NIVO za drugi red zdravljenja p/m RGV s strani FDA (Food and Drug Administration) [8].

KEYNOTE-040

Cohen s sod. je v randomizirani študiji 495 pacientov p/m RGV potrdil učinkovitost PEMBRO v drugem redu v primerjavi z monoKT, pri čemer je bila razlika v enoletnem preživetju 37,0 % proti 26,5 % [9].

KEYNOTE-048

Burtness s sod. je v randomizirani študiji 882 pacientov s p/m RGV ugotovila prednost PEMBRO in kombinacije PEMBRO in KT proti protokolu EXTREME. In sicer, PEMBRO je podaljšal skupno preživetje pri pacientih s PD-L1 CPS ≥ 20 in pri PD-L1 CPS ≥ 1 , kombinacija PEMBRO in KT pa pri PD-L1 CPS ≥ 20 , PD-L1 CPS ≥ 1 in pri celotni populaciji [10]. KEYNOTE-048 je bila ključna študija, ki je premaknila PEMBRO v prvi red zdravljenja p/m RGV – kot monoterapijo pri visokih PD-L1 CPS oziroma PEMBRO v kombinaciji s KT pri nizkih.

KEYNOTE-689

Uppaluri s sod. je v randomizirani študiji na 714 pacientih s p/m RGV dokazal prednost perioperativnega dodatka PEMBRO standardnemu kirurškemu in adjuvantnemu zdravljenju lokalno-regionalno napredujelega resektabilnega RGV. Izboljšanje 3-letnega preživetja brez dogodkov je bilo 57,6 % proti 46,4 %. Pri tem so dogodki predstavljali radiološki progres, ki prepreči operacijo, lokalni ali distalni progres ali recidiv in smrt [11]. Študija je privedla do odobritve perioperativnega PEMBRO s strani FDA.

NIVOPOST-OP

Bourhis s sod. je v randomizirani študiji proučeval 680 pacientov, ki so bili operirani zaradi lokalno-regionalno napredujelega RGV in so imeli visokorizične dejavnike tveganja za ponovitev bolezni. Primerjal je dodatek NIVO postoperativno k standardni adjuvantni RTKT s cisplatinom. Ugotovili so izboljšanje 3-letnega preživetja brez bolezni pri dodatku NIVO (63,1 % proti 52,5 %) [12].

Zaključek

IMT temelji na ponovni aktivaciji imunskega sistema pri prepoznavanju tumorskih celic in uničevanju le-teh. Postaja vedno pomembnejši del specifičnega onkološkega zdravljenja, saj so indikacije za IMT pri RGV presegle p/m RGV in posegle v perioperativno zdravljenje. Za kirurga to pomeni nove izzive tako pri izbiri bolnika kot pri organizaciji dela. Vloga kirurga se spreminja od odstranitve tumorja do vključevanja v celotno strategijo zdravljenja.

Etika, soglasja in financiranje

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06

Pediatrična otorinolaringologija

Paediatric Otorhinolaryngology

Vrsta slušne rehabilitacije bolnikov s sindromom CHARGE

Type of hearing rehabilitation in patients with CHARGE syndrome

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STRUKTURIRANI IZVLEČEK

Uvod: Sindrom CHARGE je redka razvojna motnja, najpogosteje povezana s patogenimi različicami gena CHD7. Akronim povzema kolobom očesa, srčne napake, atrezijo hoan, zastoj rasti in razvoja, genitalno hipoplazijo ter anomalije ušes oziroma izgubo sluha; fenotip lahko vključuje tudi motnje možganskih živcev, hranjenja, požiranja in ravnotežja. Prizadetost in anomalije zunanjšega, srednjega in notranjega ušesa ter slušnega živca povzročajo raznolik spekter prevodne, senzorinevrvalne in kombinirane izgube sluha. Namen raziskave je bil opisati vrsto slušne rehabilitacije, uporabo slušnih aparatov in funkcionalne izide pri bolnikih s sindromom CHARGE, obravnavanih v slovenskem terciarnem centru.

Metode: Izvedli smo retrospektivno opisno raziskavo zdravstvene dokumentacije 11 bolnikov s sindromom CHARGE, obravnavanih na Kliniki za otorinolaringologijo in cervikofacialno kirurgijo Univerzitetnega kliničnega centra Ljubljana. Zbrali smo podatke o spolu, predpisano slušno rehabilitacijo z uporabo slušnih pripomočkov, vrsto in stopnjo izgube sluha, najnovejše izvide preiskav sluha (avdiometrični odziv), timpanogram ter dokumentirani uspeh rehabilitacije naglušnosti (funkcionalni učinek). Podrobni avdiološki podatki so bili razpoložljivi za deset bolnikov.

Rezultati: Vključenih je bilo 11 bolnikov, sedem moškega in štiri ženskega spola. Slušni aparat je bil predpisan devetim bolnikom (81,8 %). Pri petih od devetih je bila dokumentirana redna uporaba, pri dveh redka uporaba ali neuporaba, pri dveh pa aktualna rednost uporabe ni bila jasno opredeljena. Enemu bolniku je bil zaradi boljše funkcionalne koristi predpisan tudi kostno prevodni aparat BAHa na traku. Nobeden izmed bolnikov ni uporabljal polževega vsadka. Izvidi testov sluha (avdiološki izvidi) so segali od skoraj normalnih pragov do praktične gluhotе. Pri osmih od devetih bolnikov z razpoložljivim timpanogramom je bil izvid nenormalen vsaj na enem ušesu. Funkcionalna korist slušne rehabilitacije je bila heterogena: pri enem bolniku so se avdiometrični pragovi izboljšali za približno 25–35 dB, pri drugem je bil doseg za šepet s kostno prevodnim slušnim aparatom na mehkem traku (BAHA) daljši kot s konvencionalnim aparatom. Pri dveh pacientih pa sta bili toleranca in redna uporaba slabi.

Zaključek: Konvencionalni slušni aparati so bili najpogostejša oblika rehabilitacije sluha, vendar podatki kažejo tudi vlogo kostno prevodnega aparata. Zaradi pogoste spremenljivke prevodne komponente ter razlik med predpisom, uporabo in koristjo je potrebno individualizirano, longitudinalno in multidisciplinarno spremljanje.

Ključne besede: sindrom CHARGE; izguba sluha; slušni aparati; rehabilitacija oseb z okvaro sluha; avdiometrija

ABSTRACT (ENGLISH SUMMARY)

CHARGE syndrome is a rare developmental disorder with heterogeneous auditory involvement. We retrospectively described hearing rehabilitation in 11 patients followed at a Slovenian tertiary otorhinolaryngology centre; detailed audiological records were available for ten. Seven patients were male and four female. Conventional hearing aids had been prescribed to nine patients (81.8%): regular use was documented in five, infrequent or no use in two, and current use was unclear in two. One patient also received a softband BAHAs prescription after greater functional benefit than with a conventional aid. No cochlear or auditory brainstem implant was documented. Findings ranged from near-normal thresholds to practical deafness. Tympanometry was abnormal in at least one ear in eight of nine patients with available results. The heterogeneity of hearing loss, fluctuating middle-ear involvement, adherence, and functional benefit supports individualised longitudinal and multidisciplinary management.

Keywords: CHARGE Syndrome; Hearing Loss; Hearing Aids; Rehabilitation of Hearing Impaired; Audiometry

Uvod

Sindrom CHARGE je redka in klinično zelo raznolika prirojena razvojna motnja. Ime je akronim za kolobom, srčno napako, atrezijo hoan, zaostanek v rasti oziroma mentalnem razvoju, genitalno hipoplazijo ter anomalije ušes oziroma gluhoti. Pri večini bolnikov je motnja povezana s patogeno različico gena CHD7, vendar diagnoza temelji na celostni klinični in genetski presoji [1].

Slušna prizadetost je ena najpogostejših značilnosti sindroma. Prisotne so lahko malformacije koščic in srednjega ušesa, displazija polža, aplazija polkrožnih kanalov ter hipoplazija ali aplazija kohlearnega živca, zato je izguba sluha lahko prevodna, senzorinevralna ali kombinirana ter pogosto asimetrična [2,3]. V novejši kohorti 57 otrok z dokazano patogeno različico CHD7 je imelo izgubo sluha 97 % otrok, pri 83 % pa je bila vsaj na enem ušesu težka ali globoka [4].

Rehabilitacija sluha lahko vključuje konvencionalne slušne aparate, kostno prevodne pripomočke, polžev vsadek, pri izbranih bolnikih slušni vsadek v možgansko deblo ter podporne in alternativne načine sporazumevanja. Izbira omejujejo anatomske posebnosti, stanje kohlearnega živca, razvojne in vidne motnje ter njihova prognoza, pridru-

žene bolezni ter dejanska sprejemljivost pripomočka [2,5]. Objavljeni evropski podatki izvirajo predvsem iz majhnih retrospektivnih serij in izbranih kohort prejemnikov polževega vsadka [3,5,6]. Slovenska serija slušne rehabilitacije pri sindromu CHARGE doslej v indeksirani literaturi ni bila opisana. Namen raziskave je bil opisati vrsto slušne rehabilitacije, uporabo slušnih aparatov in razpoložljive funkcionalne izide pri bolnikih s sindromom CHARGE, obravnavanih v našem terciarnem centru.

Metode

Zasnova in okolje. Izvedli smo retrospektivno, opisno raziskavo serije bolnikov, obravnavanih na Kliniki za otorinolaringologijo in cervikofacialno kirurgijo Univerzitetnega kliničnega centra Ljubljana. Poročanje smo zasnovali skladno z načeli smernice STROBE za opazovalne raziskave [7].

Preiskovanci. Vključili smo vseh 11 identificiranih bolnikov s klinično oziroma genetsko potrjenim sindromom CHARGE, ki so vodeni v ustanovi in za katere je razpoložljiv podatek o slušni rehabilitaciji. Analiza zajema najnovejše razpoložljive ORL in avdiološke zapise do 21. avgusta 2026. Za vseh 11 bolnikov so bili razpoložljivi spol ter osnovni podatki o slušni rehabilitaciji; podrobnejši avdiološki podatki so bili v predloženem naboru razpoložljivi za deset bolnikov.

Spremenljivke. Beležili smo spol, predpis in aktualno uporabo konvencionalnega slušnega aparata, kostno prevodnega aparata, oziroma implantabilnega pripomočka, vrsto in stopnjo izgube sluha, najnovejše rezultate testov vedenjske avdiometrije, timpanogram ter opisani funkcionalni odziv oziroma način sporazumevanja, oziroma uspeh rehabilitacije sluha. Kadar je bilo razpoložljivih več izvidov, smo za opis trenutnega stanja uporabili najnovejšega, starejše meritve pa za prikaz funkcionalnega učinka ali poteka. Izgubo sluha smo povzeli po diagnozi in zapisu lečečega avdiologa; zaradi različnih metod merjenja in sodelovanja bolnikov pragov nismo dodatno pretvarjali ali združevali.

Statistična analiza. Uporabili smo opisno statistiko. Kategorične spremenljivke prikazujemo kot absolutno število in delež. Zaradi majhnega in heterogenega vzorca nismo izvajali dodatnih statističnih testov. Podatke smo obdelali v programu Microsoft Excel.

Rezultati

V raziskavo je bilo vključenih 11 bolnikov s sindromom CHARGE, od tega sedem moškega (63,6 %) in štiri ženskega spola (36,4 %). Konvencionalni slušni aparat je bil predpisan devetim bolnikom (81,8 %); pri dveh bolnikih (18,2 %) predpis slušnega aparata ni bil dokumentiran. Enemu bolniku je bil poleg konvencionalnega aparata predpisan kostno prevodni aparat BAHA na traku. V razpoložljivem naboru ni bilo dokumentiranega uporabnika polževega ali slušnega vsadka v možgansko deblo.

Tabela 1. Osnovne značilnosti kohorte in slušna rehabilitacija

Značilnost	n/N	Delež
Moški spol	7/11	63,6 %
Ženski spol	4/11	36,4 %
Predpisan konvencionalni slušni aparat	9/11	81,8 %
Predpisan kostno prevodni aparat BAHA na traku	1/11	9,1 %
Brez dokumentiranega predpisa slušnega aparata	2/11	18,2 %
Redna oziroma pogostejša uporaba med bolniki s predpisanim aparatom	5/9	55,6 %
Redka uporaba ali neuporaba	2/9	22,2 %
Aktualna rednost uporabe ni jasno dokumentirana	2/9	22,2 %

Pri petih od devetih bolnikov s predpisanim konvencionalnim slušnim aparatom je bila dokumentirana redna oziroma pogostejša uporaba, pri dveh redka uporaba ali neuporaba, pri dveh pa aktualna rednost uporabe ni bila jasno navedena. Avdiološki spekter je bil izrazito heterogen, od skoraj normalnih pragov do obojestranske težke izgube oziroma praktične gluhotе. Pri osmih od devetih bolnikov z razpoložljivim timpanogramom izvid ni bil tipa A obojestransko, kar kaže na pogosto sočasno in spremenljivo motnjo prezračevanja srednjega ušesa.

Tabela 2. Anonimizirani avdiološki podatki desetih bolnikov z razpoložljivimi podrobnimi izvidi

Oznaka	Vrsta izgube	Odziv po zračni poti	Timpanogram	Rehabilitacija in funkcionalni zapis
B1	kombinirana, obojestranska, zmerna	55–70 dB desno; 60–70 dB levo	B/B	konvencionalna SA, redno; dober odziv in jezikovni napredek
B2	senzorinevralna, blaga levo; normalen sluh desno	15–25 dB desno; 20–40 dB levo	ni podatka	konvencionalni SA; aktualna uporaba ni jasno navedena
B3	prevodna, obojestranska, zmerna do težka	35–60 dB desno; 65–75 dB levo	B/C	konvencionalna SA, redno; zadovoljen, sluh stabilen
B4	senzorinevralna, obojestranska, težka	50–70 dB desno; 60–80 dB levo	A/A	konvencionalna SA, redno; svojci ne opažajo izrazite razlike
B5	kombinirana, obojestranska	45–90 dB desno; 65–110 dB levo	C/C	konvencionalna SA, redno; priporočena ponovna nastavev
B6	praktična gluhotа	80–90 dB desno; 75–85 dB levo	B/B	konvencionalna SA predpisana, ne uporablja; sporazumevanje s kretnjami
B7	kombinirana, prevodna komponenta v ospredju	25–40 dB desno; 55–60 dB levo	A/C	konvencionalni SA in BAHA na traku levo; šepet 4 m z BAHA, približno 0,5 m s SA

Oznaka	Vrsta izgube	Odziv po zračni poti	Timpanogram	Rehabilitacija in funkcionalni zapis
B8	senzorinevralna, obojestranska, zmerna	55–65 dB desno; 55–60 dB levo	A/zmanjšana podajnost	konvencionalna SA, uporablja; s SA 30–35 dB desno in 35–40 dB levo
B9	skoraj normalni pragovi; anamneza sekretornega otitisa	15–25 dB obojestransko	C/C	brez SA; sledenje; stanje po obojestranskih timpanalnih cevkah
B10	levo prevodna in verjetno senzorinevralna komponenta	15–30 dB desno; 65–80 dB levo	C/B	konvencionalni SA redko, levo; ponovna nastavev in sistem FM

Dokumentirani funkcionalni učinek ni bil enoten. Pri enem bolniku sta bila opisana dober odziv in jezikovni napredek, pri drugem so se pragovi s slušnim aparatom izboljšali s približno 60–70 dB na 30–40 dB NHL. Pri bolniku s prevladujočo prevodno izgubo je bolnik z BAHA na traku zaznal šepet z razdalje 4 m, s konvencionalnim slušnim aparatom pa z razdalje 0,5 m, kar kaže na večjo funkcionalno korist kostno prevodnega pripomočka. Posledično je bil BAHA predpisan za levo uho. Pri drugem bolniku pa je bila ob redki uporabi levega aparata priporočena ponovna nastavev. En bolnik s praktično gluhoto aparatov ni nosil in se je sporazumeval s kretnjami.

Razprava

V naši seriji je bil konvencionalni slušni aparat predpisan večini bolnikov s sindromom CHARGE, vendar predpis ni pomenil redne uporabe ali zadostne funkcionalne koristi. Ob neuspešni rehabilitaciji s konvencionalnim slušnim aparatom smo posegli po drugi, bolj uspešni obliki rehabilitacije. Pri enem bolniku je bila ob izrazitejši prevodni komponenti dokumentirana večja korist kostno prevodnega aparata BAHA na traku, kot konvencionalnega aparata. Tudi znotraj majhne serije je bil spekter izgube sluha širok, od skoraj normalnih pragov do praktične gluhote. Pomembna je bila prevodna komponenta: pri osmih od devetih bolnikov z razpoložljivim timpanogramom je bil izvid nenormalen vsaj na enem ušesu. To potrjuje, da enkratna opredelitev stopnje izgube sluha pri otrocih s sindromom CHARGE ne zadošča in da je potrebno redno spremljanje.

Ugotovitve so skladne z evropskimi objavami, vendar neposredna številčna primerjava ni povedna. Italijanska retrospektivna serija 31 otrok je zajela različne stopnje izgube sluha ter rehabilitacijo s slušnimi aparati in polževimi vsadki; izidi zaznavanja in govorno-jezikovnega razvoja so bili izrazito heterogeni ter povezani z razvojnimi, vidnimi in drugimi pridruženimi motnjami [3]. Nemška serija je poleg konvencionalnih aparatov opisala kostno vsidran slušni aparat, polževe vsadke in pri aplaziji kohlearnega živca razmislek o možganskodebelnem vsadku [2]. Nizozemska raziskava desetih prejemnikov polževega vsadka je pokazala slušno korist, vendar je poudarila nujnost CT in MR ocene temporalne kosti in kohlearnega živca ter individualno napoved izida [5]. Siste-

matični pregled 31 študij s 156 bolniki je zaradi heterogenosti avdioloških izidov onemogočil metaanalizo funkcionalnih rezultatov [6].

Naši rezultati dopolnjujejo evropske podatke in poudarjajo, da je treba uspešnost slušne rehabilitacije pri bolnikih s sindromom CHARGE presojati individualno. Pri nekaterih bolnikih izboljšanja sluha ni mogoče zanesljivo izmeriti, predvsem zaradi razvojnih in kognitivnih posebnosti, kombinirane senzorične prizadetosti, težav s pozornostjo ter spremenljivega sodelovanja pri avdiološkem testiranju. To predstavlja pomemben klinični izziv, saj odsotnost zanesljivo izmerljivega izboljšanja ne pomeni tudi odsotnosti funkcionalne koristi slušnega pripomočka. V naši seriji sta bila pri posameznih bolnikih dokumentirana boljši funkcionalni doseg z BAHa na traku ter izboljšanje pragov sluha s slušnim aparatom za približno 25–35 dB. Za celovito presojo učinka rehabilitacije je zato smiselno standardne avdiološke meritve dopolniti s longitudinalnim spremljanjem, opažanji staršev oziroma skrbnikov, oceno sporazumevanja in jezikovnega razvoja, podatki o dejanski uporabi pripomočka ter oceno funkcioniranja v vsakdanjem okolju.

Pri težki ali globoki senzorinevralni izgubi je smiselna zgodnja multidisciplinarna presoja za polžev vsadek. Zaradi pogoste hipoplazije kohlearnega živca in nepravilnosti temporalne kosti mora vključevati vedenjsko in objektivno avdiometrijo, timpanometrijo ter CT in MR slikanje temporalnih kosti [5,6]. Tudi ob tehnično uspešni implantaciji je treba pričakovanja prilagoditi nevrološkemu razvoju, vidu, ravnotežju, dihalni poti in komunikacijskemu okolju. Kretnje in nadomestna komunikacija niso neuspeh slušne rehabilitacije, temveč lahko predstavljajo nujen del multimodalnega načrta [3]. Pri vsadnih slušnih aparatih je potrebno pretehtati, kako bi anomalije srednjega in notranjega ušesa, odsotnost vertikalizacije osebe s sindromom CHARGE, trajno dihanje s traheostomo, lahko povzročalo pogostejše infektivne zaplete vsadkov.

Omejitve. Raziskava vključuje majhen vzorec zaradi redkosti sindroma, retrospektivne in posledično neenotno dokumentirane podatke ter rezultate avdiološke meritve, pridobljene z različnimi metodami in pri različni stopnji sodelovanja. Podrobnejši avdiološki izvidi so bili razpoložljivi za deset od 11 bolnikov. Podatki o rednosti uporabe so temeljili na anamnestičnih zapisih, ne na enotno izmerjenem dnevnem času uporabe. Prav tako nismo imeli enotnih podatkov o starosti ob diagnozi in prvi namestitvi, govorni zaznavi, slikovni diagnostiki in genotipu. Zaradi navedenega rezultatov ni mogoče posplošiti na vse bolnike s sindromom CHARGE v Sloveniji ali neposredno primerjati s tujimi serijami.

Zaključek

Najpogostejša oblika slušne rehabilitacije je bil konvencionalni slušni aparat, pri posameznih bolnikih pa je pomembno dopolnitev predstavljal tudi kostno prevodni aparat BAHa na traku. Izbira optimalne rehabilitacije je pri sindromu CHARGE zahtevna, saj je

lahko prizadetih več ravni slušne poti. Malformacije srednjega in notranjega ušesa ter hipoplazija ali aplazija kohlearnega živca lahko omejujejo izvedljivost oziroma pričakovano korist implantabilnih slušnih pripomočkov. Težave z dihalno potjo in druge pridružene bolezni lahko dodatno otežujejo operativno in pooperativno obravnavo. Tudi drugi avtorji zato poudarjajo, da mora biti otorinolaringološka obravnava bolnikov s sindromom CHARGE sistematična, individualizirana in multidisciplinarna ter vključevati ponavljajoče se avdiološke ocene in dolgotrajno spremljanje. Takšen pristop omogoča sprotno prilagajanje rehabilitacije, ocenjevanje funkcionalne koristi posameznega pripomočka in pravočasno izbiro najprimernejše oblike slušne ter komunikacijske podpore.

Etika, soglasja in financiranje

Etična odobritev: Institucionalni del temelji na retrospektivnih, anonimiziranih agregatnih podatkih rutinske klinične obravnave in registrov UKC Ljubljana.

Informirano soglasje: Uporabljeni so bili izključno anonimizirani agregirani podatki brez prepoznavnih osebnih podatkov bolnikov.

Zahvale: Avtorji se zahvaljujemo sodelavcem Avdiovestibulološkega centra in avdiologopedskega tima za longitudinalno obravnavo bolnikov.

Financiranje: Raziskava ni prejela zunanjega financiranja.

Navzkrižje interesov: Avtorji izjavljamo, da ni navzkrižja interesov.

Uporaba orodij umetne inteligence: Pri jezikovnem in uredniškem oblikovanju osnutka je bilo uporabljeno orodje generativne umetne inteligence. Avtorji prevzemajo polno odgovornost za celotno vsebino in vse podatke (skladno s priporočili ICMJE).

Razpoložljivost podatkov: Zaradi varovanja zasebnosti podatki posameznikov niso javno dostopni. Agregirani podatki so na voljo pri kontaktnem avtorju na razumno zahtevo.

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Hearing Loss in Patients with Down Syndrome – Follow-Up and Our Experience

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STRUCTURED ABSTRACT

Background/Introduction: Down syndrome is caused by trisomy 21 and is the most common chromosome abnormality in live born children. According to estimations there are 913 people with Down syndrome in Slovenia. Hearing loss is one of the frequent manifestations of Down syndrome. The combination of intellectual disability and a lack of a standardised hearing screening and referral guidelines leads to a delayed diagnosis of hearing loss in adult patients with Down syndrome.

Methods: Retrospective analysis of demographic and clinical data, including hearing threshold measurements and tympanometry of patients with Down syndrome at the Centre for Audiology and Vestibulology, Department of Otorhinolaryngology and Cervicofacial Surgery, University Medical Centre Ljubljana between the years of 2012 and 2026.

Results: 36 patients with Down syndrome were identified. 21 (58.3 %) were male and 15 (41.7%) were female. The average length of follow up was 5.2 years $\pm$ 3.9 years. 16 patients (44.4%) had hearing loss. 10 (27.8%) had narrow or stenotic external ear canals. Most patients had conductive hearing loss (n = 5, 13.9%) or sensorineural (n = 5, 13.9%), and mixed (n = 3, 8.3%) hearing loss. 9 (25%) patients received hearing rehabilitation with hearing aids. The most common coexisting conditions were obstructive sleep apnoea (n = 6, 16.7%) and congenital cardiac defects.

Conclusion: There is a high prevalence of both conductive and sensorineural hearing loss in patients with Down syndrome. Prevalence of sensorineural or mixed hearing loss may be underappreciated. A large subset of people with Down syndrome had not been examined or treated at our institution. Patients with Down syndrome, especially adults, remain an underserved population and do not reach the needed level of audiological and otolaryngological care.

Keywords: Down Syndrome; Hearing Loss; Sleep Apnoea, obstructive; Hearing Impairment Rehabilitation.

Introduction

Down syndrome (DS) is a genetic condition caused by variations in chromosome 21, namely trisomy 21. (1) It is the most common cause of intellectual disability (1–4) and the most common chromosome abnormality in live-born children. (5,6) Its estimated incidence in Europe is 10.1 per 10,000 live births, while the estimated number of people with DS in Slovenia in 2015 was 913. (7) Up to 50% of patients with DS will be seen by an otolaryngologist at least once in their lifetime. Thus, the knowledge of specific sequelae of DS is of special importance to any otolaryngologist. (3,8) Furthermore, children with DS are much more likely to need an otolaryngologic surgical procedure (i.e. tracheotomy, upper airway endoscopy or laryngoscopy, tympanoplasty with or without mastoidectomy) than the general paediatric population (9). DS is associated with Eustachian tube dysfunction (ETD), otitis media with effusion (OME), sensorineural hearing loss (SNHL), inner ear malformations, rhinosinusitis, upper airway malformations, macroglossia and sleep disorders. (3) Although patients with DS frequently need otolaryngological care their access to it is frequently limited, especially in adulthood. Most hearing screening programs aimed towards children with DS, while adult patients are not a targeted population. Instead, they need to be referred to otolaryngological care and are often dependent on their guardians and primary care physicians.

Chronic ear disease is a prevalent clinical feature of DS. (5,10) Due to a high incidence of upper respiratory tract infection and Eustachian tube dysfunction, children with DS are prone to OME. (10,11) Midface hypoplasia and pharyngeal narrowing change the insertion of the already narrow Eustachian tube, while generalized hypotonia diminishes the function of the tensor veli palatini muscle. (5) All above factors contribute to Eustachian tube dysfunction. (10)

Patients with DS have a high incidence of cholesteatoma. When compared to the general population, the disease is more advanced at the time of diagnosis and more often involves the tegmen and the ossicular chain. (11)

Children with DS have a higher rate of secondary hearing loss due to chronic ear disease even when compared to other children with developmental delay. The majority of hearing loss in DS is conductive, (10) but can also be sensorineural, with the reported incidence ranging from 4 to 55 %. (5) It can be caused by inner ear abnormalities: internal acoustic canal hypoplasia, enlarged vestibular aqueducts and cochlear nerve hypoplasia. (5) The pinna of children with DS is smaller and the external ear canal is often narrowed or even stenotic. (5,10) This can cause conductive hearing loss.

The constellation of midface hypoplasia, pharyngeal narrowing, macroglossia, retrognathic mandible, generalized hypotonia and predisposition to obesity lends itself (1,3,12) to a high rate of obstructive sleep apnoea (OSA) with incidence varying from

45 – 80 %. (13) For instance, the incidence of OSA in the general paediatric population is 0 – 5.7 %. (13)

Methods

A retrospective analysis of patients diagnosed with DS treated at the Centre for Audiology and Vestibulology, Department of Otorhinolaryngology and Cervicofacial Surgery, University Medical Centre Ljubljana from 2012 to 2026 was performed. Patients were identified through the hospital electronic medical record (EMR) system Hipokrat (List d.o.o., Ljubljana, Slovenia). Demographic and clinical data were extracted from the EMR. Previous medical history was extracted from Central Registry of Patient Data (CRPP, National Institute of Public Health, Ljubljana, Slovenia). Data were compiled in Microsoft 365 Excel (Microsoft Corporation, Redmond, WA, USA). Exclusion criteria were other coexistent chromosome abnormalities ($n = 1$, coexistent Klinefelter syndrome) and no performed audiological testing ($n = 4$)

Results of audiologic tests from the latest follow up appointment were retrieved from OtoAccess Software (Interacoustics, Denmark) ($n = 34$, 94.4%) or from exam notes ($n = 2$, 5.5%), if not available in OtoAccess Software.

Thresholds higher than 16 dB were considered pathological when measured with pure tone audiometry, while thresholds higher than 35 dB were considered pathological when measured with free field audiometry. Conductive hearing loss was defined as hearing loss in the presence of type B tympanogram. Sensorineural hearing loss was defined as pathological hearing threshold in the presence of type A or C tympanogram. In cases of PTA with both air and bone conduction measurements, hearing loss was classified based on the audiogram.

Statistical analysis was performed in JASP (version 0.19.3, JASP Team, University of Amsterdam, The Netherlands) and Microsoft 365 Excel. Graphic analysis was performed in Microsoft Excel and Microsoft Power Point (Microsoft Corporation, Redmond, WA, USA). Average, median, maximum and minimum values, standard deviation and interquartile range were calculated for the ages at the first and the most recent outpatient visit and for the length of the follow up. Length of follow up was defined as the time elapsed between the first outpatient visit and the latest outpatient visit. Patients ($n = 3$) with only one outpatient visit were excluded as they were deemed to have effectively had no follow up. Visits in other outpatient clinics were excluded. Four frequency pure tone average (4fPTA) was calculated separately for free field and pure tone audiometry from hearing thresholds at 0.5 kHz, 1 kHz, 2 kHz and 4 kHz, respectively. Average, median and standard deviation of 4fPTA was calculated.

Results

36 patients with DS were identified. 21 (58.3 %) were male and 15 (41.7%) were female. The calculated ages at the first and last visit and the length of follow up are reported in **Table 1**.

Table 1: Ages of patients	Age at 1 st visit	Age at last visit	Length of FU
Median	1.0	5.9	4.3
Mean	4.8	9.9	5.7
Std. Dev.	9.1	10.1	3.9
IQR	2.6	7.3	6.4
Minimum	0.2	1.2	0.02
Maximum	36.5	47.3	13.4

The average number of visits per patient was 6.1, the median number of visits was 5. The maximum number of visits was 16, and the minimal number of visits was 1.

Patients had the following coexisting ENT conditions: 6 (16.7%) patients had OSA, 3 (8.3%) patients had laryngomalacia. One (2.8%) patient had been intubated due to aspiration and had a postintubation injury of the larynx and vocal cord palsy. 10 (27.8%) patients had narrow or stenotic external ear canals.

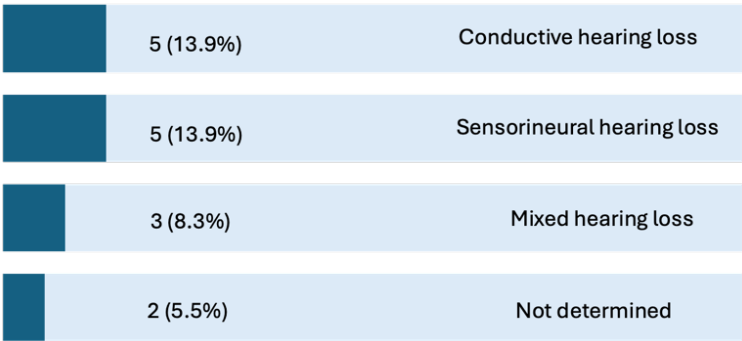
Systemic manifestations of DS and other comorbidities are reported in **Table 2**.

Table 2: Coexisting conditions	n	%		n	%
Congenital cardiac disease	10	27.7	Duodenal atresia	1	2.8
Coeliac disease	4	11.1	MASLD	1	2.8
Urologic conditions	4	11.1	Pyloric stenosis	1	2.8
Orthopaedic conditions	4	11.1	Leukaemia	1	2.8
Hypothyroidism	3	8.3	Facial nerve palsy	1	2.8

Most common hearing threshold measurement method was free field audiometry (n = 21, 58.3%), followed by pure tone audiometry (n = 11, 30.6%) and transient otoacoustic emissions (TOAE) (n = 4, 11.1%). In those with pure tone audiometry, most (n = 8, 22.2%) only had air conduction measured, while 3 (8.3%) also had bone conduction measurements.

16 patients (44.4%) had hearing loss, which was bilateral in all cases. Most patients had conductive (n = 5, 13.9%) and sensorineural (n = 5, 13.9%) hearing loss, followed by mixed (n = 3, 8.3%) hearing loss. In two cases (5.5%), hearing loss could not be further specified. (**Graph 1**)

Graph 1: Types of hearing loss in patients with DS.



In patients with hearing loss who had undergone pure tone audiometry, the average 4fPTA was 37.1 dB ± 16.0 dB. Patients with hearing loss measured with free field audiometry had an average 4fPTA of 44.5 dB ± 4.1 dB.

9 (25%) patients received hearing rehabilitation with hearing aids. The average age of the start of hearing aid use was 16.0 years ± 16.1 years, with the median age 9.5 years. The oldest patient who received hearing aids was 36.8 years old and the youngest 0.67 years old.

Discussion

Patients with DS who were followed up at the Centre for Audiology and Vestibulology, UMC Ljubljana have a high prevalence of hearing loss, which is in accordance with the available literature. (5,14) Conductive and sensorineural hearing loss were the most common, followed by mixed hearing loss. Interestingly, all three patients with measurements of both bone and air conduction had mixed hearing loss, showing a possibly understated prevalence of sensorineural or mixed hearing loss. This is further substantiated by a high prevalence of narrow or stenotic external ear canals which may contribute to overstating the prevalence of conductive hearing loss. Narrow external ear canals often make objective hearing test difficult to perform e.g. collapse of the external ear canal may give false result of conductive hearing loss. Furthermore, narrow external ear canals in combination with intellectual disability make follow up after surgical procedures, e. g. tympanotomy tubes, difficult and should thus be considered in a risk-benefit analysis before referring the patient to surgery.

Calculated 4fPTA measured with pure tone audiometry correlate well with published values. (14)

These thresholds are notably higher than reported values of the general population, 7.5 ± 4.2 dB.

While most patients with DS did not require any hearing rehabilitation, a comparatively high number ($n=9$, 25 %) received hearing aids, further underscoring the need for audiological care in patients with DS.

Incidence of obstructive sleep apnoea was lower than reported in literature, yet still higher than that of the general population. This can partially be explained by the possibility of these patients being followed up due to OSA in other outpatient clinics in our department and in other departments. Further research should expand to cover these potential patients as well. (15) A significant number of patients with DS had life-threatening coexisting medical conditions such as congenital cardiac defects that required multiple surgeries. In such cases, hearing loss can be missed due to more pressing medical issues. Furthermore, due to generalised hypotonia and intellectual disability speech development is delayed even in patients with DS with normal hearing which can further delay the diagnosis.

In a 2021 paper, De Graaf et al approximated that 913 patients with DS lived in Slovenia in 2015. (7) Extrapolating from this data, only approximately 4 % of patients with DS were followed up at the Centre for Audiology and Vestibulology, UMC Ljubljana. While follow up at different institutions may account for a small part of this disparity, the more likely explanation is limited access to care for patients with DS. Young patients with DS are heavily represented in our population as shown by low average and median ages. The oldest patient in our care was less than 50 years old, and the median age of patients at the last follow up was 5.9 years. This is consistent with frequent follow up of children with DS. However, the small number of adult patients is cause for concern. While screening of children with DS is often done as a part of screening programme, adults lack an entry point into otorhinolaryngological and audiological care. The Healthy Hearing programme at the Special Olympics represented one such point of entry of older patients with DS into the healthcare system while it was available. It consisted of audiological screening of athletes participating in the Special Olympics and additional otolaryngological and audiological testing, treatment and follow-up if needed. (16) Up to 40 % of athletes with intellectual disabilities competing at the Special Olympics were found to have hearing loss – a fact that was validated in the general population as well. (17) In the years 2006 and 2007, 208 athletes participated in the programme in Slovenia. 26 % of athletes did not pass the screening test and 39% were referred for further otolaryngological examination. This data clearly underscores the utility and necessity of such screening programs. Regretfully, it is not available to Slovenian athletes anymore (18)

Currently, there is no available standardised clinical pathway through which adult patients with DS can reach the care needed. Instead, they are dependent solely on referrals from primary care physicians and carers, while systemic inertia with protocolised regular screening protocols is direly needed. Although important strides have been

made in follow up of patients with DS, they still, especially as adults, remain an underserved population.

Conclusion

Knowledge of Down syndrome is of great importance to an otolaryngologist as a large portion of its manifestations occur in the head and neck. One of the most common manifestations of DS is HL, which is most often conductive, but can also be sensorineural or mixed. Currently there is a large underrepresentation of patients with DS at our institution. Patients with DS remain an underserved population in Slovenia and lack an entry point into comprehensive otolaryngological and audiological care, especially as adults.

Ethics, Consent and Funding

Ethical Approval: The study was designed as a retrospective analysis of previously gathered and anonymised clinical data. No additional diagnostic or therapeutic procedures were performed due to the study, nor was the course of treatment influenced by the study. The analysis was performed on an anonymised dataset. Patients and/or their legal guardians gave their written consent for participation in the study and the use of their data for research purposes.

Funding: The study received no external funding.

Conflict of Interest: The authors declare that they have no conflict of interest.

Use of Artificial Intelligence (AI): No generative artificial intelligence has been used.

Data Availability: Data are available from the corresponding author on reasonable request.

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07

Kirurgija žlez slinavk

Salivary Gland Surgery

KIRURGIJA ŽLEZ SLINAVK · SALIVARY GLAND SURGERY

Sialendoscopy and CT Navigation Assistance in the Surgical Management of Complex Sialolithiasis

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STRUCTURED ABSTRACT

Background. A sialendoscopy-assisted combined approach is well established in the surgery of sialolithiasis. In cases of proximal salivary stones, transcutaneous sialendoscopy-assisted extractions with parotid and submandibular gland preservation are the primary intention of treatment. We recently added computed tomography (CT) navigation to improve the results of this challenging surgery equally in both localizations.

Methods. All the patients submitted to sialendoscopy and sialendoscopy-assisted procedures at the tertiary institution between January 2012 and September 2026 were included in the present study. From November 2019, CT navigation was added in cases with sialolithiasis and a presumably poor sialendoscopic visibility. We evaluated the parameters of the disease, diagnostic procedures, sialendoscopic findings and outcomes, with or without optical surgical navigation.

Results. We performed 355 successful salivary stone removals, of which 220 were combined sialendoscopy-assisted approaches, including 35 transcutaneous proximal, 21 submandibular and 14 parotid stone operations. Surgical navigation was used in 16 patients, by transcutaneous approach eight times for submandibular and seven for parotid sialolithiasis. In the remaining case, navigation assistance was used with a transoral combined approach for a distal submandibular stone. These were all non-palpable, sialendoscopically invisible or partially visible stones, and we managed to preserve 15 of the 16 salivary glands.

Conclusion. The addition of CT navigation to sialendoscopy-assisted procedures for non-palpable, sialendoscopically invisible and fixed stones is a significant advantage in managing sialolithiasis. By consistently performing sialendoscopy and related preservation procedures, we significantly reduced the need for sialoadenectomies in patients with obstructive salivary gland disease.

Keywords: sialendoscopy; sialolithiasis; surgical navigation; computed tomography

Introduction

Sialendoscopy enables us to remove most salivary stones and, consequently, preserve salivary glands.^{1,2} In cases with a tortuous course of the salivary ducts, far proximal stone position and corresponding narrow duct diameter, or with stones located behind the stricture, deeply embedded or positioned in an abscess formation, even the use of sialendoscopy can be insufficient in determining the exact position of the stone. Transcutaneous sialendoscopy-assisted combined stone removals with intended gland preservation are particularly demanding, and their outcome may be unpredictable. The ongoing search for an additional guiding system is therefore justified.³ Attempts to use ultrasound as guidance to help locate difficult salivary stones during surgery have been reported in previous years. However, its use is highly dependent on various factors, including the lack of direct stone visualization.⁴ Surgical navigation using a computed tomography scan (CT) is regularly used in anterior skull base and paranasal sinus surgery with high precision.⁵ Under clinical conditions, an accuracy of about 2 mm is expected.⁶ It has been applied in various other therapeutic scenarios, including electrochemotherapy of deep-seated tumors in the head and neck region.⁷ Following experiences reported by Capaccio et al.⁸, we therefore added CT based navigation to the demanding combined approach to stone extractions to improve our results. To the best of our knowledge, we describe the first series in which navigation was used to locate the salivary stones and present it in the context of other endoscopic and combined salivary stone removals.

Methods

Data were prospectively collected in an institutional sialendoscopic database. On the proposal of the European Sialendoscopic Training Centre (ESTC), the database is a common source of data on imaging results before sialendoscopy, the exact indications for these procedures and their type, the procedure's findings, and follow-up.^{9, 10} All patients signed written consent for the respected procedure and data collection according to hospital policy.

Ultrasound diagnostics

Ultrasound examination was carried out in all patients to evaluate major salivary glands and their ductal systems and to detect any ultrasonographically visible salivary stones and to exclude possible tumor growth.

Computed tomography

The CT scan was primarily used to display more precisely the localization and number of salivary stones. Secondly, the use of CT enabled an estimation of the glands, their ducts and surrounding tissues. We performed contrast-enhanced CT in all cases of relapsing/persistent or complicated sialolithiasis, in order to show salivary stones,

their embedded or even extraluminal position and possible abscess formation or other soft tissue formations related to sialolithiasis with a more chronic course.

Magnetic resonance sialography

Standard and magnetic resonance imaging (MRI) - based sialography were used in sialendoscopically identified impassable distal strictures. We occasionally added standard MRI to estimate the status of glandular parenchyma.

Surgical navigation

After the workup described above, we performed sialendoscopic and sialendoscopy-assisted procedures. Our database was reviewed for less than sufficient endoscopic exposition in purely endoscopic and combined procedures from January 1st 2012 to September 1st 2026. We compiled the criteria for the use of the CT navigation listed in Table 1.

TABLE 1. Inclusion criteria for the use of CT navigation (if three or more criteria were met)

Nonpalpable stone
Difficult or even impossible endoscopic visualization of the stone
Far proximal position of the stone
Probably a fixed stone
Extraluminal stone (in an abscess or embeded)
„Salvage procedure“ after previously unsuccessful sialendoscopy or sialendoscopy-assisted surgery

CT navigation was added from November 2019 in all planned combined sialendoscopy-assisted surgery cases if three or more inclusion criteria were met.

A CT scan of the facial and salivary structures was done one day before surgery with 4 or 5 radiopaque surface fiducial markers (Figure 1). They were placed directly on the skin. Their position was additionally marked with a waterproof skin marker. The exact position was chosen according to the planned approach and incision placement.

It has to be emphasized that the arrangement should preferably be on hard anatomical parts of the face. Differences in jaw angle during CT imaging and when the patient is under general anesthesia were avoided by using a standard dental mouth gag in both situations. Acquired data in standard digital imaging and communication in medicine (DICOM) format were transferred to navigation. Brainlab Kolibri (Brainlab, München, Germany) fiducial markers were automatically recognized by the navigation software (Brainlab Cranial ENT V 2.1). No additional ad-hoc markers were chosen. The registration was done by touching the markers only. When the system perceived their order as ambiguous, the navigation itself chose the appropriate registration points sequence. When at least medium precision was achieved (self-assessment of the system), we checked the position of known anatomical landmarks and reconfirmed the accuracy to the surgeon's preference.

The first goal was to find the salivary stone's external approach path with the navigational tool lightly pressed on the skin. Since the CT presentation is divided into axial, coronal and sagittal planes, the surgeon must see the stone on all the planes. The trajectory may only then be approved. Both authors approved the trajectory before the continuation of the procedure. The contact point on the skin was marked as point zero, and the angle of the instrument was checked by both surgeons.

After incision and careful preparation, special care was taken not to change the position of the lower jaw. It can change the navigation accuracy when dealing with sub-mandibular pathology; the same mouth gag in the same position was therefore used again.

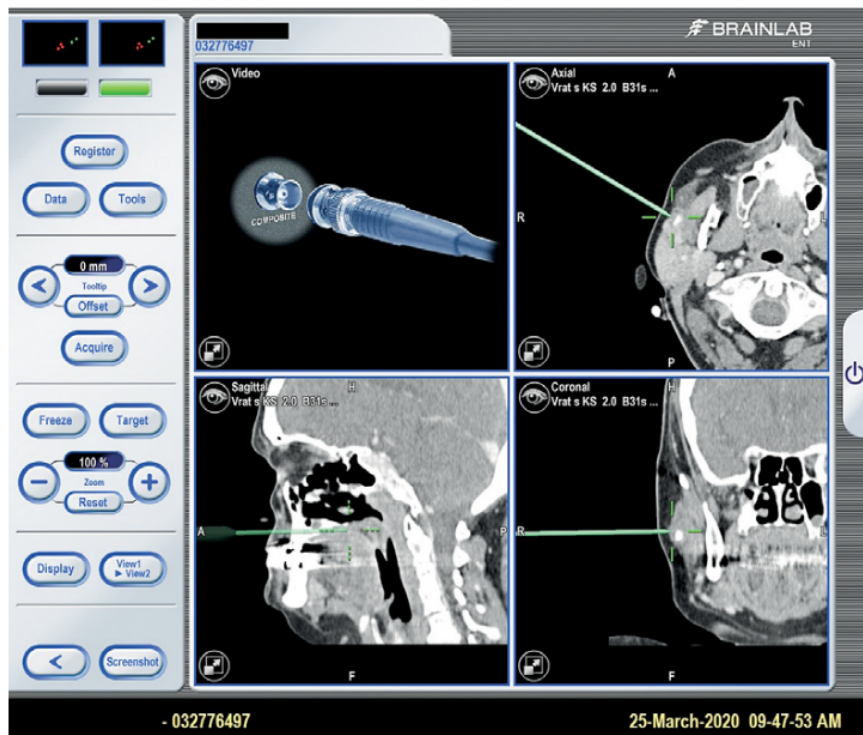
The orientation axis is an imaginary line from point zero on the skin to the deep-seated stone (Figure 2). During the dissection, the surgeon is virtually travelling through tissue on the same three-dimensional pathway from a stone's skin reference point. When necessary, an additional sialendoscopic approach was made to control the position of the stone. It also represented backup guidance in the final approach to the stone (Figure 3). Stones were removed through transcutaneous (Figure 4) or transoral incisions. Routine facial nerve neuromonitoring (Medtronic, Jacksonville, USA) was used in all transcutaneous procedures. Data analysis and statistics were done using Microsoft Excel 2019 (Microsoft, Redmond, USA) and SPSS V20.0 (IBM, Armonk, USA).

The study was approved by the institutional Committee for Medical Ethics and the Slovene National Medical Ethics Committee approved data collection and review of outcomes (0120-80/2017/4). The study was performed according to the principles of the Helsinki Declaration.

FIGURE 1. Patient, prepared for surgery. With fiducial markers attached to the skin and navigational star on the patient's forehead (BrainLab, München, Germany).



FIGURE 2. After identifying the skin's reference point with the stone being visible in the three-axes, the surgical trajectory is checked by the navigation.



Results

Six hundred and thirty-six patients underwent a sialendoscopic approach for treating obstructive salivary gland disease, of which 316 (49.69%) were female and 320 (50.31%) males, with an average age of 48 years (median 47.5 years) and an age span from 4 to 84 years. We performed 712 sialendoscopic and sialendoscopy-assisted procedures, roughly in two thirds because of submandibular pathology (66%). The essential sialendoscopy data on the patients and sialendoscopic operations at the Department of Otorhinolaryngology and Cervicofacial Surgery January 2012 – September 2026 is shown in Table 2.

Table 2. Sialendoscopic operations – Department of Otorhinolaryngology and Cervicofacial Surgery, University Medical Center Ljubljana, Slovenia: January 2012 – September 2026

Operations			712 (100%)	
operated salivary system	Submandibular		66%	
	Parotid		34%	
Anesthesia	Local		72.96%	
	General		27.04%	
Patients	All		636	
	Male		50.31%	
	Female		49.69%	
	Age (average, range – y.)		48 (4-84)	
Interventional procedures	All		433	
	Salivary stone removal	355	Combined app.	220
			Only basket	112
			LASER	23 (total 39)
	Dilation of the stenosis		78	
	Stent insertion		210 (for strictures and stones)	

Ultrasound diagnostics

In the present group, ultrasound examination proved accurate in evaluating the salivary glands' morphology and identifying stones, their size and localization, or possible dilatation of the ducts. In fourteen cases, ultrasound missed diagnosing rather long but narrow salivary stones (longer diameter of 8–10 mm and transverse diameter of 2–3 mm), which were all localized in the last distal 2 cm of Wharton's duct. We diagnosed these stones during sialendoscopy, four of them also by palpation in the office. Among 406 ultrasonographical examinations of submandibular glands, these fourteen cases resulted in a 3.4% false-negative rate.

Computed tomography

CT imaging was used in 378 patients (59.4%), mostly with sialolithiasis (288 patients or 76.19%). The proportion of all patients with sialolithiasis in whom a CT examination was performed was 66.36% (288/434).

MR sialography

MRI sialography was used in nineteen patients with sialendoscopically identified tight proximal

strictures: four of them at a 30–45 mm depth of Wharton's duct and in the same number of patients with Stensen's duct strictures and a 50–60 mm endoscopic reach. A typical examination showed a sausage-like series of strictures and dilatations or long segments of the main and secondary duct strictures.

Types of anesthesia, procedures and use of additional tools

The majority of our sialendoscopies and sialendoscopy-assisted operations were performed under local anesthesia (464/636; 72.96%) and were well-tolerated. There were eight recorded cases of transient paresis of the buccal branch of the facial nerve after parotid sialendoscopy, lasting from 3 to 6 hours; no other adverse reactions to local anesthesia were recorded. We performed 433 interventional procedures (68.08%), with 355 successful salivary stone extractions and 78 stricture dilatations. A total of 210 temporary stents were inserted in these cases.

FIGURE 3. In case the stone is at least partially sialendoscopically visible, it can represent a backup guidance in a challenging final combined approach.



Surgical approach and outcomes

The essential data on the patients and sialendoscopic operations at the Department of

Otorhinolaryngology and Cervicofacial Surgery January 2012 – September 2026 are shown in

Table 2. Pure sialendoscopic stone removal using endoscopic basket was performed in 123 patients, and additional laser fragmentation was used in 11 (8.94%) of them. A laser assisted fragmentation procedure was performed in a total of 39 patients with sialolithiasis (11%). The combined sialendoscopy-assisted approach was the most common method of salivary stone extraction (220/355 procedures, 62%). The majority of the combined approach operations were performed through incisions of the oral mucosa (185 surgeries, 84 %), mainly for the removal of submandibular stones (168 cases, 90.81%). A transcutaneous approach was employed in the remaining 35 procedures, in 21 of them using a transcervical approach (for submandibular stones) and 14 a transfacial approach (for parotid stones) (Table 3). A salivary gland resection was performed in nine out of 636 patients in whom sialendoscopy was part of their treatment.

A combination of sialendoscopy and navigation was used in 16 patients, 15 by transcutaneous approach, eight of them with submandibular and seven with parotid stones (Table 3). In all 15 patients, the stones were non-palpable, and only two of them were partially visible on sialendoscopy. In the remaining case a distal submandibular stone was removed using transoral combined approach with navigation, so all but that stone were in a proximal position and fixed. We had two cases of complicated sialadenitis: a parotid abscess in one and an initial phlegmon of the mouth floor in the other case. Two cases with submandibular sialolithiasis were salvage procedures following previous unsuccessful non-guided sialendoscopy. With the use of CT guidance, we were able to preserve all but one salivary gland. The latter patient had an obstruction due to a severe far proximal stricture and a stone positioned behind it (i.e., more proximally than the stricture itself).



FIGURE 4. All stones were removed following the navigational trajectory with a transcutaneous or transoral approach.

TABLE 3.

Gland	Parotid gland	SM gland	Total
Without navigation	7	13	20
CT Navigation	5	8	13
CT + Ultrasound navigation	2	0	2
Total	14	21	35

Some stones measured less than 7 mm
 - far proximal position, narrow ducts and impaction

Sialendoscopy-assisted transcutaneous salivary stone extractions with or without the use of navigation at the Department of Otorhinolaryngology and Cervicofacial Surgery, University Medical Centre Ljubljana, Slovenia 2012 – 2026

Discussion

Ultrasonography proved to be an accurate tool in our preoperative workup of sub-mandibular

sialolithiasis, with a 3.4% false-negative rate. All of the missed stones were in the distal Wharton's duct and had a narrow and elongated shape, with a transverse diameter 3 mm or less. Similar findings (5.1% false-negative cases) were published by German authors and explained by the mandible acoustic shadow.¹¹ In addition to the salivary stone position (proximity along the ductal tree), the ultrasonography's sensitivity for detecting the calculi mainly depends on their sheer size. Authors from Geneva report that stones with a diameter of less than 3 mm were missed in ultrasonical diagnosis in 10 out of 19 glands in their study and explain this by the absence of dorsal acoustic shadow of the calculi.¹² Our findings confirm the relationship between the sensitivity of the ultrasound examination and the size of the salivary stones. In our series, fourteen lengthy but narrow salivary stones were missed (longer diameter 8–10 mm and transverse 2–3 mm). Ultrasonography also proved to be a sensitive tool in estimating the state of the related soft tissue, i.e., for exclusion of nonobstructive pathology.

The proportion of patients with a CT examination has been more extensive in the last 9 years as a result of growing experience of the importance of input diagnostic information on possible multiplicity of stones. High-resolution CT has a crucial role in treatment planning and post-treatment monitoring, especially in submandibular sialolithiasis, since it offers more information about possible residual stones than do clinical and ultrasound findings.¹³

Due to its noninvasiveness and accuracy, sialo-MRI is the most appropriate method for assessing high-grade salivary duct strictures.¹⁴ There is no need for cannulation of the duct for endoluminal contrast injection. The procedure can therefore be used even during acute sialadenitis. Although we have used it relatively sparsely, in only nineteen patients, we believe that sialo-MRI has many advantages and should be used more often.

Most of the sialendoscopies and sialendoscopy assisted operations were performed under local anesthesia (72.96%). With proper patient selection, procedures were well tolerated, and there were no adverse reactions to local anesthesia. Cases of transient, short-lasting paresis of the buccal branch of the 7th cranial nerve after parotid sialendoscopy were rare. Our experience is consistent with already reported good tolerance of sialendoscopies conducted under local anesthesia by Luers et al¹⁵ There

were 355 successful salivary stone extractions in the present series, and the combined sialendoscopy-assisted approach was the most common type of procedure. Slovenia was also a »sialendoscopic naive« area, with a great proportion of previously untreated patients with large salivary stones.¹⁰ On the other hand, there has been a general trend of a »combined approach come back« in the last few years. According to the recommendations of ESTC and some other authors, it still has an important place in calculi bigger than 7 mm. Our own experience with deeply embedded, extraluminal and especially in abscess formation positioned stones corroborates their opinion. The majority of salivary calculi were removed through oral mucosa incisions during combined approach surgery. We had a significantly higher proportion of transcutaneous procedures than reported by authors from purely sialendoscopic quaternary centers.¹⁶ The number of submandibular transcutaneous operations, in particular, was exceptionally high. Salivary stones are found significantly more often in the submandibular than in the parotid ductal systems.¹⁷ On the other hand, parotidectomy is often avoided in patients with sialolithiasis because of the risk of facial nerve injury. For the same reason, the transfacial combined approach with gland preservation is well established for proximal stones of Stensen's duct.¹⁸ On the other hand, submandibular gland resection was the most frequently performed type of endstage treatment in patients with salivary stones.¹⁰ The gland preservation procedure for far proximal submandibular sialolithiasis was reported and recommended more modestly.¹⁹ The reason may be doubt in the long-term success of this type of procedure and a (repeated) possibility of marginal branch injury. Our attitude on the importance of salivary gland preservation, both parotid and submandibular, is based on findings of the indispensable role of saliva in maintaining the health of the oral and upper gastrointestinal system.²⁰ In addition, there is undoubtedly enough evidence of salivary gland function recovery after sialendoscopy.²¹ For these reasons, we endeavored 21 successful transcutaneous combined sialendoscopy-assisted procedures for far proximal submandibular stones; in eight of them, CT navigation was also employed. With the consistent implementation of all kinds of sialendoscopic techniques, we significantly reduced the need for sialoadenectomies in patients with obstructive salivary gland disease. We were forced to resect one of the salivary glands in only nine of 636 patients (1.4%) in whom sialendoscopy was a part of the treatment. All 16 patients in our navigation subgroup had non-palpable salivary stones, even though their stones were relatively large (only one measured less than 5 mm). The reason for this seemingly paradoxical situation was the far proximal position of the stone in most cases, the phlegmon of the floor of the mouth in one and a parotid abscess formation in the remaining case. Good visibility on sialendoscopy is mandatory for all successfully performed solely endoscopic stone extractions and for a majority of combined approach procedures. Our inability to display calculi during sialendoscopy was also among the indications for the use of CT navigation: stone inside abscess formation, far proximal position of the calculi (literally in the middle of

the gland), and bad visibility inside the main duct. There is only one procedure described so far combining salivary stone removal with both sialendoscopy and CT navigation assistance: the authors reported an excellent matching of the two guidance methods.⁸ They therefore confirmed the probable validity of additional CT navigation guidance. Its introduction in sialolithiasis surgery represents a significant improvement and, in our opinion, has great added value, especially in challenging cases. We observed no facial nerve paresis or paralysis, sialoceles or salivary fistula among the patients with the transcutaneous navigation-assisted approach. We therefore regard it as equally safe as a non-navigated combined approach. It is essential to point out more or less obvious pitfalls of the CT navigation guidance method. Without the additional acquisition of (less than accessible) intraoperative CT, it does not allow any real-time correction, which makes CT navigation guidance an excellent method in patients with fixed salivary stones. The final step in locating the stone in virtually any type of approach is careful preparation of the last remnants of tissue over the stone. In difficult cases, the final position of the stone is easily missed; repeated axis check using the navigation may therefore be the only way to localize the stone or multiple stones. Since we had experience with a proximally shifted stone, the authors believe that the navigation in possibly nonfixed stones should be used with caution. Even with navigation, the obstruction caused by a severe stricture containing the stone in an intraglandular position could not be resolved without gland resection.

Conclusion

The combined use of sialendoscopy and CT navigation assistance is a step forward in minimally invasive surgery of sialolithiasis, especially in far proximal, intraparenchymal, non-palpable and sialendoscopically non-visible fixed stones, irrespective of the type of combined approach or salivary gland. CT navigation proved to be of help in demanding transcutaneous submandibular stone extractions, with gland preservation. It is invaluable in cases of extraluminal, i.e., positioned in an abscess or deeply embedded stones. With the consistent implementation of sialendoscopy and related minimally invasive procedures, we can significantly reduce the need for sialoadenectomies in patients with obstructive salivary gland disease.

Ethics, Consent and Funding

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Authors' contributions: Both authors contributed equally to the article.

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KIRURGIJA ŽLEZ SLINAVK · SALIVARY GLAND SURGERY

Intraoperative Neuromonitoring in Parotid Surgery: Standard of Care or Just an Adjunct?

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Background/Introduction: Facial nerve injury remains the most feared complication of parotid surgery, with transient dysfunction reported in up to three-quarters of patients in some series and permanent paralysis in a smaller minority. Intraoperative Neuromonitoring (IONM) of the facial nerve is now used by the majority of head and neck surgeons. However, whether it should be considered part of the standard of care for parotidectomy is a matter of ongoing debate. This systematic review provides an overview of the evidence for the use of IONM for parotid surgery published within the last decade. The physiological basis of IONM and the relevant technical parameters are also described.

Results: Fourteen studies published in 2016–2026 met inclusion criteria. Most centers use intramuscular needle electrodes in 2-channel or 4-channel configurations, tracking free-running EMG, stimulation threshold, and evoked amplitude as the principal intraoperative parameters. The only randomized controlled trial in this window (n=106) showed non-significant trends favoring monitoring. A two-center retrospective study found no benefit from IONM in primary surgery but a significant benefit in reoperative cases. A December 2025 meta-analysis (10 studies, n=1047) claiming reduced permanent dysfunction was retracted in July 2026 after a data-extraction error was identified; correction eliminated statistical significance for the permanent-outcome endpoint. Conversely, a 2025 ten-year retrospective cohort (n=329) found IONM significantly reduced facial nerve injury (OR 0.35, 95% CI 0.25–0.50, $p < 0.05$). Survey data from 2021–2024 show adoption rates of 94–97% among practicing surgeons internationally.

Conclusion: A decade of evidence does not support IONM as an unconditional standard of care in low-risk primary parotidectomy, but supports its use as a strongly recommended, risk-adapted adjunct, with the clearest benefit in reoperative, malignant, and anatomically complex cases. An adequately powered randomized trial remains the field's principal unmet need.

Keywords: Facial Nerve; Intraoperative Neurophysiological Monitoring; Electromyography; Parotidectomy; Facial Paralysis; Standard of Care; Systematic Review.

Introduction

Postoperative facial nerve dysfunction is the major and feared complication of parotid surgery. Transient facial nerve dysfunction is observed in up to three quarters of patients within the first postoperative month. The majority of them resolve within 6 months; permanent dysfunction or even palsy is the exception rather than the rule [1]. For localization of the facial nerve before its visual identification, for the detection of potential injury during dissection, and for the objective assessment of the remaining function at the end of the surgery, intraoperative neuromonitoring (IONM) using intramuscular electromyography (EMG) electrodes has found growing acceptance in otolaryngology and head and neck surgery.

In 2021 a systematic review and meta-analysis of intraoperative monitoring of the facial nerve in parotid surgery was published. However, use of IONM in parotid gland surgery remains a matter of debate amongst otolaryngologists and head and neck surgeons [2]. Recently, use of IONM in parotid surgery has come under increased scrutiny, when the most comprehensive meta-analysis to date on the subject was retracted due to a data-extraction error several years after the conclusions had been published for implementation into clinical practice in a 2025–2026 episode.

This systematic review consolidates evidence from studies reporting comparative, prognostic and practice-related data concerning the use of IONM in parotid surgery over the last decade (2016–2026). A description of the physiological basis for IONM, the types of recording electrodes currently in use, and the various parameters measured intraoperatively will serve as background information to the subsequent comparative studies.

Physiological Principles and Technical Parameters of Facial Nerve Monitoring

Physiological basis

For IONM of the facial nerve, monitoring relies on the electromyographic (EMG) recording of compound muscle action potentials (CMAPs) in the mimetic muscles. These signals are generated either by stimulation of the nerve trunk by direct electrical current or by the muscle automatically firing off due to surgical manipulation. Monitoring with non-depolarizing muscle relaxants (NDMRs) is ineffective because these drugs block the signal generation at the neuromuscular junction. Hence, all non-depolarizing muscle blockers should be avoided after induction of anesthesia or allowed to wear off before start of the nerve dissection in close cooperation with the anesthesiologist team [3].

For practical use, two signal types are found in clinics. First, the free-running (continuous, passive) EMG detects mechanical, compression, or thermal damage to nerves. It

records spontaneous activity of muscles as so-called spikes, neurotonic trains or even bursts of activity. Ideally, such signals are recorded before any visible damage to a nerve occurs. Second, the triggered (evoked) EMG is used for stimulation of suspected nerve trunks with a monopolar or bipolar probe. This allows for the identification of a nerve before it is exposed. During dissection, conduction through a segment of interest can be tested. At the end of a surgery, residual function of a nerve can even be estimated.

Electrode configuration and channel number

The vast majority of contemporary facial nerve monitoring systems use paired intramuscular needles or very fine subdermal electrodes placed in muscles supplied by main branches of the facial nerve. Signals from needle electrodes are far more reliable and less affected by artifact than those from surface electrodes. In a 2024 survey of the Korean Society of Head and Neck Surgery, 61% of surgeons used 2 channels (orbicularis oculi and orbicularis oris) to monitor the temporofacial and cervicofacial divisions of the facial nerve. Thirty-nine percent used 4 channels including frontalis and mentalis/depressor anguli oris to separately monitor the temporal/zygomatic and marginal mandibular branches of the facial nerve[4]. The literature describes 6- to 8-channel systems with additional electrodes over the procerus/corrugator and platysma muscles to individually monitor all main facial nerve branches, but this approach is not yet standardized. The number and placement of electrodes varies particularly in systems used for reoperative or malignant cases with expected multiple branch involvement [3,5].

Intraoperative parameters

The following intraoperative electrophysiological parameters are utilized by surgeons and neurophysiology teams during monitored parotidectomy:

- **Free-running EMG activity** (mechanically- or thermally-induced spontaneous activity such as bursts or trains of discharges): indicates traction, compression or damage by energy-device before it becomes apparent visually.
- **Stimulation threshold (mA)**: The amount of current in milliamperes required to elicit a reproducible CMAP recording. It is used to confirm the identity of a nerve pre-operatively, and as the dissection proceeds, an increase in the stimulation threshold can indicate an evolving nerve injury.
- **Evoked (supramaximal) amplitude (μV)**: Amplitude of supramaximal CMAP recorded at the proximal main trunk and at the distal branches in comparison before and after the surgery.
- **Amplitude ratio**: final amplitude/initial amplitude (%): The amplitude ratio of the initial to the final amplitude of the CMAP is one of the more consistently validated parameters to predict degree and likelihood of permanent facial nerve paresis after surgery. A

lower % indicates greater paresis [6,7]; a recent systematic review of predictive parameters reported that an amplitude drop exceeding 50% was specifically associated with severe postoperative palsy [7].

- Latency:** The time period from the electrical stimulation to the onset of the CMAP, which is in some centers monitored throughout the surgery. However, in parotid surgery latency changes are of little value as a prognostic indicator.

- Concurrent train-of-four (TOF) monitoring by anesthesia:** The present monitoring parameters for neuromuscular transmission are concurrently recorded by anesthesia to check for adequate EMG signal amplitude.

These parameters allow monitoring in three different ways: 1) anatomical localization of the nerve before it is seen; 2) alerting to mechanical or thermal injury during dissection; 3) quantitative prediction of postoperative facial function at the end of the case[3,6,7].

Methods

Information sources and search strategy

PubMed/MEDLINE was searched together with supplementary web-based bibliographic searches, restricted to the 2016–2026 publication window. Reference lists of included systematic reviews were hand-searched for additional eligible primary studies.

Eligibility criteria

Population: patients undergoing parotidectomy (partial, superficial, or total) for benign or malignant disease, including primary and reoperative surgery.

Intervention/Comparator: intraoperative facial nerve monitoring (any electromyographic modality) compared with visual/anatomical dissection alone, or practice-pattern/technical data on IONM use.

Outcomes: immediate and/or permanent postoperative facial nerve dysfunction (House–Brackmann or equivalent grading), intraoperative prognostic parameters, or surgeon-reported practice patterns.

Study design: randomized controlled trials; prospective or retrospective comparative cohort studies; systematic reviews and meta-analyses; multidisciplinary consensus/best-practice statements; and national or multicenter practice-pattern surveys.

Publication window: January 2016 to September 2026 (last decade), English language.

Exclusions: case reports/series without a comparator or denominator, studies not distinguishing monitored from unmonitored outcomes, and publications predating the ten-year window.

Study selection

We found 14 studies published between 2016 and 2026 that met our inclusion criteria: one randomized controlled trial, two comparative cohort studies, two systematic reviews with meta-analysis (one of which was retracted and its retraction notice included), one large single-center retrospective cohort study, a cohort study on intraoperative prognostic factors, an incidence/risk-factor study, two national surveys of current practice, and two multidisciplinary documents outlining consensus/standards for management.

Synthesis method

Because of the great variability in the definitions of outcomes (e.g. House–Brackmann grades, length of follow-up), the monitoring (number of channels, settings of threshold values), and the cases (patients) in the 14 studies reviewed here, a quantitative meta-analysis was not performed. Instead, the findings were grouped thematically and reviewed in a narrative fashion, i.e. as a “systematic review without meta-analysis”.

Results

Primary comparative studies

A two-center retrospective analysis of 128 parotidectomies (2007–2012) found that facial nerve monitoring did not have a significant effect on postoperative facial functions in primary surgeries but that it did enhance facial nerve-sparing in reoperative cases [9]. The only RCT (randomized controlled trial) published within this time frame was a pilot study of 106 patients who were monitored during 106 superficial parotidectomies. Immediate facial dysfunction was reported in 38.3% of the monitored patients and in 51.8% of the unmonitored patients ($p = 0.1$). Late facial dysfunction up to 180 days postop was reported in 3.8% of monitored patients and in 5.5% of unmonitored patients ($p = 0.4$). Neither of these differences, however, was statistically significant in this underpowered trial [10].

Systematic reviews and meta-analyses

A 2021 systematic review and meta-analysis of studies of monitoring for facial nerve function found some evidence that monitoring was associated with a reduced amount of immediate postoperative dysfunction. However, there was substantial heterogeneity between studies, and most of the studies included in the review were of retrospective design [2]. A more recent meta-analysis of 10 studies with 1047 patients published in December 2025 found that intraoperative monitoring of the facial nerve was

associated with a reduction in both immediate and permanent postoperative facial dysfunction. However, the authors later identified that a single study's follow-up data had been incorrectly classified as part of the data that had been extracted for the analysis and, when this study was removed from the analysis for permanent-weakness, the pooled odds ratio for this outcome was no longer statistically significant [11,12]. The article was subsequently retracted in July 2026 by the authors, the journal's editor-in-chief, the sponsoring society and the publisher [11].

Recent large cohort data

Recently a 10-year single-center retrospective study of 329 patients with parotid gland tumors that were resected (2010–2023) found that IONM was an independent and significant protective factor for facial nerve injury (odds ratio 0.35, 95% CI 0.25–0.50, $p < 0.05$), whereas deep/inferior tumor location was an independent risk factor for nerve injury ($p = 0.035$) [13].

Prognostic value of intraoperative parameters

Independent of any effect on injury rates, intraoperative EMG parameters – including supramaximal stimulation amplitude and end-of-case evoked threshold, as introduced above – have been studied for their correlation with the likelihood and severity of postoperative facial dysfunction [6]. However, a 2025 systematic review registered in PROSPERO, pooling 8 studies and 632 patients (193 of whom developed postoperative facial palsy), found that only 5 of the 8 included studies reported a significant association between reduced amplitude or increased threshold and postoperative dysfunction, and concluded that current evidence does not provide conclusive support for the predictive value of intraoperative neuromonitoring parameters overall. Nevertheless, the same review reported that an amplitude drop exceeding 50% was consistently linked to severe postoperative palsy, and judged that continued use of IONM for prognostic purposes remains reasonable given its established protective role [7]. This tempers, without eliminating, the counseling value of intraoperative EMG parameters: individual parameters such as a large amplitude drop appear meaningfully predictive, but the evidence base as a whole is still heterogeneous and not yet conclusive.

Practice patterns

Survey data indicate very high real-world adoption of IONM. A national survey of the Korean Society of Head and Neck Surgery found that 97% of respondents used monitoring selectively or routinely during parotidectomy, with usage decreasing as surgeon experience increased – from 100% among surgeons with under five years of experience to 75% among those with 20 or more years ($p = 0.089$) [4]. A Spanish national survey similarly found that 94% of otolaryngologists used IONM during parotid surgery, primarily to improve patient safety; only three respondents reported a career

history of a parotid-surgery-related lawsuit, and in only one of those cases had the monitor not been used [14].

Discussion

Interpreting a fragmented decade of evidence

The literature over the last 10 years has not reached a consensus on whether IONM reduces permanent facial nerve injury. There is only one randomized trial (underpowered as a pilot study [10]) and several meta-analyses that have found benefit of IONM in reducing permanent injury, with the largest being retracted [11]. The literature reports a range of 'no benefit' for primary surgery [9] to a significant large effect in reducing facial nerve injury in a large, recent cohort [13]. Importantly, these studies are extremely heterogeneous, as described in the Physiological Principles section above, meaning that there are real differences between studies in case mix, electrode placement, monitored parameters, surgeon expertise and study outcomes. The retraction of the largest meta-analysis to claim benefit of IONM for a permanent-injury end-point [11,12] is particularly instructive in this regard. A 'sweeping statement' that IONM reduces permanent facial nerve injury must be viewed with healthy skepticism.

The case for near-mandatory use

Several arguments support a strong, if not unconditional, recommendation for IONM. First, IONM provides the best nerve localization in reoperative cases where anatomical landmarks are less reliable. Second, a recent large cohort study demonstrated a significant reduction in facial nerve injury in cases where IONM was used [13]. Third, intraoperative EMG parameters, particularly the amplitude ratio of the final to the initial supramaximal stimulation, provide the clinician with objective and reproducible data regarding the functional status of the facial nerve that cannot be obtained by visual inspection of the operative site. This information can be used to provide patients with earlier and more accurate information regarding their potential for recovery of facial nerve function; a 2025 systematic review specifically noted that an amplitude drop exceeding 50% was consistently associated with severe postoperative palsy[6,7]. Fourth, there exists a detailed, multidisciplinary, consensus document outlining best practices for facial nerve monitoring that describes the technical standards for the safe and effective use of IONM, including electrode placement and anesthetic management [3]. Standardization proposals for parotid surgery have also been published with the goal of increasing inter-study comparability [5]. Finally, the use of IONM for facial nerve monitoring is now so widespread that its omission, particularly in higher-risk cases, would be unusual and thus difficult to defend against even in the absence of trial-level proof of benefit for its use [4,14]. In two national surveys of practicing otolaryngologists in 2021 and 2024, respectively, 94–97% of respondents reported the routine use of IONM for facial nerve monitoring [4,14].

The case against a blanket mandate

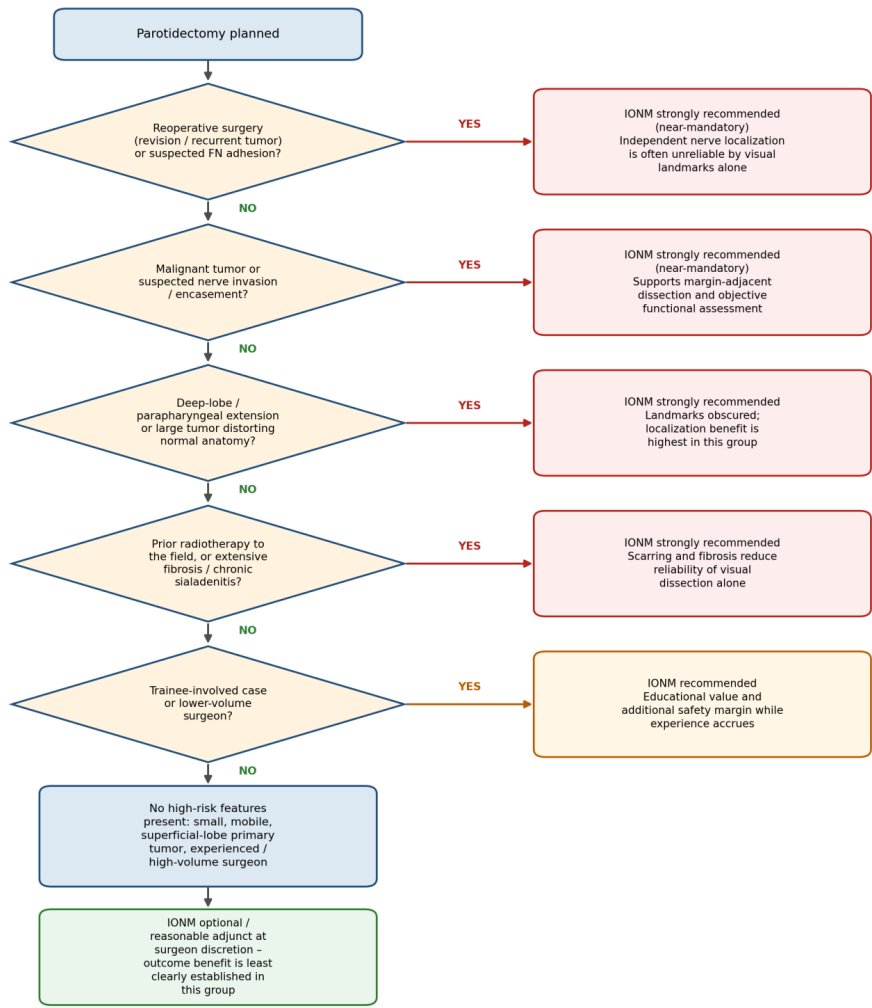
In the same decade there is considerable evidence against the use of IONM for reducing permanent facial nerve injury in parotid surgery. No randomized study of sufficient power has shown benefit [10]. In the largest series of primary low-risk parotidectomy cases, there was no benefit from IONM [9]. The largest single series claim of reducing permanent facial nerve injury has been withdrawn due to a major error in data extraction [11]. A survey of current users found that IONM use is not uniform, dropping with surgeon experience, from 100% by the least experienced to 75% by the most experienced surgeons [4]. Furthermore, electrode configuration and number of channels for IONM are not standardized between centers [3,4]. Thus, such studies are not easily compared and any single "standard" for IONM would be tenuous at best. Practice guidelines for the use of facial nerve monitoring are Level of Evidence 4, i.e. consensus statements, rather than a formally graded clinical practice guideline mandating its use [3].

A risk-stratified framework

Contrary to a simple yes/no answer for utility of IONM in parotid surgery, all evidence from the last decade can be placed into a risk-stratified framework. In simple, superficial-lobe, small benign tumors, monitored by an experienced surgeon in an 'untouched' surgical field with meticulous anatomical dissection, the value of IONM as an adjunct to surgery is reasonable and supported by evidence, but difficult to quantify in terms of marginal benefit. However, in reoperative cases of malignant parotid tumors with suspected nerve involvement, in deep-lobe or parapharyngeal space tumors, in previously irradiated surgical fields, in cases in which trainees or lower volume surgeons are involved, the benefit of IONM is substantially greater than in simple parotid surgery, and its use becomes practically necessary [9,13]. The benefits of IONM in parotid surgery are seen mostly in technically difficult, reoperative, and other high risk cases and do not demonstrate benefit across all parotidectomies. A structured decision algorithm synthesizing these indications, consistent with the literature on IONM indications [15] and the selective-use criteria reported in practice surveys [4], is presented in Figure 1.

Figure 1. Decision Algorithm for Selective vs. Routine Use of IONM in Parotid Surgery

(synthesized from indications reported by Sajjisevi [15] and the KSHNS practice survey [4]; consistent with the risk-stratified framework in the Discussion)



Limitations

This review has several limitations. Restricting eligibility to 2016–2026 excludes earlier literature. Screening and data extraction were performed by a single reviewer with AI assistance rather than two independent reviewers, no formal risk-of-bias appraisal tool was applied, and the review was not prospectively registered – all deviations from

full PRISMA methodology. Included studies used heterogeneous outcome definitions, follow-up durations, and monitoring techniques, precluding meta-analytic pooling and limiting direct comparability. Finally, the retraction discussed in this review is a recent event, and the evidence base should be expected to continue evolving as corrected or new pooled analyses, and ideally an adequately powered randomized trial, become available.

Conclusion

The use of intraoperative neuromonitoring (IONM) in parotid surgery is supported by strong physiological and technical evidence, has a standardized technical execution (free-running and triggered EMG using 2-8 channels of intramuscular electrodes) and is widely used by head and neck surgeons. There is strong evidence to support the use of IONM in reducing morbidity and in particular temporary facial nerve weakness. There is also strong evidence to support its use as part of the multidisciplinary team and the guidelines produced by this group of experts. However, there is a lack of high quality evidence in the form of a randomized controlled trial to show that IONM reduces or prevents facial nerve injury of any permanent nature. Furthermore, a recent high profile study claiming to show that IONM reduced permanent facial nerve weakness was withdrawn from publication due to errors in data extraction. In conclusion, the current best evidence suggests that in the majority of primary parotid surgeries, IONM is a reasonable addition to the existing arsenal but it is not yet proven to reduce any form of permanent facial nerve weakness. In high risk cases (i.e. reoperative, malignant, deep lobe or distorting lesions) it is a strongly recommended adjunct that is used by most surgeons and could be considered necessary. A high quality randomized controlled trial is needed to provide the evidence required to change clinical practice in all cases.

Ethics, Consent and Funding

Ethical Approval: Not applicable. This is a systematic review of previously published, publicly available data; no new patient data were collected and no ethical committee approval was required.

Informed Consent: Not applicable. No patient-identifiable data, clinical photographs, or original patient material are presented in this review.

Registration: This review was not prospectively registered (e.g., PROSPERO); see Limitations.

Funding: Study received no external funding.

Conflict of Interest: The authors declare that they have no conflict of interest.

Use of Artificial Intelligence (AI): An AI-based language model (Claude, Anthropic) was used to assist with the literature search, screening and source synthesis. All cited sources were verified by the author(s) against the original publications prior to submission, in line with ICMJE recommendations on the use of AI in scholarly writing; the author(s) reviewed, edited, and take full responsibility for the accuracy and integrity of the final content, including the search strategy and study selection described in Methods.

Data Availability: No new data were generated or analyzed for this review. All sources discussed are publicly available via the journals and DOIs listed in the reference list.

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08

Posterji

Posters

POSTERJI · POSTERS

Normative values for the Sniffin' Sticks Screening 12 test in the Slovenian population: a pilot study

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STRUCTURED ABSTRACT

Background/Introduction: The Sniffin' Sticks Screening 12 test (SST-12) is widely used to screen olfactory function, but its interpretation depends on the language of the descriptors and on the reference population, and no normative values exist for the Slovenian version. Screening may also be needed outside the clinic, for example in museums. This pilot study aimed to obtain preliminary normative SST-12 values for healthy Slovenian adults and to assess whether testing in a non-clinical setting affects the results.

Methods: Healthy Slovenian adults were tested with the Slovenian version of the SST-12 in a library (n = 12) or in an ENT clinic (n = 12) and retested after 7 days in the same setting. We compared these scores with two reference groups of healthy volunteers tested in the clinic in previous studies (n = 9, aged 27–65 years; n = 12, aged 18–38 years). We compared groups using the Kruskal–Wallis and Mann–Whitney U tests. Normative values were derived from the pooled first-test scores.

Results: Mean SST-12 scores were 10.67 (SD 0.89) in the library, 11.17 (SD 0.40) in the clinic and 10.56 (SD 0.73) and 11.08 (SD 0.79) in the two reference groups; the groups did not differ (p = 0.142). Retest scores did not differ from the first test in either setting (p = 0.470 and p = 0.381). In the pooled sample (n = 45; aged 18–65 years), the mean score was 10.89 (SD 0.75), the median 11, and the 10th percentile 10. Eight participants (18%) scored 10 or less, which the manufacturer classifies as impaired.

Conclusion: In healthy Slovenian adults, SST-12 scores clustered at 11, and a score of 10 lay within the normal distribution. Testing in a library gave results comparable to the clinic. Larger, age- and sex-stratified samples are needed to establish definitive Slovenian norms.

Keywords: Smell; Olfaction Disorders; Reference Values; Slovenia; Environment

Normative values for the Sniffin' Sticks Sc

Slovenian population: a pilot study

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Background

The SST-12 is widely used to screen olfaction, but scores depend on the descriptor language and the reference population. No normative values exist for the Slovenian version. Screening may also be needed outside the clinic, e.g. in museums presenting olfactory cultural heritage.

Aim

To obtain preliminary normative SST-12 values for healthy Slovenian adults and to test whether a non-clinical setting changes the results.

Methods

- Slovenian SST-12 (12 pens, 4-choice)
- Library (NUK) n = 12 · ENT clinic n = 12 · retest after 7 days
- Reference groups: n = 9 (27–65 y), n = 12 (18–38 y)
- Kruskal–Wallis, Mann–Whitney U
- Norms from pooled first tests; 10th percentile = lower limit of normal

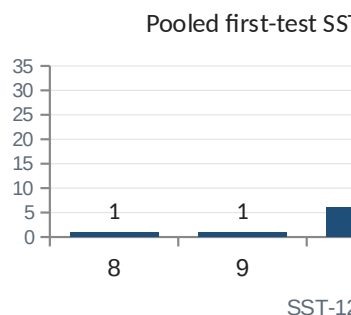
Results

45

healthy adults, 18–65 years

10

10th percentile



Screening 12 test in the

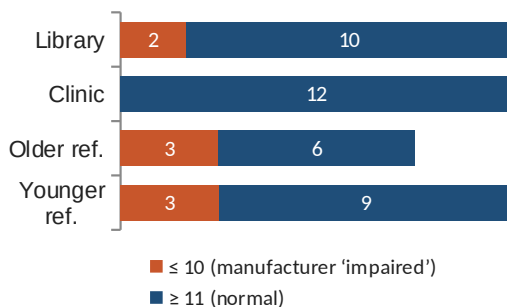


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Scores by group



Means 10.67 · 11.17 · 10.56 · 11.08; no difference between groups ($p = 0.142$). Library vs clinic retest stable ($p = 0.470$; $p = 0.381$).

Conclusion

- Healthy Slovenian adults score mostly 11; a score of 10 is within the normal range.
- The manufacturer's cut-off (≥ 11) may overestimate impairment.
- A library setting gives results comparable to the clinic.

Funding: ARIS project J7-50233 (Smell and Intangible Cultural Heritage).
Contact: jure.urbancic@kclj.si

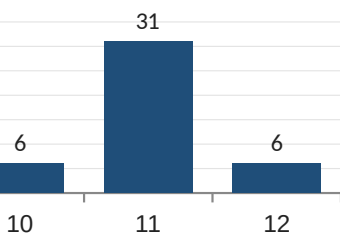
11

median score

18%

scored ≤ 10 ('impaired')

T-12 scores (n = 45)



2 score

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Revision after endoscopic frontal sinus surgery: neo-ostium stenosis, diagnosis, extent of surgery and stenting in a single-centre cohort

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Disclosure: J. U.: research grant from Medis d.o.o.; lecturer for Sanofi, AstraZeneca and Bayer.

SUMMARY

Background: The frontal sinus is involved in approximately 73–81% of patients with chronic rhinosinusitis with nasal polyps and in 75–80% of revision cases, and the frontal recess is a frequent site of surgical failure. Draf IIA, IIB and III procedures offer progressively wider frontal drainage; closure of the neo-ostium is closely linked to persistent symptoms and revision. Restenosis has been associated with uncontrolled eosinophilic (T2) inflammation, AERD and smoking rather than with surgery itself, and the long-term benefit of stents remains uncertain.

Aim: To identify factors associated with revision after endoscopic frontal sinus surgery, focusing on neo-ostium stenosis, diagnosis, type of procedure and stenting.

Methods: Single-centre cohort of 36 patients after Draf IIA (n = 11), IIB (n = 15) or III (n = 10), with follow-up of 6–60 months (median 24). Diagnosis, prior surgeries, baseline and outcome SNOT-22, tissue and blood eosinophils, neo-ostium stenosis (%), stenting and compliance were recorded. Patients with revision (n = 6) were compared with those without revision (n = 30); p < 0.05 was considered significant.

Results: Six of 36 patients (16.7%) required revision surgery. Compared with patients without revision, revised patients had a higher baseline SNOT-22 (68.5 vs 57.0; p = 0.034), complete neo-ostium stenosis (100% vs 25%; p < 0.001), a worse outcome SNOT-22 (60.3 vs 12.7; p < 0.001) and a shorter follow-up (15.0 vs 27.9 months; p = 0.030). In the whole cohort, mean SNOT-22 decreased from 59 to 21. As non-significant trends, the revision rate rose with the extent of surgery (9% → 13% → 30%; p = 0.396), five of six revisions occurred in CRSwNP (p = 0.085), no stented patient required revision (p = 0.564), and revision occurred in 33% of non-compliant vs 11% of compliant patients (p = 0.151).

Conclusion: Complete closure of the frontal neo-ostium was the hallmark of revision and went together with poor symptom control; a higher preoperative SNOT-22 identified patients at risk. Revisions clustered in CRSwNP and after Draf III, and none occurred after stenting, but these trends need confirmation in larger, prospective cohorts.

Revision after endoscopic frontal sinus surgery: neo-ostium stenosis cohort

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36

patients after endoscopic frontal sinus surgery (Draf IIA, IIB or III)

16.7%

required revision surgery (6 of 36) during 6–60 months of follow-up

Background

- The frontal sinus is involved in ~73–81% of CRS with nasal polyps and ~75–80% of revision cases; the frontal recess is a frequent site of surgical failure [1,2].
- Draf IIA, IIB and III offer progressively wider frontal drainage; closure of the neo-ostium is closely linked to persistent symptoms and revision [3].
- Restenosis has been associated with uncontrolled eosinophilic (T2) inflammation, AERD and smoking rather than with surgery itself [4,5].
- Stents may improve early patency, but long-term benefit remains uncertain [6].

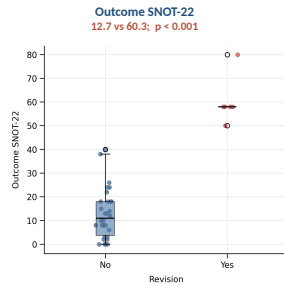
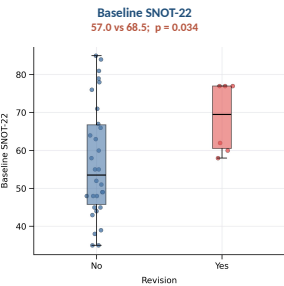
Aim To identify factors associated with revision after endoscopic frontal sinus surgery, focusing on neo-ostium stenosis, diagnosis, type of procedure and stenting.

Methods

- Single-centre cohort of 36 patients after Draf IIA (n = 11), IIB (n = 15) or III (n = 10); follow-up 6–60 months (median 24).
- Recorded: diagnosis, prior surgeries, baseline and outcome SNOT-22, tissue and blood eosinophils, neo-ostium stenosis (%), stenting and compliance.
- Patients with revision (n = 6) were compared with those without (n = 30); p < 0.05 was considered significant.

Cohort (n = 36)	Mean ± SD
Age (years)	53.8 ± 9.7
Sex, M / F	22 / 14
Baseline SNOT-22	58.9 ± 14.8
Outcome SNOT-22	20.6 ± 20.8
Tissue eosinophils (eoHPF, n = 26)	47.4 ± 39.6
Blood eosinophils	313.6 ± 208.6

Significant differences



■ no revision (n = 30) ■ revision (n = 6)
Box plots with individual patients; values are group means (no revision and sex did not differ significantly).

Conclusion

Complete closure of the frontal neo-ostium was the hallmark of revision and went together with poor symptom control; identified patients at risk. Revisions clustered in CRSwNP and after Draf III, and none occurred after stenting, but these two prospective cohorts.

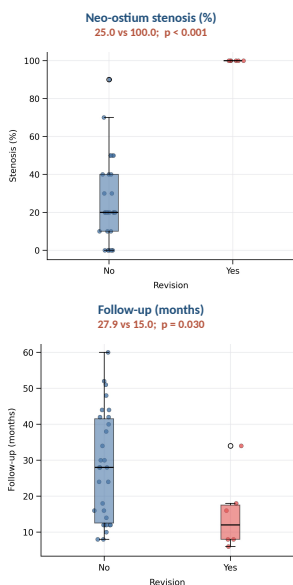
Diagnosis, diagnosis, extent of surgery and stenting in a single-centre

100%

mean neo-ostium stenosis in revised patients vs 25% without revision ($p < 0.001$)

59 → 21

mean SNOT-22 before surgery and at last follow-up (whole cohort)



(revision vs revision), Age, prior surgeries, tissue and blood eosinophils

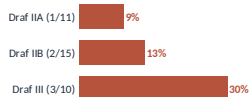
? Diagnosis, procedure, stenting

Revision rate within each subgroup (revised / total)

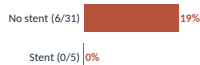
Diagnosis · $p = 0.085$ · 5 of 6 revisions in CRSwNP



Type of procedure · $p = 0.396$



Stenting · $p = 0.564$



Trends, not significant: revision rate rose with extent of surgery (9% → 13% → 30%); no stented patient required revision. Revision also occurred in 33% of non-compliant vs 11% of compliant patients ($p = 0.151$).

higher preoperative SNOT-22
trends need confirmation in larger,

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Definitive Chemoradiotherapy for Synchronous HPV-Negative Oropharyngeal and Thoracic Oesophageal Squamous Cell Carcinoma: Dosimetric Comparison of Two- and Three-Isocentre VMAT

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STRUCTURED ABSTRACT

Background: Synchronous squamous cell carcinoma (SCC) of the oropharynx and thoracic oesophagus is uncommon and presents a considerable therapeutic challenge because of the extensive target volumes requiring definitive radiotherapy. We present a patient with synchronous HPV-negative oropharyngeal and thoracic oesophageal SCC and compare the robustness of two- and three-isocentre volumetric modulated arc therapy (VMAT) planning approaches.

Methods: A 60-year-old man with HPV-negative SCC of the right oropharynx, metastatic cervical lymph nodes and synchronous thoracic oesophageal SCC was discussed at a multidisciplinary tumour board and selected for definitive concurrent chemoradiotherapy with weekly carboplatin and paclitaxel. Radiotherapy was delivered using VMAT with a simultaneous integrated boost, prescribing 70 Gy to the primary oropharyngeal tumour and involved cervical lymph nodes, 56 Gy to the bilateral elective neck and 52.5 Gy to the thoracic oesophageal tumour in 35 fractions. Two- and three-isocentre VMAT plans were compared with respect to target coverage, organ-at-risk sparing and planning robustness.

Results: Both treatment plans achieved clinically acceptable target coverage and comparable organ-at-risk sparing. The three-isocentre technique avoided positioning the high-dose lower cervical planning target volume within the overlapping region between isocentres, thereby reducing the risk of dose inhomogeneity caused by setup uncertainties while maintaining comparable dosimetric quality.

Conclusion: This case highlights the importance of careful isocentre placement when treating extensive synchronous head and neck-oesophageal target volumes. Although both VMAT techniques achieved comparable target coverage and organ-at-risk sparing, the three-isocentre approach provided greater planning robustness by avoiding placement of the high-dose lower cervical planning target volume within the overlapping re-

gion between isocentres. This approach may therefore represent the preferred planning strategy for similarly complex clinical scenarios.

Keywords: synchronous neoplasms; oropharyngeal neoplasms; oesophageal neoplasms; volumetric modulated arc therapy; chemoradiotherapy



Definitive Chemoradiotherapy for Synchronous HPV-Negative Oropharyngeal and Thoracic Oesophageal Cancer

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BACKGROUND

Synchronous squamous cell carcinoma (SCC) of the oropharynx and thoracic oesophagus is uncommon and presents a significant radiotherapy planning challenge because of extensive target volumes.

This report compares two- and three-isocentre VMAT planning strategies for definitive chemoradiotherapy, focusing on dose distribution in the overlapping region and its impact on treatment robustness.

CASE PRESENTATION

- 59-year-old man
- Long history of tobacco smoking and alcohol consumption
- Progressive dysphagia and odynophagia
- HPV-negative squamous cell carcinoma of the right oropharynx
- Synchronous squamous cell carcinoma of the thoracic oesophagus
- FDG-avid metastatic lower cervical lymph nodes
- Multidisciplinary decision for definitive concurrent chemoradiotherapy
- Weekly carboplatin and paclitaxel
- Feeding jejunostomy placed before treatment
- Comparison of two- and three-isocentre VMAT planning strategies

TREATMENT

- Definitive concurrent chemoradiotherapy
- Weekly carboplatin and paclitaxel
- Volumetric modulated arc radiotherapy (VMAT) with simultaneous integrated boost (SIB)
- Treatment planning performed in Eclipse v15.6 using the Varian TrueBeam beam model with a High Definition multileaf collimator (HD MLC)
- PTV2/5: 52.5 Gy in 35 fractions (thoracic oesophageal tumour)
- PTV5/6: 56 Gy in 35 fractions (bilateral elective neck)
- PTV7/8: 70 Gy in 35 fractions (primary oropharyngeal tumour and involved cervical lymph nodes)
- Dosimetric comparison of two- and three-isocentre VMAT plans
- The patient is currently undergoing treatment

MULTIDISCIPLINARY TUMOUR BOARD

- Head and Neck Surgeon
- Thoracic Surgeon
- Radiation Oncologist
- Medical Oncologist
- Radiologist
- Pathologist
- Medical Physicist

Consensus recommendation for definitive concurrent chemoradiotherapy

DISCUSSION

Definitive chemoradiotherapy for synchronous oropharyngeal and thoracic oesophageal SCC requires irradiation of extensive target volumes with multiple dose levels.

Both VMAT strategies achieved comparable target coverage and organ-at-risk (OAR) sparing.

The three-isocentre technique provided superior robustness by widening the overlapping region and reducing the dose gradient within the high-dose lower cervical PTV.

DVH analysis demonstrated improved robustness of the three-isocentre plan while maintaining comparable OAR dosimetry.

Careful isocentre placement is a key factor in achieving robust treatment plans for complex synchronous head and neck–oesophageal irradiation.

BASELINE FDG PET/CT

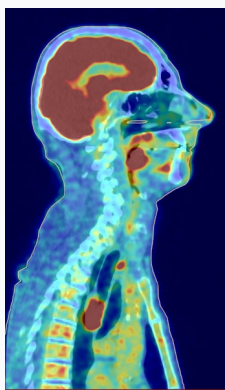
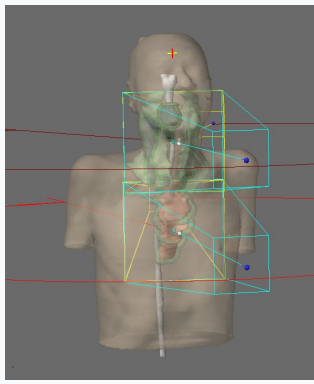


Figure 1. Baseline FDG PET/CT demonstrating synchronous FDG-avid oropharyngeal and thoracic oesophageal cancer (sagittal image), together with FDG-avid metastatic lower cervical lymph nodes.

COMPARISON OF TWO- AND THREE-ISOCENTRE VMAT BEAM ARRANGEMENT

TWO-ISOCENTRE PLAN

The 70 Gy target volume including lower cervical lymph nodes is located in the overlapping region → high risk of dose inhomogeneity with setup uncertainties.



THREE-ISOCENTRE PLAN

The 70 Gy target volume is positioned away from the overlapping region around the middle isocentre and improved treatment robustness.

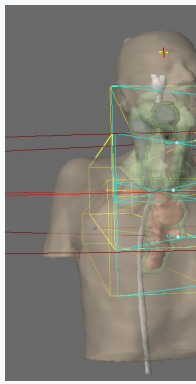


Figure 4. Two-isocentre plan (left) places the 70 Gy target in the overlapping region, whereas the three-isocentre plan (right) positions it away from the overlapping region.

KEY MESSAGE

For extensive target volumes, a three-isocentre VMAT approach is recommended as a more robust technique while preserving comparable target coverage and OAR sparing.

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Petrous Apex Mucocele: A Case Report and Literature Review

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SUMMARY

Background: A petrous apex mucocele is a rare benign cystic lesion resulting from obstruction of pneumatized petrous air cells. Progressive expansion may compress the internal carotid artery (ICA), Meckel's cave, trigeminal and abducens nerves, cavernous sinus and temporal lobe, causing neurological symptoms.

Case report: A 36-year-old man presented with an 8-month history of right-sided temporoparietal headache, diplopia on right gaze and right facial paresthesia. MRI demonstrated a 26 × 32 × 37 mm right petrous apex lesion compressing the right ICA, Meckel's cave, trigeminal and abducens nerves, temporal lobe and cerebellopontine cistern. CT angiography confirmed marked compression of the petrous ICA. The radiological findings were most consistent with a petrous apex mucocele.

Surgery: Following multidisciplinary skull-base evaluation, endoscopic endonasal transclival marsupialization was performed. A wide transclival opening was created medial and posterior to the right paraclival ICA, allowing drainage of thick yellow mucoid contents, and the bony margins were widely enlarged to establish permanent drainage. A mometasone furoate-eluting sinus implant and a mini-Hadad flap were placed.

Outcome: Diplopia and right facial paresthesia improved immediately. A transient episode of severe arterial hypertension (220 mmHg systolic) required intravenous antihypertensive treatment. CT showed no intracranial complications and a widely patent marsupialization pathway; the patient was discharged on postoperative day 3. At 1 month there was no mucus accumulation or obstruction, and at 6 months the drainage ostium was well epithelialized and patent, with complete resolution of diplopia and facial paresthesia and no residual abducens or trigeminal nerve deficit.

Conclusion: For medially located mucocèles adjacent to the sphenoid sinus, an endoscopic endonasal transclival approach allows direct decompression and establishment of a durable drainage pathway.

Petrous Apex Mucocele: A Case Report and Literature Review



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Introduction and case report

A 36-year-old man presented with an 8-month history of right-sided temporoparietal headache, diplopia on right gaze and right facial paresthesia. MRI demonstrated a 26 × 32 × 37 mm right petrous apex lesion. The lesion compressed the right ICA, Meckel's cave, trigeminal and abducens nerves, temporal lobe and cerebellopontine cistern. CT angiography confirmed marked compression of the petrous ICA. The radiological findings were most consistent with a petrous apex mucocele.

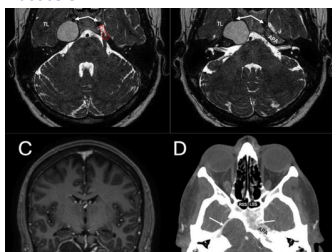


Figure 1. MRI of a patient with a right petrous apex mucocele.

Surgery

Following multidisciplinary skull-base evaluation, endoscopic endonasal transclival marsupialization was performed. A wide transclival opening was created medial and posterior to the right paraclival ICA, allowing drainage of thick yellow mucoid contents. The cavity was inspected and the bony margins were widely enlarged to establish permanent drainage. A mometasone furoate-eluting sinus implant and a mini-Hadad flap were placed.

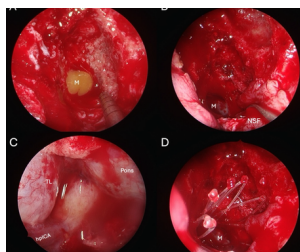


Figure 2. Endoscopic transnasal marsupialization of a right petrous apex mucocele. A: Opening through the midline posterior to the right internal carotid artery, with drainage of yellowish mucocele contents (M). B: Panoramic view of the mucocele through the midline; a nasoseptal flap (NSF) is positioned at the floor of the sphenoid sinus. C: A 30° endoscope demonstrates the denuded horizontal petrous segment of the right internal carotid artery (hICA) inferolaterally, the temporal lobe superolaterally, and the pons posteromedially. D: A second sinus implant is inserted to prevent closure or re-obstruction of the marsupialized mucocele.

Outcome

The patient experienced immediate improvement in diplopia and right facial paresthesia. A transient episode of severe arterial hypertension (220 mmHg systolic) occurred after surgery and required intravenous antihypertensive treatment. CT showed no intracranial complications and confirmed a widely patent marsupialization pathway. The patient was discharged on postoperative day 3.

At 1-month follow-up, there was no mucus accumulation or obstruction. At 6 months, the drainage ostium was well epithelialized and remained patent. The patient reported complete resolution of diplopia and facial paresthesia, with no residual abducens or trigeminal nerve deficit.

Discussion

A petrous apex mucocele is a rare benign cystic lesion resulting from obstruction of pneumatized petrous air cells. Progressive expansion may compress the internal carotid artery, Meckel's cave, trigeminal and abducens nerves, cavernous sinus and temporal lobe, causing neurological symptoms.

For medially located mucoceles adjacent to the sphenoid sinus, an endoscopic endonasal transclival approach allows direct decompression and establishment of a durable drainage pathway.

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EPOS4Patients in informacijske potrebe bolnikov s kroničnim rinosinuzitisom: pregled vodnika in rezultati ankete na terciarni kliniki

EPOS4Patients and the information needs of patients with chronic rhinosinusitis: a review of the guide and survey results at a tertiary clinic

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STRUKTURIRANI IZVLEČEK

Uvod: Kronični rinosinuzitis (KRS) je pogosta, večinoma vseživljenjska bolezen, pri kateri sta uspeh zdravljenja in sodelovanje bolnika odvisna od razumevanja bolezni in možnosti zdravljenja. Evropsko stališče EPOS2020 dopolnjuje vodnik za bolnike EPOS4Patients, pripravljen v sodelovanju z bolniki. Namen raziskave je bil oceniti, kako bolniki s KRS ocenjujejo količino prejetih informacij in potrebo po dodatnih informacijah, ter s tem potrebo po slovenski različici vodnika.

Metode: Pilotno raziskavo smo začeli leta 2023 in jo nadaljevali do leta 2026. Bolnike s KRS, obravnavane na Kliniki za otorinolaringologijo in cervikofacialno kirurgijo UKC Ljubljana, smo povabili k anonimni spletni anketi (Google Forms, dostop prek kode QR) s petimi trditvami, ocenjenimi na lestvici od 1 do 10. Povezane ocene smo primerjali z Wilcoxonovim testom predznačenih rangov, povezanost pa ocenili s Spearmanovim koeficientom korelacije (ρ).

Rezultati: Anketo je izpolnilo 17 bolnikov. Željo po dodatnih informacijah so ocenili z mediano 9 (IQR 8–10), pomen razumevanja zdravljenja za uspeh z mediano 9 (IQR 9–10), zadostnost prejetih informacij z mediano 6 (IQR 2–8) in lastno razumevanje diagnostike in zdravljenja z mediano 5 (IQR 3–7). Želja po informacijah je bila statistično značilno višja od ocene prejetih informacij ($p = 0,002$), pomen razumevanja pa višji od dejanskega razumevanja ($p < 0,001$). Ocena zadostnosti informacij je bila močno povezana z oceno razumevanja ($p = 0,82$; $p < 0,001$). Informacije v spletni ali mobilni obliki si je izrazilo želelo 14 bolnikov (82 %).

Zaključek: Med potrebo bolnikov s KRS po informacijah in informacijami, ki jih prejmejo, obstaja izrazita vrzel. Rezultati utemeljujejo pripravo slovenske različice vodnika EPO-

S4Patients, dostopne tudi v digitalni obliki, ki bi lahko izboljšala razumevanje bolezni in podprla skupno odločanje o zdravljenju.

Ključne besede: sinusitis; izobraževanje bolnikov; zdravstvena pismenost; skupno odločanje; ankete in vprašalniki

ABSTRACT (ENGLISH SUMMARY)

Chronic rhinosinusitis (CRS) is a common, usually lifelong disease in which treatment success depends on patients understanding their condition and participating in their care. EPOS4Patients, a patient-facing supplement to EPOS2020 developed together with patients, explains rhinosinusitis and its management in accessible language. In a pilot study started in 2023 and continued until 2026 at the Department of Otorhinolaryngology and Cervicofacial Surgery, UMC Ljubljana, we assessed the need for a Slovenian version of the guide with an anonymous online survey. Seventeen patients rated five statements on a 1–10 scale. The desire for more information (median 9) exceeded the perceived sufficiency of information received (median 6; $p = 0.002$), and the importance attributed to understanding treatment (median 9) exceeded self-rated understanding (median 5; $p < 0.001$). Sufficiency of information correlated strongly with understanding ($p = 0.82$). Most patients (82%) wanted information in digital form. These findings support a Slovenian version of EPOS4Patients.

Keywords: Sinusitis; Patient Education as Topic; Health Literacy; Decision Making, Shared; Surveys and Questionnaires

1. MEDNARODNI LJUBLJANSKI OTORINOLARINGOLOŠKI KONGRES · ILOC 2026 · Portorož, 2.–3. oktober 2026

EPOS4Patients in informacijske potrebe bolnikov s kroničnim terciarni kliniki

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Ključne ugotovitve · anonimna anketa, n = 17 bolnikov s KRS · delež bolnikov z oceno 8–10 na lestvici od 1 do 10

82 %

si želi dodatnih informacij o svoji bolezni

29 %

meni, da je od zdravnika ali medicinske sestre prejel dovolj informacij



Uvod

- Kronični rinosinuzitis (KRS) traja več kot 12 tednov, prizadene 5–12 % prebivalstva in je večinoma vseživljenjska bolezen [1].
- Pomembno zniža kakovost življenja (SNOT-22) ter pomeni veliko breme za bolnika, zdravstvo in družbo [2–4].
- Uspeh lokalnih kortikosteroidov in izpiranja nosu je odvisen od pravilne tehnike in doslednosti, zato potrebujemo obveščenega in sodelujočega bolnika (medicina 4P) [1,5,6].



EPOS4Patients – vodnik za bolnike

Dopolnilo smernic EPOS2020, pripravljeno skupaj z bolniki [7]. V razumljivem jeziku razloži akutni in kronični rinosinuzitis (s polipi in brez njih, tudi pri otrocih) ter podpira skupno odločanje. Ni samostojno zdravljenje ali klinična raziskava.



Izpiranje nosu



Kortikosteroidi



Antibiotiki



Biološka zdravila



Kirurško zdravljenje



Izguba voha



Klinične raziskave



Pogosta vprašanja



Metode



Pilotna študija

2023–2026, Klinika za ORL in CFK, UKC Ljubljana



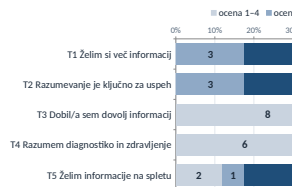
Vabilo

institucionalna baza bolnikov in koda QR na oglasni deski

Demografskih in kliničnih podatkov v pilotni fazi namenoma validiran.



Rezultati



Slika 1. Porazdelitev ocen po razredih; številke = število bolnikov (n = 17)

Zaključek

Slovenski bolniki s KRS želijo in pričakujejo več informacij o bolezni in zdravljenju. Vzel med potrebo in prejetim slovensko različico EPOS4Patients v tiskani in digitalni obliki kot podporo skupnemu odločanju.

[1] Fokkens WJ, et al. Rhinology. 2020;58(Suppl S29):1–464. [2] Hopkins C, et al. Clin Otolaryngol. 2006;31(5):390–8. [3] Gliklich RE, Metson R. Otolaryngol Head Neck Surg. 1995;113(1):104–9. [4] Bhattacharyya N. Am J Rhinol Allergy. 2009;23(4):392–5. [5] Hellings PW. Rhinology. 2010;16(1):1–10.

Rinosinuzitisom: pregled vodnika in rezultati ankete na

C Ljubljana

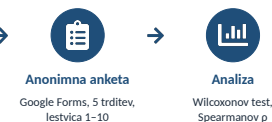
24 %

meni, da dobro razume diagnostiko in zdravljenje

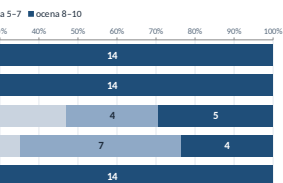
82 %

si želi informacij tudi na spletu ali pametnem telefonu

prejmejo in koliko si jih želijo, ter s tem 4Patients.

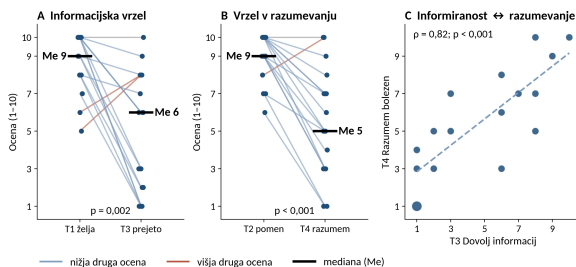


ismo zbirali (popolna anonimnost). Vprašalnik ni bil



17).

ni informacijami utemeljuje



Slika 2. Ocene posameznih bolnikov: vsaka črta povezuje oceni istega bolnika (A, B); povezanost informiranosti in razumevanja (C).

- Želja po informacijah (Me 9) je bila višja od ocene prejetih informacij (Me 6; $p = 0,002$) pri 14 od 17 bolnikov.
- Pomen razumevanja (Me 9) je presegal lastno razumevanje (Me 5; $p < 0,001$) pri 15 od 17 bolnikov.
- Več prejetih informacij je bilo povezano z boljším razumevanjem ($p = 0,82$; $p < 0,001$).
- Želja po več informacijah ni bila odvisna od že prejetih ($p = 0,02$) – potreba je splošna.

Omejitve: majhen vzorec, en center, nevalidiran vprašalnik, brez demografskih podatkov; digitalna anketa lahko preceni željo po digitalnih informacijah.



Vodnik EPOS4Patients
RhinoLOGY 2021; Suppl 30

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