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CASE STUDY

Translabyrinthine approach in acoustic neuroma surgery – case report

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ABSTRACT

Introduction. Acoustic neuroma is a benign tumor that arises from the glial Schwann sheath junction of the vestibulocochlear nerve. It has an incidence of 1:100000 population. Despite the fact that this is a rare tumor, it accounts for approximately 6% of all intracranial tumors and 80% of tumors localized in cerebellopontine angle. Treatment of acoustic neuroma is represented by "Wait and Scan" monitoring, radiologic and surgical treatment. The latter remains the primary treatment for acoustic neuroma and consists of 3 main approaches: retrosigmoid approach, middle cranial fossa approach and translabyrinthine approach. Until now, in our country, acoustic neuroma surgery was done only by retrosigmoid approach.

Case presentation. The first translabirinthine surgery for acoustic neuroma in our country was done on 09.12.2021 on a 60-year-old patient who, during preparation for cochlear implant surgery, was accidentally diagnosed with 3rd grade right acoustic neuroma, according to Koos classification. Patient had cophosis on the right ear and moderate hearing loss in the left ear. During the surgery, a gross total resection of the tumor was accomplished. The patient was discharged from the medical institution on 20.12.2021 in a satisfactory condition. Magnetic resonance imaging performed 3 months and 1 year after the surgery showed no complications or tumor remnants.

Conclusion. The current report, which describes an accidental diagnosis of acoustic neuroma during preparation for a cochlear implantation surgery, resulted in acoustic neuroma surgery through the translabyrinthine approach. This serves as an eloquent example of why it is necessary to perform initially a magnetic resonance examination in cases of sensorineural hearing loss or tinnitus. The translabyrinthine approach in acoustic neuroma surgery allows for the removal of tumors of any size without affecting the brain, especially the cerebellum. In our case, where the patient had cophosis on the side of the tumor, this was the most appropriate surgical approach.

Keywords: acoustic neuroma, translabyrinthine approach, retrosigmoid approach, magnetic resonance imaging, hearing loss.

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Key messages

What is not yet known on the issue addressed in the submitted manuscript

Acoustic neuroma is a rare brain tumor that, up to now, can only be diagnosed through magnetic resonance imaging. This article emphasizes the importance of magnetic resonance imaging in diagnosing acoustic tumors and the necessity performing it in all patients with sensorineural hearing loss.

The research hypothesis

In our case, the patient, who was prepared for cochlear implant surgery due to total hearing loss on one side, was accidentally diagnosed with an acoustic tumor during a magnetic resonance examination, and as a result underwent acoustic neuroma surgery.

The novelty added by manuscript to the already published scientific literature

The current paper describes the first translabyrinthine surgery of acoustic neuroma performed in the Republic of Moldova. Additionally, along with other studies, this paper confirms that it is essential to perform a brain magnetic resonance in patients with sensorineural hearing loss in order to diagnose or to exclude acoustic tumors.

Introduction

Acoustic neuroma (AN) which is also known as vestibular schwannoma is a benign tumor that originates from the Glial Schwann sheath junction of the VIII pair of cranial nerves and arises more frequently from the inferior vestibular nerve [1]. Although AN is a rare disorder and has an incidence of only 1.09 per 100,000 population, it represents 5-6% of all intracranial tumors and 80% of tumors found in cerebellopontine angle (CPA) [2, 3]. AN is a well-known pathology, with over 10,000 articles published in the Pubmed database and more than 2,000 articles in the last 5 years. The high interest is due to the not very elucidated evolution of AN. According to various articles, AN may remain stable, shrink in size or grow rapidly resulting in a poor outcome [4, 5]. The diagnosis of AN is made by the help of various tests: audiometry, vestibulometry, auditory evoked potentials, vestibular evoked myogenic potentials, but the gold standard in the diagnosis of this tumor is the magnetic resonance imaging (MRI) with gadolinium [6-8]. Nowadays, considering the evolution aspects of AN and the tumor size diagnosed by MRI examination, there are various treatment possibilities such as "Wait and Scan" monitoring, radiological and surgical treatment. The latter remains the gold standard in the treatment of acoustic neuroma and is done through 3 main approaches: retrosigmoid approach (RS), translabyrinthine approach (TL) and middle fosa approach. The surgical treatment of AN started with the first successful removal of this tumor by Thomas Annandale on May 3, 1895. The RS approach was further developed and extensively practiced by Harvey William Cushing who was a pioneer of neurosurgery and is considered the "father of the modern neurosurgery". He performed his first AN surgery on 12th of January 1906. The TL surgery of AN was developed by William Fouts House, who started to operate this type of tumor through TL approach on 2nd of June 1962. He is also considered to be the "father of neurootology" [9, 10]. In our country, AN surgery was done only through RS approach. A retrospective study on AN, starting from 2010 to 2019 in our country, revealed that 65 patients with histologically confirmed AN were operated in 2 high level neurosurgery departments. According to this study, most of the tumors operated on were large or giant in size, a fact that led to many postoperative complications. The late diagnosis of AN in these cases revealed a series of problems such as: insufficient study of this pathology and inadequate or insufficient use of imaging methods, especially MRI [11].

Case presentation

The 60-year-old patient was hospitalized in the ENT department of *Timofei Moșneaga* Clinical Republican Hospital with the diagnosis of bilateral sensorineural hearing loss for cochlear implantation surgery on the right ear (Fig. 1).

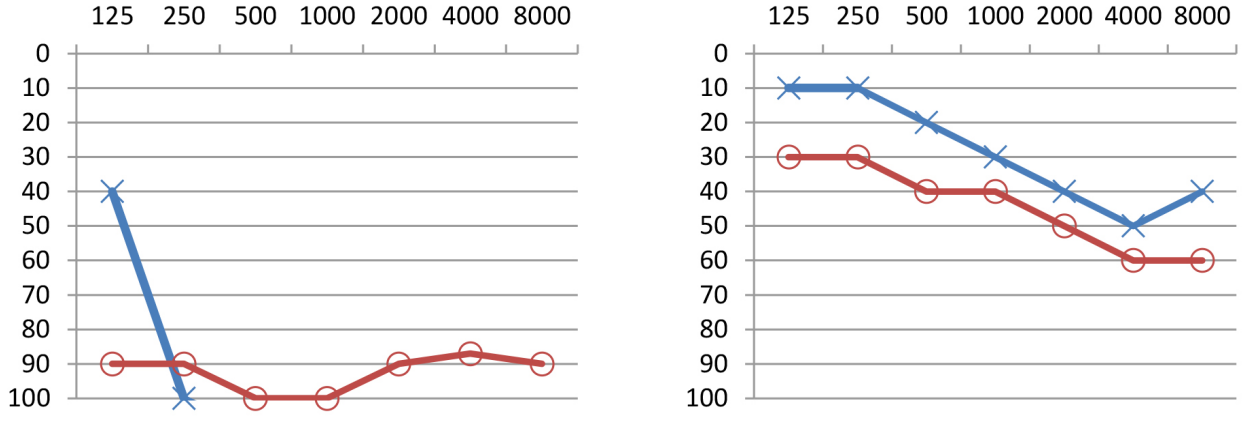


Fig. 1 Audiometry result – cophosis on the right ear and moderate sensorineural hearing loss on the left ear.

The bilateral hearing loss has been present for more than 10 years, but since 2018 a progressive hearing loss developed in the right ear. Beside the hearing loss, other symptoms were present, such as: permanent high frequency tinnitus on the right ear, which increased with tiredness; periodical vertigo; permanent moderate headache, that was influenced by emotional, physical or atmospheric pressure; unsteadiness and disturbed coordination, especially when walking in the dark. In order to perform the planned surgery (cochlear implantation surgery), patient underwent a brain MRI examination that revealed a 3rd grade CPA tumor on the right side (Fig. 2).

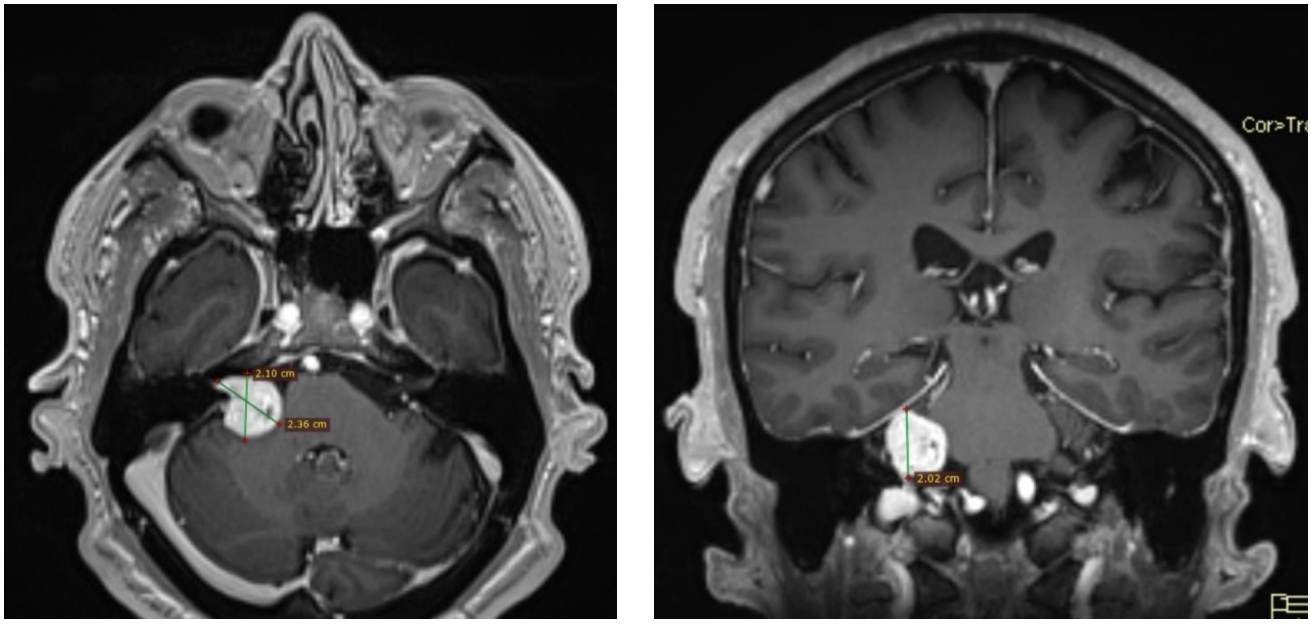
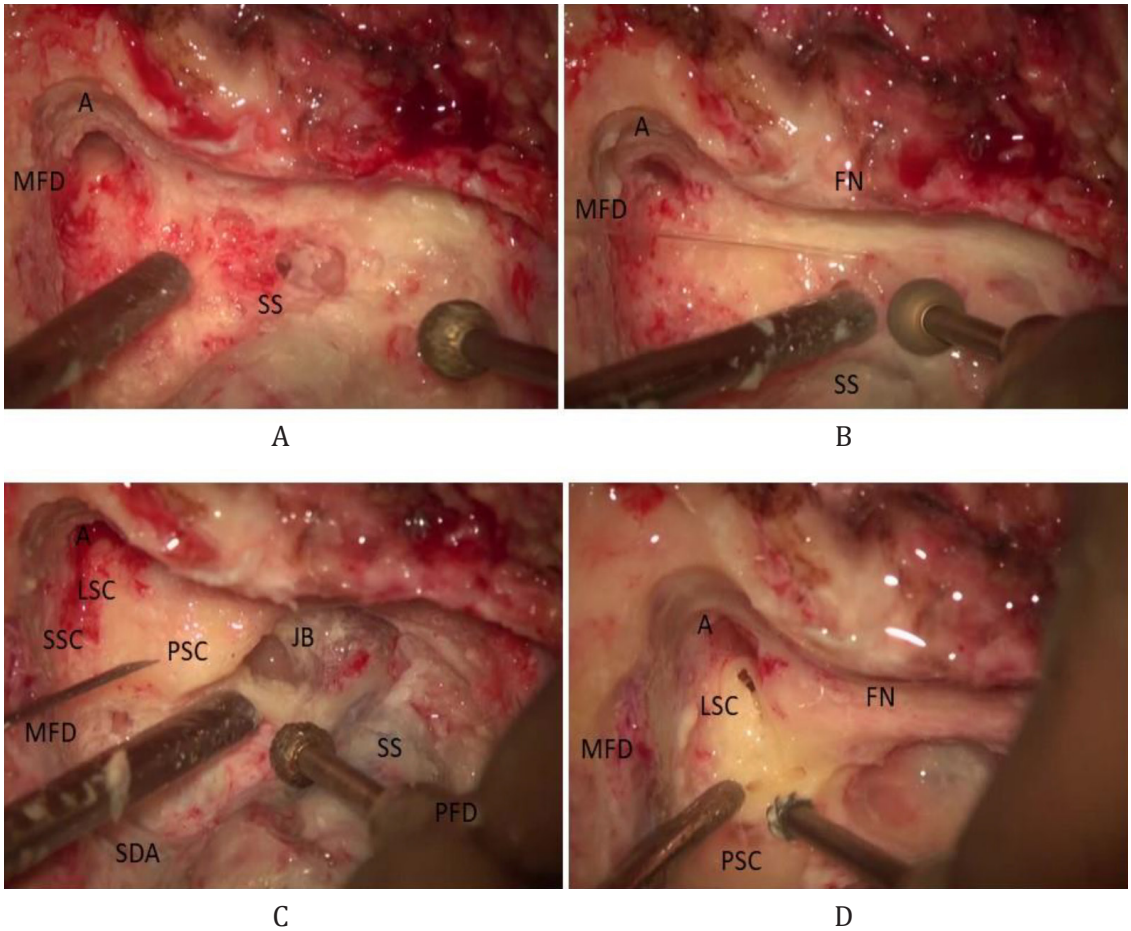


Fig. 2 Brain MRI shows an internal auditory canal and a CPA tumor on the right side.

According to the obtained results, the diagnosis of a 3rd grade right AN (by Koos classification) was established.

Afterwards, the patient was consulted by a neurosurgeon and a decision has been taken to switch from cochlear implantation surgery to vestibular schwannoma surgery through a TL approach. The surgery was performed at the *Diomid Gherman* Institute of Neurology and Neurosurgery by a team of surgeons from the above-mentioned institute, *A.I. Kolomiychenko* Institute of Otolaryngology from Kiev, Ukraine and colleagues from the *Nicolae Testemițanu* State



A B C D

Fig. 3 Microscopic imaging of the mastoidectomy:

A – opening of the antrum (A), sigmoid sinus (SS) and middle fossa dura (MFD); B – determination of the facial nerve (FN) along the mastoid segment; C – determination of the semicircular canals: lateral (LSC), posterior (PSC), superior (SSC) and determination of the jugular bulb (JB); D - opening of the lateral and posterior semicircular canals.

University of Medicine and Pharmacy and *Timofei Moşneaga* Republican Clinical Hospital.

Intraoperatively, a large mastoidectomy was performed, with opening of the middle and posterior fossa dura. The facial nerve was identified along the mastoid segment, the sigmoid sinus was uncovered down to the jugular bulb, and all three semicircular canals were determined. Subsequently, a labyrinthectomy was performed by drilling the lateral, superior and posterior semicircular canals (Fig. 3).

The internal auditory canal (IAC) was visualized and delimited from the lateral, superior, and inferior side. An incision of the dura mater was performed at the level of IAC and CPA and a total resection of the tumor was accomplished. The dura was sutured and the incus was removed. Subsequently, the middle ear has been obliterated with temporalis muscle fragments and the postoperative defect was packed with pieces of abdominal fat (Fig. 4).

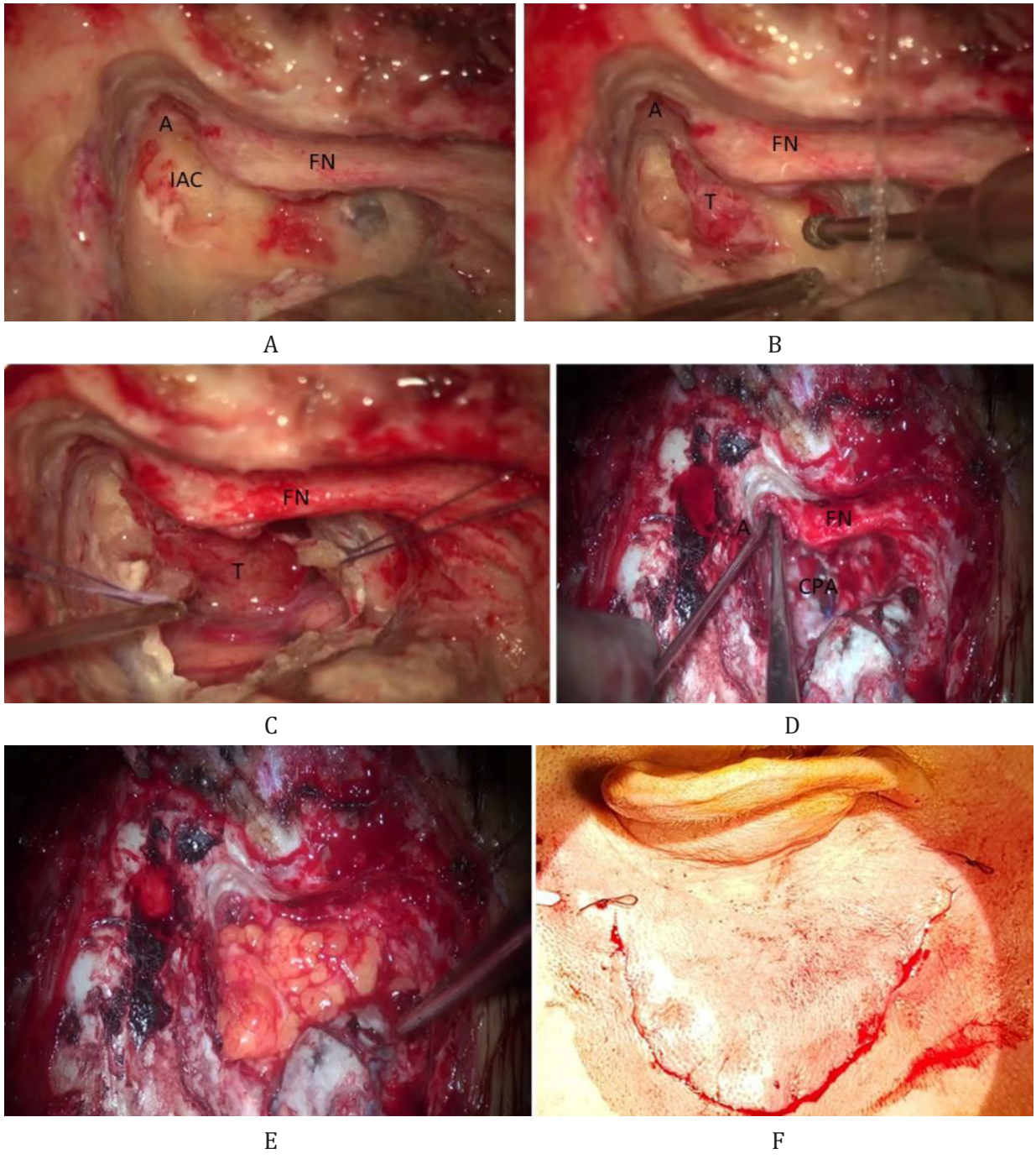
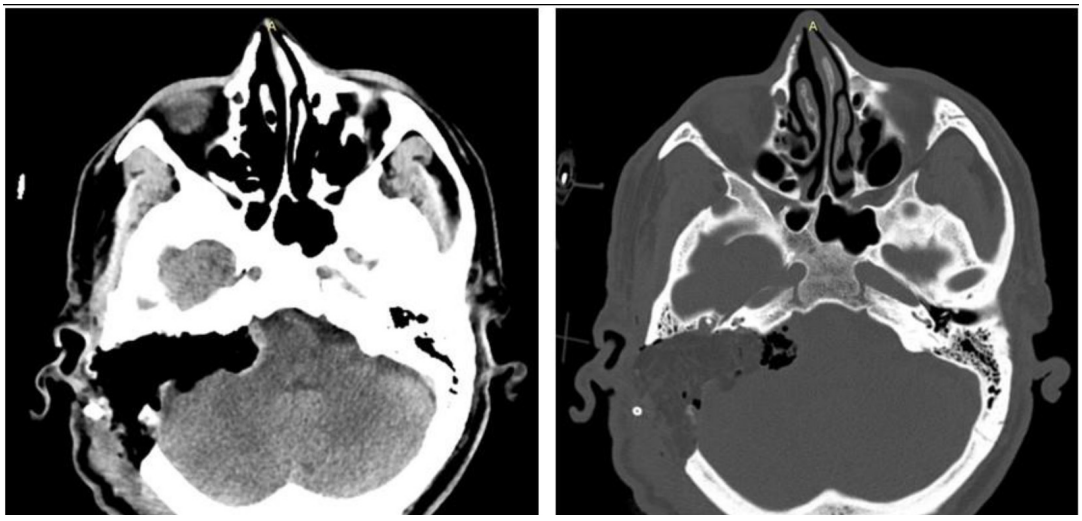


Fig. 4 Microscopic imaging of tumor resection

A – internal auditory canal (IAC); B – tumor (T) at the level of IAC; C – Tumor (T) at the level of cerebellopontine angle (CPA); D – CPA after complete removal of the tumor and obliteration of the middle ear with temporalis muscle fragments; E – packing of the postoperative defect with abdominal fat; F – aspect of intraoperative sutured incision.

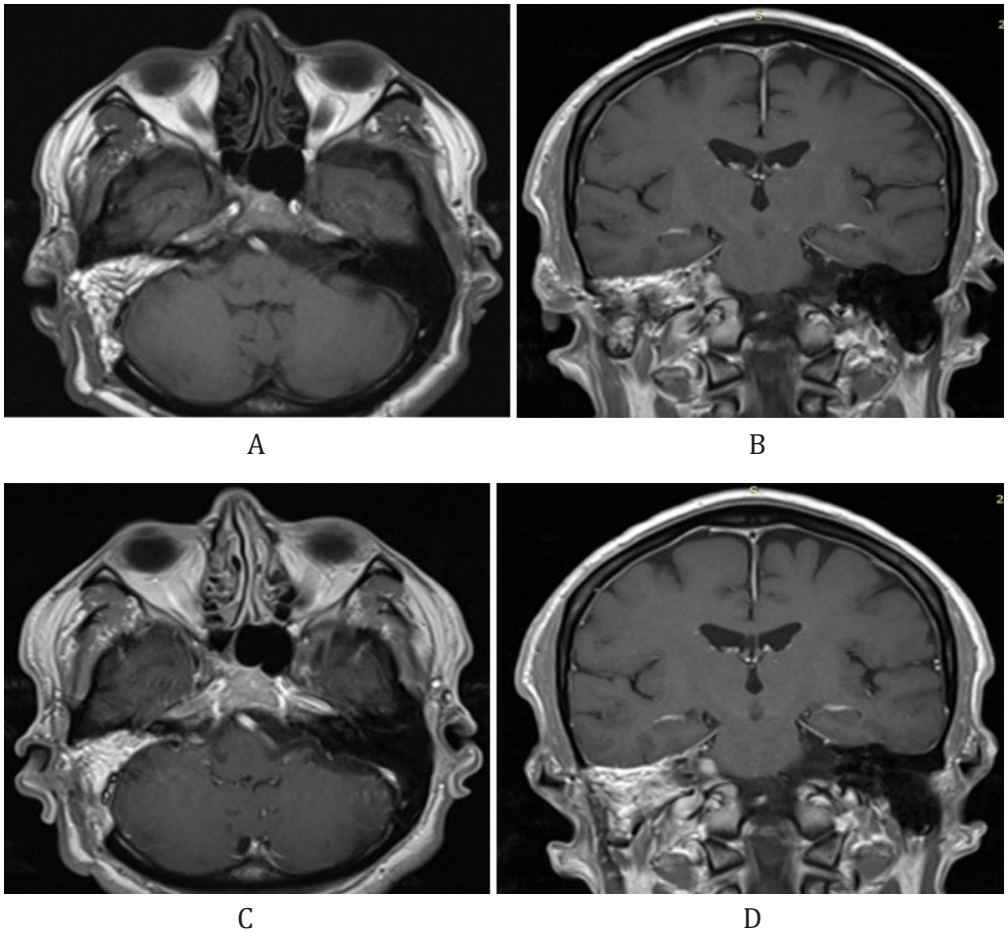


A B

Fig. 5 Postoperative computed tomography images show: A – postoperative defect; B – obliteration of the defect with fat tissue.

The surgery was performed under the permanent control of the facial nerve function with the help of intraoperative neuro-monitoring. The postoperative patient's condition was favorable without any signs of facial nerve paralysis. Postoperatively, on the second day, patient underwent a brain computed tomography that showed the volume of the performed intervention which did not reveal any complications (Fig. 5).

The patient was discharged from medical institution on 20.12.2021 in a satisfactory condition. A brain MRI with contrast was performed 3 months and one year postoperatively, both of them did not reveal any complications or signs of tumor recurrence (Fig. 6).



A B

C D

Fig. 6 MRI imaging with visualization: CPA 3 months postoperatively A – axial plane; B – coronal plane; CPA 1 year postoperatively C – axial plane; D – coronal plane.

Discussion

The role of MRI is essential in the diagnosis of AN and it is the gold standard in diagnosing this type of tumor. According to a systematic review made by Fortnum *et al.*, the incidence of AN has increased over the last 30 years due to of the widespread of MRI. This is why Celis-Aguilar *et al.* concluded that an MRI is strictly necessary in cases of unilateral sensorineural hearing loss [12]. Also, according to the protocol of the European Academy of Otology and Neuro-otology, sensorineural hearing loss of more than 20 decibels in two near frequencies or 15 decibels in frequencies between 2000 – 8000 Hz or unilateral tinnitus serve as recommendations for an MRI examination [13]. The current case revealed an acoustic tumor accidentally found on a MRI examination that was performed during preparation for a cochlear implant, in a patient who mainly complained for bilateral hearing loss and tinnitus for more than 2 years. Nowadays, the most used approaches in AN surgery remain to be the RS and TL approach. The RS approach is mainly used by neurosurgeons, has the advantage of removing CPA tumors of different dimensions, while preserving hearing. The TL approach is performed by a team an otologist and a neurosurgeon, allows for the removal of tumors of any dimension without the need for cerebellar retraction and permits identifying the facial nerve in all its segments. However, because it sacrifices hearing, it is preferably used in patients with profound or total hearing loss [14]. Many studies discuss the comparative results of both approaches and according to Cole *et al.,* the TL approach decreases the risk of facial nerve injury in comparison to RS approach [15]. Also, Pogoda *et al.*, after performing a systematic review about postoperative headache, concluded that it is more frequent in RS approach than in TL approach [16]. Obaid *et al.* concluded that both approaches have almost similar results in AN surgery, but the TL approach is associated with a less complication rate, making it preferable for patients with profound hearing loss [17]. Despite these findings, Tonn *et al.* and de Boer *et al.* stated that both RS and TL approach remain safe and efficient in AN surgery [18-19]. In addition, according to a systematic review performed by Hadjipanayis *et al.*, there is no clear superiority of one approach over the other [20].

In our case, we performed an AN surgery through TL approach because of the cophosis on the affected side and total removal of the tumor was accomplished without any postoperative complications.

Conclusion

The current report, which described an accidental diagnosis of AN, during preparation for a cochlear implantation surgery, resulted in an AN surgery through the TL approach and it serves as an eloquent example of why, in cases of sensorineural hearing loss or tinnitus, it is necessary to perform initially an MRI examination. TL approach in acoustic neuroma surgery allows removal of any size tumors without affecting the brain, especially the cerebellum. In our case, the patient had cophosis on the side of tumor, and it was the most appropriate surgical approach.

Competing interests

None declared.

Authors' contributions

Concept and design of study, acquisition of data, interpretation of data, revising the manuscript critically for important intellectual content – MB, SV, OB, GZ, VM. All authors have read and approved the final version of the manuscript.

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Patient consent

Obtained.

Ethics approval

Not needed for this study.

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