Pristop do vrha petrozne kosti pod polžem: prikaz dveh primerov

Infracochlear approach to the petrous apex: a report of two cases

Avtor / Author

Janez Rebol[1, 2], Vojin Milojković[3], Goran Cvetić[1]

Ustanova / Institute

[1]Univerzitetni klinični center Maribor, Oddelek za otorinolaringologijo in maksilofacialno kirurgijo, Maribor, Slovenija; [2]Univerza v Mariboru, Medicinska fakulteta, Maribor; [3]Univerzitetni klinični center Maribor, Oddelek za nevrokirurgijo, Maribor, Slovenija

Medical Centre

[1]University Medical Centre Maribor, Department of Otorhinolaryngology and Maxillofacial Surgery, Maribor, Slovenia; [2]University of Maribor, Faculty of Medicine, Maribor; [3]University Medical Centre Maribor, Department of Neurosurgery, Maribor, Slovenia

Ključne besede:
infrakohlearni pristop, petrozni apeks, holesterinski granulom

Key words:
infracochlear approach, petrous apex, cholesterol granuloma

Članek prispel / Received
25. 9. 2017
Članek sprejet / Accepted
15. 3. 2017

Naslov za dopisovanje / Correspondence
Janez Rebol, dr. med.
UKC Maribor, Oddelek za otorinolaringologijo in maksilofacialno kirurgijo
Ljubljanska ulica 5, 2000 Maribor
Telefon +386 23211303
E–pošta: janez.rebol@ukc–mb.si

Izvleček

Namen: *Namen prispevka je predstaviti infrakohlearni pristop k petroznemu apeksu temporalne kosti.*
Poročilo o primeru: *Infrakohlearni pristop smo izvedli pri bolniku s holesterinskim granulomom in bolnici s plazmocitomom. Dostopali smo skozi zunanji sluhovod, dvignili timpanomeatalni reženj in zvrtali trikotno/pravokotno okno, ki je omejeno z notranjo karotidno arterijo, jugularno veno in okroglim oknom polža, vse do petroznega apeksa.*
Zaključek: *Infrakohlearni pristop k petroznemu apeksu je varna operacija, ki omogoča ohranitev struktur zunanjega sluhovoda in srednjega ušesa. Je najbolj direktna in najmanj invazivna operacija za pristop k petroznemu apeksu. Opisan pristop je primeren tako za drenažo kot*

Abstract

Purpose: *Presentation of the infracochlear approach to the petrous apex of the temporal bone, based on two clinical cases.*
Case report: *Infracochlear approach to the petrous apex of the temporal bone was performed on two patients with cholesterol granuloma and plasmocytoma. The procedure was performed through the external auditory meatus, the tympanomeatal flap was raised, and the triangular/rectangular window bounded by the internal carotid artery, jugular vein, and round window of the cochlea was drilled out to the petrous apex.*
Conclusion: *Infracochlear approach to petrous apex is a safe operating procedure that preserves the normal external auditory canal and middle ear conductive mechanism. It is the most*

za biopsijo procesa v petroznem apeksu temporalne kosti.

direct and least invasive of all procedures to reach the petrous apex, and it is suitable for both drainage procedures and biopsy of lesions in the petrous apex of the temporal bone.

CASE REPORT

Cholesterol granuloma

A 34–year old male first presented with diplopia and aural fullness. The workup consisted of ophthalmologic examination and head CT, which yielded unremarkable results, and head MRI, which confirmed a tumor in the petrous apex of the right temporal bone, with signs of bone erosion. The lesion was 3 × 2 × 3 cm in size. A pure tone audiogram showed normal hearing status. In preoperative evaluation, a diagnosis of cholesterol granuloma was made.

The cholesterol granuloma was evacuated through open access surgery with an approach through the zygomatic arch and disarticulating temporomandibular joint. After more than one year, the patient began to experience facial spasms. Follow–up MRI and CT examinations were performed and showed recurrence of a destructive process in the petrous apex of the right temporal bone pyramid (Fig. 1).

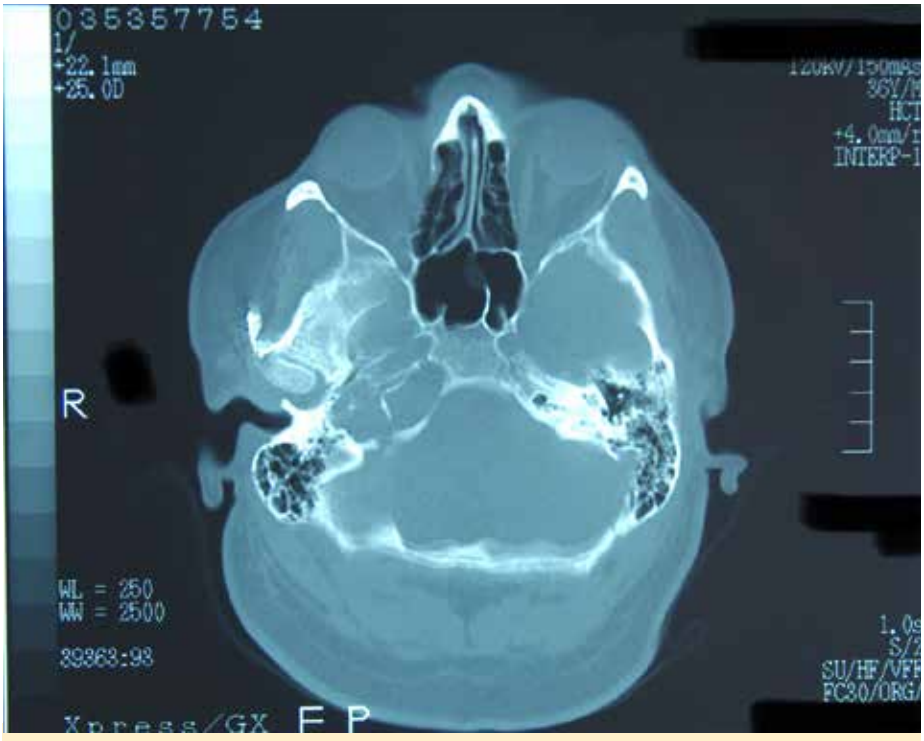

Figure 1. *CT scan showing recurrence of the destructive process in the petrous apex of the right temporal bone.*

For the revision operation, we decided to use an infracochlear approach to reach the petrous apex cholesterol granuloma. The approach was made through a post–auricular incision. A tympanomeatal flap was elevated from the 2–o'clock position to the 10–o'clock position. The external auditory canal was enlarged anteriorly and inferiorly to expose the hypotympanum. The chorda tympani nerve was followed inferiorly, posterior to lateral, to define the extent of posterior dissection possible without injuring the facial nerve. The bony triangular window between the jugular bulb and carotid artery was drilled away in an anterior–medial direction, using the carotid artery as the anterior limit, the round window as the superior limit, and the jugular bulb as the posterior limit. If the plane of dissection is below the round window, the internal auditory canal structures will not be at risk (Fig. 2, 3). The cholesterol granuloma cavity was then incised and drained. We placed a drainage catheter approximately 2.5 mm wide and 3 cm long in the opening of the cavity. The other end of the catheter was placed in the Eustachian tube. The position of the drainage catheter was con-

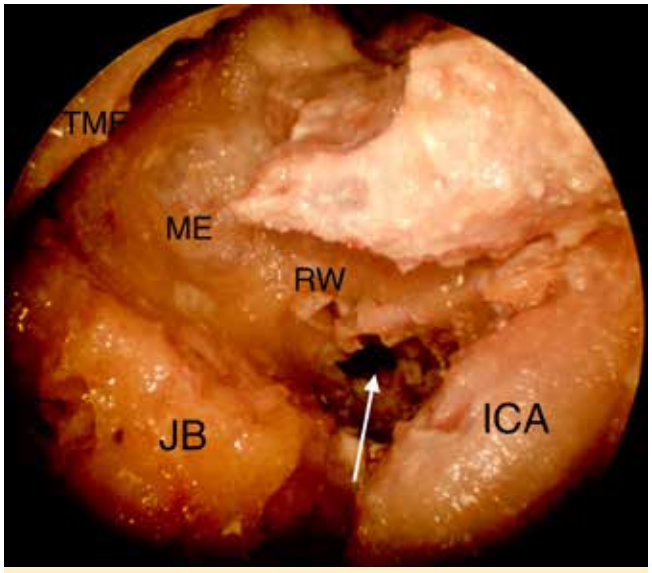

Figure 2. *Infracochlear approach in cadaveric dissection. Opening to the petrous apex (arrow); ICA, internal carotid artery; ME, middle ear; TMF, tympanomeatal flap; JB, bone covering jugular bulb; RW, round window.*

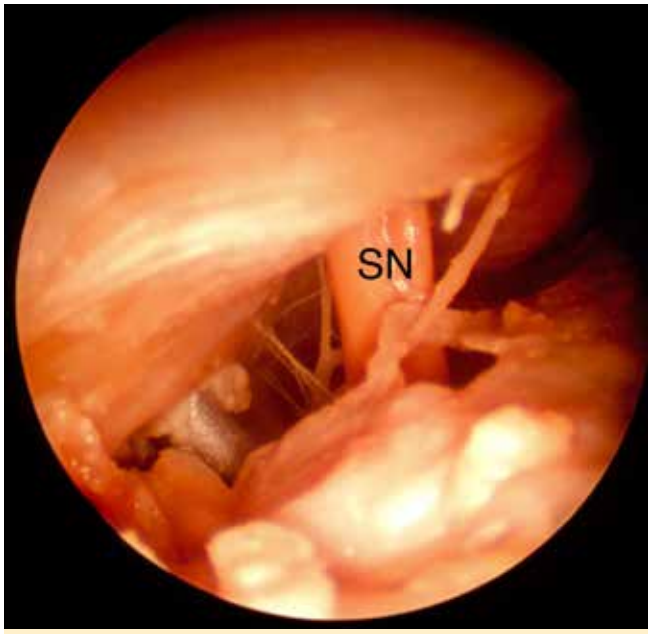

Figure 3. *Instrument entering the petrous apex from the cranial side. SN, statoacoustic nerve.*

trolled via CT scan (Fig. 4).

We checked CT scans yearly. The post–surgery status was observed radiologically in the apex of the right pyramid and indicated no fluid collection. During 5 years after the second surgery, the patient began experiencing tinnitus, and hearing in his right ear gradually worsened. At 5 years after the second surgery, the patient experienced sudden complete hearing loss on the operated side.

At 10 years after the second surgery, MRI showed re-accumulation of fluid in the petrous apex of the right temporal bone. The patient was advised to undergo a revision procedure through the same approach to check the patency of the drain, which he refused.

Plasmacytoma

The patient was a 54–year–old female who had been treated for plasmacytoma for 8 years before being examined by our department. At the time of presentation, the disease was in remission stage. In April 2004, she noticed diplopia, and soon afterward she experienced severe headache. She underwent a CT scan and MRI of the head, which showed a bone eroding tumor in the petrous apex of the right temporal bone (Fig. 5). To decide how to further treat the patient, the oncologist requested a biopsy of the neoplasm

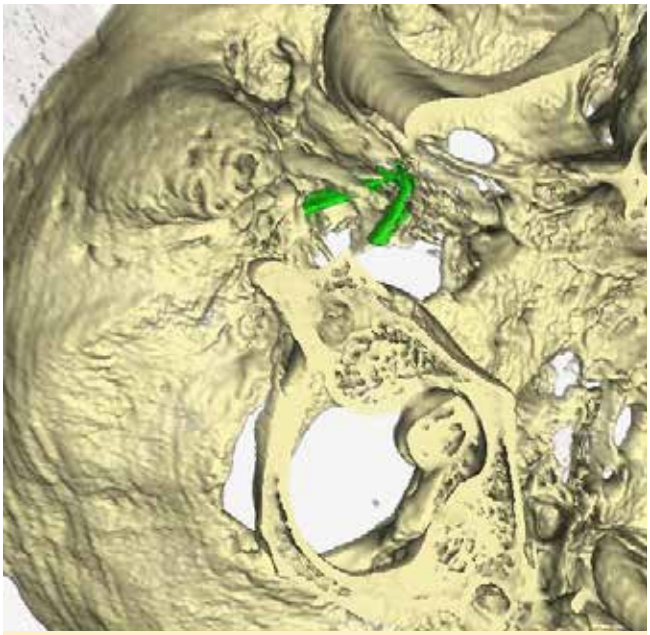

Figure 4. *3D CT scan reconstruction of the right skull base showing the position of the drainage catheter (green) connecting the granuloma cavity with the Eustachian tube.*

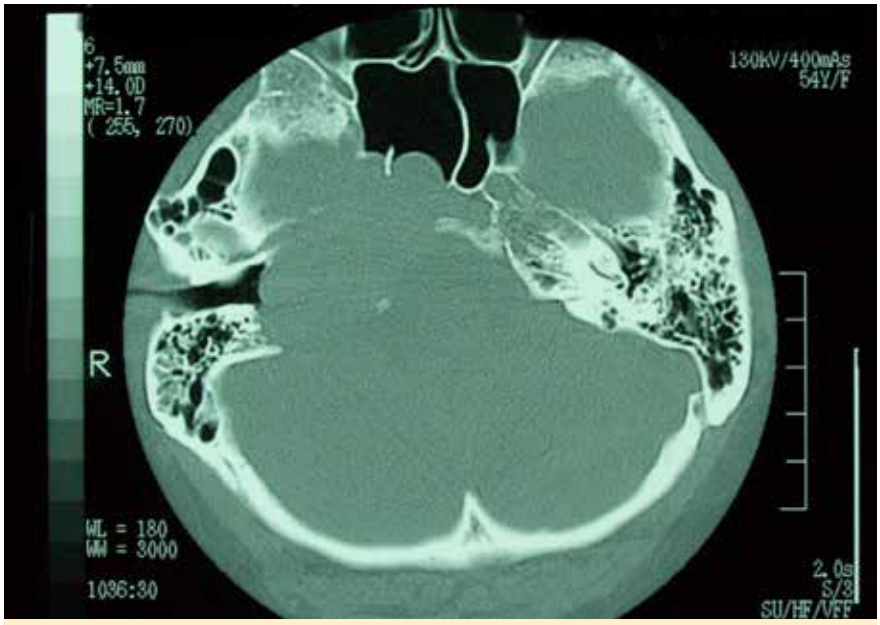

Figure 5. *CT scan of the patient with plasmocytoma in the petrous apex of the right temporal bone.*

Figure 6. *Intraoperative CT scan in a patient with cholesterol granuloma before the final opening of the granuloma cavity. Note the distance from the meatus of the external ear canal, which is approximately 31 mm.*

in the right petrous apex. Before surgery, a pure tone audiogram had been performed and showed moderate combined hearing loss in the right ear and mild sensorineural hearing loss in the left ear. A neurological exam showed no neurological deficits; furthermore, the patient no longer experienced diplopia and headaches.

The procedure itself histologically demonstrated the presence of plasmacytoma in the right petrous apex, and the patient started chemotherapy.

DISCUSSION

The petrous apex is reachable through a number of different routes. It can be reached through the middle fossa, through a translabyrinthine approach, or along lines of developed air cell tracts, as in the infracochlear approach, which is a combination of the transcanal approach for small glomus tumors of the hypotympanum described by Farrior and the subcochlear/infracochlear approaches described by Ghorayeb and Jahrsdoerfer and Giddings et al., respectively (1,2,3). Other neurosurgical approaches include the infratemporal approach, petro–occipital-transigmoid approach, pre–sigmoid–retrolabyrinthine approach, and retrosigmoid approach.

Infracochlear approach fenestra between the jugular bulb, carotid artery, and cochlea have been measured in several studies (2, 4, 5, 6). The size has been found to vary

from 4.7 × 3.2 mm to 10.1 × 7.6 mm. In all of these studies, this approach has been feasible, even in cases with a high jugular bulb, for which the competitive infralabyrinthine approach was deemed not possible or unsafe.

The drawback of this approach for cholesterol granuloma is a somewhat high recurrence rate; nevertheless, recurrence has not occurred in all reports (7, 8, 9). The reported recurrence rates range from 0% to 46%. In most cases requiring revision surgery, no stents had initially been used for drainage. However, stent placement does not necessarily guarantee that the drainage pathway will remain patent, but it can lower the recurrence rate significantly. Cases in which stents are placed for drainage have a recurrence rate ranging from 0% to 18%. In cases of recurrence, an exploratory tympanotomy can effectively allow for re–drainage, at which point the tubes can be checked for patency and/or replaced.

The infracochlear approach to the petrous apex is useful for preserving hearing. However, the cholesterol granuloma patient experienced complete anacusis on the operated side 5 years after surgery. The true cause of anacusis remains unknown because the patient refused the re–drainage procedure. Most probably, the cause was enlargement of the cyst due to stent occlusion by fibrous tissue or disturbed CN VIII blood flow. Potential intraoperative damage to the cochlea is always a possible cause of hearing loss; however, such damage was probably not the case with our patient, because he did not experience hearing loss immediately after surgery.

The use of image–guided surgery is useful for avoiding intraoperative damage to adjacent neurovascular structures (10, 11). Imaging can also be used intra–operatively, as in our case of cholesterol granuloma, in which we used a CT–scan to confirm the right direction (Fig. 6).

REFERENCES

1. Farrior JB. Anterior hypotympanic approach for glomus tumor of the infratemporal fossa. The Laryngoscope 1984;94:1016-20.
2. Ghorayeb BY, Jahrsdoerfer RA; Subcochlear approach for cholesterol granulomas of the inferior petrous apex. Otolaryngol Head Neck Surg 1990;103:60-5.
3. Giddings NA, Brackmann DE, Kwartler JA. Transcanal infracochlear approach to the petrous apex. Otolaryngol Head Neck Surg 1991;104:29-36.
4. Haberkamp TJ. Surgical anatomy of the transtemporal approaches to the petrous apex. Am J Otol 1997;18:501-6.
5. Gerek M, Satar B, Yazar F, Ozan H, Özkaptan Y. Transcanal Anterior Approach for Cystic Lesions of the Petrous Apex. Otology & Neurotology 2004;25:973-6.
6. Leung R, Leach JL, Murugappan S, Stredney D, Wiet G. Radiographic anatomy of the infracochlear approach to the petrous apex for computer-assisted surgery. Otology & Neurotology 2010;31(3):419-23.
7. Brackmann DE, Toh EH. Surgical Management of Petrous Apex Cholesterol Granulomas. Otology & Neurotology 2002;23:529-33.
8. Mosnier I, Cyna-Gorse F, Grayeli AB, Fraysse B, Martin C, Robier A et al. Management of Cholesterol Granulomas of the Petrous Apex Based on Clinical and Radiologic Evaluation. Otology & Neurotology 2002;23:522-28.
9. Hoa M, House J, Linthicum FH Jr. Petrous apex cholesterol granuloma: Maintenance of drainage pathway, the histopathology of surgical management and histopathologic evidence for the exposed marrow theory. Otology & Neurotology

2012; 24:96-106.
10. Pietrantonio A, D'Adrea G, Famà I, Volpini L, Raco A, Barbara M. Usefulness of Image Guidance in the Surgical Treatment of Petrous Apex Cholesterol Granuloma. Case reports in Otolaryngology 2013; http://dx.doi.org/10.1155/2013/257263
11. Caversaccio M, Panosetti E, Ziglinas P, Lukes A, Häusler R. Cholesterol Granuloma of the petrous apex: benefit of computer-aided surgery. Eur Arch Otorhinolaryngol 2009;266:47-50.