ScientificScholar®
Knowledge is power
Publisher of Scientific Journals

www.surgicalneurologyint.com

Surgical Neurology International

Editor-in-Chief: Nancy E. Epstein, MD, Clinical Professor of Neurological Surgery, School of Medicine, State U. of NY at Stony Brook.

SNI: Skull Base

Editor
Mitsutoshi Nakada, MD
Kanazawa University, Ishikawa, Japan

SNI
Open Access

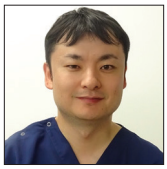
Case Report

Unexpected recovery from complete deafness to normal hearing post surgical excision of a cerebellopontine angle meningioma: A case report

Campbell Chukwuebuka Francis[1], Kohei Kanaya[2], Hiromu Murase[2], Ridzky Firmansyah Hardian[2], Tetsuyoshi Horiuchi[2], Samuel Chukwunonyerem Ohaegbulam[1]

[1]Department of Neurosurgery, Memfys Hospital for Neurosurgery, Enugu, Nigeria, [2]Department of Neurosurgery, Shinshu University School of Medicine, Matsumoto, Japan.

E-mail: Campbell Chukwuebuka Francis - drcampbellfrancis4@yahoo.com; *Kohei Kanaya - kanaya@shinshu-u.ac.jp; Hiromu Murase - pta218526@gmail.com; Ridzky Firmansyah Hardian - ridzky@shinshu-u.ac.jp; Tetsuyoshi Horiuchi - tetuyosi@shinshu-u.ac.jp; Samuel Chukwunonyerem Ohaegbulam - samcohaegbulam@hotmail.com



***Corresponding author:**
Kohei Kanaya,
Department of Neurosurgery,
Shinshu University School of Medicine, Matsumoto, Japan.

kanaya@shinshu-u.ac.jp

Received : 29 March 2023
Accepted : 03 May 2023
Published : 19 May 2023

DOI
10.25259/SNI_276_2023

Quick Response Code:

ABSTRACT

Background: Cerebellopontine angle (CPA) meningioma presents a significant management challenge due to its intricate relationship with the brainstem neurovascular bundles. The emphasis in the past has been on facial nerve preservation, but the current management standard is hearing preservation in patients with serviceable hearing; however, hearing restoration after complete loss is rare. We report an elderly man who had restoration of hearing in the right ear after complete loss following tumor resection through the retrosigmoid route.

Case Description: A 73-year-old male patient presented with progressive hearing impairment in the right ear, culminating in hearing loss for about 2 months (the American Academy of Otolaryngology-Head and Neck Surgery [AAO-HNS] class D). He also had mild cerebellar symptoms, but other cranial nerves and long tracts were normal. Brain magnetic resonance imaging confirmed a right CPA meningioma, and he had tumor resection through the retrosigmoid route using meticulous microsurgical technique with vestibulocochlear nerve preservation, facial nerve monitoring, and intraoperative video angiography. He had restoration of hearing on follow-up (the American Academy of Otolaryngology-Head and Neck Surgery class A). Histology confirmed World Health Organization central nervous system grade 1 meningioma.

Conclusion: This case illustrates that hearing restoration is possible after complete loss in patients with CPA meningioma. We advocate hearing preservation surgery even in patients with non-serviceable hearing, as the chance of hearing recovery is possible.

Keywords: Cerebellopontine angle meningioma, Hearing preservation, Hearing restoration, Retrosigmoid approach

INTRODUCTION

Meningioma is the second most common tumor in the cerebellopontine angle (CPA), accounting for 10–15% of mass lesions.[1,2] They usually have complicated, intimate relationships with the middle and lower brainstem neurovascular complexes, and may extend upward to the middle fossa or cause brainstem compression with attendant neurological sequelae.[4,13]

The emphasis in the past has been tumor excision and facial nerve preservation; however, with improvement in microneurosurgery and neurophysiological monitoring, hearing preservation is achievable.[3,7,9,10] The premorbid hearing status, the tumor size, and consistency, associated neurovascular invasion and surgical technique are factors to be considered in attempting hearing preservation in CPA tumors. Reports in the literature have shown differing results in hearing preservation, with some even offering hearing apparatus destructive approaches in patients with non-serviceable hearing;[7,10,11,13] nevertheless, reports of hearing improvement after a complete loss are rare.[5,6]

We report a case of an elderly man who had loss of hearing (the American Academy of Otolaryngology-Head and Neck Surgery [AAO-HNS] class D) in the right ear caused by CPA meningioma and had hearing restoration to normal after tumor excision through the retrosigmoid approach. The current emphasis on managing CPA tumors should attempt hearing preservation in patients with CPA meningioma despite the preoperative hearing status.

CASE PRESENTATION

We report a 73-year-old man who presented to our outpatient department with a 3-year history of painless but progressive hearing impairment in the right ear, culminating in hearing loss about 2 months before the presentation. There were associated dizziness and mild gait disturbances. He has well-controlled diabetes and hypertension and is a gastric cancer survivor with no feature of recurrence for more than 20 years.

Brain magnetic resonance imaging (MRI) showed a right-sided CPA meningioma measuring 26 × 15 × 30 mm filling the cistern and significant cerebellar peduncular compression [Figures 1a-c]. Computed tomography (CT) scan showed no calcification and normal-sized and symmetrical internal acoustic meatus [Figures 1d and e].

Significant examination findings were a conscious man with intact higher cerebral function (Mini-mental state examination 30). He had sensorineural hearing loss in the right ear, pure-tone audiometry (PTA) was 90 decibels (dB), and the speech discrimination test was 0 (AAO-HNS class D) [Figure 1f]. Other cranial nerves, including the trigeminal and facial nerves, were intact. Long tract signs and cerebellar function were preserved except for positive Bruns nystagmus and mild derangement in tandem walk.

The routine workup was done, and he had a right retrosigmoid craniotomy in the supine-lateral position. Facial nerve monitoring was done using motor-evoked potential and electromyography; however, auditory brainstem response was not performed due to the profound hearing loss. The tumor was firm and occupied the right CPA cistern with attachment to the dura anterior to the internal acoustic meatus and adjacent parts of the petrous bone and extending posteriorly. It displaced the facial-vestibulocochlear nerve complex superolateral and the lower cranial nerves inferiorly. About 95% of tumor resection was achieved with an operating microscope and cavitron ultrasonic aspirator; however, a minute segment of the lesion that was morbidly adherent to the right facial and vestibulocochlear nerves was left *in situ*. Internal acoustic meatus was not drilled because the tumor did not invade it. Intraoperative video indocyanine green fluorescent angiography and micro-Doppler ultrasound were used to confirm the patency of regional vessels during tumor resection and before wound closure. Hemostasis was secured, and the wound was closed without drainage.

Postoperative recovery was uneventful, and he was discharged home after about 1 week of admission. Postoperative MRI showed satisfactory tumor excision with small remnant of the tumor around the rihgt facial-vestibulocochlear nerve complex [Figures 2a and b]. He had subjective hearing improvement in the immediate postoperative period, which persisted on follow-up. An audiometry examination repeated 2 months after discharge showed significant improvement in hearing with PTA 18.8 dB and speech discrimination score (SDS) 100% (AAO-HNS Class A) [Figure 2c]. The histology showed World Health Organization central nervous system grade 1 meningothelial meningioma. The patient is still being followed up in our department.

DISCUSSION

CPA meningioma poses a significant surgical challenge due to its anatomic complexity and arborization with the middle and lower neurovascular complex.[4,13] Improvements in microneurosurgical and neurophysiological monitoring have allowed for possible hearing preservation in patients with serviceable hearing; however, in the setting of complete hearing loss preoperatively, hearing restoration is very rare.[5-7] Some surgeons have advocated for translabyrinthine or transcochlear approaches for patients without serviceable hearing defined as PTA ≥50 dB and speech discrimination scores at least 50% because the chances of hearing restoration are improbable, and the improved access with these approaches allows for the wider operative corridor and lesser cerebellar retraction.[3,11,13] Other authors have suggested hearing preservation, irrespective of the preoperative hearing status, because the cochlear nerve injury could recover post-decompression.[5,7] The recovery mechanism is unclear but may be related to improved blood flow, axonal regeneration, and pressure off-loading of the cochlear nerve complex.

This index patient had profound hearing impairment, which was non-serviceable by definition (AAO-HNS class D) before surgical intervention and had hearing restoration to normal (AAO-HNS class A) within 2 months after surgery. We opted for the retrosigmoid route, a versatile operative

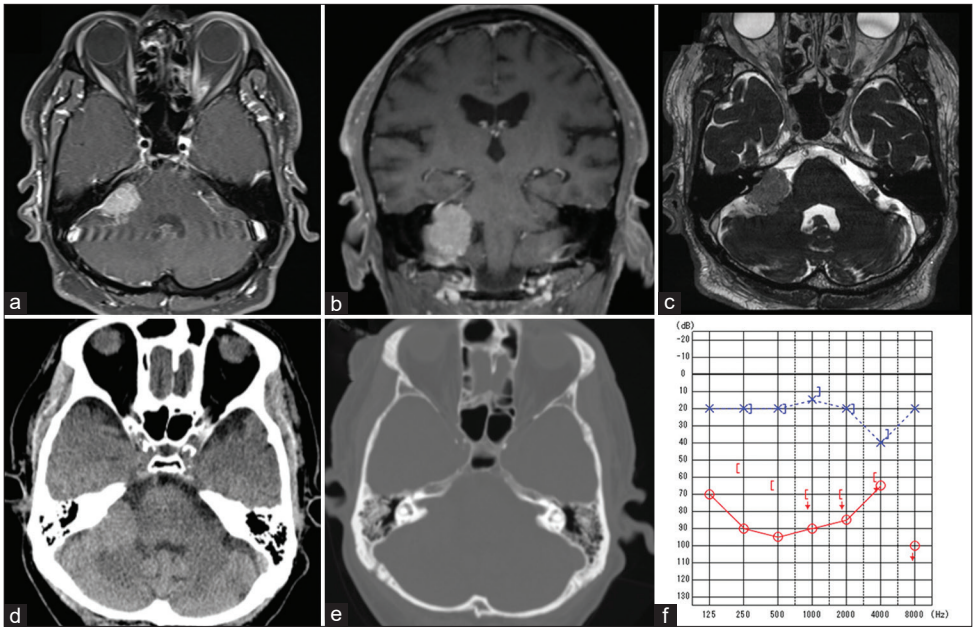


Figure 1: Preoperative brain magnetic resonance imaging showing a right-sided cerebellopontine angle (CPA) meningioma with associated effacement of the ipsilateral CPA cistern and cerebellar compression on gadolinium-enhanced T1-weighted image (a and b) and constructive interference in steady state (c). Brain computed tomography scan showing no calcification in the tumor and normal-sized and symmetrical internal acoustic meatus (d and e). Preoperative pure-tone audiometry showing 90 decibels in the right ear (f).

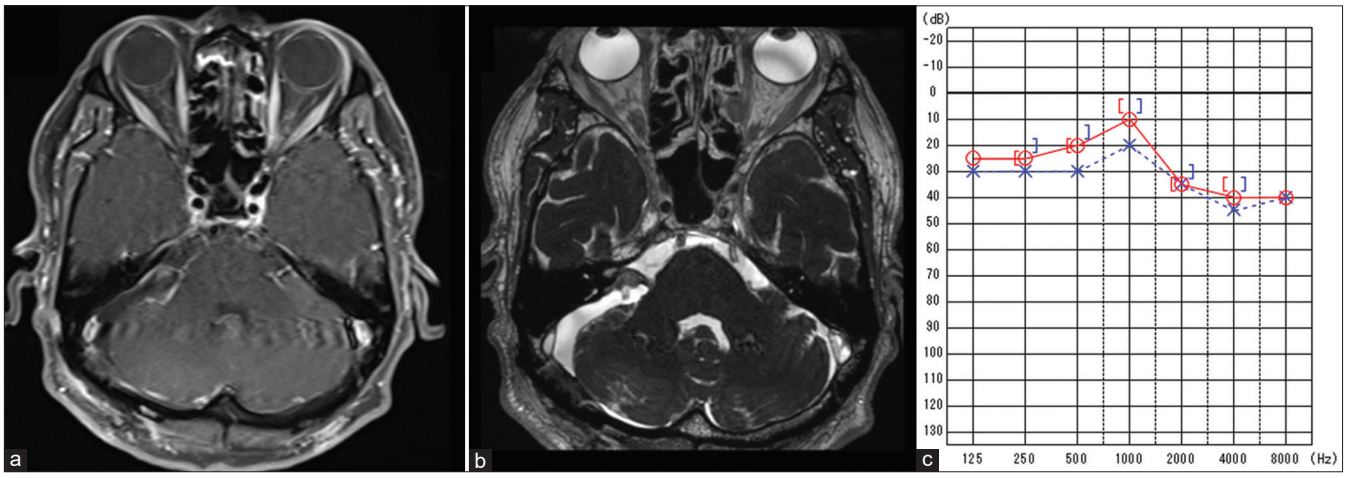


Figure 2: Postoperative brain magnetic resonance imaging showing adequate removal of the tumor with small remnant of the tumor around the facial-vestibulocochlear nerve complex (a and b). Postoperative pure-tone audiometry showing significant improvement in the right ear (c).

corridor that affords a panoramic view of the CPA cistern and enables early identification of the facial nerve close to the brainstem and other surrounding neurovascular structures in the CPA cistern.[3,11,12] In addition, meticulous dissection technique under magnification coupled with judicious use of adjuncts, including video impedance cardiograpymonitoring, avoidance of traction to facial-vestibulocochlear nerve complex, and preservation of the feeding vessels and perforators are factors that may explain his hearing improvement.

The pathoanatomic characteristics of the tumor suggest a premeatal type since it originates from the petrous dura anterior to and involves the internal auditory canal (IAC), and further extends inferolateral toward the lower neurovascular complex. It displaced the facial and vestibulocochlear nerve complex anterosuperiorly and the lower cranial nerve

inferiorly. The premeatal tumors are generally challenging due to their intimate relationship with the IAC and its associated neurovascular structures and often present early with hearing disturbances,[2,4,10,13] as seen in this index case. This is in contrast to the retromeatal tumors that arise posterior to the IAC and adjoining tentorium and usually do not involve the hearing apparatus early in the disease course.[4,8,9] They have ample space to grow in the cerebellomedullary cistern and frequently present with bigger-sized lesions with associated cerebellar, brainstem, and lower cranial nerve involvement.

Schaller *et al*. found that premeatal tumors become symptomatic earlier when compared to retromeatal types and have worse postoperative functional outcomes.[10] They did not attempt hearing preservation in premeatal CPA meningioma, which has been similarly reported in other studies due to the inherent surgical challenges and poor outcomes;[2,13] nonetheless, they achieved hearing preservation in 65% of patients with retromeatal tumors. In contrast to their findings, Nakamura *et al*.,[7] in their large series of 347 patients with CPA meningioma, achieved hearing preservation in 90.8% of patients with preoperative functional hearing and even in the cohorts who had premeatal or intrameatal lesions, were able to achieve hearing preservation in 55.8%. However, among their patient subpopulations with complete preoperative deafness, only 1.8% recovered, and it was very rare among lesion anterior or involving the IAC. They advocated that hearing preservation is possible in every type of CPA meningioma irrespective of the topological tumor type, size, or preoperative hearing status.

Gross total resection should be attempted in CPA meningioma if possible to achieve cure nevertheless, due to their intimate relationship to the brainstem middle and lower neurovascular complex, subtotal or near-total resection are options for tumors morbidly adherent to critical neurovascular structures.[1,2,11,13] In this index case, the lesion was morbidly adherent to the facial nerve consequently, a small portion of the lesion was left in situ to preclude facial nerve impairment postoperatively. Long-term follow-up is required for the monitoring of residual tumor to ensure early intervention

Unlike CPA meningioma, vestibular schwannoma (VS) is of intraneural origin and has a more intimate relationship with the cochlear nerve with which it shares similar vascular feeders and may be disrupted during tumor extirpation.[1,3,8,12,13] In addition, VS has a higher propensity for IAC involvement and having an intracanalicular component and more likelihood of hearing loss preoperatively. Hearing preservation is about 39% in VS, dependent on the lesion size and patients' preoperative hearing status, compared with 67% in CPA meningioma.[12,13] Some authors believe that hearing preservation for VS ≥2.5 cm is usually not successful and places the patient at higher risk of postoperative facial nerve dysfunction, whereas lesion size is not a major consideration in hearing preservation for CPA meningioma.[3,12]

We advocate an attempt at hearing preservation for all CPA meningioma irrespective of lesion size, topographic type, and preoperative hearing status, as seen in this index case who had both anatomic and unfavourable clinical factors yet had hearing restoration (AAO-HNO class A). Utilizing hearing-saving approaches and preserving the cochlear nerve should be the goal in all cases of CPA meningioma, irrespective of the serviceability of the hearing status.

CONCLUSION

This case illustrates that hearing restoration is possible after complete loss in patients with CPA meningioma. Utilizing the retrosigmoid approach and meticulous microsurgical techniques to preserve the vestibulocochlear nerve and its associated neurovascular bundles and neurophysiological monitoring are veritable to ensure success. We advocate hearing preservation surgery even in patients with non-serviceable hearing, as the chance of hearing recovery is possible.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Agarwal V, Babu R, Grier J, Adogwa O, Back A, Friedman AH, *et al*. Cerebellopontine angle meningiomas: Postoperative outcomes in a modern cohort. Neurosurg Focus 2013;35:E10.
2. Batra PS, Dutra JC, Wiet RJ. Auditory and facial nerve function following surgery for cerebellopontine angle meningiomas. Arch Otolaryngol Head Neck Surg 2002;128:369-74.
3. Cohen NL, Lewis WS, Ransohoff J. Hearing preservation in cerebellopontine angle tumor surgery: TheNYU experience 1974-1991. Am J Otol 1993;14:423-33.
4. Ito T, Kasuya M. Classification of meningiomas. Gan 1950;41:61-2.
5. Katsuta T, Inoue T, Uda K, Masuda A. Hearing restoration from deafness after resection of a large cerebellopontine angle meningioma--case report. Neurol Med Chir (Tokyo) 2001;41:352-5.
6. Kiyomizu K. Hearing improvement after conservative approach for large C-P angle meningioma. Otolaryngol Head Neck Surg 2004;76:765-9.

7. Nakamura M, Roser F, Dormiani M, Matthies C, Vorkapic P, Samii M. Facial and cochlear nerve function after surgery of cerebellopontine angle meningiomas. Neurosurgery 2005;57:77-89.
8. Okwunodulu O, Campbell FC, Inojie MO, Ndubuisi CA, Hart IT, *et al*. Obstructive hydrocephalus with impaired ventricular compliance resulting in visual deterioration in an adult with vestibular schwannoma. IOSR-JDMS 2020;19:8-11.
9. Sanna M, Karmarkar S, Landolfi M. Hearing preservation in vestibular schwannoma surgery: Fact or fantasy? J Laryngol Otol 1995;109:374-80.
10. Schaller B, Merlo A, Gratzl O, Probst R. Premeatal and retromeatal cerebellopontine angle meningioma. Two distinct clinical entities. Acta Neurochir (Wien) 1999;141:465-71.
11. Sweeney AD, Carlson ML, Ehtesham M, Thompson RC, Haynes DS. Surgical approaches for vestibular schwannoma. Curr Otorhinolaryngol Rep 2014;2:25664.
12. Trevisi G, Beggio G, Raneri F. Hearing preservation in vestibular schwannoma surgery. Acta Neurochir (Wien) 2020;162:71.
13. Voss NF, Vrionis FD, Heilman CB, Robertson JH. Meningiomas of the cerebellopontine angle. Surg Neurol 2000;53:439-46.

How to cite this article: Francis CC, Kanaya K, Murase H, Hardian RF, Horiuchi T, Ohaegbulam SC. Unexpected recovery from complete deafness to normal hearing post surgical excision of a cerebellopontine angle meningioma: A case report. Surg Neurol Int 2023;14:174.