

Case Report

Surgical ligation of A Large Mastoid Emissary Vein in A Patient Complaining of Pulsatile Tinnitus

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Cite this article as: Kim SG, Koh JH, Kim BJ, Lee EJ. Surgical ligation of A Large Mastoid Emissary Vein in A Patient Complaining of Pulsatile Tinnitus. J Int Adv Otol 2021; 17(1): 84-6.

Pulsatile tinnitus is an uncommon symptom characterized by a perceived sound pulsing like a heartbeat. Here, we report an unusual case of a patient with unilateral pulsatile tinnitus caused by a large, prominent mastoid emissary vein (MEV). A 45-year-old woman presented at our hospital with pulsatile tinnitus. She had persistent tinnitus for 20 years, and her symptoms had worsened in the previous 2 years. She said that she perceived a sound pulsing like a heartbeat. She had some hearing impairment in both the ears for a long time owing to long-term otitis media. The temporal bone computed tomography scan showed a large right jugular bulb, and there was a large MEV canal draining into the right sigmoid sinus. Therefore, we decided to perform a large MEV ligation with the planned right tympanoplasty. On follow-up, the patient's pulsatile tinnitus improved completely. According to reviews, this is the first reported case of surgical ligation of a large MEV as a treatment for pulsatile tinnitus; therefore, we report this case with a brief literature review.

KEYWORDS: Tinnitus of vascular origin, pulsatile tinnitus, ligation

INTRODUCTION

Tinnitus is the acoustic perception of sound without an external stimulus. Pulsatile tinnitus is an uncommon symptom characterized by a perceived sound pulsing like a heartbeat ^[1]. It is most likely caused by a venous anomaly or variant, which is related to abnormal flow in the vascular structures near the cochlea. In most cases of venous pulsatile tinnitus, blood flow turbulence, which originates in the internal jugular vein, is transferred to the adjacent inner ear structures through a thin bone plate. The blood flow turbulence directly stimulates the semicircular canal, which gives rise to pulsatile tinnitus. Here, we report an unusual case of a patient with unilateral pulsatile tinnitus owing to a large mastoid emissary vein (MEV).

CASE PRESENTATION

A 45-year-old woman presented at our hospital with pulsatile tinnitus. She had persistent tinnitus for 20 years, and her symptoms had worsened in the previous 2 years. She reported that she perceived a sound pulsing like a heartbeat. The patient described that when she manually compressed the right neck, the loudness of the tinnitus reduced. She did not suffer from aural fullness, dizziness, headache, or hyperacusis. She had some hearing impairment in both the ears for a long time owing to long-term otitis media. She had a medical history of breast cancer and iron deficiency anemia, but there was no other specific medical history. She had also undergone a left type III tympanoplasty on March 20, 2017. We conducted a hearing test and found that the air conductive hearing of the right side was 25 dB, bone conductive hearing of the right side was 13 dB, air conductive hearing of the left side was 18 dB, and bone conductive hearing of the left side was 8 dB. The auditory brainstem response results were 30 on both sides. The temporal bone computed tomography scan indicated a large right jugular bulb in a high position, which was observed at the level of the external auditory canal (Figure 1); there was a large MEV canal draining into the right sigmoid sinus (Figure 2). The diameter of the mid portion was approximately 2.5 mm, and the diameter of the area connected to the sinus was approximately 3 mm. Therefore, we decided to perform a large MEV ligation with the planned right tympanoplasty.

Preoperative Doppler ultrasonography guided the marking of the MEV and branches (Figure 3 and Figure 4). We decided to opt for the surgery after confirming the improvement of symptoms by compressing the largest branch of the large MEV on Doppler ultrasonography before surgery. After posterior auricular incision, flap dissection was performed. The main branch seemed very fragile;

This study was presented as a poster presentation at the 32nd Politzer Society Meeting/2nd World Congress of Otology, 2019.05.28-2019.06.01, Warsaw, Poland.

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Submitted: 09.01.2020 • Revision Received: 04.14.2020 • Accepted: 15.04.2020

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Figure 1. Right high jugular bulb.



Figure 2. Right large mastoid emissary vein.

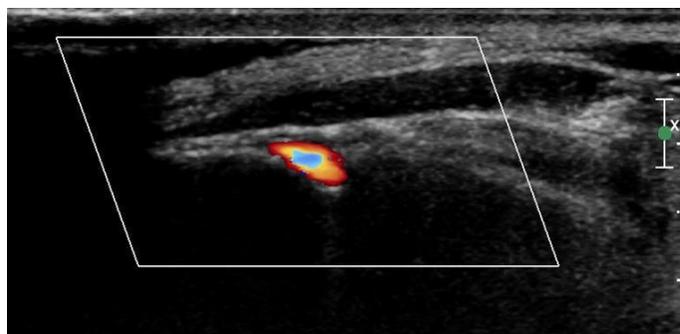


Figure 3. Preoperative Doppler ultrasonography-guided marking of the mastoid emissary vein and its branches.

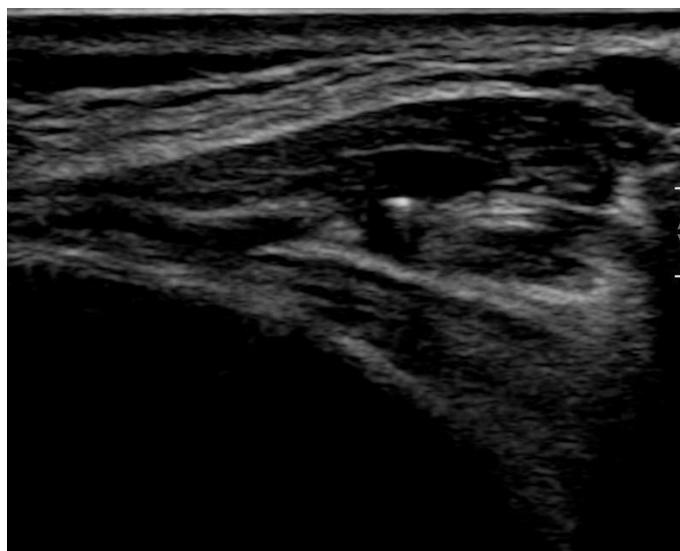


Figure 4. Doppler ultrasonography performed 2 months postoperatively showing that the blood flow in the mastoid emissary vein had stopped.

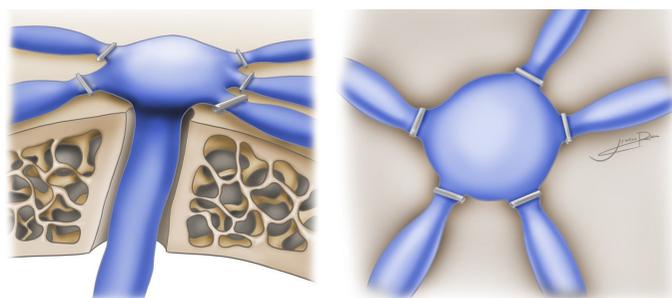


Figure 5. Clipped branches of the mastoid emissary vein.

MAIN POINTS

- Large mastoid emissary veins can cause pulsatile tinnitus.
- This is the first reported case of surgical ligation of a large MEV as a treatment for pulsatile tinnitus.
- If you have a planned ear surgical procedure such as tympanoplasty, surgical ligation may be an option to treat pulsatile tinnitus due to large mastoid veins.

therefore, clipping was performed on star-shaped branches (Figure 5). The branch was clipped by observing the emissary vein that protruded round the sternocleidomastoid muscle, and it was cauterized with bipolar electrocautery. No signs of intracranial pressure, such as papilloedema, severe headache, or neurological symptoms, were observed immediately after the surgery and in the follow-up period.

Doppler ultrasonography performed at 2 months postoperatively showed no blood flow in the MEV, and the patient's symptoms had improved (Figure 3 and Figure 4). For more than 2 years after the surgery, follow-up was performed through outpatient department. There was no recurrence of symptoms.

DISCUSSION

Only a small portion (5%-10%) of patients with tinnitus show pulsatile tinnitus, and in rare cases, it involves blood vessels. The cause of pulsatile tinnitus can be venous or arterial in origin^[2]. The one with venous origin presents as a sigmoid sinus dehiscence, an anomaly defined as an incomplete bone around the sigmoid sinus, and the other origin presents high jugular bulb. In contrast, the arterial origin is as an intra-petrosal carotid aneurysm, arteriovenous fistula, or carotid fibrodysplasia. Both the jugular bulb and intra-petrosal carotid artery run adjacent to the inner ear.

The emissary veins traverse the skull by the foramina and connect directly between the superficial veins of the scalp and dural venous sinuses. These blood vessels have no valves and blood that can flow in both directions, but blood generally flows from outside to inside^[3]. Both MEV and the internal jugular veins are a part of extracranial venous drainage. When the standard route of venous drainage is intact, the role of the MEV is limited. In contrast, they can be the primary efflux route in patients whose standard route of venous drainage is not intact, such as in patients with high-flow vascular anomalies, intracranial hypertension, or occlusion of the internal jugular vein. The MEV goes through the sigmoid sinus and posterior auricular or occipital veins; therefore, it runs near the cochlea and gives rise to pulsatile tinnitus.

It is well known that endovascular intervention generally produces good results in the treatment of pulsatile tinnitus by idiopathic intracranial hypertension. However, the treatment of pulsatile tinnitus by venous anomaly, for example, high jugular bulb and venous sinus stenosis, has no clear standard. Yang et al.^[4] have conducted a systematic literature review of endovascular treatment in patients with severe pulsatile tinnitus. The symptoms improved completely in 95.1% of patients, and there was only 1 cerebellar infarct complication. We explained that ligation of a large MEV can alleviate or worsen the patient's symptoms. In addition, the patient had a high jugular bulb. The possibility of pulsatile tinnitus owing to the high jugular bulb was also sufficiently recognized. The patient decided to operate after receiving sufficient explanation. For treatment of chronic otitis media, tympanoplasty was already scheduled; therefore, patients also wanted to try the ligation of large MEV.

Jackler et al.^[5] have mentioned that interruption of a major venous pathway can cause serious intracranial venous hypertension, which can lead to serious problems. Inducing noise in the jugulo-sigmoid venous system may maintain the physiological intracranial hemodynamics. That is, it may be caused by stenosis or atresia on the other side. In particular, obstruction of the sigmoid sinus or jugular bulb site can be dangerous, because it eliminates alternative pathways through the petrosal sinuses. However, the reported dangerous situations are those reported in other treatment situations and are rare for treatment of pulsatile tinnitus alone. Moreover, the surgeon must be fully aware of these risks.

Forte et al.^[6] have reported a comparable case of pulsatile tinnitus related to an abnormal MEV. In contrast, Chauhan et al.^[7] have experienced unusual origin of the left petrosquamosal sinus from a dilated MEV and multiple emissary veins of the posterior fossa. In addition, there is another case report of pulsatile tinnitus involving a large MEV

with a diameter of approximately 4.5 mm^[1]. Thus, our case report might be the fourth reported case of pulsatile tinnitus related to MEV.

There are some limitations to our study. The average diameter of the MEV is <2 mm at 60% and <3.5 mm at 80%. In our case, the diameter of the MEV was only 2.5-3.0 mm. This suggests that the effect of the presence of the right high jugular bulb on the pulsatile tinnitus cannot be totally excluded, but it proves the efficacy of our treatment in that the patient's pulsatile tinnitus decreased sharply after MEV ligation and the symptoms completely disappeared after 6 months of surgery. The pulsatile tinnitus remaining right after the procedure may be owing to the high jugular bulb. In our case, the patient was planning to have a tympanoplasty because of the presence of the chronic otitis media, and thus, the 2 procedures were performed together. More research is required to determine the value of performing MEV ligation surgery on its own. Long-term follow-up is needed to compare living with the condition and surgical intervention. Therefore, our case is of significance because the results of postoperative Doppler ultrasonography and the improvement in the patient's symptoms demonstrate the merits of surgical ligation in patients with pulsatile tinnitus owing to a large prominent MEV.

CONCLUSION

In the treatment of pulsatile tinnitus owing to large MEVs, surgical ligation can be performed more easily than conventional intervention, such as angiographic approach, and the postoperative outcome is favorable.

Informed Consent: Written informed consent was obtained from the patients who participated in this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept – E.J.L., S.G.K.; Design – E.J.L., S.G.K.; Supervision – E.J.L.; Resource – E.J.L., S.G.K.; Materials – E.J.L., S.G.K.; Data Collection and/or Processing – S.G.K., B.J.K., J.H.K.; Analysis and/or Interpretation – E.J.L., S.G.K.; Literature Search – S.G.K., B.J.K., J.H.K.; Writing – S.G.K.; Critical Reviews – E.J.L.

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

Financial Disclosure: This paper was supported by Fund of Biomedical Research Institute, Jeonbuk National University Hospital.

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