

CASE REPORT

Pulsatile Tinnitus Caused by an Unusual Dural Arteriovenous Fistula

Sung Won Chae, Hyun-Woo Lim, Sang Il Suh, Moo Kyun Park

Department of Otolaryngology-Head and Neck Surgery, Korea University College of Medicine, Seoul, Korea (SWC, HWL)

Department of Radiology, Korea University College of Medicine, Seoul, the republic of Korea (SIS)

Department of Otolaryngology-Head and Neck Surgery, Bucheon hospital, Soonchunyang University College of Medicine, Bucheon-si, the republic of Korea (KP)

Pulsatile tinnitus can be the only symptom of serious underlying pathology and one of many symptoms of a neurological disorder. Dural arteriovenous fistula (DAVF) is a common cause of pulsatile tinnitus. Transverse and sigmoid dural sinuses are the most common sites involved, followed by the cavernous sinus. We herein report a case of unusual DAVF and discuss its clinical features and radiological findings. The DAVF in question was situated between the internal maxillary artery and external jugular vein, causing pulsatile tinnitus. We attempted embolization of the DAVF without success but the symptoms nevertheless resolved.

Submitted : 29 March 2011

Accepted : 15 July 2011

Introduction

Tinnitus is the perception of sound without external stimuli. Tinnitus can be characterized as subjective or objective, irrespective whether it is audible only by patient or by the patient and the examiner. It is, and also classified as pulsatile or non-pulsatile, on the basis of sound quality perceived by the patient.^[1, 2]

Pulsatile tinnitus can be the only symptom of a serious underlying pathology, or one of many symptoms of a neurological disorder. As such, a vascular cause should be excluded. Vascular causes of pulsatile tinnitus include extracranial or intracranial dural arteriovenous fistula (DAVF), atherosclerosis, aneurysm or internal carotid artery dissection, cerebral venous sinus thrombosis and other rare disorders.^[2-4] DAVF is a common cause of pulsatile tinnitus, and it is important to exclude this pathology because of the

serious sequel. Arterial origins of DAVF include the middle meningeal artery, the ophthalmic arteries, ascending pharyngeal, occipital, vertebral arteries, and the internal maxillary artery.^[5] Venous drainage of DAVF may be extra cranial, intracranial or both.^[6]

We herein present a case of pulsatile tinnitus caused by an unusual DAVF situated the internal maxillary artery and external jugular vein.

Case Report

A 59-year-old woman presented a 5-month history of pulsatile tinnitus in the right ear, which developed suddenly without trauma, thrombosis, infection or surgery. The patient was not taking any drugs prior to the onset of tinnitus. She did not experience headaches or visual disturbance. Her pulsatile tinnitus was synchronous with the heartbeat. Auscultation of the

Corresponding address:

Moo Kyun Park
Department of Otorhinolaryngology-Head and Neck Surgery,
Bucheon hospital, Soonchunyang university college of medicine
1174 Jung-Dong, Wonmi-Gu, Bucheon-Si, Gyeonggi-Do, 420-767, Korea
Phone: 82-32-621-5054 • Fax: 82-32-621-5440
E-mail: aseptic@schmc.ac.kr

Copyright 2005 © The Mediterranean Society of Otolaryngology and Audiology

right external auditory canal, periauricular region, with a modified electronic stethoscope (Starkey ST3; Starkey laboratories, Inc, Eden Prairie, Minn) confirmed bruit like pulsatile tinnitus.

Both tympanic membranes were unremarkable on otoscopic examination. There was no evidence of neurological deficits or papilledema on fundoscopic examination. The results of the audiology evaluation were unremarkable. The intensity of the tinnitus remained unchanged by compression of the common carotid artery and jugular vein.

Angiography demonstrated a DAVF fed by the first and second portion of the right internal maxillary artery and a branch of the occipital artery. The DAVF exclusively drained the external jugular vein (Figure 1A, B). Subsequently, elective arterial embolization of the DAVF was performed with 10% glue and 150~250 μ m sized polyvinyl alcohol particles for the feeders from the internal maxillary artery and the venous channels of the fistula. Very fine feeders from the right occipital artery were not embolized due to the small caliber of the feeders (Figure 1C, D). The patient did not experience complications secondary to embolization, such as intracranial hemorrhage or neurological deficits, during or after the procedure. The symptoms of tinnitus resolved immediately following treatment and did not recur during the one-year follow-up period. Angiography performed one year later showed no significant change at the site of the DAVF embolization (Figure 1 E, F).

Discussion

The sound of non-laminar blood flow transmitted to the inner ear causes pulsatile tinnitus. Pulsatile tinnitus occurs with systemic diseases, such as anemia, thyrotoxicosis, valvular heart disease, that alter the hemodynamics of the vascular system and local disorders, such as circumscribed vascular variations, arteriovenous malformations, dural arteriovenous and arterial wall diseases.^[2-4] DAVF is likely to be caused by spontaneous dural venous sinus thrombosis, as in this case, or secondary to infection, trauma, neoplasm, or surgery. DAVFs may lead to intracranial hemorrhage, with a high associated mortality rate.

The diagnostic approach of tinnitus should always be guided by the symptoms and physical findings. Diagnostic modalities used for DAVF include magnetic resonance imaging (MRI), magnetic resonance angiography, digital subtraction angiography, and carotid ultrasonogram.^[7, 8] When tinnitus is pulsatile, contrast enhanced temporal bone CT is the preferred imaging study.^[9] However, if the origin of the pulsatile tinnitus is thought to be vascular, such as secondary to dural arteriovenous malformation (DAVM) or DAVFs, angiography may be indicated.^[9] Angiography was used as the diagnostic modality because DAVM or DAVFs are among the most common causes of pulsatile tinnitus against the background of normal otoscopic examination.^[3, 4] Angiography is often the only study capable of illustrating a DAVM or DAVF.^[9]

If there is objective unilateral tinnitus diminished by compression over the mastoid region or over the course of the common carotid artery, an arteriovenous fistula should be excluded. However, in this case, pulsatile tinnitus did not decrease with compression over the course of the external carotid artery or jugular vein. We postulated that compression over the external carotid artery or jugular vein was insufficient to reduce blood flow between the internal maxillary artery and external jugular vein or there were too many collateral channels between the internal maxillary artery and external jugular vein.

To the best of our knowledge, pulsatile tinnitus caused by DAVF between the internal maxillary artery and external jugular vein has not been reported previously. There is a limited number of case reports which discussed arteriovenous fistula between the carotid arterial system and the internal jugular vein.^[10-13] They described carotid-jugular fistula as rare and secondary to congenital cause or trauma. The symptoms of those cases vary from neurologic, such as amnesia, to brutal mass. In only one case pulsatile tinnitus was a primary symptom, of which the venous drainage was the internal jugular vein.^[14]

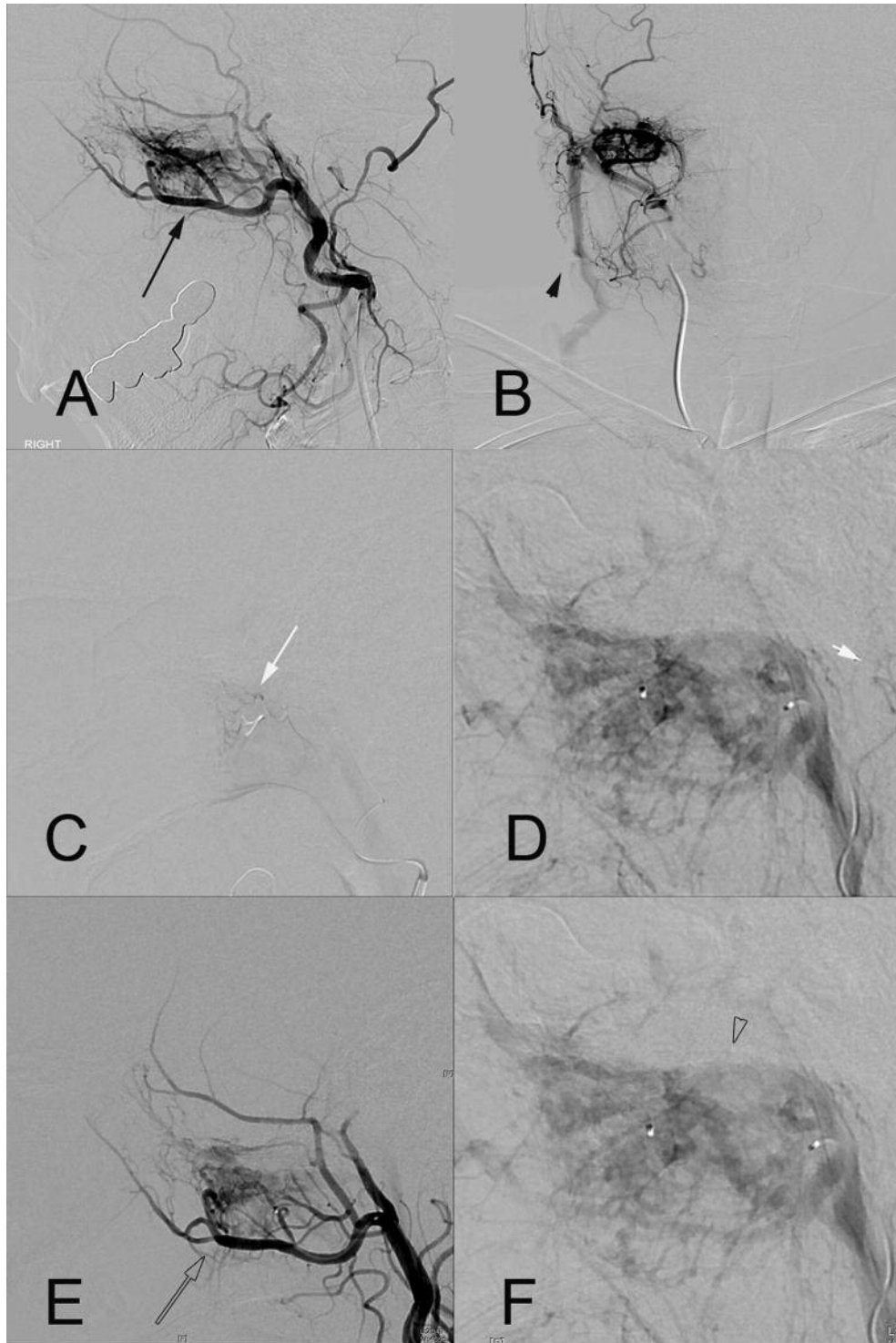


Figure 1. Angiography of a dural arteriovenous fistula between the internal maxillary artery and external jugular vein: Angiography showed a dural arteriovenous fistula, which was occluded following embolization. Before embolization, the main feeders of the dural arteriovenous fistula were from the first and second portion of the right internal maxillary artery (black arrow) (A). The dural arteriovenous fistula drained into the external jugular vein (black arrow head) (B). The main feeders from the right internal maxillary artery underwent embolization using a microcatheter system with 10% glue and polyvinyl alcohol particles (White arrow) (C). Complex and fine feeders from the right occipital artery were not embolized due to small caliber of the feeders (White arrow head) (D). Angiography performed after 1 year showed no significant change at the embolization site at the main feeders of the dural arteriovenous fistula (E), and complex and fine feeders from the right occipital artery (F).

The treatment strategy for DAVF includes conservative management, embolization and surgical resection. Surgical resection has been associated with complications, such as cerebral venous drainage disturbance and cerebrospinal fluid leakage. Embolic agents, such as polyvinyl alcohol, can angiographically obliterate a DAVF.^[8, 15] Embolization material includes detachable balloon and coils. However, incomplete occlusion is not uncommon. In addition, embolization by angiography has a higher recurrence rate compared to surgery.^[3, 15] Interestingly for our patient, the symptoms of tinnitus completely resolved even DAVF was incompletely occluded. After 1 year of follow up, the symptom of tinnitus did not recur and angiography showed no significant change at the site of DAVF embolization.

References

1. Heller AJ: Classification and epidemiology of tinnitus. *Otolaryngol Clin North Am* 2003; 36:239-248.
2. Sismanis A: Pulsatile tinnitus. *Otolaryngol Clin North Am* 2003; 36:389-402, viii.
3. Waldvogel D, Mattle HP, Sturzenegger M, Schroth G: Pulsatile tinnitus--a review of 84 patients. *J Neurol* 1998; 245:137-142.
4. Sonmez G, Basekim CC, Ozturk E, Gungor A, Kizilkaya E: Imaging of pulsatile tinnitus: A review of 74 patients. *Clin Imaging* 2007; 31:102-108.
5. van Berkel JP, Matricali B, Batchelor DA: Occipital dural arteriovenous fistulas. *Diagn Imaging Clin Med* 1985; 54:240-250.
6. Hasso AN: Imaging of pulsatile tinnitus: Basic examination versus comprehensive examination package. *AJNR Am J Neuroradiol* 1994; 15:890-892.
7. Madani G, Connor SE: Imaging in pulsatile tinnitus. *Clin Radiol* 2009; 64:319-328.
8. Mattox DE, Hudgins P: Algorithm for evaluation of pulsatile tinnitus. *Acta Otolaryngol* 2008; 128:427-431.
9. Weissman JL, Hirsch BE: Imaging of tinnitus: A review. *Radiology* 2000; 216:342-349.
10. Dell'Amore A, Castriota F, Calvi S, Magnano D, Noera G, Lamarra M: Post-traumatic carotid-jugular arterio-venous fistula. *Heart Lung Circ* 2009; 18:293.
11. Gobin YP, Garcia de la Fuente JA, Herbreteau D, Houdart E, Merland JJ: Endovascular treatment of external carotid-jugular fistulae in the parotid region. *Neurosurgery* 1993; 33:812-816.
12. Ramsay DW, McAuliffe W: Traumatic pseudoaneurysm and high flow arteriovenous fistula involving internal jugular vein and common carotid artery. Treatment with covered stent and embolization. *Australas Radiol* 2003; 47:177-180.
13. Tan ME, Rijken M, Moll FL: Spontaneous external carotid-jugular fistula in repetitive hyperextension of the neck. *Ann Vasc Surg* 2002; 16:771-773.
14. Tan M, Rijken M, Moll F: Spontaneous external carotid-jugular fistula in repetitive hyperextension of the neck. *Annals of Vascular Surgery* 2002; 16:771-773.
15. Van de Heyning P, Meeus O, Blaivie C, Vermeire K, Boudewyns A, De Ridder D: Tinnitus: A multidisciplinary clinical approach. *B-ENT* 2007; 3 Suppl 7:3-10.