A Pulsatile Tinnitus Case Associated with Internal Jugular Vein Stenosis Diagnosed by Multidetector Computerised Tomography Angiography

K Kilic[1], MS Sakat[2], E Altas[2], M Kantarci[3], H Ucuncu[4]

ABSTRACT

Tinnitus is a discomforting condition associated with a sound in one or both ears that occurs without an external stimulus and can be either pulsatile or continuous. Vascular and non-vascular factors involve in etiology of pulsatile tinnitus (PT) that requires a careful physical examination and evaluation with proper and sophisticated imaging techniques to identify the cause(s). In clinical experience, it is known that turning neck towards affected ear decreases PT, whereas turning neck towards unaffected side increases PT in venous hum, due to bending of internal jugular vein (IJV) over the transverse process of the atlas which leads to increased blood flow. In this report, we presented a rare PT case caused directly by jugular vein stenosis, in which clinical characteristics were in disagreement with the literature. In our case, PT markedly reduced, instead of being aggravated, when turning neck to unaffected side in a 35-year old woman. Moreover, there were axial maximal intensity above the left jugular bulb and about 85% stenosis in 3-D volume rendering images. We also discussed the differential diagnosis by multidetector computed tomography angiography with respect to its advantageous over other imagining techniques such as CT, MRI, and MRA as well as conventional angiography.

Keywords: Jugular vein stenosis, multidetector computed tomography-angiography, pulsatile tinnitus

---

From: [1]Otorhinolaryngology Clinics, Erzurum, Regional Training and Research Hospital, Turkey, [2]Department of Otorhinolaryngology, Faculty of Medicine, Ataturk University, Erzurum, Turkey,[3]Department of Radiology, Ataturk University, Faculty of Medicine, Erzurum, Turkey,[4]Department of Otorhinolaryngology, Faculty of Medicine, Sıtkı kocman University, Mugla, Turkey.

Correspondence: Dr K Kilic, Department of Otorhinolaryngology, Regional Training and Research Hospital, Erzurum 25240, Turkey, E-mail: korhankilic@gmail.com

 DOI: 10.7727/wimj.2016.552

INTRODUCTION

Tinnitus is a discomforting condition associated with a sound in one or both ears such as ringing, whistling, clicking or buzzing that occurs without an external stimulus and can be either pulsatile or continuous (1). Tinnitus is either pulsatile or continuous. Underlying factors causing pulsatile tinnitus (PT) can be considered in two groups: non-vascular and vascular causes. The cause of pulsatile tinnitus may be the turbulence of the blood flow which depends on increased flow volume or stenosis of vessel lumen (1). The PT cases resulted from venous factors are reported to be mostly due to benign intracranial hypertension (BIH), and followed by jugular bulb abnormality, and dural sinus stenosis (1), whereas those resulted from arterial factors are mostly linked to carotid atherosclerotic diseases and glomus tumors (2).

Pulsatile tinnitus requires a careful physical examination and evaluation with proper and sophisticated imaging techniques to identify the origin of the symptoms. The differentiation of venous PT and arterial PT can be provided by pressing on the internal jugular vein (IJV). In patients with PT caused by venous factors; this application ends up with pause of PT (1). It is known that turning neck towards affected ear decreases tinnitus, whereas turning neck towards unaffected side increases tinnitus in venous hum, due to bending of IJV over the transverse process of the atlas which leads to increased blood flow (3).

External factors pressing on jugular vein may lead to PT. However, to our knowledge, no report on PT caused directly by jugular vein stenosis has been documented. In this report, we presented a unique PT case associated with jugular venous stenosis diagnosed by multidetector computed tomography angiography (CTA) and discussed its clinical characteristics which are in disagreement with current literature.

CASE REPORT

A 35-year-old female presented with a 3-year history of non-progressive PT in the left ear. There was no history of hearing loss, trauma of head or neck, ototoxicity, or cardiovascular disease. The physical examination except auscultation was normal. The noise was abolished by occluding the left IJV. Pure tone audiometry and tympanometry were normal. In opposite to common experience, PT markedly reduced, instead of being aggravated, when she turned her neck to unaffected side. Tinnitus completely disappeared after digital pressure on the left side of her neck.

Because of being claustrophobic, the patient was subjected to multidetector CTA (Aquillon, Toshiba Medical Systems, Tokyo, Japan). In addition to the traditional axial images, all the other available techniques (multiplanar reconstructions and 3D volume-rendering images) were used to assess the arterial and venous structures. There were axial maximal intensity above the left jugular bulb and about 85% stenosis in 3-D volume rendering images (Figure 1)

DISCUSSION

Pulsatile tinnitus is a common disorder and results from a variety of otologic and vascular lesions, including primary venous anomalies as well as conditions causing increased cranial pressure and transmission of arterial pulsation to the dural venous sinuses (4). Pulsatile tinnitus may be originated from vascular diseases and tumors. The most common tumoral causes are glomus jugulare and glomus tympanicum. In a review involving 107 patients with PT or vascular retrotympanic mass, it was reported that 25% had objective tinnitus and 25% had acquired vascular lesions and that a vascular tympanic membrane was present in 35%, whereas normal vascular variants were present in 21% (5).

Unilateral objective tinnitus caused by IJV is a mystery. Movement of the neck to the contrary side causes the IJV to bend over the transverse process of the atlas give rise to turbulence in blood flow, with this maneuver, the effective lumen of the vein is being opened up because of the contraction of ipsilateral SKM, therefore the venous return increases. Movement of the neck to the affected side has the contrary effect resulting in decrease of the tinnitus (1). The neck movement rearranges turbulent flow in the IJV in association with BIH and/or external compression on the IJV because the IJV curves around the lateral process of the atlas (6).

Nehru et al reported reduction in tinnitus when turning neck to affected ear and aggravation in tinnitus when turning neck to unaffected ear in patients with venous hum, also known as idiopathic or essential PT when etiology is unclear (3). Our patient has 85% stenosis in IJV, which was located above the transverse process of the atlas. In contrast with the literature, the PT significantly reduced when the neck was turned to unaffected ear in our case. This reduction was probably related to blocking of blood flow further due to squeezing IJV by the transverse process of the atlas at time of turning neck to unaffected ear. In addition to involvement of IJV in the PT, this is the first case, to our knowledge, showed further impeding blood flow to reduce PT.

Various imaging modalities, including CT, MR imaging (MRI) and MR angiography (MRA), and conventional angiography, are used for the PT diagnosis. However, selection of the most appropriate imaging method is essential for determining underlying cause. Krishnan et al evaluated PT using CT arteriography and venography (CTA/V) and reported their comprehensiveness and high reliability (7). The CT angiography was employed in diagnosis of the PT cases caused by an aberrant internal carotid artery (8) and high homolateral jugular bulb and aplasia of the contralateral transverse and sigmoid sinuses (9). Various diagnostic imaging methods have been suggested. In the absence of objective PT, use of MRI/MRA (5),

whereas in the presence of PT, use of high-resolution CT (HRCT) followed by Doppler ultrasonography or HRCT followed by temporal MRI and carotid Doppler may be an appropriate initial diagnostic step (10). These suggest that imagining method for the initial diagnostic step can be complicated and time consuming. However, the clinician may choose directly angiography to be certain about involvement of vascular factor (11). Indeed, CTA spatial resolution is higher than MRA. Moreover, CTA image can be obtained while running CT without necessitating an extra labor, especially for claustrophobic patients and patients with aneurysm clips and pace makers. Moreover, despite digital subtraction angiography being a standard reference for evaluation of aneurysms, stenosis and vascular malformations, CTA is a new cost-effective and minimally invasive alternative (12).

Using 3D-CTA for entire head from the skull base to the vertex, Matsumato et al showed that this modality provided the acquisition of information on detailed vasculature of tumor and cerebral hemodynamics (13). This precludes that in the diagnosis and preoperative evaluation, 3D-CTA may replace conventional angiography which is an invasive method and does not reflect peripheral connection because it is more sophisticated in regard to having an ability to demonstrate images of the lesion, arteries, veins and bony structures, and of their relationships. In our case, we were able to detect internal jugular vein stenosis and its location using multidetector CTA (Figure 1).

Figure: Appearance of the left jugular bulb and stenosis in Multidetector Computed Tomography Angiography

CONCLUSION

A unique PT case we presented was resulted from internal jugular vein stenosis and clinically reduced by turning neck to unaffected side, in contrast with the literature. Moreover, employing CTA directly as a first initial diagnostic step allowed us not only to save time by eliminating multiple radiological examinations but also to view middle and inner ear, arterial, and venous structures.

REFERENCES

1. Liyanage SH, Singh A, Savundra P et al. Pulsatile tinnitus. J Laryngol Otol 2006; **120:** 93-7.
2. Mattox DE, Hudgins P. Algorithm for evaluation of pulsatile tinnitus. Acta Otolaryngol 2008; **128:** 427-31.
3. Nehru VI, al-Khaboori MJ, Kishore K. Ligation of the internal jugular vein in venous hum tinnitus. J Laryngol Otol 1993; 107: 1037-38.
4. Sismanis A. Pulsatile tinnitus. Otolaryngol Clin North Am 2003; **36:** 389-402.
5. Remley KB, Coit WE, Harnsberger HR et al. Pulsatile tinnitus and the vascular tympanic membrane: CT, MR, and angiographic findings. Radiology 1990; **174:** 383–89.
6. Sismanis A. Otological manifestations of benign intracranial hypertension syndrome: diagnosis and management. Laryngoscope 1987; **97:** 1–17.
7. Krishnan A, Mattox DE, Fountain AJ et al. CT arteriography and venography in pulsatile tinnitus: preliminary results. AJNR Am J Neuroradiol 2006; **27:** 1635–8.
8. Endo K, Maruyama Y, Tsukatani T et al. Aberrant internal carotid artery as a cause of objective pulsatile tinnitus. Auris Nasus Larynx 2006; **33:** 447–50.
9. Zanetti D, Pianta L, Piazza C et al. Pulsating tinnitus associated with high homolateral jugular bulb and aplasia of the contralateral transverse and sigmoid sinuses. Acta Otorhinolaryngol Ital 2001; **21:** 248-53.
10. Foyt D, Carfrae MJ, Rapoport R. Fibromuscular dysplasia of the internal carotid artery causing pulsatile tinnitus. Otolaryngol Head Neck Surg 2006; **134:** 701–2.
11. Shin EJ, Lalwani AK, Dowd CF. Role of angiography in the evaluation of patients with pulsatile tinnitus. Laryngoscope 2000; **110:** 1916–20.

12. Enterline DS, Kapoor G. A practical approach to CT angiography of the neck and brain. Tech Vasc Interv Radiol 2006; **9:** 192–204.

13. Matsumoto M, Kodama N, Sakuma J, Sato S, Oinuma M, Konno Y, Suzuki K, Sasaki T, Suzuki K, Katakura T, Shishido F. 3D-CT arteriography and 3D-CT venography: the separate demonstration of arterial-phase and venous-phase on 3D-CT angiography in a single procedure. AJNR Am J Neuroradiol 2005; **26:** 635-41.