PULSATILE TINNITUS: AUDIOLOGIC AND MR IMAGING DIAGNOSTIC ISSUES

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ABSTRACT
Pulsatile tinnitus often presents a diagnostic and management dilemma to the neurotologists. Correct diagnosis is imperative because in the majority of cases, there is a treatable underlying etiology. In addition, failure to make proper diagnosis may be disastrous because in some patients, a life-threatening intracranial disease may be present. This study was carried out aiming to investigate the feasibility of differentiating the possible causes of pulsatile tinnitus, particularly in patients with normal otoscopy, using clinical, audiological and radiological tools. 29 patients complaining of pulsatile tinnitus were evaluated by history taking, clinical examination, laboratory investigations, otoscopy, basic audiological evaluation, MRI for petrous bone and brain and MRA. Glomus jugulare tumor was diagnosed in 3 patients. Benign intracranial hypertension (BIH) was diagnosed in 4 patients. Intraventricular neoplasm in 2 patients. Internal carotid artery stenosis in one patient. Post-traumatic pseudoaneurysm in one patient. Scalp AVM in one patient. Temporal bone metastasis in one patient. Severe anemia in one patient and no identifiable cause (idiopathic) in 15 patients. A unilateral mild low frequency pseudosensorineural hearing loss was identified in 10 patients with normal otoscopy. Hearing loss was normalized after elimination of tinnitus by applying a light digital pressure over the ipsilateral internal jugular vein.

INTRODUCTION
Tinnitus is a very common otolog-
1. Full history taking.
2. Clinical examination including:
   a. General examination for obesity, anaemia, hypertension and hyperthyroidism.
   b. Local head and neck examination for audible bruit, palpable masses or pulsatile swelling.
   c. Neurological examination for the presence of cranial nerve palsy or signs of increased intracranial pressure.
3. Otoscopy.
4. Pure-tone and speech audiometry in a sound booth using a Madsen pure-tone and speech audiometer model OB822.
5. Immittance meter using an immittance meter, Interacoustics model AZ7.
6. Laboratory investigations for anemia and hyperthyroidism.
7. MR imaging of the temporal bone and brain: MR imaging examinations were carried out using a 1.5 Tesla system unit. Evaluation of the temporal bone region was done using thin sections axial and coronal non contrast T1 and T2 weighted spin echo sequences. Axial T1 weighted images with repetition time (TR) of 500 msec, echo time (TE) of 20 msec, slice thickness = 3 mm and axial T2 weighted images with TR of 5000 msec, TE of 90 msec and slice thickness = 3 mm. Evaluation of the whole brain was done using thicker slice thickness (5-7 mm) axial, coronal and sagittal planes T1 and T2 weighted spin echo sequences. Post contrast T1 weighted images were obtained in 8 patients after intravenous injection of 10 cc of gadolinium. Magnetic resonance angiography (MRA) was done using non contrast 3D time of flight sequence (3D TOF) for all cases.

RESULTS

Pulsatile tinnitus was unilateral in 27 patients (right sided in 15 and left sided in 12 patients) and bilateral in 2 patients.

Otoscopic examination did not reveal anything remarkable except in 3 female patients aged 45 to 52 years, where there is a reddish retrotypanic mass. Their pure-tone audiometry revealed a unilateral mild conductive hearing loss. Immittanceometry showed a humped curve with cyclic perturbations consistent with the patient pulse. Glomus jugulare tumor...
Table (1): Causes of pulsatile tinnitus in the study group

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>No. of cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benign intracranial hypertension (BIH)</td>
<td>4</td>
</tr>
<tr>
<td>Glomus Jugular tumour</td>
<td>3</td>
</tr>
<tr>
<td>Intraventricular neoplasm</td>
<td>2</td>
</tr>
<tr>
<td>Internal carotid artery stenosis</td>
<td>1</td>
</tr>
<tr>
<td>Post-traumatic pseudoaneurysm</td>
<td>1</td>
</tr>
<tr>
<td>Scalp AVM</td>
<td>1</td>
</tr>
<tr>
<td>Temporal bone metastasis</td>
<td>1</td>
</tr>
<tr>
<td>Severe anemia</td>
<td>1</td>
</tr>
<tr>
<td>Idiopathic</td>
<td>15</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>29</strong></td>
</tr>
</tbody>
</table>

Figure (1): Left glomus jugular tumor. Axial T2 WI showing slight hyperintense lesion in the left jugular foramen region with multiple signal void areas.

Figure (2): Large right glomus jugular tumor. Axial post contrast T1 WI with fat suppression showing the marked contrast enhancement of the mass.
Figure (5): Right ICA stenotic segment. MRA showing the stenotic segment within the left internal carotid artery (arrows).

Figure (6): Left external carotid pseudo aneurysm. MRA showing large aneurysm on the left side related to branches of the external carotid artery.

Figure (7): Left temporal scalp AVM. MRA showing the scalp AVM with intracranial extension

Figure (8): Left skull base and temporal bone metastasis. Axial post contrast MRI of temporal bone shows enhancing soft tissue mass involving the clivus and skull base on the left side.
cause for intracranial hypertension. The findings on MRI are often to subtle and non-specific to allow the diagnosis of BIH on the basis of MRI scans alone (Binder et al., 2004). Attenuated small sized ventricles and empty sella were the only MR abnormality. In our study, BIH was the second most common cause of pulsatile tinnitus with normal otoscopy. However, in a study carried out on 145 patients by Sismanis (1998), BIH was the most common cause of pulsatile tinnitus with normal otoscopy.

Two other patients had a history of persistent pulsatile tinnitus for about two years, both had normal otoscopy and normal hearing. MRI revealed an intraventricular space occupying lesion. Surgical excision was done in one patient and the pathologic diagnosis was ependymoma. The mechanism of pulsatile tinnitus was unclear, but these patients had mild dilatation of the ventricular system which is reported in literature as a potential cause of pulsatile tinnitus (Lo and Maya, 2003).

A stenotic segment of internal carotid artery (ICA) on the side of pulsatile tinnitus was diagnosed by MRA in one patient. MRA showed the site and extent of the stenotic segment which also was clearly visible on reviewing the axial source images. Westwood et al. (2002) reported that MRA was found to be highly sensitive and specific in diagnosing carotid artery stenosis.

A scalp AVM may cause pulsatile tinnitus. Controversy still exists about the etiology of scalp AVMs, but it is accepted that they may be either of congenital or traumatic origin, with the congenital lesion being the more commonly encountered variety (Fisher-Jeffes et al., 1995). One of our patients complained of pulsatile tinnitus associated with a retro auricular swelling. On examination, it was compressible and pulsatile. Although the condition was diagnosed clinically as a scalp AVM, imaging was still indicated for confirmation and to delineate the extent and connections of the AVM. MRA study revealed a scalp AVM with an intracranial connection to branches of the middle ce-
malized. Non contrast MRI of the brain and temporal bones is the initial investigation together with MRA of the head and the neck vessels. If no abnormality is detected by these procedures, the probability of a significant disease becomes minimal.

REFERENCES


طينين الأذن النابض؛ التشخيص بالاختبارات السمعية والرئين المغناطيسي

ملخص البحث:

يوجد الكثير من أطباء الأذن بعض الصعوبة في تشخيص وعلاج طنين الأذن النابض. ويحتاج التشخيص الصحيح لسبيس هذا العرض لأنه في حالات كثيرة يكون من الممكن علاجه. أما عدم الوصول إلى تشخيص صحيح لسبب هذا الطنين يمكن أن يؤدي إلى كارثة نظرًا لاحتمالية وجود مرض داخل الدماغ يهدد حياة المريض. تهدف هذه الدراسة إلى إمكانية استخدام الاختبارات السمعية والتصوير بالرنين المغناطيسي لتشخيص الأسباب المختلفة لطنين الأذن النابض وبالذات في المرضى ذي فحص منظوري طبيعي للأذن.

أجرت الدراسة على 29 مريض يشكلون من طنين الأذن النابض. وقد تم تقييم هؤلاء المرضى بتأخير التاريخ المرضي، الفحص الأكلينيكي، فحوصات معملية، اختبارات السمع الأساسية بالإضافة إلى التصوير بالرنين المغناطيسي للمخ.

تم الوصول إلى سبب طنين الأذن النابض في 14 مريض وكانت الأسباب كالآتي:

- ورم بكتلة الأوعية الدموية الكفية في 3 مريض، إرتفاع حميد للضغط داخل الدماغ في 4 مريض، ورم داخل البطين الخث في 2 مريض، ضيق بالشريان السباتي الداخلي في مريض واحد، ورم مخالي كاذب في مريض واحد، تسهيف سريان وريدي ببضرة الإس في مريض واحد، إتلاف سرطان بالوظيمة الصدغي في مريض واحد، فقر الدم حاد في مريض واحد، ولم يتم الوصول لأي سبب في 10 مريض.

وجد أن هناك 10 مريض ممن يعانون من طنين الأذن النابض وفحص منظوري طبيعي للأذن كان القياس السمعي بالنغمات التقنية يشير إلى وجود ضعف سمع حسي/ عصبي بدرجة بسيطة بالتردادات الرخيمة إلا أنه بمجرد الضغط على الوريد الوداجي الداخلي تنفس جمه الطنين، اختفت الطنين وأصبح قياس السمع طبيعيًا.

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