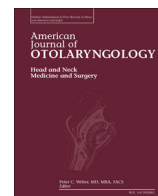




Contents lists available at ScienceDirect

# American Journal of Otolaryngology–Head and Neck Medicine and Surgery

journal homepage: [www.elsevier.com/locate/amjoto](http://www.elsevier.com/locate/amjoto)

## Transtympanic pseudoaneurysm of the internal carotid artery complicating a myringotomy in a four-year old child: Case report and literature review

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### ARTICLE INFO

Article history:  
Received 19 July 2017  
Available online xxxx

Keywords:  
Aneurysm  
Carotid artery injuries  
Cardiovascular abnormalities  
Endovascular procedures  
Middle ear

### ABSTRACT

We report the first case of a *transtympanic* iatrogenic internal carotid artery (ICA) pseudoaneurysm diagnosed in a 4-year-old child following a myringotomy. An endovascular treatment with a covered-stent was decided; spontaneous thrombosis was found during the therapeutic arteriography, and the procedure was aborted. Otoscopy and computed tomography (CT) scan monitoring showed a prolonged thrombosis and the disappearance of the pseudoaneurysm 18 months after the diagnostic arteriography. Based on literature review, endovascular techniques seem to be preferred to the surgical approach for treatment of intrapetrous ICA pseudoaneurysm, however clinical and CT scan monitoring may also be a valid option.

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### 1. Introduction

The temporal bone is situated at the intersection of the cerebral-committed blood vessels, which are the internal jugular vein and the internal carotid artery (ICA) [1]. Vascular masses, which can be seen behind the eardrum, are likely to be three different types of lesion, listed by ascending prevalence: a high dehiscent jugular bulb, a glomus jugulare or tympanicum tumour, and an aberrant internal carotid artery [2]. The aberration of the internal carotid artery from its typical course through the middle ear is very rare [1,3–29]. Lasjaunias' embryologic theory is the most commonly accepted theory to explain this congenital malformation [30]. The abnormal involution of the first vertical portion of the ICA induces a diversion in the vascular pathway into the inferior tympanic artery, supplied by the external carotid artery. The inferior tympanic artery provides the carotido-tympanic artery by a reverse flow, which in turn supplies the distal horizontal transpetrous portion of the ICA.

Symptoms for an aberrant ICA are not specific (conductive hearing loss, pulsatile tinnitus) or absent. Diagnosis can be made either fortuitously using a cerebral or temporal computed tomography (CT) scan, or during surgery for a middle ear exploration or myringotomy. Haemorrhagic complications are extremely rare and potentially

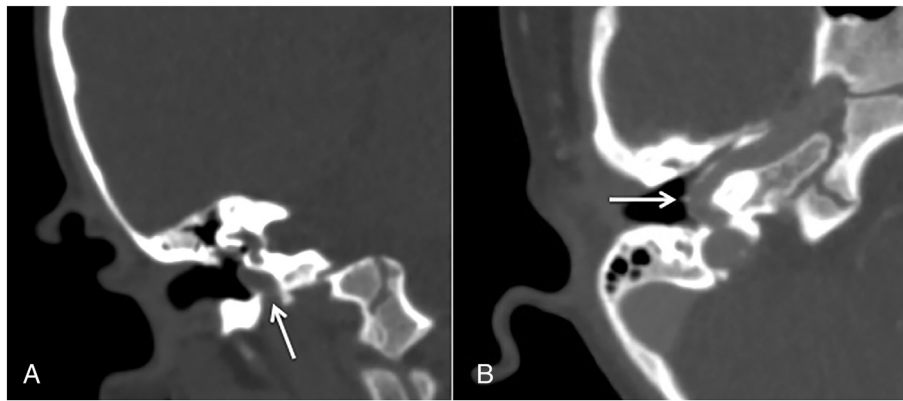
life threatening. The aim of this paper is to analyse the unique case report of an iatrogenic transtympanic pseudoaneurysm of the intrapetrous ICA. To our knowledge, it is the first case report treating a pseudoaneurysm directly in the external auditory canal. The diagnostic circumstances and the treatment modalities are discussed in a review of the iatrogenic haemorrhagic complications of the intrapetrous ICA.

### 2. Case report

A 4-year-old boy with no particular background was referred to our University Hospital three months after profuse bleeding during a right myringotomy for chronic otitis media with a conductive hearing loss. The haemorrhage was controlled by external auditory canal packing. The procedure was aborted and the child immediately underwent a CT scan. The scan showed an aberrant course of both intrapetrous ICA. In the right ear, the ICA occupied the whole space of the middle ear and came in contact with the eardrum's inferior portion (Fig. 1). The packing was retrieved a couple of days later and no haemorrhagic episode was noted.

During the clinical examination three months later, a greyish beating mass bulging in the right external auditory canal, through the tympanic membrane, was assessed. The audiogram showed a 30 dB conductive hearing loss in the right ear. A new CT scan was done and a 4 mm pseudoaneurysm was found to be erupting from the ICA into the external auditory canal. A diagnostic arteriography was performed in order to evaluate the exact position of the pseudoaneurysm, the aneurysm's

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**Fig. 1.** Computed Tomography scan of the right petrous bone immediately after the myringotomy. Coronal view (a) and axial view (b) showing an aberrant internal carotid artery in contact with the malleus inside the middle ear cavity (arrows).

collar, the Willis' polygon permeability, and the endovascular treatment feasibility. The arteriography showed an irregularity of the external wall of the right intrapetrous ICA's elbow with an aneurysm in front of the tympanic membrane (Fig. 2). The Willis' polygon was permeable with a good diameter of the communicating arteries.

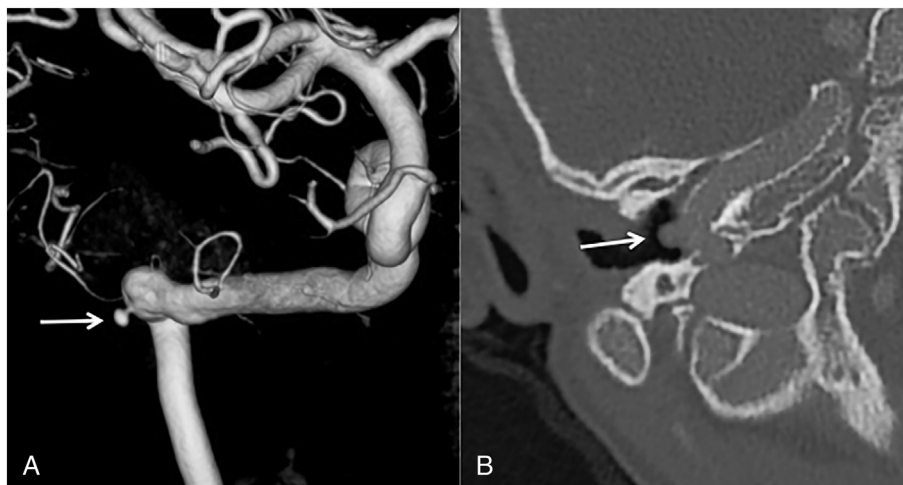
After a multidisciplinary meeting with neurosurgeons, neuro-interventionalists, and otolaryngologist surgeons, an endovascular treatment was decided upon by placing a covered-stent to exclude the right ICA pseudoaneurysm. In the case of per-operative impossibility, an endovascular balloon occlusion of the right ICA would have been done in the same surgical intervention. The child received medication with Clopidogrel 75 mg, one pill a day, two days before the procedure. Seven days after the first diagnostic arteriography, the therapeutic arteriography was carried out and an aneurysm thrombosis was found, although it was permeable during the first arteriography. No curative endovascular treatment was decided upon, and clinical and radiological surveillance was prescribed.

An otoscopy and CT scan performed the next day showed a stable thrombosis and a reduction in size of the pseudoaneurysm (Fig. 3a). Four months later, the CT scan showed a stable thrombosis with a pseudoaneurysm involution (Fig. 3b). Six months after the first arteriography, otoscopy examination showed a healed tympanic membrane. Eighteen months after the thrombosis, otoscopy examination

showed a retraction of the *pars flaccida*, taking the mould of the ICA in the inferior quadrants. The CT scan showed a complete disappearance of the aneurysm and the wall of the ICA had reverted back to normal (Fig. 3c).

### 3. Discussion

Aberrant intrapetrous ICA course is a rare anatomic variation. The iatrogenic risk of intrapetrous ICA injury is particularly high as the position of the aberrant ICA is inside the middle ear, in front of the myringotomy site (*i.e.* the antero-inferior quadrant of the tympanic membrane). Hasebe et al. studied the distance between the intrapetrous carotid canal and the tympanic membrane; a 4.9 mm ( $\pm 1.7$  mm) length was found on 15 temporal bones [31]. In 13.3% of the cases, a length under 3 mm was found, which is smaller than most myringotome blades. The carotid canal dehiscence in the middle ear contributes a higher iatrogenic haemorrhagic risk. Moreano et al. found a 7.7% prevalence rate of carotid canal dehiscence in 1000 temporal bone dissections [32]. Little information is given on the prevalence of aberrant ICA in the middle ear in literature. In 1934, Myerson et al. came up with a prevalence of approximately 1% [33].



**Fig. 2.** (a) Right internal carotid artery's arteriography and (b) computed tomography scan of the right ear showing the pseudoaneurysm in the external auditory canal (arrows).

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