

Aberrant Internal Carotid Artery in the Middle Ear

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The knowledge about the aberrant internal carotid artery (ICA) in the middle ear is essential for clinicians, because a misdiagnosis of the aberrant ICA could have serious consequences such as excessive aural bleeding during a middle ear surgery. A 38-year-old woman presented with tinnitus and hearing difficulties of the left ear that had started 5 years ago. During otoscopy, an anteroinferior bluish mass was seen in the tympanic space. Computed tomography and magnetic resonance imaging demonstrated a left-side aberrant ICA with bony dehiscence of the carotid canal in the middle ear and a reduced diameter of the tympanic ICA. Herein we report a case of an aberrant ICA in the middle ear. We also review the literature regarding this important vascular anomaly of the temporal bone which may lead to disastrous surgical complications.

Index terms

Aberrant Internal Carotid Artery
Computed Tomography
Magnetic Resonance Angiography

INTRODUCTION

The aberrant internal carotid artery (ICA) in the middle ear is a rare, but important vascular anomaly of the temporal bone. The clinical diagnosis of an aberrant ICA is often difficult, because signs and symptoms such as conductive hearing loss, pulsatile tinnitus and vertigo are nonspecific. The aberrant ICA is frequently confused with otosclerosis, glomus tumor and other vascular malformations such as dehiscent jugular bulb, hemangioma and aneurysm (1, 2). A misdiagnosis of this anomaly could have serious consequences. An excessive aural bleeding during a myringotomy or tympanotomy is a life-threatening complication (3). Although the identification became easy with the temporal bone computed tomography (CT), it is not unusual for this anomaly to be discovered during middle ear surgery. Our literature review yielded 78 cases of aberrant ICA in the middle ear, with 11 of them presenting with a persistent stapedial artery. Herein, we report a case of aberrant ICA in the middle

ear and describe the clinical and radiological features of this vascular anomaly.

CASE REPORT

A 38-year-old woman visited our hospital due to tinnitus and hearing difficulties of the left ear that had started 5 years ago. During otoscopy, an anteroinferior bluish pulsating mass was seen in the tympanic space (Fig. 1A). The audiometry showed a hearing loss of conductive type in the left ear. High resolution temporal bone CT scanning and CT carotid angiography were performed and showed a left-side aberrant ICA with a bony dehiscence of the carotid canal (Fig. 1B). The left ICA was seen entering the tympanic cavity through the markedly enlarged inferior tympanic canaliculus (Jacobson canal) (Fig. 1C), crossing the cochlear promontory and projected into the tympanic space (Fig. 1D). The native vertical portion of the petrous carotid canal and the foramen spinosum were absent. The magnetic reso-

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nance angiography (MRA) showed a reduced diameter of the tympanic ICA. The vertical segment of the carotid artery was laterally located to a line drawn vertically through the vestibule. An aplasia was revealed of the A1 segment of the left anterior cerebral artery (ACA) (Fig. 1E).

DISCUSSION

Normally, the ICA enters the petrous bone medial to the styloid process via the carotid canal. The initial vertical segment is separated from the tympanic cavity by a thin plate of bone. The

ICA then turns anteriorly to lie inferior and posteromedial to the eustachian tube, traverses the foramen lacerum and enters the medial cranial fossa.

Rarely, the ICA takes an aberrant course. Several hypotheses have been considered concerning the genesis of aberrant ICA. Lasjaunias and Santoyo-Vazquez (4) hypothesized the alternate blood flow theory that the C1 portion of the ICA involutes owing to the persistence of the pharyngeal artery system and as a consequence, an anomalous course develops with blood flowing via the ascending pharyngeal artery to the enlarged inferior tympanic artery with retrograde flow through the caroticotym-

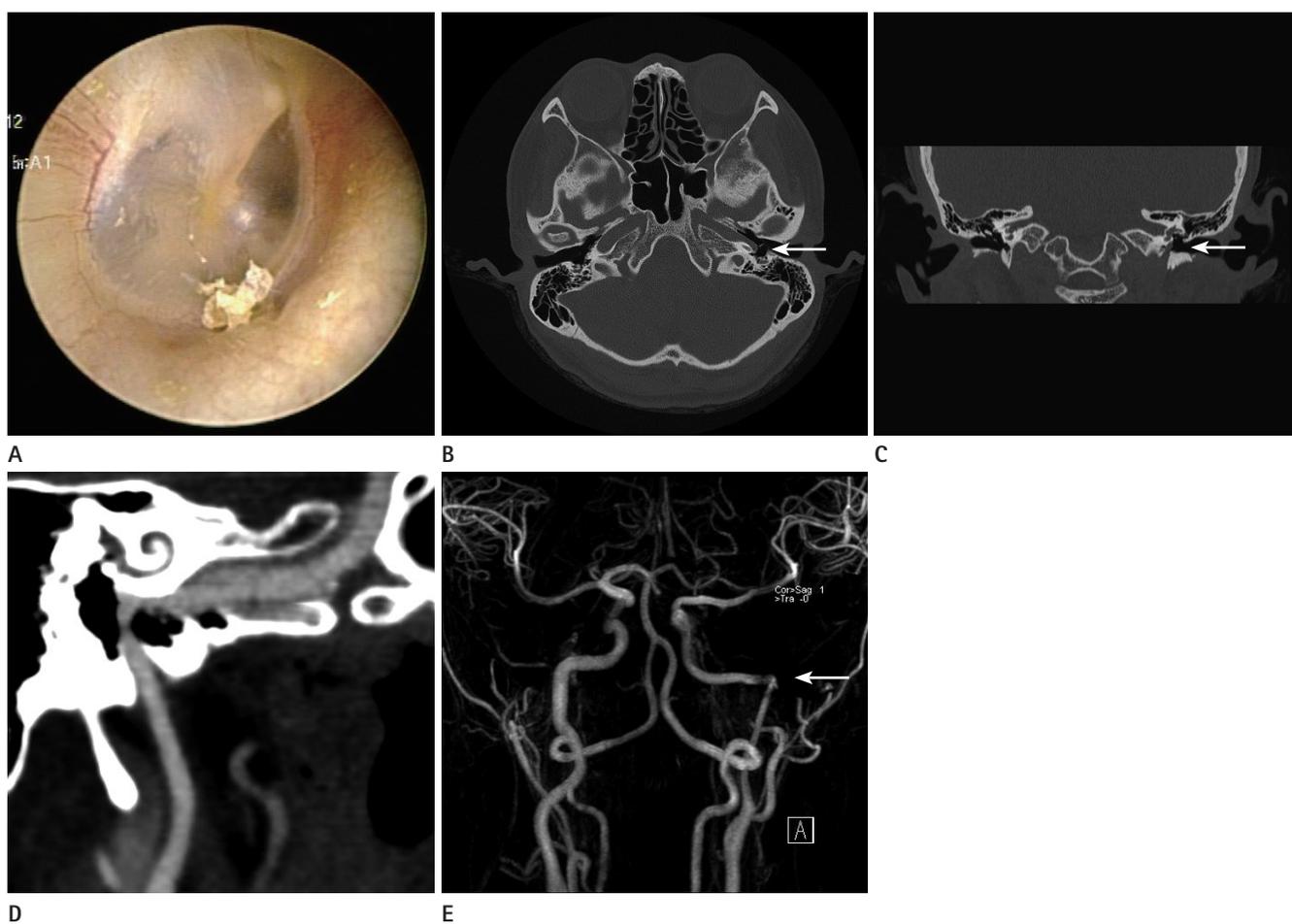


Fig. 1. 38-year-old female with tinnitus and hearing difficulty of the left ear history.
A. At otoscopy, an anteroinferior bluish mass in the left tympanic space is seen.
B. Axial high resolution temporal bone CT scan shows the aberrant left ICA (white arrow), entering the tympanic cavity through a dehiscence carotid plate.
C. The left ICA (white arrow) is seen entering the tympanic cavity through the markedly enlarged inferior tympanic canaliculus (Jacobson canal) on coronal temporal bone CT.
D. Curved multiplanar reformation CT carotid angiography shows the aberrant left ICA, crossing the cochlear promontory and projected into the tympanic space.
E. MRA shows a reduced diameter of the left tympanic ICA (white arrow). The vertical segment of the left ICA is lateral to a line drawn vertically through the vestibule. The aplasia of the A1 segment of the left ACA is revealed.
 Note.—ACA = anterior cerebral artery, ICA = internal carotid artery, MRA = magnetic resonance angiography

panic vessels into the horizontal segment of the ICA. This theory may explain the radiological features with an enlargement of the inferior tympanic canaliculus, the presence of a mass like lesion found in the anterior hypotympanum and the absence of the vertical portion of the ICA.

The clinical diagnosis of an aberrant ICA appears as difficult because signs and symptoms such as pulsatile tinnitus, conductive hearing loss and a pulsatile tympanic mass in the anteroinferior area are often nonspecific or absent (5, 6). The results of a conductive hearing loss component from an audiometric evaluation may be attributed to a malleus or incus blockage. Those findings could be regarded as otosclerosis, glomus tumor or other vascular malformation. However, a tympanic mass due to an aberrant ICA looks different from a glomus tumor and dehiscent jugular bulb: anterior, pulsatile and white or rosy (1, 2). Thus, a mostly asymptomatic aberrant ICA will be diagnosed during middle ear surgery (7). A temporal bone CT should be performed before any middle ear surgery in order to avoid a surgical injury due to misdiagnosis. On CT scan, an aberrant ICA is identified by an ICA that runs adjacent to the jugular bulb, in a posterior position and with a reduced diameter, an enhancing mass in the hypotympanum, a deficient bony plate along the tympanic portion of the ICA, an enlargement of the inferior tympanic canaliculus and the absence of the vertical segment of the carotid canal (2). The MRA can be used as an additional tool if a definitive diagnosis is not possible with a CT scan only (6). It provides an excellent visualization of the intracranial and extracranial circulation. In this case, the MRA showed a reduced diameter of the tympanic ICA, the absence of the vertical segment of the carotid canal and a aplasia of the A1 segment of the ACA on the same side. All of these anomalies were located on the same side and probably may have a common cause. This common cause is most likely a maldevelopment of the vascular network (1).

The knowledge about this rare entity is essential for a clinician, because an accidental injury after myringotomy or in case of misdiagnosis with another vascular tumor may lead to disastrous consequences. Most authors recommend a conservative approach in case of an asymptomatic and proven aberrant ICA (7, 8), but Ruggles and Reed (9) advocated a surgery to relieve the patient of troublesome symptoms and to prevent a possible destruction of

the middle ear structures and formation of an aneurysm.

The knowledge about the aberrant ICA in the middle ear is essential for clinicians, because a misdiagnosis of this anomaly could lead to serious consequences such as excessive aural bleeding or vascular occlusion. All masses in the middle ear, especially pulsating masses, should be studied by imaging methods such as CT and MRA.

REFERENCES

1. Shimizu S, Sasahara G, Iida Y, Shibuya M, Numata T. Aberrant internal carotid artery in the middle ear with a deficiency in the origin of the anterior cerebral artery: a case report. *Auris Nasus Larynx* 2009;36:359-362
2. Sauvaget E, Paris J, Kici S, Kania R, Guichard JP, Chapot R, et al. Aberrant internal carotid artery in the temporal bone: imaging findings and management. *Arch Otolaryngol Head Neck Surg* 2006;132:86-91
3. Eryilmaz A, Dagli M, Cayonu M, Dursun E, Gocer C. An aberrant internal carotid artery in the temporal bone presenting as a middle-ear mass: a case report. *J Laryngol Otol* 2008; 122:983-985
4. Lasjaunias P, Santoyo-Vazquez A. Segmental agenesis of the internal carotid artery: angiographic aspects with embryological discussion. *Anat Clin* 1984;6:133-141
5. Koizuka I, Hattori K, Tsutsumi K, Sakuma A, Katsumi N, Kikuchi H, et al. Objective tinnitus caused by an aberrant internal carotid artery. *Auris Nasus Larynx* 1998;25:323-327
6. Botma M, Kell RA, Bhattacharya J, Crowther JA. Aberrant internal carotid artery in the middle-ear space. *J Laryngol Otol* 2000;114:784-787
7. Cole RD, May JS. Aberrant internal carotid artery. *South Med J* 1994;87:1277-1280
8. Duclos JY, Darrouzet V, Martel J, Berge J, Calas V, Bébéar JP. [Abnormal trajectory of the internal carotid artery in the middle ear. Report of a case]. *Rev Laryngol Otol Rhinol (Bord)* 2000;121:187-192
9. Ruggles RL, Reed RC. Treatment of aberrant carotid arteries in the middle ear: a report of two cases. *Laryngoscope* 1972;82:1199-1205

중이내 미입 내경동맥

노근탁 · 강현구

중이내 미입 내경동맥의 인지는 임상에게 중요하다. 중이내 미입 내경동맥의 오진단은 중이 수술 중 심각한 출혈을 야기할 수 있기 때문이다. 5년 전부터 시작된 좌이의 이명과 청력감소를 주소로 내원한 38세 여성 환자의 검이경 소견상 좌이 고막 전하부위에 청색의 종물이 관찰되었다. 컴퓨터단층촬영과 자기공명영상에서 좌이의 중이내 미입 내경동맥과 좌측 내경동맥의 고실부분의 형성저하증이 관찰되었다.

서울보훈병원 영상의학과