



Case Report

Aberrant internal carotid artery presenting with chronic suppurative otitis media and moderate conductive hearing loss

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Abstract

Aberrant internal carotid artery (ICA) is a rare congenital vascular anomaly where the artery takes an atypical course through the temporal bone and middle ear cavity. Its co-existence with chronic suppurative otitis media (CSOM), a persistent inflammatory disease of the middle ear and mastoid cavity, creates complex diagnostic and therapeutic challenges. This case report presents a 37-year-old female with a 14-year history of CSOM accompanied by pulsatile tinnitus and progressive conductive hearing loss. High-resolution CT and MRI confirmed the presence of an aberrant ICA traversing the tympanic cavity, closely related to the ossicular chain and tympanic membrane.

The clinical examination included tuning fork tests which indicated right-sided conductive hearing loss, supported by audiometric findings revealing moderate conductive hearing loss in both ears. The right ear audiogram showed consistent thresholds around 60 dB HL, with absent responses at high frequencies, necessitating careful interpretation to rule out mixed hearing pathology. A multidisciplinary team including otolaryngologists, radiologists, and an audiologist collaborated to manage this case conservatively to avoid catastrophic intraoperative bleeding.

This case underscores the critical role of comprehensive imaging, detailed audiological evaluation, and collaborative planning in managing such complex otologic conditions. Early identification of vascular anomalies like an aberrant ICA can dramatically alter surgical decisions and outcomes.

Keywords: Aberrant internal carotid artery (ICA), Chronic suppurative otitis media (CSOM), Conductive hearing loss, Pseudoaneurysms, embolization

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1. Introduction

Chronic suppurative otitis media (CSOM) is a common otologic condition marked by chronic inflammation, cases, tympanoplasty or mastoidectomy is considered to otorrhea, and varying degrees of hearing loss. In routine resolve infection and improve hearing. However, anatomical anomalies like an aberrant internal carotid artery (ICA) can complicate diagnosis and increase the risk of potentially life-threatening intraoperative complications, such as massive hemorrhage, stroke, or cranial nerve damage.

An aberrant ICA occurs when the vessel takes an anomalous course through the middle ear due to developmental absence or underdevelopment of the bony

carotid canal. While rare, its clinical significance is profound, particularly in the context of middle ear surgeries. The aberrant ICA may present subtly, with nonspecific symptoms such as pulsatile tinnitus or conductive hearing loss. Thus, this case report seeks to highlight the diagnostic diligence required in such cases, the importance of imaging, and the necessity of multidisciplinary care.

2. Case Presentation

A 37-year-old female presented at the ENT department due to a constellation of otologic symptoms. She reported experiencing persistent, purulent discharge from her right ear for more than 14 years, a condition that reportedly worsened with seasonal changes. Concurrently, she had been suffering

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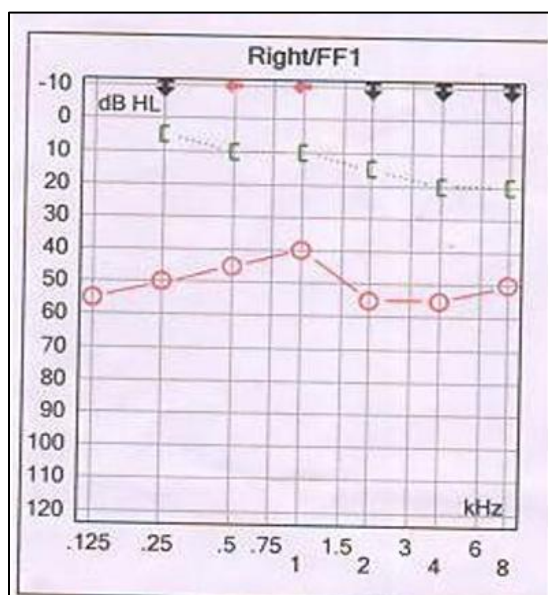
from progressive bilateral hearing loss, which was notably more severe in her right ear. Adding to her discomfort was a pulsatile tinnitus in the right ear, characterized by a rhythmic sound that coincided with her heartbeat.

2.1. Clinical examination

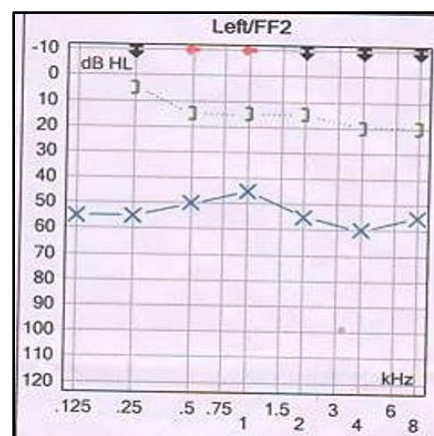
During the otoscopic examination, the right tympanic membrane was observed to be intact, exhibiting some thickening but no visible perforation or evidence of cholesteatoma. Tuning fork tests revealed a negative Rinne's test in the right ear (bone conduction greater than air conduction) and a positive Rinne's test in the left ear. Weber's test lateralized to the right ear, while absolute bone conduction was found to be normal bilaterally, matching that of the examiner. Further neurological assessment showed no cranial nerve deficits, facial asymmetry, or balance disturbances.

2.2. Role of audiologist

Mr. Ghanshyam Joshi played a crucial role in the patient's care by actively performing pure tone audiometry and impedance testing. He was responsible for interpreting these results in correlation with the patient's clinical symptoms, providing valuable insights for diagnosis. Furthermore, Mr. Joshi counseled the patient on various conservative and surgical hearing rehabilitation options, such as hearing aids versus ossiculoplasty, enabling informed decision-making. He also assisted the medical team in differentiating between conductive and sensorineural components of the hearing loss, contributing significantly to a comprehensive understanding of the patient's condition.



Graph 1: Right ear pure tone audiogram



Graph 2: Left ear pure tone audiogram

Right Ear: Moderate conductive hearing loss with flat thresholds around 60 dB HL across 250 Hz to 4 kHz. High frequencies showed no response, represented by arrow symbols, raising concern for a potential sensorineural component.

Interpretation update: A flat audiogram with consistent thresholds around 60 dB HL is characteristic of moderate conductive loss. The absence of response at high frequencies warrants further exploration to exclude early mixed hearing loss or masking artifacts. **(Graph 1)**

Left ear: Thresholds ranged from 50–60 dB HL, forming a flat audiometric configuration with no significant sloping. This suggests symmetrical moderate conductive hearing loss. **(Graph 2)**

Clarification: Consistent flat thresholds across all frequencies in the left ear rule out noise-induced or age-related high-frequency loss and support the diagnosis of bilateral conductive pathology.

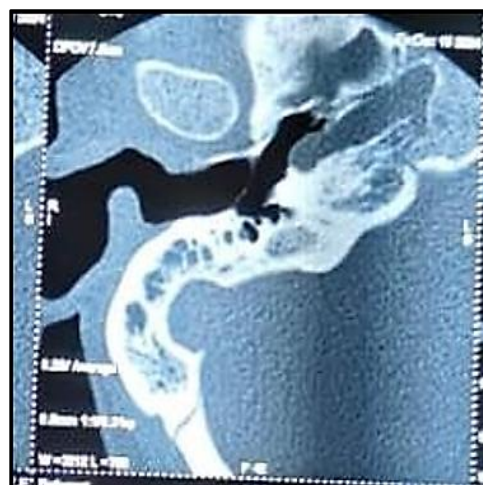


Figure 1: Axial CT image



Figure 2: Axial CT image



Figure 3: Coronal CT reconstruction

The axial CT image shows duplication of the left internal carotid artery with a normal vertical petrous carotid canal. The aberrant ICA represents the enlargement of the inferior tympanic and caroticotympanic arteries. The inferior tympanic artery passes through the inferior tympanic canaliculus within the caroticojugular spine, which is usually imperceptible. (**Figure 1, Figure 2**)

The inferior tympanic artery then anastomoses with the caroticotympanic artery within the middle ear cavity, over the cochlear promontory. In **Figure 3** the coronal CT reconstruction reveals the close proximity of the aberrant internal carotid artery to the ossicular chain and tympanic membrane. The caroticotympanic artery passes through a dehiscence carotid.

Plate and anastomoses with the petrous portion of the internal carotid artery.

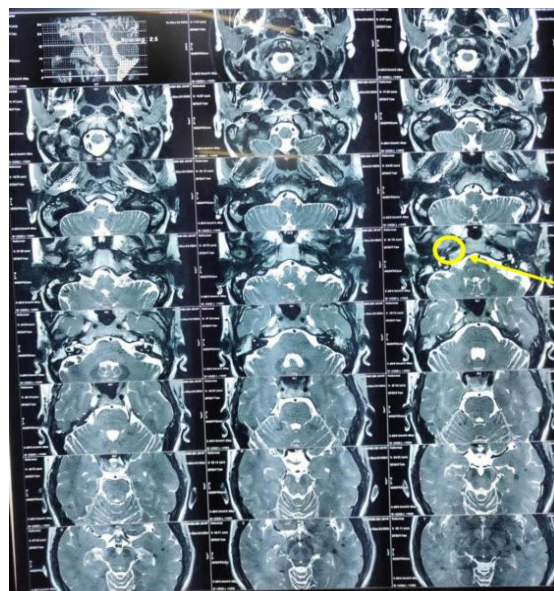


Figure 4: Coronal MRI scan highlighting anatomical structures and potential abnormalities.

In **Figure 4** the yellow arrow indicates a specific region of interest the MRI image demonstrate bilateral duplication of the internal carotid arteries. These vessels merge just before the horizontal petrous segment.

3. Management

3.1. Multidisciplinary approach

1. Our team of ENT surgeons: Managed otorrhea conservatively and refrained from surgical exploration.
2. Radiologists: Provided vital input on anatomical variations and vascular imaging.
3. Audiologist: Advised non-invasive hearing solutions and monitored hearing level

3.2. Treatment strategy

1. Medical Management.
2. Topical antibiotic drops.
3. Oral antibiotics for active infection.
4. Aural toilet and follow-up to monitor symptom control.

3.3. Surgical considerations

1. Tympanoplasty/myringoplasty were avoided due to high ICA risk.
2. Surgical planning was deferred until vascular stabilization or definitive endovascular clearance.

3.4. Endovascular discussion

Not immediately pursued, but embolization/stenting considered for future if symptoms or risks escalated.

4. Discussion

The coexistence of an aberrant internal carotid artery (ICA) with chronic suppurative otitis media (CSOM) introduces considerable diagnostic complexity. Symptoms such as pulsatile tinnitus may suggest a vascular anomaly like an aberrant ICA, yet they often overlap with those of other otologic conditions, making accurate diagnosis challenging. In such cases, detailed clinical history and symptom correlation are essential for early suspicion.^{1,4,6}

Advanced imaging plays a central role in identifying these anomalies. High-resolution computed tomography (CT) and magnetic resonance imaging (MRI) are critical for visualizing the aberrant ICA and planning a safe surgical approach. These modalities enable clinicians to assess the anatomical course of the ICA and differentiate it from other pathologies, thus reducing the risk of misdiagnosis and inappropriate surgical intervention.^{1,4,6}

Surgical management of CSOM becomes significantly more complex when an aberrant ICA is present. The artery's proximity to the middle ear surgical field heightens the risk of life-threatening complications such as massive hemorrhage or neurological injury. Preoperative imaging and thorough knowledge of temporal bone vascular anatomy are therefore indispensable to reduce surgical risk and ensure patient safety.^{2,3,5}

A multidisciplinary approach is essential for optimal management. Collaboration between otolaryngologists, radiologists, audiologists, and vascular surgeons allows for comprehensive evaluation and treatment of both the middle ear disease and the vascular anomaly. This team-based strategy improves diagnostic accuracy, surgical planning, and long-term outcomes by minimizing the risk of adverse events.⁷

The prognosis for patients with an aberrant ICA and CSOM is generally favorable when the condition is diagnosed early and managed appropriately. Early intervention helps preserve hearing and prevents catastrophic complications. However, delayed diagnosis or inadequate management can lead to significant morbidity, reinforcing the importance of early imaging and conservative decision-making in vascular cases.^{6,8}

5. Conclusion

This case underscores the critical importance of early diagnosis and a multidisciplinary approach in managing patients with coexisting aberrant internal carotid artery (ICA) and chronic suppurative otitis media (CSOM). The presence of a developmental vascular anomaly significantly alters the

standard approach to CSOM, demanding heightened clinical vigilance. Thorough otological and audiological evaluation, complemented by high-resolution imaging, is essential before considering any surgical intervention. Such imaging not only facilitates accurate diagnosis but also aids in meticulous surgical planning, thereby minimizing the risk of life-threatening complications. A team-based strategy involving ENT specialists, radiologists, and audiologists ensures comprehensive management of these complex cases. Furthermore, proper documentation and continued analysis of such rare clinical entities are vital for enhancing understanding, refining management protocols, and ultimately improving patient outcomes in otologic surgery.

6. Conflict of Interest

None.

7. Source of Funding

None.

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