Case Report

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Anteriorly Placed Sigmoid Sinus: A Critical Anatomical Variant Necessitating Pre-operative CT Temporal Bone Imaging

ABSTRACT

Sigmoid sinus forms the posterior limit during our regular mastoid surgeries. Anatomical variations of the sigmoid sinus, particularly anterior positioning, represent significant surgical challenges in otologic procedures. Mastoid surgery becomes difficult if the sigmoid sinus is placed so anteriorly, making the surgery troublesome with massive bleed. Like every other structures, sigmoid sinus too undergoes anatomical variations, making its location during surgeries variable. we present a case of Right anteriorly placed sigmoid sinus with no bony posterior wall in external auditory canal with sigmoid sinus projecting into the ear canal. Every surgeon should be aware of the abnormal variations of sigmoid sinus to avoid intraoperative surprises and complications. Pre-operative imaging is crucial for identifying these variants to prevent intraoperative complications. This case emphasizes the critical importance of routine CT temporal bone imaging prior to mastoid surgery to identify sigmoid sinus anatomical variants and ensure safe surgical planning.

Keywords: Anatomical variant, sigmoid sinus, temporal bone CT

INTRODUCTION

Sigmoid sinus forms the posterior limit during our regular mastoid surgeries. It is a major venous structure within the temporal bone that drains blood from the transverse sinus to the internal jugular vein. Anatomical variations in sigmoid sinus position and course are well-documented in the literature, with anterior positioning being one of the most clinically significant variants encountered in ear surgery[1].

Normal sigmoid sinus anatomy demonstrates a predictable S-shaped course along the posterior-medial aspect of the mastoid process. However, in cases of anterior positioning, the sinus may extend significantly forward into the mastoid air cell system, creating a potential hazard during mastoidectomy procedures[2]. The incidence of sigmoid sinus anatomical variants ranges from 5-15% in various radiological studies, with anterior positioning accounting for approximately 3-7% of cases[3].

Pre-operative imaging, particularly high-resolution computed tomography (HRCT) of the temporal bone, has become the gold standard for evaluating temporal bone anatomy and identifying potential surgical challenges. It provides detailed visualization of the temporal bone, allowing surgeons to plan the needed surgical approaches and anticipate potential complications[4].

The consequences of unrecognized sigmoid sinus variants can be severe, including massive hemorrhage, air embolism, and potential neurological complications. Several case reports have documented such complications when anatomical variants were not identified pre-operatively[5]. This case report highlights the critical importance of routine temporal bone CT imaging in preventing such complications.

CASE REPORT

A 49-year-old Female, presented to our ENT Department with the complaints of right ear discharge, Pulsatile tinnitus, and intermittent ear pain since 6 months. The patient had no significant past medical history and denied any previous ear surgeries or trauma. Physical examination revealed attic retraction pocket with otomycosis. Posterior wall of External auditory canal shows pulsations. Initial treatment with topical antibiotics provided temporary improvement, but tinnitus didn't improve. Patient had similar complaints 2 weeks later, with foul smelling ear discharge. Given the persistent nature of the condition, Foul smelling discharge and attic retraction, surgical intervention was planned.

Pre-operative high-resolution CT of the temporal bone was performed using a 64-slice CT scanner with 0.5mm slice thickness in both axial and coronal planes. The imaging revealed sclerotic mastoid. Critically, the study demonstrated significant anterior positioning of the right sigmoid sinus. It was also noted to project into the posterior ear canal, with the bony sigmoid plate measuring less than 1mm in thickness and even absent in few sections. The facial nerve canal

appeared intact with normal bony covering throughout its mastoid segment.

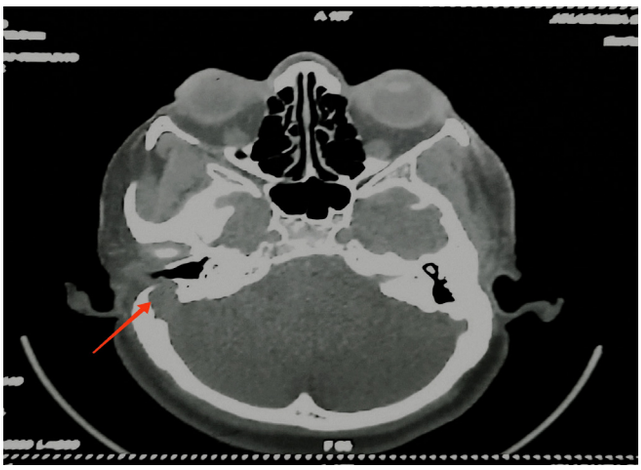


Figure 1: Non-contrast computed tomography (CT) of the temporal bone in axial view demonstrating an anteriorly displaced sigmoid sinus (red arrow) extending into the right external auditory canal.



Figure 2. Non-contrast computed tomography (CT) of the temporal bone in coronal view demonstrating an laterally displaced sigmoid sinus (red arrow) with 2mm bone lying superficially.

DISCUSSION

This case illustrates the critical importance of pre-operative CT temporal bone imaging in identifying anatomical variants that can significantly impact surgical planning and patient safety. The anteriorly placed sigmoid sinus represents one of the most challenging anatomical variants encountered in otologic surgery, as it directly impinges upon the standard surgical field used in mastoidectomy procedures[6].

The normal sigmoid sinus follows a predictable course along the posterior aspect of the mastoid process, typically remaining 10-15mm posterior to the posterior external auditory canal wall. In cases of anterior positioning, this distance may be reduced to as little as 2-5mm, or even 1mm, significantly limiting the available working space for mastoid drilling and increasing the risk of inadvertent sinus injury[7].

Several factors contribute to sigmoid sinus anatomical variants, including developmental variations, previous inflammatory disease, and individual anatomical differences[8]. However, in many cases, these variants represent normal developmental variations that become clinically significant only in the context of surgical intervention.

The consequences of unrecognized sigmoid sinus injury during otologic surgery can be severe. Reported complications include massive hemorrhage requiring blood transfusion, venous air embolism, and in rare cases, stroke or death[9]. Even minor sinus injuries can result in significant morbidity, including prolonged operative times, need for additional surgical procedures, and increased risk of post-operative complications.

Modern imaging techniques have significantly improved our ability to identify these anatomical variants pre-operatively. High-resolution CT provides excellent visualization of bony anatomy and can accurately delineate the course and position of major vascular structures within the temporal bone[10].

The economic implications of routine pre-operative imaging must also be considered. While CT temporal bone imaging adds to the overall cost of surgical care, the potential costs associated with managing intraoperative complications far exceed the expense of routine imaging[11]. Additionally, the medicolegal implications of failing to identify known anatomical variants that could impact surgical safety cannot be overlooked. Based on comprehensive temporal bone dissection studies, Sarmiento and colleagues established a standardized anatomical classification system for sigmoid sinus positioning utilizing seven distinct reference points[12]. Through systematic analysis of 96 temporal bone specimens, they categorized sigmoid sinus variations into three morphological types according to their spatial relationship with Trautmann's triangle. Type 1 configuration demonstrates posterior sigmoid sinus positioning, resulting in enlargement of Trautmann's triangle and providing optimal surgical access. Type 2, representing the most frequently encountered variant, is characterized by anterior sigmoid sinus displacement, which consequently reduces the dimensions of Trautmann's triangle. Type 3 morphology involves medial sigmoid sinus displacement, similarly compromising the available area within Trautmann's triangle. In the present case, morphological analysis suggests a Type 2 configuration in the anteroposterior plane, with the notable distinction of marked superficial (lateral) positioning relative to the expected anatomical depth, creating unique surgical considerations for posterior fossa approaches.

CONCLUSIONS

This case demonstrates the critical importance of pre-operative CT temporal bone imaging in identifying anatomical variants that can significantly impact surgical planning and patient safety. Anteriorly positioned sigmoid sinus represents a relatively common variant that can lead to serious complications if not recognized pre-operatively. Routine imaging should be considered standard of care for all patients undergoing mastoid surgery to ensure optimal surgical outcomes and patient safety.

REFERENCES

1. Manjila S, Semaan MT, Megerian CA. Anatomical variants of the sigmoid sinus: implications for mastoid surgery. Otol Neurotol. 2011;32(4):542-7.

2. Kohan D, Sorin A. Anterior sigmoid sinus: surgical anatomy and clinical implications. Am J Otol. 1999;20(3):372-7.

3. Ikeda M, Nakazato H, Onoda K, et al. Sigmoid sinus anatomical variations in temporal bone CT. Auris Nasus Larynx. 2018;45(3):473-8.

4. Jackler RK, Dillon WP, Schindler RA. Computed tomography in suppurative ear disease: a correlation of surgical and radiographic findings. Laryngoscope. 1984;94(6):746-52.

5. Bozorg Grayeli A, Refass A, Smail M, et al. Temporal bone dissection for surgical training: a systematic review. Eur Arch Otorhinolaryngol. 2018;275(3):639-49.

6. Merchant SN, Rosowski JJ. Conductive hearing loss caused by third-window lesions of the inner ear. Otol Neurotol. 2008;29(3):282-9.

7. Calhoun KH, Wax MK, Sebelik ME. Temporal bone computed tomographic imaging for chronic otitis media. Am J Otolaryngol. 1991;12(1):15-9.

8. House JW, Friedman RA, Mickelson PG. Complications of mastoid surgery. Otolaryngol Head Neck Surg. 1999;121(5):557-61.

9. Casselman JW, Kuhweide R, Deimling M, et al. Constructive interference in steady state-3DFT MR imaging of the inner ear and cerebellopontine angle. AJNR Am J Neuroradiol. 1993;14(1):47-57.

10. Arriaga MA, Carrier D. Costs of preoperative CT scan in chronic ear surgery. Am J Otol. 1997;18(3):283-7.

11. Rosenfeld RM, Schwartz SR, Cannon CR, et al. Clinical practice guideline: acute otitis externa. Otolaryngol Head Neck Surg. 2014;150(1 Suppl):S1-24.

12. Sarmiento PB, Eslait FG. Surgical classification of variations in the anatomy of the sigmoid sinus. Otolaryngol Head Neck Surg. 2004;131(3):192– 9.

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