

## Unusual Anteriorly Placed Sigmoid Sinus: A Rare Case Report from Uttarakhand (India)

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### Abstract

The location of the sigmoid sinus within the mastoid cavity can be variable. An anteriorly displaced vertical segment of the sigmoid sinus constitutes an uncommon but potentially dangerous anatomical variation that surgeons can encounter during surgery. In this, the sigmoid sinus lays underneath a very thin bony flap, which can be easily damaged. Thus, an abrupt bleeding might occur. We present a case where the vertical segment of the left sigmoid sinus was encountered just underneath the posterior wall of the external auditory canal during evaluation of a case of COM. Anatomical variations of the sigmoid sinus are not uncommon, and the otolaryngologist should be aware of such variations to prevent intra-operative surprises.

**Keywords:** Sigmoid sinus; Abnormally displaced; Anterior course; Anatomical variation.

### Introduction

The sigmoid sinus is a venous space between the endosteum of the occipital bone and the dura. It possesses an endothelium lining without valves or muscle in its walls.<sup>1</sup> The sigmoid sinus originates at the junction of the transverse and the superior petrosal sinuses at the superior border of the petrous bone. From this point it changes direction in the vertical plane toward the medial portion of the mastoid cavity carving a deep canal in an S

form and terminates anteriorly at the jugular bulb. The sino-dural angle is formed at the junction of the sigmoid sinus and superior petrosal sinus. The sigmoid sinus forms the posterior limit of Trautmann's triangle.

The location of the sigmoid sinus within the mastoid cavity is quite variable, and thus impacts surgical planning and execution profoundly. An anterior location of the sinus will limit access to the internal auditory canal via a translabyrinthine approach.<sup>2</sup> Also, an anterior or a medial location of

the sigmoid sinus limits access to the endolymphatic sac near the posterior semicircular canal.<sup>3</sup> Thus, an anteriorly-displaced vertical segment of the sigmoid sinus is an important anatomical variation that triggered a debate about its causality.<sup>4</sup> Some studies showed that the distance between the sigmoid sinus and the posterior wall of the external auditory canal is significantly smaller in patients with sclerotic mastoids due to chronic otitis media (COM) in childhood, or genetic factors that provoke mastoid hypopneumatization,<sup>5</sup> while other studies refuted this claim, and hypothesized that volume reduction may result from the sclerotic change in the air cell system, rather than from shrinkage of the mastoid bone, and even suggested that the sinus location is responsible for decreasing the mastoid pneumatization.<sup>6</sup>

This variation has been scarcely reported during surgery nevertheless, it might easily provoke a massive bleeding if the surgeon didn't take caution to the abnormal sinus that lies underneath a thin bony flap. The anteriorly-displaced sinus is a well-defined anomaly in high resolution computed tomography imaging (HRCT). We report a case where the sigmoid sinus was seen in HRCT just underneath the posterior wall of EAC, which led to a change in our surgical approach.

### Case Report

A 31 year-old female patient presented to our OPD clinic with bilateral ear discharge and decreased hearing since childhood. On otoscopy, a posterosuperior retraction pocket with a central perforation was seen in left ear, the fundus of retraction pocket was not visible (Grade-IV). In right ear, a central perforation was seen. 35 dB air-bone gap was seen in both ears. A high-resolution CT scan of temporal bone was planned, which suggested a soft tissue density in the left mastoid air cells, aditus, middle ear cavity and antrum. However on observing the scan on console, surprisingly, the vertical segment of the left sigmoid sinus was abnormally anteriorly displaced, almost dehiscent to the posterior wall of EAC, which was actually mimicking as soft tissue density in antrum on CT films provided to us (Fig. 1). A change in surgical approach was planned and an inside out approach was taken due to the anteriorly placed sigmoid sinus. During surgery, retraction pocket was removed, malleus and incus were eroded and autologous umbrella PORP and ossicular reconstruction (using cortical bone) was undertaken with Type III b tympanoplasty.



**Fig 1:** HRCT Temporal bone showing anteriorly placed sigmoid sinus on left side

### Discussion

High-resolution temporal bone CT imaging has become a key investigation in the management of ear disorders. Although the primary responsibility of reporting on CT images lies with a head and neck radiologist, it is nevertheless important for the practising otologist to be aware of common anatomical variants and their clinical relevance. An anterior course of the sigmoid sinus is a rare anatomical variation that has been reported in the medical literature. Gangopadhyay *et al.*<sup>7</sup> reported a similar case to ours, as they came upon the sigmoid sinus underneath the skin of the posterior wall of the external auditory canal during an attempted myringoplasty, while Ulug and colleagues<sup>8</sup> confronted massive bleeding from an anteriorly-displaced sigmoid sinus during stapedectomy. Moreover, Puraviappan and colleagues<sup>9</sup> discovered the abnormal anterior course of a ruptured sigmoid sinus in a referral case of middle ear and mastoid exploration via post-auricular approach.

An antero-medially displaced sinus has been described in patients with Meniere's disease, the researchers justified this finding as a result of tightened Trautmann's triangle in these patients. Nevertheless, it's not infrequent to catch this same variation in disease-free temporal bone as stated by Sarmiento and colleagues,<sup>4</sup> Ulug and colleagues.<sup>8</sup>

An anteriorly located sigmoid sinus limits the amount of space for a postaural approach to the mastoid antrum. In a series by V. Vishwanathan and MSC Morrissey,<sup>10</sup> 10 patients out of 186 demonstrated no anterosuperior space between

most anterior aspect of sigmoid sinus wall and posterior aspect of EAC wall, as in our case. Prior to undertaking mastoidectomy, its important to study the location of sigmoid sinus in order to avoid unnecessary injury. We had to take the inside out approach to reach the aditus and antrum, as no space was left due to anteriorly placed sigmoid sinus.

A study compared the intraoperative data and computed tomography measures of 30 patients and concluded that the tomographic distance between the sigmoid sinus and the external ear canal measuring less than 9 mm complicated the procedure, their lowest distance was 4.7 mm.<sup>11</sup> In our case the distance was almost 6 mm, which could potentially expose the sinus to haemorrhage jeopardy. By using seven reference points, surgical classifications of the location of sigmoid sinus were proposed. Based on the 96 temporal bone dissection performed, they were grouped into 3 types. In Type 1, the location of the sigmoid sinus was posterior, enlarging the Trautmann's triangle. In Type 2 (the most common), the sigmoid sinus was located anteriorly diminishing the size of Trautmann's triangle.<sup>4</sup> In the Type 3, the sigmoid sinus was medially displaced which also reduced the area of Trautmann's triangle. In our case, the sigmoid sinus most probably was the Type 2 in anteroposterior axis but very superficial (lateral) in term of depth.

## Conclusion

Anatomical variations related to sigmoid sinus in temporal bone are not uncommon. It is vital for the investigating otologist to be aware of such variations when considering differential diagnoses of temporal bone disorders and also prior to undertaking surgery to prevent unpleasant intraoperative surprises. Furthermore, it is crucial that the investigating radiologist is aware of such variations and flags them as necessary to aid effective patient care.

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