



Neuroradiology/Head and Neck Imaging Original Research

## Supralabyrinthine air cell is not present in superior semicircular canal dehiscence

Alok A. Bhatt<sup>1</sup>, Larry B. Lundy<sup>2</sup>, Patricia A. Rhyner<sup>1</sup>

Departments of <sup>1</sup>Radiology, <sup>2</sup>Otolaryngology, Mayo Clinic, Jacksonville, United States.



**\*Corresponding author:**

Alok A. Bhatt,  
Department of Radiology,  
Mayo Clinic, Jacksonville,  
United States.

bhatt.alok@mayo.edu

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### ABSTRACT

**Objectives:** Superior semicircular canal dehiscence (SSCD) is defined as a defect in the bone overlying the superior semicircular canal (SSC). The purpose of this study is to evaluate the pre-operative imaging examinations of patients who have undergone SSCD repair. We hypothesize that these patients will not have a supralabyrinthine air cell on the side of surgery.

**Material and Methods:** Our group retrospectively reviewed 50 consecutive pre-operative computed tomography (CT) temporal bone examinations who had confirmed SSCD on intraoperative examination and underwent repair for the presence of a supralabyrinthine air cell.

**Results:** 100% of patients who had confirmed SSCD on intraoperative examination had no supralabyrinthine air cell on pre-operative CT of the temporal bone.

**Conclusion:** This study shows that a supralabyrinthine air cell is not present in SSCD. When a supralabyrinthine air cell is present, the roof of the SSC is intact. CT and magnetic resonance imaging (MRI) are often performed together to evaluate for SSCD and exclude other etiologies. We propose that if a supralabyrinthine air cell is seen on MRI, no CT is necessary, thus avoiding unnecessary radiation exposure and additional imaging costs to the patient.

**Keywords:** Temporal bone, Semicircular canal dehiscence, Computed tomography, Magnetic resonance imaging

### INTRODUCTION

Superior semicircular canal dehiscence (SSCD) is a defect in the bone overlying the superior semicircular canal (SSC) and can present with variable symptoms and often unusual complaints. The most common and classically known are vestibular symptoms (vertigo, imbalance, and oscillopsia) induced by loud sounds, also known as Tullio phenomenon. Patients can also present with conductive hearing loss, autophony (hearing one's own voice in the ear), pulsatile tinnitus, and hyperacusis.<sup>[1,2]</sup> Some patients may even be asymptomatic.<sup>[3]</sup>

Both computed tomography (CT) and magnetic resonance imaging (MRI) can be used to evaluate for SSCD and exclude other etiologies. It is our practice to evaluate the SSC on CT in multiplanar reconstructions, both parallel and perpendicular to the SSC to optimize detection of dehiscence. When there is a supralabyrinthine air cell (a mastoid air cell superior to the SSC), the roof of the SSC is intact [Figure 1].<sup>[4]</sup> Therefore, we hypothesize that no patient who has undergone SSCD repair will have a supralabyrinthine air cell on the side of surgery. This project is to evaluate for the

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presence of a supralabyrinthine air cell in a cohort of patients that have undergone repair of SSCD at our institution.

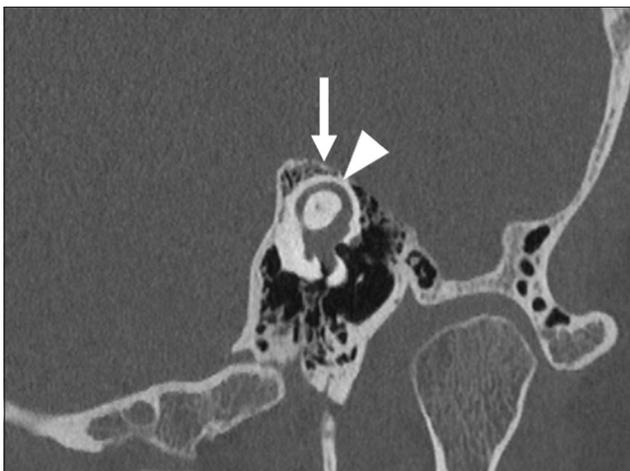
## MATERIAL AND METHODS

Retrospective review of cases was approved by the Institutional Review Board. We searched for and pulled from our database 50 consecutive patients who had confirmed SSCD on intraoperative examination and undergone repair from November 11, 2016, to March 3, 2020. Pre-operative CT of the temporal bones on these patients was evaluated by two neuroradiologists blinded to both the initial interpretation and each other's interpretation. A supralabyrinthine air cell on the symptomatic side was recorded as present or absent. SSC roof was recorded as intact, markedly thin but probably still intact, or dehiscent. The contralateral side was also reviewed. All clinical charts were reviewed for patient demographics and presenting otologic symptoms.

The pre-operative CT temporal bone examinations were obtained on Siemens helical CT scanners (Sensation, Definition Edge, Definition Flash) using a  $16 \times 0.6$  mm, U30 ultrahigh resolution kernel. Right and left reformatted images were created as follows: axial and coronal ( $1.0 \times 0.5$  mm), parallel, and perpendicular to the SSC ( $0.8 \times 0.2$  mm).

## RESULTS

In our population of 50 patients, 31/50 were female and 19/50 were male. Mean age was 55.5 years (range 28–87 years). Patients had variable symptoms, ranging from classic Tullio phenomenon to autophony, oscillopsia, tinnitus, and hearing loss. No patient had prior temporal bone surgery. All CT scans were adequate quality for review.



**Figure 1:** Computed tomography image parallel through the superior semicircular canal, with a supralabyrinthine air cell (solid arrow) and an intact superior semicircular canal (arrowhead).

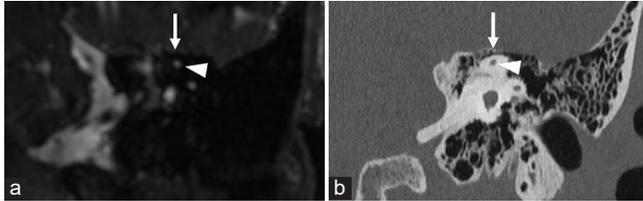
None of the 50 operated temporal bones had a supralabyrinthine air cell on pre-operative CT temporal bone scans [Figure 2]. There were three patients who had a supralabyrinthine air cell on the contralateral side, all of which had an intact SSC. There was 100% interobserver agreement in the 50 subjects.

## DISCUSSION

Both CT and MRI can be used to confirm SSCD and are often performed in conjunction to exclude other pathologies. In our practice, the SSC is evaluated in multiplanar reconstructions, both perpendicular and parallel to the SSC, which has shown to optimize detection.<sup>[5]</sup> However, studies have shown that CT scan overestimates the size of dehiscence or falsely suggests dehiscence.<sup>[5,6]</sup> Heavily T2-weighted sequences on MRI can also detect dehiscence with most references using 0.7–0.8 mm thick slices; dehiscence is defined as loss of the normal low-signal layer (bone) between the high-signal labyrinth fluid and high-signal intracranial cerebrospinal fluid (CSF) along the floor of the middle cranial fossa.<sup>[7-9]</sup> Browaeys *et al.* used the fast imaging employing steady-state acquisition sequence and noted a 100% sensitivity and negative predictive value for excluding SSCD when there was a low-signal intensity rim above the labyrinth fluid signal.<sup>[8]</sup> This low T2 signal rim presumably corresponds to a supralabyrinthine air cell [Figure 3]. In our head and neck imaging practice, the temporal bone MRI protocol for hearing loss and potential SSCD includes a 3D volumetric high-resolution T2-weighted sequence, which can be reformatted in multiple planes at the workstation.



**Figure 2:** Computed tomography image parallel through the superior semicircular canal, which shows dehiscence (solid arrow). Note the absence of a supralabyrinthine air cell.



**Figure 3:** (a) High-resolution T2-weighted image perpendicular through the superior semicircular canal (arrowhead) demonstrates a curvilinear rim of low T2 signal (arrow), corresponding to an air cell. Therefore, the roof is intact. (b) Computed tomography image of the same patient perpendicular through the superior semicircular canal (arrowhead) at the same level confirms an intact superior semicircular canal with a supralabyrinthine air cell (arrow).

## CONCLUSION

Our study reviewed pre-operative CT temporal bone examinations in 50 consecutive patients that underwent SSCD repair, none of which had a supralabyrinthine air cell on the repaired side. The presence of a supralabyrinthine air cell confers an intact SSC, and presumably serves as a protective barrier to acquiring SSCD.<sup>[4]</sup> We propose that when the initial test for hearing loss or otologic symptoms is MRI, if CSF-bright coronal images (either reformatted or direct) through the temporal bones show a supralabyrinthine air cell, CT is not necessary to confirm the SSC roof is intact. Advantages include avoiding unnecessary radiation exposure and additional imaging costs to the patient.

## Declaration of patient consent

Institutional Review Board (IRB) permission obtained for the study.

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Nil.

## Conflicts of interest

There are no conflicts of interest.

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