



## Incidence and Prevalence Of Korner's Septum and Associated Anatomical Variations

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### Abstract:

Korner's septum is a petrosquamous lamina found within the temporal bone separating the mastoid air cells. Failure of the petrosquamous lamina to involute after development of the antrum causes the Korner's septum to persist completely or partially. The lamina is known to have anterior, middle and posterior parts and the middle part has been of more clinical significance as it has been responsible for decreased ventilation of the tympanic cavity serving as a leading cause for the beginning of an inflammatory process. Korner's septum has also been noted to be present with other anatomical anomalies that may have a bearing on the nature of mastoid surgery. Due to its clinical and surgical importance, it has over the years become very vital to identify the presence and extent of the Korner's septum prior to mastoid surgery. In the past, failure to recognize the septum has led to inadequate disease clearance and increase incidence of postoperative disease recurrence. There has been a discrepancy in the incidence of the Korner's septum and the associated anatomical variations noted in temporal bones with a septum. The study aims at determining the incidence and prevalence of the petrosquamous lamina and all the anatomical variation associated with it.

**Keywords:** Korner's septum, petrosquamous lamina, temporal bone.

### Introduction

Korner's septum (KS), first reported by Hartmann in 1887, is a thin bony wall situated between antrum petrosus and antrum mastoideum.<sup>1</sup> It was not until 1926 when Korner raised the clinical significance of the septum.<sup>2</sup>

Subsequent studies on the Korner's septum focused on its morphology, clinical significance and anatomical variations. Although the mastoid cell system begins to develop after the development of the antrum, the petrosquamous lamina begins to resolve and usually completely disappears.<sup>3</sup> A failure during this development may cause this lamina to persist completely or partially, forming the petrosquamous lamina/Korner's septum. Korner

further postulated in his study that the petrosquamous plate is hardly recognizable in a well-pneumatized mastoid.

The Korner's septum may be present with discontinuities or disruptions. Virapongse et al. proposed a classification distinguishing the septum into anterior (ventral), middle and posterior (dorsal) parts. The middle part of the septum was commonly noted to be responsible for decreased ventilation of the tympanic cavity there by increasing the chances of inflammatory processes.<sup>4</sup> Further researchers revealed that the continuity of the Korner's septum may be disrupted in more than just one point.

Owing to its clinical and surgical importance, it is imperative to recognize KS prior to mastoid surgery.

If unrecognized, it may be dangerous to mistake an extensive septum as the medial wall of the mastoid during surgery. This may lead to closed space remaining within the pneumatized part of the temporal bone causing high chances of disease recurrence. Failure to recognize the KS may also misdirect the surgeon to seek the antrum at a more superficial level.<sup>5,6</sup>

The incidence of Korner's Septum has been found to range between 7 to 47%.<sup>7</sup> However, in most cases, the identification of this septum is missed by experienced surgeons, who do not seek the guidance of surgical landmarks on their way to the mastoid antrum. This has attributed to the lower incidence and reporting of KS in the past.

This retrospective-archival temporal bone dissection study was done to assess and re-establish the true prevalence of Korner's septum and to also evaluate the wide range of anatomical variations associated with it. We aim at providing readers a clearer picture of the orientation of the Korner's septum, thus aiding aspiring otologic surgeons in understanding the intricate aspects of its anatomy and surgical importance.

#### Materials And Methods:

This is a retrospective observational study, bearing Institutional Ethical Committee clearance no. DMC/KLR/IEC/461/2021-22.

A total of 132 wet temporal bone samples were harvested from cadaveric skulls and preserved in 10% formalin. Dissection of wet temporal bone specimens was carried out over a five-year duration in the department of Otorhinolaryngology in a tertiary health care centre.

#### Methodology

We used a Zeiss microscope, a high-speed microdrill equipped with a foot-operated switch, an adjustable suction and with continuous irrigation. Cutting and diamond burs of variable sizes ranging from 3-5mm in diameter were used. In all bones, first cortical mastoidectomy was performed, delineating the dural plate superiorly, sinus plate posteriorly with exposure of sinodural angle, lateral semicircular canal in the floor and digastric ridge inferiorly. All identified anatomical structures and variations were documented.

Results are presented as median (min-max). The distribution of data was confirmed using Kolmogorov- Smirnov normality test ( $p < 0.001$ ). We used SPSS software for Windows (SPSS Inc, Chicago, IL) for statistical analysis. We considered a P value less than 0.05 statistically significant.

#### Results:

A total of 132 wet temporal bone specimens were dissected. In 71 (54%) temporal bones, the mastoid was pneumatic, 36 (27%) mastoids were diploic and 25 (19%) were sclerotic.

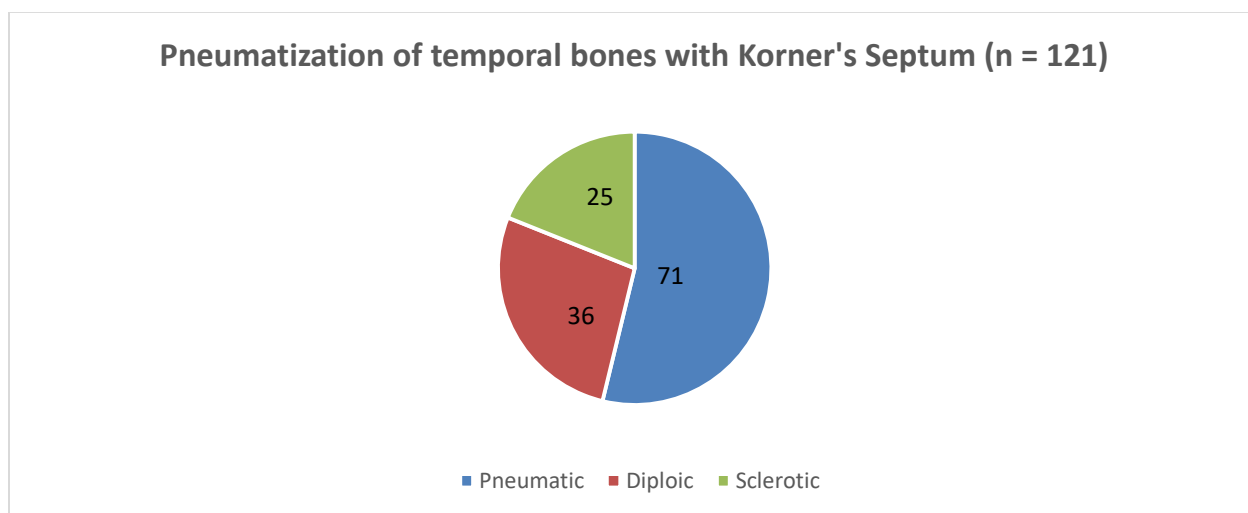
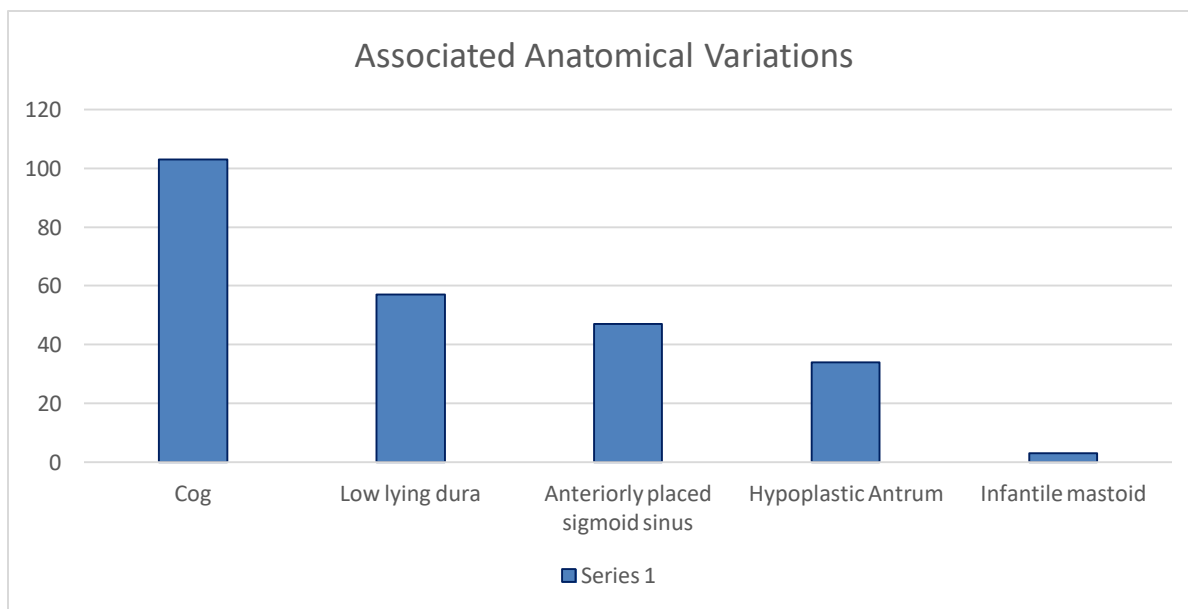


Figure 1: Pneumatization of temporal bones with Korner's Septum

In our study, 121 bones were found to have Korner's septum (91.67%).

Among the bones with an identified Korner's septum, 103 temporal bones (85%) had a recognizable cog and 57 bones (47%) had low-lying dura. 47 bones (39%) had an anteriorly placed sigmoid sinus and 34 specimens (28%) had a hypoplastic antrum. Only three dissected bones had an infantile mastoid.



**Figure 2: Frequency of associated anatomical variations**

**Discussion:**

Failure during the development of the petrosquamous lamina leads to the persistence of a complete or partial lamina or the Korner's septum, contributing to the development of chronic otitis media by narrowing ventilation and drainage routes between the mastoid air cell system and middle ear.<sup>7,8</sup> It is therefore important to understand the true incidence and prevalence of the septum to help in better treatment outcomes.

Over the years, the radiological and surgical documentation of the incidence of the septum has been quite low. A study performed by Toros et al. identified the septum in only 28% of the total cases that underwent tympanoplasty.<sup>9</sup> However, in our study of 132 wet temporal bone specimens, the Korner's septum was identified in 92% (121).

Research in the past has revealed that the continuity of the Korner's septum may be disrupted or dehiscent in more than one point. Wojciechowski et al. encountered an incomplete Korner's septum in 75% of the temporal bones they radiologically assessed.<sup>10</sup>

In our study, an incomplete Korner's septum was observed in 102 (84%) bones and a continuous septum was noted in 19 (16%) specimens.

Of the 121 bones with an identified Korner's septum, we found that 103 (85%) temporal bones dissected had a recognizable cog. The finding was in accordance to a study conducted by Ozer et al., in which they stated that Korner's septum was found in all patients who had a cog.<sup>5</sup> A low-lying dura constitutes difficulty to access the aditus, lateral semicircular canal and is also often seen in association with a sclerotic mastoid. 57 bones (47%) with Korner's septum also had a low-lying dura.

We identified an anteriorly placed sigmoid sinus in 47 (38.8%) out of the 121 bones in our study. The sigmoid sinus is a vital landmark in mastoidectomy surgery and the optimum level for drilling. An anteriorly placed sinus or bulging sinus is important to be watched for, as the distance between the sinus to the posterior wall of the external auditory canal determines the amount of space available for the postaural approach to the mastoid antrum.<sup>11,12</sup>

We observed that in 28% (34) of bones with Korner's septum, the mastoid antrum was hypoplastic. This was also reported by Cigdem et al. in a case report of a patient who presented with bilateral Korner's septum and bilateral agenesis of the mastoid antrum.<sup>13</sup>

In our experience the incidence of Korner's septum was high and there were considerable associated anatomical variations observed. These findings support the contention that pre- and intra-operative identification of the septum is very important and contributes in safe surgery and complete disease clearance.

### Conclusion:

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