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A STUDY OF VARIATIONS IN SUPRAMEATAL SPINE AND OTHER LANDMARKS ON THE LATERAL SURFACE OF TEMPORAL BONE AMONG CSOM PATIENTS

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ABSTRACT

Background: Chronic Suppurative Otitis Media (CSOM) is a common middle ear disease requiring surgical management. Identification of reliable anatomical landmarks, particularly the suprameatal spine (Henle's spine), is essential for safe mastoidectomy. The objective is to evaluate the variations in the suprameatal spine and its relationship with lateral temporal bone landmarks in patients with CSOM.

Materials and Methods: A hospital-based cross-sectional study was conducted on 120 patients with CSOM undergoing mastoidectomy at a tertiary care center. Intraoperative assessment included morphology of the suprameatal spine, mastoid pneumatization, ossicular status, and morphometric measurements of key anatomical landmarks. Data were analyzed using SPSS version 19.

Results: The crest type of suprameatal spine was most common (68.3%), followed by triangular type (15%) and absence (16.7%). Absence of the spine was significantly associated with non-pneumatized mastoids ($p < 0.05$). The mean distance from Henle's spine to the lateral semicircular canal and sinodural angle was 15.2 mm and 16.8 mm, respectively. Ossicular erosion was observed in 30% of cases, with the incus most commonly affected. Most patients had mild to moderate conductive hearing loss.

Conclusion: Although the suprameatal spine is a valuable surgical landmark, its variability—especially in sclerotic mastoids—necessitates the use of multiple anatomical references during mastoidectomy. Understanding these variations can improve surgical safety and outcomes.

Keywords: Chronic Suppurative Otitis Media; Suprameatal Spine; Henle's Spine; Mastoidectomy; Hearing Loss.

INTRODUCTION

Chronic Suppurative Otitis Media (CSOM) is a persistent inflammatory disease of the middle ear cleft characterized by recurrent or continuous otorrhea through a perforated tympanic membrane. It remains a major public health concern, particularly in developing countries, due to its high prevalence and association with hearing impairment and potential intracranial complications.[1,2] Despite advances in antimicrobial therapy, surgical intervention remains the cornerstone of management in cases with persistent infection, cholesteatoma, or complications.[2]

Mastoidectomy is a commonly performed procedure in CSOM, and its safety largely depends on precise identification of anatomical landmarks on the lateral surface of the temporal bone. The suprameatal spine (also known as Henle's spine) is a prominent bony projection located superior and posterior to the external auditory canal. It serves as an important surgical landmark for locating the mastoid antrum during cortical mastoidectomy.[3,4] Accurate identification of this structure assists surgeons in orienting the drill trajectory while avoiding injury to critical structures such as the facial nerve, sigmoid sinus, and middle cranial fossa dura.[5]

However, the morphology of the suprameatal spine and adjacent landmarks—including the external auditory canal, zygomatic root, mastoid tip, and temporal line—may exhibit considerable anatomical variation.[4,6] In patients with CSOM, chronic

inflammation, sclerosis, altered mastoid pneumatization, and bone remodeling may further obscure or distort these surface landmarks.[7] Such variations can increase surgical difficulty and potentially elevate the risk of intraoperative complications.

A comprehensive understanding of these anatomical differences is therefore essential for otologic surgeons, particularly in settings where advanced intraoperative navigation systems may not be available. Studying the variations of the suprameatal spine and other lateral temporal bone landmarks in CSOM patients may provide valuable insights for safer surgical planning and improved outcomes.

Hence, the present study aims to evaluate the variations in the suprameatal spine and other anatomical landmarks on the lateral surface of the temporal bone among patients diagnosed with chronic suppurative otitis media.

MATERIALS AND METHODS

Study Design: This was a hospital-based cross-sectional study.

Study Setting: The study was conducted in the Department of ENT, Government Medical College and Government General Hospital (GGH), Nandyal.

Study Duration: The study was carried out over a period of six months.

Study Population: The study population comprised in-patients admitted to Government General Hospital, Nandyal, either from the outpatient department or casualty, who were diagnosed with chronic suppurative otitis media (CSOM) and scheduled to undergo mastoidectomy.

Sample Size: According to the World Health Organization, the prevalence of chronic suppurative otitis media is approximately 7.8% [8]. For the present study, the prevalence (p) was taken as 8%.

$$q = 100 - p = 100 - 8 = 92$$

Absolute precision (d) was taken as 5%.

$$n = \frac{4pq}{d^2}$$

$$n = \frac{4 \times 8 \times 92}{25} = 117$$

The calculated sample size was 117 and was rounded off to 120 subjects.

Sampling Technique: Convenient sampling technique was adopted.

Inclusion Criteria

- Patients aged between 18 and 60 years
- Patients diagnosed with chronic suppurative otitis media
- Patients undergoing mastoidectomy
- Patients willing to provide informed consent

Exclusion Criteria

- Patients below 18 years and above 60 years
- Patients presenting with complications of chronic suppurative otitis media
- Patients not willing to participate in the study

Study Tool: A structured case study proforma was used for data collection.

Data Collection Procedure: Detailed clinical history and examination findings were recorded in the case study proforma. Intraoperative findings were documented during mastoidectomy. After performing cortical mastoidectomy, intraoperative assessment was carried out to determine:

- Type and prominence of the suprameatal spine
- Distance and relation of suprameatal spine to the mastoid antrum
- Relationship of other surface landmarks on the lateral surface of the temporal bone, linea temporalis, lateral semicircular canal, sinus plate, sinodural angle, tegmen antri

Measurements were made using sterile measuring instruments under direct visualization.

Statistical Analysis: Data were entered into Microsoft Excel and Statistical analysis was performed using SPSS version 19. Qualitative variables were expressed as frequencies and percentages. The Chi-square test was applied to assess associations between variables. A p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 120 patients diagnosed with Chronic Suppurative Otitis Media (CSOM) who underwent mastoidectomy were included in the study. The demographic details, clinical profile, mastoid pneumatization, suprameatal spine morphology, ossicular erosion, and morphometric measurements of lateral temporal bone landmarks were analyzed.

Most patients (53.3%) were between 31–50 years of age as shown in [Table 1].

Table 1: Age Distribution

Age Group (years)	Frequency (n=120)	Percentage (%)
18–30	32	26.7%
31–40	34	28.3%
41–50	30	25.0%
51–60	24	20.0%

Female predominance was observed with a female-to-male ratio of approximately 2.1:1 as shown in [Table 2].

Table 2: Gender Distribution

Gender	Frequency	Percentage
Female	82	68.3%
Male	38	31.7%

Most patients (38.3%) had disease duration between 2–5 years as shown in [Table 3].

Table 3: Duration of Disease

Duration	Frequency	Percentage
< 1 year	28	23.3%
2–5 years	46	38.3%
6–10 years	26	21.7%
> 10 years	20	16.7%

Mucosal type was the predominant form type of CSOM as shown in [Table 4].

Table 4: Type of CSOM

Type of CSOM	Frequency	Percentage
Mucosal	86	71.7%
Squamosal	34	28.3%

Majority of patients had pneumatised mastoid as shown in [Table 5].

Table 5: Mastoid Pneumatization

Mastoid Type	Frequency	Percentage
Pneumatized	78	65.0%
Non-pneumatized (Sclerotic)	42	35.0%

Ossicular erosion was observed in 30% (36/120) of case as shown in [Table 6].

Table 6: Ossicular Erosion

Ossicular Status	Frequency	Percentage
Present	36	30.0%
Absent	84	70.0%

Among the patients with ossicular erosion, the incus was the most commonly affected ossicle (66.7%) as shown in [Table 7].

Table 7: Pattern of Ossicular Involvement in Cases with Ossicular Erosion

Ossicle Involved	Frequency	Percentage
Incus	24	66.7%
Malleus	6	16.7%
Stapes	4	11.1%
Multiple	2	5.5%

The crest type of suprameatal spine was the most frequently observed morphology, accounting for 68.3% (82/120) of cases as shown in [Table 8].

Table 8: Morphology of Suprameatal Spine (Henle's Spine)

Type of Spine	Frequency	Percentage
Crest type	82	68.3%
Triangular type	18	15.0%
Absent	20	16.7%

The average distance from Henle's spine to the lateral semicircular canal was 15.2 mm, and to the sinodural angle was 16.8 mm, indicating consistent anatomical reference points during mastoidectomy as shown in [Table 9].

Table 9: Morphometric Measurements (in mm)

Parameter	Mean ± SD (mm)	Range (mm)
HS to Linea Temporalis	10.4 ± 2.1	6 – 14
HS to Lateral Semicircular Canal	15.2 ± 2.8	11 – 19
HS to Sinus Plate	14.1 ± 2.4	9 – 18
HS to Sinodural Angle	16.8 ± 3.2	12 – 22
Tegmen Antri to LSCC	6.2 ± 1.1	4 – 8

Absence of the suprameatal spine was more commonly seen in non-pneumatized mastoids. The association was statistically significant (Chi-square test, $p < 0.05$) as shown in [Table 10].

Table 10: Association Between Mastoid Pneumatization and Spine Morphology

Mastoid Type	Crest	Triangular	Absent	Total	p value
Pneumatized	60	10	8	78	0.047
Non-pneumatized	22	8	12	42	

Mild to moderate conductive hearing loss was most commonly observed as shown in [Table 11].

Table 11: Hearing Loss

Type of Hearing Loss	Frequency	Percentage
Mild (26–40 dB)	54	45.0%
Moderate (41–55 dB)	40	33.3%

Moderately severe (>55 dB)	18	15.0%
Mixed hearing loss	8	6.7%

DISCUSSION

Chronic Suppurative Otitis Media (CSOM) remains a prevalent otological condition in developing regions, often leading to long-standing disease and hearing impairment. The present study focused on evaluating variations in the suprameatal spine and its surgical relevance in patients undergoing mastoidectomy.

The majority of patients in this study were within the 31–50-year age group, indicating that CSOM commonly affects individuals in their active years. Similar age distribution patterns have been reported in earlier studies, where prolonged exposure to environmental and infectious risk factors contributes to disease persistence.[9] A notable female predominance was observed, which differs from some prior reports. This variation may be attributed to differences in healthcare access, awareness, or regional demographic factors.[10]

Most patients had a disease duration of 2–5 years, reflecting delayed treatment-seeking behavior and chronicity of infection. Comparable findings have been documented in previous studies, emphasizing that untreated or inadequately treated middle ear infections often progress to chronic stages.[11] The predominance of mucosal type CSOM in this study is consistent with established literature, where this type is more frequently encountered in clinical practice.[12]

Mastoid pneumatization showed that a significant proportion of patients had well-pneumatized mastoids, while a considerable number demonstrated sclerotic changes. These findings are in agreement with earlier studies that suggest chronic inflammation can influence mastoid air cell development and lead to sclerosis.[13] Importantly, the present study found a statistically significant association between mastoid pneumatization and suprameatal spine morphology. The absence of the spine was more frequently noted in sclerotic mastoids, indicating that poor pneumatization may alter or obscure key surgical landmarks.[14]

Ossicular erosion was identified in 30% of cases, with the incus being the most commonly affected ossicle. This observation aligns with previous reports, which attribute incus vulnerability to its anatomical position and relatively poor vascular supply.[15] Lesser involvement of the malleus and stapes has also been consistently described in literature.[16]

With respect to the morphology of the suprameatal spine, the crest type was most frequently observed, followed by triangular type and absence. These findings are broadly comparable to earlier anatomical studies, which highlight that although the suprameatal spine is commonly present, its morphology can vary considerably.[17] The absence of the spine in a notable percentage of cases reinforces the need for surgeons to rely on additional anatomical landmarks during mastoidectomy.

The morphometric measurements in this study demonstrated relatively consistent distances between Henle's spine and vital structures such as the lateral semicircular canal and sinodural angle. These measurements are clinically significant as they help guide safe drilling and reduce the risk of complications. Similar morphometric consistency has been reported in previous cadaveric and intraoperative studies, supporting their usefulness as surgical guides.[18]

Hearing assessment revealed that most patients had mild to moderate conductive hearing loss, which correlates with the predominance of mucosal disease and limited ossicular destruction. The presence of mixed hearing loss in a small proportion of patients may suggest more advanced disease or inner ear involvement, as described in earlier studies.[19]

Overall, the present study emphasizes that anatomical variations of the suprameatal spine and mastoid pneumatization can significantly influence surgical orientation. A thorough understanding of these variations is essential, particularly in settings where advanced imaging modalities are not routinely available. Surgeons must therefore integrate knowledge of multiple anatomical landmarks to ensure safe and effective mastoid surgery.

CONCLUSION

The suprameatal spine is a useful surgical landmark in mastoidectomy, but its morphology varies, with absence more common in sclerotic mastoids. Consistent morphometric relationships with key structures support its role in surgical orientation. However, due to anatomical variability, surgeons should rely on multiple landmarks to ensure safe and effective surgery in CSOM patients.

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