



Original Article

Middle Ear Risk Index as A Predictive Tool for Surgical Outcome in Csom: A Prospective Study

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ABSTRACT

Chronic suppurative otitis media (CSOM) is a persistent inflammatory condition of the middle ear cleft and remains one of the leading causes of preventable hearing loss, particularly in developing countries. The clinical course of the disease is variable, and surgical outcomes are influenced by several factors including the status of middle ear mucosa, ossicular integrity, presence of cholesteatoma, and chronicity of infection. Tympanoplasty with or without mastoidectomy is the mainstay of treatment; however, predicting surgical success remains challenging. The Middle Ear Risk Index (MERI) has been proposed as an objective scoring system that integrates multiple clinical parameters to assess disease severity and estimate surgical prognosis. The present prospective observational study was conducted to evaluate the correlation between MERI score and surgical outcomes in patients undergoing tympanomastoidectomy for CSOM. A total of 80 patients fulfilling the inclusion criteria were enrolled over a period of 18 months. Preoperative evaluation included detailed clinical examination, otoscopic and microscopic assessment, and audiological evaluation using pure tone audiometry. MERI score was calculated for each patient, and subjects were categorized into mild, moderate, and severe groups. Postoperative follow-up was carried out at 1 month, 3 months, and 6 months to assess graft uptake and hearing improvement. The study demonstrated that the majority of patients belonged to the mild MERI category. Graft uptake at six months was highest among patients with lower MERI scores and progressively declined with increasing disease severity. Similarly, hearing improvement greater than 20 dB was significantly more common in the mild group compared to moderate and severe groups. Statistical analysis revealed a significant association between MERI score and both anatomical and functional outcomes. The findings of this study suggest that MERI is a reliable and practical tool for predicting surgical outcomes in CSOM. Its routine use in clinical practice may assist in surgical planning, prognostication, and patient counselling by providing a structured assessment of disease severity.

Keywords: Chronic Suppurative Otitis Media (CSOM), Middle Ear Risk Index (MERI), Tympanomastoidectomy, Graft Uptake, Hearing Improvement.

INTRODUCTION

Chronic otitis media (COM) refers to a long-standing pathological condition of the middle ear characterized by persistent structural changes in the tympanic membrane, involving either the pars tensa or pars flaccida. It commonly develops as a consequence of previous episodes of acute otitis media, prolonged negative pressure within the middle ear, or unresolved

middle ear effusion. These processes can result in various structural abnormalities of the tympanic membrane (TM), including perforation, retraction pockets, atelectasis, tympanosclerosis, and the development of cholesteatoma¹

COM can be classified according to the location of disease and the type of epithelial involvement affecting the tympanic membrane. Based on this, it is commonly divided into the following categories: inactive mucosal COM, active mucosal COM, inactive squamosal COM, active squamosal COM, and healed COM.²

It continues to pose a significant health burden in developing countries, where delayed presentation and limited access to healthcare contribute to disease progression and complications.

Surgical management aims to eradicate disease, achieve a dry ear, and restore hearing function.³ However, the outcomes of surgery are not uniform and are influenced by multiple factors related to disease severity.

To address this variability, the Middle Ear Risk Index (MERI) was developed as a composite scoring system that incorporates important clinical parameters such as otorrhea, tympanic membrane status, ossicular condition, presence of cholesteatoma, and middle ear mucosal health. By quantifying disease severity, MERI provides an objective framework for predicting surgical outcomes and guiding clinical decision-making.⁴

The present study was undertaken to evaluate the correlation between MERI score and postoperative anatomical and functional outcomes in patients undergoing tympanomastoidectomy.

MATERIALS AND METHODS

This prospective observational study was conducted in the Department of ENT at G.S.V.M. Medical College and its associated hospital over a period of 18 months. A total of 80 patients diagnosed with chronic suppurative otitis media and planned for surgical management were included in the study after obtaining informed consent and institutional ethical clearance. Patients aged between 6 and 60 years with clinically diagnosed CSOM were enrolled, while those with acute ear infections, otitis externa, neoplastic conditions, or neurological disorders were excluded.

All patients underwent a detailed preoperative evaluation, including history taking with emphasis on duration of symptoms, ear discharge, hearing loss, and previous surgical interventions. Clinical examination was carried out using otoscopy and microscopic evaluation to assess tympanic membrane status, middle ear mucosa, presence of granulation tissue, and cholesteatoma. Audiological assessment was performed using pure tone audiometry to determine hearing thresholds and air–bone gap.

The Middle Ear Risk Index (MERI) score was calculated for each patient based on predefined parameters, including otorrhea, perforation status, presence of cholesteatoma, ossicular condition, middle ear mucosa, history of previous surgery, and smoking status. Based on the total score, patients were categorized into mild (0–3), moderate (4–6), and severe (≥ 7) disease groups.

All patients underwent appropriate surgical procedures, including tympanoplasty alone or in combination with mastoidectomy depending on the extent of disease. Postoperative follow-up was conducted at 1 month, 3 months, and 6 months. Surgical outcomes were assessed in terms of graft uptake (anatomical success) and hearing improvement, defined as a gain of more than 20 dB on pure tone audiometry.

The collected data were entered into a spreadsheet and analysed using statistical software. Categorical variables were expressed as percentages, and the association between MERI score and surgical outcomes was evaluated using the Chi-square test. A p-value of less than 0.05 was considered statistically significant.

RESULTS

The study was conducted in 80 diagnosed cases of CSOM, aged 6–60 years. From total 80 subjects taken in the study, males (46,57.5%) outnumbered females (34,42.5%).

Table No.1 Showing gender distribution in our study

Gender Distribution		
GENDER	Number (n=80)	Percentage (%)
Male	46	57.5%
Female	34	42.5%

The most common age group was 21–30 years, comprising 24 participants, followed closely by the 31–40 years group (21 participants) as given in table number 2. Mean age was 33.61 ± 11.45

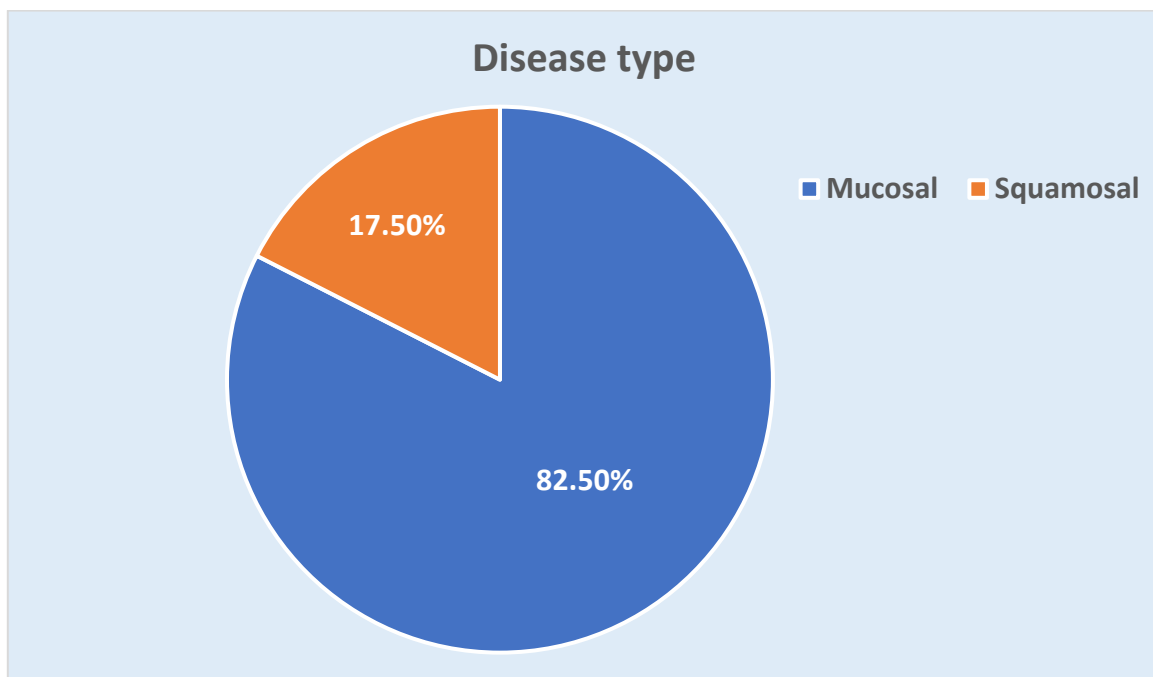
Table No.2 Age Distribution

Age Distribution		
Age Range (years)	Number of Patients	Percentage (%)
6-10	04	05.0
11-20	06	07.5
21-30	24	30.0
31-40	21	26.25
41-50	17	21.25
51-60	08	10.0

From the total of 80 cases of CSOM, majority of the studied cases were of mucosal variant (66,82.5%) with the remaining (14,17.5%) being squamousal type. Table no. 3 below showing distribution of disease type.

Table no. 3: Distribution of Disease Type

Distribution of Disease Type		
Disease Type	Number of Patients	Percentage
Mucosal Disease	66	82.5%
Squamosal Disease	14	17.5%

**Graph 1: Distribution of disease type**

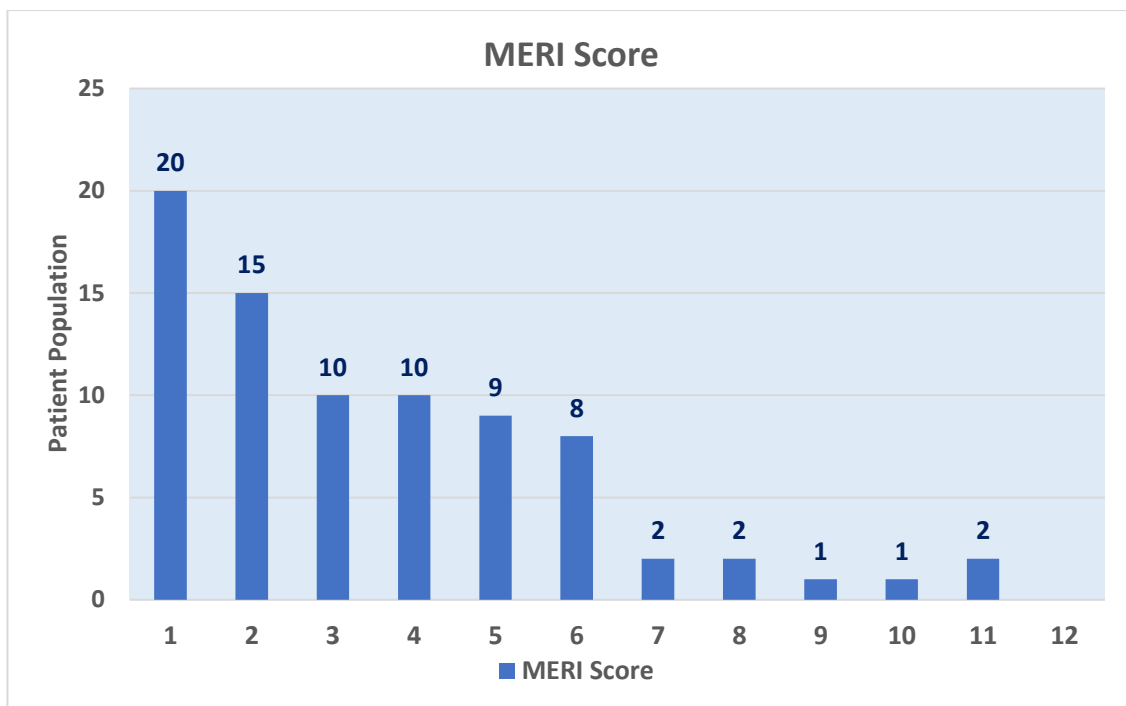
Although some patients presented with bilateral ear disease, only the ear that underwent surgical intervention was included in the analysis. As a result, all clinical, operative, and postoperative findings reported in this study relate solely to the operated ear. Of the 80 cases of CSOM, right ear was involved in 41 cases and left ear in 39 cases.

MERI SCORE CALCULATION

MERI score for each patient was calculated by systematically evaluating multiple clinically relevant parameters like the status of otorrhea, presence or absence of TM perforation, cholesteatoma, ossicular status (intact, partial erosion, or extensive destruction), middle ear mucosa health (presence or absence of granulation tissue or effusion), history of previous ear surgery, and smoking.

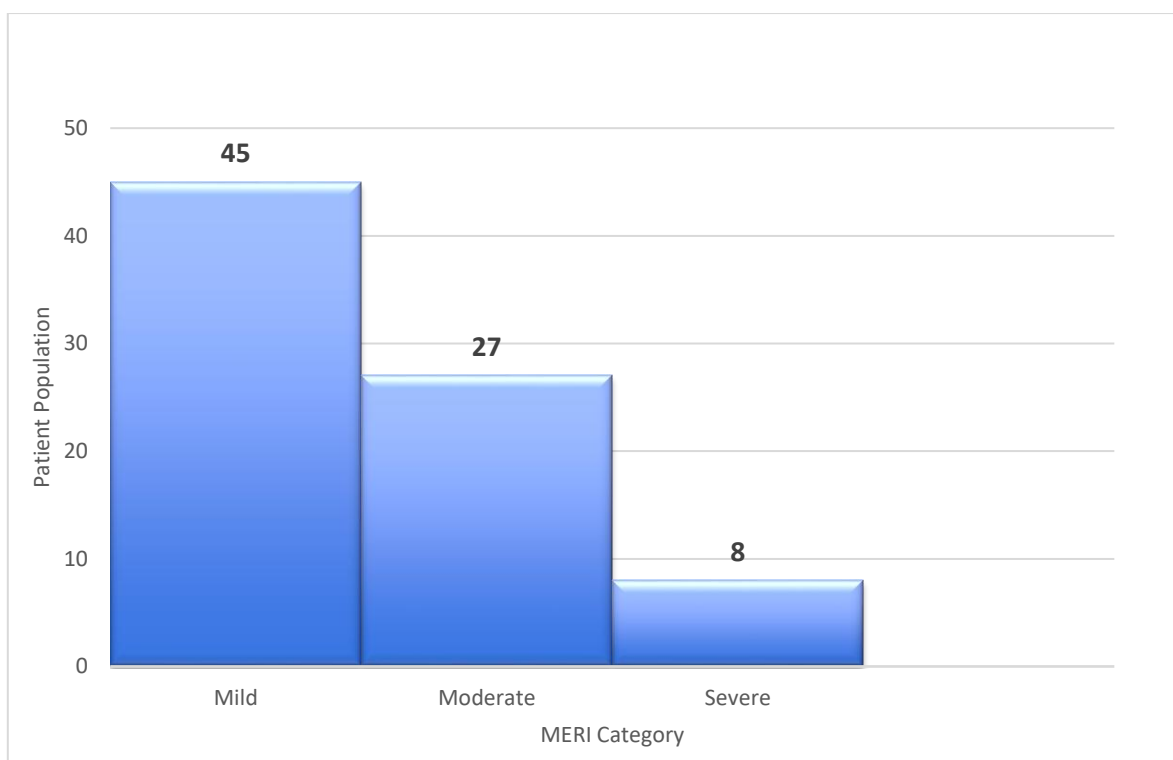
The individual scores for all parameters were summed to obtain the total MERI score for each patient, which was then used to categorize patients into mild (0–3), moderate (4–6), and severe (≥ 7) disease groups.

All the above parameters were summed to obtain the total MERI score for each patient. The distribution as per individual MERI scores is depicted in Graph 2. The most common MERI score was 1, seen in 20 patients, followed by a score of 2 in 15 patients. Scores of 3 and 4 were observed in 10 patients each, while scores of 5 and 6 were seen in 9 and 8 patients, respectively. Higher MERI scores of 7 and more were seen in 8 patients.



Graph 2: Distribution of MERI Score in the patient population

Patients were grouped into MERI categories based on their preoperative Middle Ear Risk Index scores. The mild MERI group (score 0–3) included 45 patients (56.25%), making it the largest category in the study. The moderate MERI group (score 4–6) comprised 27 patients (33.75%). The severe MERI group (score ≥ 7) included 8 patients (10%), forming the smallest subset of the study population.



Graph3: Distribution of Patients According to MERI category

Patients of CSOM were subjected to surgery. Among the 80 patients included in the study, tympanoplasty alone was the most commonly performed procedure (52, 65%), predominantly in patients with mild MERI scores (39 cases), followed by moderate scores (13 cases), with no cases in the severe category.

Cortical mastoidectomy with tympanoplasty was performed in 19(22.6%) patients, with a higher proportion in the moderate category (10 cases), followed by mild (6 cases) and severe (3 cases).

More extensive procedures such as modified radical mastoidectomy (MRM) and MRM with mastoid obliteration were mainly carried out in patients with higher MERI scores. Each of these procedures accounted for 3 (3.7%) cases, with the majority falling under the severe category (2 cases each) and the remaining in the moderate category (1 case each).

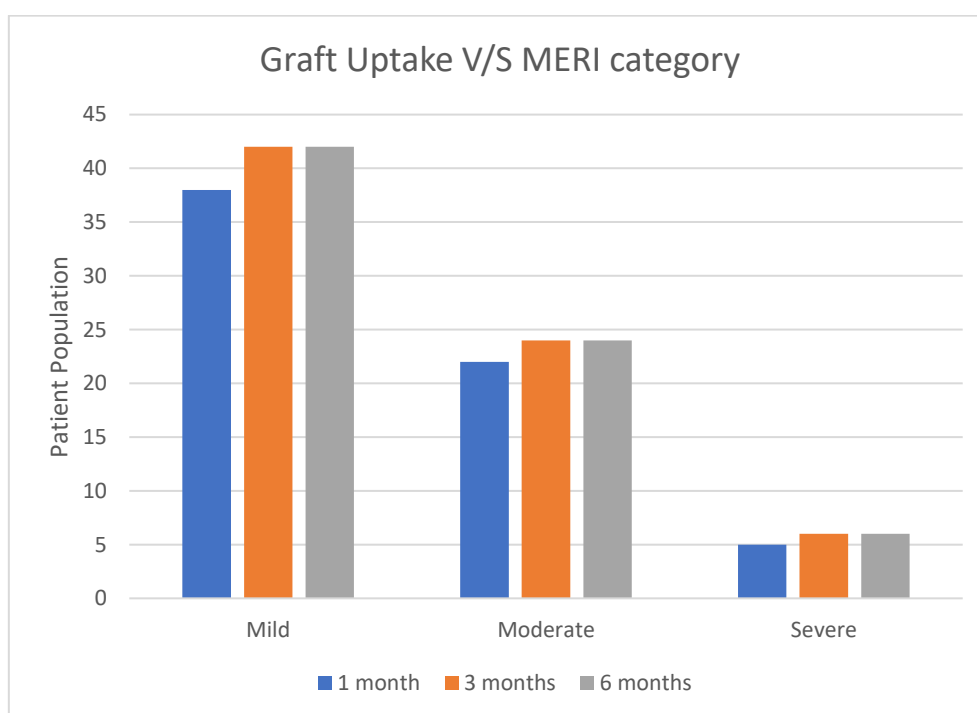
Similarly, combined approach tympanoplasty (CAT) was performed in 3 (3.7%) patients, with 2 in moderate and 1 in severe category.

Post operative assessment was done at 1, 3 and 6 months, based on outcomes which include audiological assessment and graft uptake. These outcomes were then compared against different MERI categories to assess the influence of middle ear risk status on surgical success.

- A) Graft uptake : The graft uptake rate improved progressively over time in all categories. At 1-month, successful graft uptake was observed in 38 (84.4%) patients in the mild group, 22 (81.5%) in the moderate group, and 5 (62.5%) in the severe group. At 3 months, uptake improved to 42 (93.3%), 24 (88.9%), and 6 (75%) respectively. At 6 months, graft uptake remained stable with no further change.

Table 4: GRAFT UPTAKE

GRAFT UPTAKE				
MERI CATEGORY	GRAFT UPTAKE			
	TOTAL PATIENTS	1 MONTH	3 MONTHS	6 MONTHS
MILD	45	38	42	42
MODERATE	27	22	24	24
SEVERE	08	05	06	06
TOTAL	80	65	72	72



Graph 4: Graft uptake V/S MERI category

B) Audiological Gain:

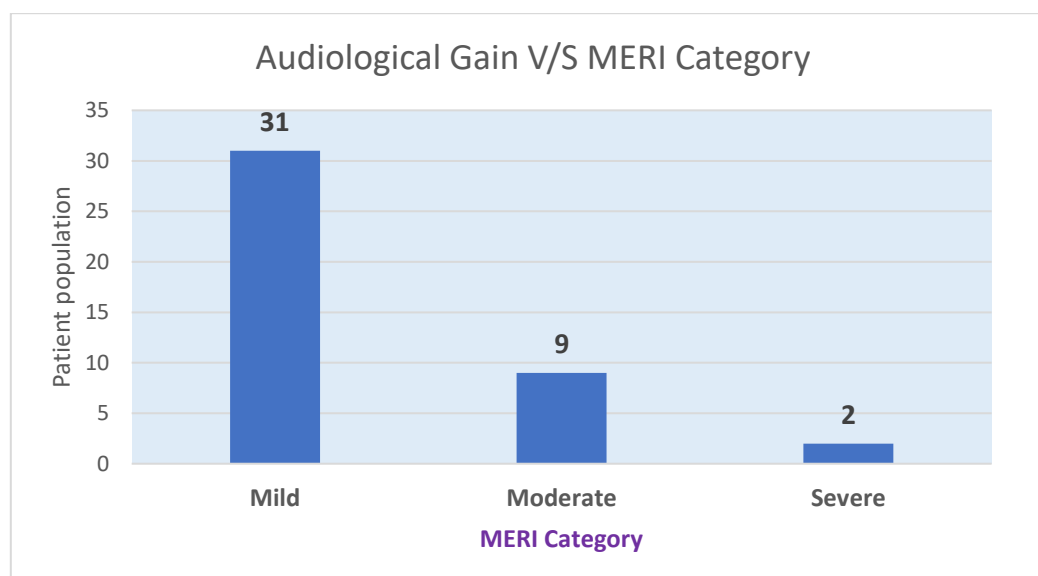
In the mild category, the mean gain increased from 12 ± 4 dB at 1 month to 24 ± 5 dB at 6 months. The moderate group showed improvement from 10 ± 3 dB to 18 ± 4 dB, while the severe group demonstrated comparatively lower gain. At 6 months, a statistically significant difference in mean audiological gain was observed among the groups ($p = 0.005$).

Table 5: AUDIOLOGICAL GAIN

AUDIOLOGICAL GAIN				
MERI CATEGORY	AUDIOLOGICAL GAIN in dB (Mean $\pm$ SD)			
	TOTAL PATIENTS	1 MONTH	3 MONTHS	6 MONTHS
MILD	45	12 $\pm$ 4	18 $\pm$ 4	24 $\pm$ 5
MODERATE	27	10 $\pm$ 3	16 $\pm$ 4	18 $\pm$ 4
SEVERE	08	8 $\pm$ 3	12 $\pm$ 3	14 $\pm$ 4

Table 6: Number of patients achieving >20 dB gain

Number of patients achieving >20 dB gain			
MERI CATEGORY	Total Patients	>20 dB Gain	Percentage
MILD	45	31	68.8%
MODERATE	27	09	33.3%
SEVERE	08	02	25.0 %



Graph 5: Audiological gain V/S MERI Category

The association between disease severity and successful audiological outcome (≥ 20 dB gain) was statistically significant ($\chi^2 = 8.14$, $p = 0.017$), with better outcomes observed in patients with lower disease severity.

Statistically significant association was observed between MERI score and both graft uptake and hearing improvement, indicating that increasing disease severity adversely affects surgical outcomes.

DISCUSSION

The present study demonstrates a significant association between Middle Ear Risk Index (MERI) score and surgical outcomes in patients with CSOM, supporting its role as a reliable prognostic tool.

In current study, mean age of patients was 33.61 ± 11.45 years, with the majority of cases of second decade (30%), followed by the 31–40 years age group (26.2%). These findings indicate the delayed presentation for surgical management after years of recurrent infection.

In accordance to our findings, similar observations were reported by Verma JK et al. (2021)⁵ who noted that 42% of patients belonged to the 20–30-year (second decade) age group. Likewise, Thakur SK et al. (2021)⁶ in their study of 75 patients undergoing tympanoplasty also reported that most patients belonged to younger age groups. While the present study demonstrated a higher prevalence of CSOM in the 21–30-year age group, some studies have reported different age distributions. Mohamed Modather Abd ElNaem et al. (2021)⁷ reported a wider age distribution with a significant proportion of patients belonging to older age groups. These variations may be due to differences in healthcare access, disease duration before surgical intervention, and demographic characteristics of the study populations.

Gender distribution in the present study showed a slight male predominance, with males accounting for 57.5% (46 patients) and females accounting for 42.5% (34 patients). Similar findings of male preponderance have been reported by Abhinav et al.⁸, supporting the trend observed in the present study. However, contrasting observations have been documented in other

studies. Verma JK et al. (2021)⁵ reported a higher proportion of female patients (54%) compared to males (46%). These variations in gender distribution across studies may reflect differences in geographic, socio-cultural, and healthcare accessibility factors.

In the present study, the mucosal type of CSOM accounted for 82.5% of cases, whereas squamous disease constituted 17.5%. This predominance of mucosal disease indicates that the majority of patients presented with relatively less aggressive pathology. Similar findings were reported by Bothra J et al. (2020)⁹, who retrospectively analysed 185 cases of CSOM and also found that mucosal disease constituted the majority of cases.. Thakur SK et al. (2021)¹⁰ noted that a considerable number of patients undergoing surgery had cholesteatoma-associated disease. Differences in disease distribution may be related to referral patterns, delayed presentation, and variations in regional epidemiology of chronic otitis media.

The distribution of patients according to MERI score showed 56.3% of patients belonging to the mild MERI category, 33.7% to the moderate, and 10% to the severe category. This distribution indicates that most patients presented with relatively favourable middle ear conditions and limited disease severity. Similar findings were reported by Nallapaneni LS et al. (2022)¹¹ in their study of 75 patients. Gundu P et al. (2022)¹² also observed maximum population of mild MERI category. Comparable trends have been documented by Pinar et al.¹³ and Kumar et al.¹⁴, who likewise reported a higher proportion of patients in the mild MERI group. These consistent findings across multiple studies suggest that patients commonly present at an earlier stage of disease, possibly due to improved awareness and accessibility to healthcare services.

The type of surgical procedure performed in the present study showed a clear relationship with MERI category. Patients with mild MERI scores predominantly underwent tympanoplasty, patients with moderate MERI scores required cortical mastoidectomy with tympanoplasty, while severe MERI scores underwent modified radical mastoidectomy with or without mastoid obliteration, reflecting advanced disease with cholesteatoma and ossicular destruction. Similar observations were reported by Harugop AS et al. (2020)¹⁵. These findings indicate that higher MERI scores are associated with more complex disease requiring more extensive surgical intervention.

Postoperative hearing outcomes in the present study showed progressive improvement during follow-up. Hearing gain greater than 20 dB was observed in 31 patients in the mild MERI group, 9 patients in the moderate group, and 2 patients in the severe group at six months follow-up. These findings indicate that patients with lower MERI scores achieve greater functional improvement following surgery. Similar observations were reported by Gundu P et al. (2022)¹², who found significantly better air-bone gap closure in patients with mild MERI scores. Nallapaneni LS et al (2022)¹¹ Lima et al¹⁶, Vignadutt et al¹⁷, Albu S et. Al¹⁸ and Toner JG et al¹⁹ also concluded that patients with lower MERI scores demonstrated greater hearing improvement compared with those with higher scores.

However, Almazrou et al²⁰ and Judd et al²¹ in their study concluded that MERI was not a reliable tool for hearing results. Evaluation of graft uptake in the present study further demonstrated the influence of MERI score on anatomical success. At six months follow-up, graft uptake was achieved in 42 patients in the mild MERI group, 24 patients in the moderate group, and 06 patients in the severe group. These findings indicate that increasing MERI scores are associated with reduced graft success rates. Similar results were reported by Thakur SK et al. (2021)¹⁰, who observed graft uptake rates of 82.6% in mild MERI cases and 33.3% in severe cases. Likewise, Verma JK et al. (2021)⁵ reported an overall graft success rate of 89%, with 67.9% success in mild MERI cases compared with only 8.18% in severe cases.

CONCLUSION

The present study confirms that MERI is a valuable and practical tool for predicting surgical outcomes in CSOM. Lower scores are associated with better anatomical and functional results, while higher scores indicate advanced disease and poorer prognosis. Incorporation of MERI into routine clinical practice can aid in surgical planning and patient counselling.

Compliance with Ethical Standards

Conflict of interest

All the authors declare they have no competing interest.

Informed Consent

Informed consent was obtained from all individual participants in the study.

Ethical Approval

All procedures performed in the study were in accordance with the ethical standards of the institution.

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