

RESEARCH ARTICLE

Prognostic Significance of MERI in Predicting the Postoperative Outcome of Surgery for Chronic Otitis Media

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Abstract

Background: Chronic otitis media (COM) is a long-term, irreversible inflammation of the middle ear lining that causes changes in the tympanic membrane. Chronic otitis media (COM) is a common middle ear disease and a serious health problem worldwide, especially in developing countries. The aim of this study was to investigate the role of the Middle Ear Risk Index (MERI) on the outcome of chronic otitis media and COM surgery to investigate implantation success and hearing improvement.

Methods: This was a prospective study conducted in the Department of Otolaryngology and Head Neck Surgery, BSMMU, Dhaka, Bangladesh January to June 2023. A total of 55 patients of COM were included in this study. Detailed ENT examination and preoperative pure tone audiometry were done in all patients. MERI score was calculated and patients were stratified based on the MERI score. All patients were evaluated at the end of 3 months postoperatively, for the status of graft uptake and improvement in hearing.

Results: Total 55 patients of COM were included in this study. The total numbers of males in our study were 23 (41.8%) and females were 32 (58.2%) which were almost comparable. Majority of the cases with mucosal disease underwent tympanoplasty (43.6%) and cortical mastoidectomy with tympanoplasty (38.2%) and cases with squamosal disease underwent combined approach tympanoplasty (5.4%), modified radical mastoidectomy (9.1%) and modified radical mastoidectomy with mastoid obliteration (3.6%). The difference in the proportion of the AB gap across the severity of MERI was statistically significant ($p=0.011$). The mean preoperative air conduction was 43.3 ± 13.9 and the mean postoperative air conduction was 35.07 ± 16.4 in the study population. The mean preoperative bone conduction was 15.04 ± 10.5 and the mean postoperative bone conduction was 16.13 ± 10.7 . The mean preoperative AB gap was 28.28 ± 11.2 and the mean postoperative AB gap was 18.65 ± 11.6 . The difference in the proportion of pre and postoperative AB gap was statistically significant ($p<0.001$). In our study 41 (74.5%) patients fell into the mild MERI category, 8 (14.6%) patients were categorized as moderate MERI group and only 6 (10.8%) patients were categorized as severe MERI group. Out of 41 mild MERI, 34 (82.9%) had successful graft uptake. In the moderate MERI group, the success rate was 75% (6 out of 8) and in the severe MERI group, it was 50% (3 out of 6). Among the people with mild MERI, the mean pre-op AB gap and post-op AB gap were 28.29 and 17.15 respectively. In moderate MERI group, the mean pre-op AB gap and post-op AB gap were 27.50 and 20.41 respectively and in severe MERI, the mean pre-op AB gap and post-op AB gap were 29.27 and 26.95 respectively. The MERI was found to be a remarkable predictor of the outcome of surgeries for COM. The patients with mild MERI scores had a significantly better prognosis than patients with severe MERI scores.

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Conclusion: MERI is a very useful and honest predictor of the graft uptake and hearing benefit in patients undergoing surgeries for COM. It has an inverse relation with graft uptake and hearing benefit. Based on the MERI score, the likelihood of surgical success and hearing benefit could be explained to the patient of COM to give them realistic expectations.

Keywords: Meri, Com, Graft Uptake, Hearing Benefit.

1. Introduction

Chronic suppurative otitis media, also known as chronic otitis media, is a stage of ear disease in which there is an on-going chronic infection of the middle ear without an intact tympanic membrane. This disease is a chronic inflammation of the middle ear and mastoid cavity. Chronic otitis media (COM) is a well-known ear disease worldwide. The prevalence of COM in the UK and Korea is 4.1% and 3.8%, respectively.¹ Although the severity varies, the majority of patients with COM develop progressive hearing loss. Many factors can affect the outcome, including the function of the Eustachian tube, middle ear disease, type of surgery, status of the ossicular remnants, and type of surgery and prosthesis.² The main aim of surgery for COM is to eradicate the disease and provide a safe and secure treatment. In cases of dry ears, the secondary goal is to restore hearing. Some studies recommend a one-stage operation aimed at both eradicating the disease and restoring hearing.^{2,3} The main aim of tympanoplasty is to reduce the number of infections and improve hearing. According to the literature, the success rate varies between 75 and 98%. Some recommend a two-stage surgery to achieve different goals.^{4,5} The success of the surgery depends on both the surgical principle and the pathophysiological factors associated with the disease. A small incision is made in the tympanic membrane to drain fluid from the middle ear. Tympanotomy is most often recommended to treat middle ear infections with effusion (fluid in the ear). Recovery from tympanotomy takes about 4 weeks on average. A patient's MERI score is a numerical rating used to classify the severity of their COM. MERI is calculated by assigning a specific value to each risk factor. These values are then summed to determine the MERI score. Risk factors include the Austin/Kartsch criteria for ossicular status, the Bellucci criteria for assessing the degree of otorrhea, the presence of perforation, middle ear granulation/effusion, cholesteatoma, smoking history, and previous surgery. The suggested risk categories can be derived from MERI as follows: 0=normal; 1-3=mild disease; 4-6=moderate disease; >7=severe disease. It is vital to study the various factors influencing the outcome of surgery for COM as it will not only help in predicting the outcome of surgery

but will also promote the compliance of the patient. As otitis media is prevalent and tympanoplasty is often needed, it is crucial to assess the severity of the disease and predict the success of the surgery. "MERI is a proposed indicator for evaluating and forecasting the outcome of tympanoplasty, which takes into account seven risk variables, such as smoking, otorrhea, perforation, cholesteatoma, ossicular status, and prior surgery in the same ear.

2. Methods

This was a prospective study conducted in the Department of Otolaryngology and Head Neck Surgery, BSMMU, Dhaka, Bangladesh January to June 2023. A total of 55 patients of COM were included in this study. All the patients with COM both mucosal and squamosal type who underwent surgery during this time were included in this study. Patients who have not given consent and those who lost to follow-up before 03 months were excluded from the study. Detailed history, thorough ENT examination, otoendoscopic examination, and preoperative PTA were done in all patients. Intraoperative findings were recorded. Based on this, MERI was calculated and the patients were stratified into mild (0-3), moderate (4-6), and severe (≥ 7) MERI.

The anatomical and functional outcomes of surgery were evaluated in terms of graft uptake and mean audiological gain at 03 months. Successful uptake of the graft was taken only in those patients who had no remnant of perforation in any of the quadrants of the tympanic membrane or the patients with well epithelialized non discharging mastoid cavity who underwent CWD procedure. The audiological gain was taken as the closure of the air-bone gap (AB gap). AB gap was calculated as the mean of AB gap at three frequencies (500Hz, 1000Hz and 2000 Hz) preoperatively and postoperatively at 03 months. The audiological gain was derived for each patient by subtracting the post-op AB gap from the pre-op AB gap. Audiological gain >20 dB was taken as a success; 11-20 dB was taken as improvement and <10 dB was taken as a failure following surgical procedures.

3. Statistical analysis

Descriptive analysis was carried out by mean and

standard deviation for quantitative variables and by frequency and proportion for categorical variables. All quantitative variables were checked for normal distribution within each category of the explanatory variable by using visual inspection of histograms and normality Q-Q plots. Shapiro-Wilk test also conducted to assess normal distribution. Shapiro Wilk test $p > 0.05$ was considered as a normal distribution. Change in quantitative parameters assessed by paired t- test. Categorical outcomes compared using the chi-square test. $P < 0.05$ was considered statistically

significant (IBM SPSS version 22 used for statistical analysis).

4. Results

Total 55 cases were included in our study. The mean age was 38.46 ± 14.78 years, the minimum being 7 years and the maximum of 70 years. Age-wise distribution is shown in Fig-1. Among the study population (55), 4 cases (7.2%) were < 20 years, 12 (21.8%) were between 21-30 years, 15 (27.2%) were between 31 to 40 years and 24 (43.6%) were > 40 years.

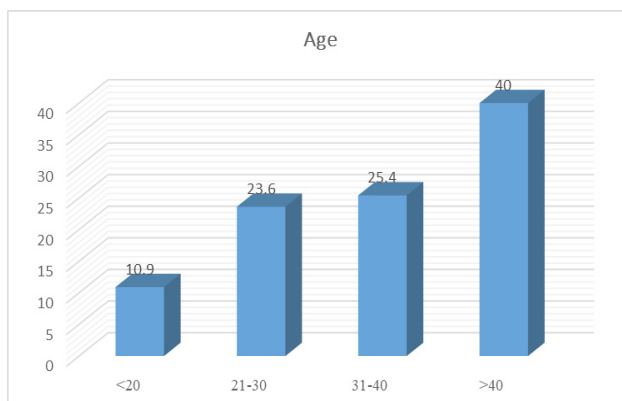


Figure 1. Age in groups in the study population (n=55).

The total numbers of males in our study were 23 (41.8%) and females were 32 (58.2%) which were almost comparable (Fig-2).

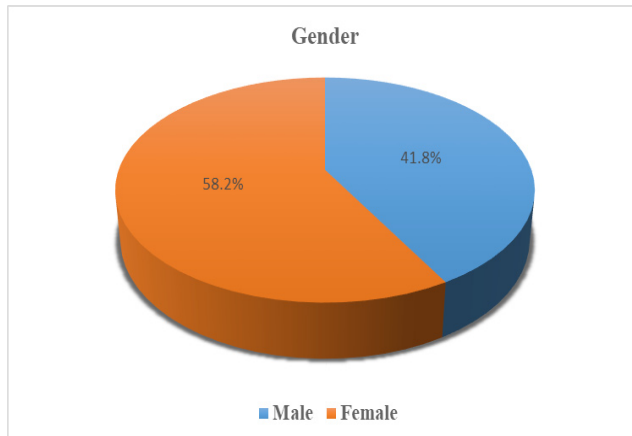


Figure 2. Gender in the study population, (n=55).

Majority of the cases with mucosal disease underwent tympanoplasty (43.6%) and cortical mastoidectomy with tympanoplasty (38.2%) and cases with squamosal disease underwent combined approach tympanoplasty

(5.4%), modified radical mastoidectomy (9.1%) and modified radical mastoidectomy with mastoid obliteration (3.6%) (table-1).

Table 1. Descriptive analysis of surgery in the study population, (n=55).

Surgery	N	Percentage (%)
Tympanoplasty	24	43.6
Cortical mastoidectomy with tympanoplasty	21	38.2
MRM (Modified radical mastoidectomy)	5	9.1
MRM with mastoid obliteration	2	3.6
Combined approach tympanoplasty	3	5.4

The difference in the proportion of the AB gap across the severity of MERI was statistically significant ($p = 0.011$).

Table 2. Descriptive analysis of AC, BC and AB Gap in study population (n=55)

Parameters	Mean	SD	Minimum	Maximum
Air conduction (AC)				
Pre	43.3	13.9	15.0	80.0
Post	35.07	16.4	15.0	90.0
Bone conduction (BC)				
Pre	15.04	10.5	0.0	60.0
Post	16.13	10.7	3.3	62.0
Air bone gap (AB Gap)				
Pre	28.28	11.2	6.6	56.7
Post	18.65	11.6	1.7	51.8

The mean preoperative air conduction was 43.3±13.9 and the mean postoperative air conduction was 35.07±16.4 in the study population. The mean preoperative bone conduction was 15.04±10.5 and the mean postoperative bone conduction was 16.13±10.7. The mean preoperative AB gap was 28.28±11.2 and the mean postoperative AB gap was 18.65±11.6 (Table 2).

Table 3. Comparison of mean preoperative AB gap (dB) and post-operative AB gap (dB) in the study population (n=55)

Pre op AB gap (Mean ± SD)	Post op AB gap (Mean ± SD)	Mean difference	95% CI		P value
			Lower	Upper	
28.28±11.23	18.65±11.58	9.63	6.58	12.68	<0.001

The difference in the proportion of pre and postoperative AB gap was statistically significant (p<0.001) (Table 3).

Table 4. Correlation of MERI score and graft uptake/epithelization, (n=55)

Severity of MERI	Graft uptake/ epithelization (%)		Chi square	P value
	Yes	No		
Mild, (n=41)	34 (82.9)	7 (17.1)		
Moderate, (n=8)	6 (75)	2 (25)	3.415	0.181
Severe, (n=6)	3 (50)	3 (50)		

In our study 41 (74.5%) patients fell into the mild MERI category, 8 (14.6%) patients were categorized as moderate MERI group and only 6 (10.8%) patients were categorized as severe MERI group. The success rate has been explained concerning two different entities-successful graft uptake and hearing benefit. The overall success rate was 82.9% according to graft status. Out of 41 mild MERI, 34 (82.9%) had successful graft uptake. In the moderate MERI group, the success rate was 75% (6 out of 8) and in the severe MERI group, it was 50% (3 out of 6) (Table 4).

Table 5. Correlation of cholesteatoma and graft uptake/ epithelization

Cholesteatoma	Total cases (n)	Graft uptake/ epithelization		Failure rate (%)
		Yes	No	
Absent	44	37	7	15.9
Present	11	7	4	36.3

The squamosal disease had a 61.8% success rate whereas mucosal disease had 37 (84.09%) (Table-5).

Table 6. Comparison of severity of MERI and number of cases with audiological gain (n=55)

MERI	Number of case (n)	Audiological gain (n)			Chi square	P value
		Yes	No			
		Successful (Gain >20 dB)	Improvement (Gain=10-20 dB)	Not improved (Gain <10 dB)		
Mild	41	16	20	5		
Moderate	8	1	5	2	9.095	0.011
Severe	6	0	3	3		

In our study, the overall hearing benefit is observed in 80% patients. Out of 41 participants who had mild MERI score, 36 (87.8%) participants had an audiological gain. Out of 8 participants who had a

moderate MERI score, 6 (75%) participants had an audiological gain. Out of 6 participants who had severe MERI score, 3 (50%) participants had audiological gain (Table 6).

Table 7. Comparison of mean preoperative AB gap and postoperative AB gap among the severity of MERI group

MERI	Pre op mean AB gap (dB)	Post op mean AB gap (dB)	Average improvement
Mild	28.29	17.15	11.1
Moderate	27.50	20.41	7.1
Severe	29.27	26.95	2.3

Among the people with mild MERI, the mean pre-op AB gap and post-op AB gap were 28.29 and 17.15 respectively. In moderate MERI group, the mean pre-op AB gap and post-op AB gap were 27.50 and 20.41 respectively and in severe MERI, the mean pre-op AB gap and post-op AB gap were 29.27 and 26.95 respectively (Table 7).

5. Discussion

Chronic suppurative otitis media is a persistent, chronically draining (> 6 weeks), suppurative perforation of the tympanic membrane. Symptoms include painless otorrhea with conductive hearing loss. Complications include development of aural polyps, cholesteatoma, and other infections. COM is a very common disease worldwide, particularly in developing countries.⁷ It is associated with illiteracy, poor personal hygiene, and lower socioeconomic status and more common in the rural population.⁹ Patients may report no symptoms, but some (or their family members) note hearing loss. Patients may experience a feeling of fullness, pressure, or popping in the ear during swallowing. Otalgia is rare. Various factors influence the outcome of surgery for COM and MERI combines these factors in a numerical value. This study was conducted to assess the prognostic value of the MERI score for the outcome of the surgeries for COM. Total 55 cases were included in our study. The mean age was 38.46±14.78 years, the minimum being 7 years and the maximum of 70 years. Among the study population (55), 4 cases (7.2%) were <20 years, 12 (21.8%) were between 21-30 years, 15 (27.2%) were between 31 to 40 years and 24 (43.6%) were >40 years. According to Pinar et al and Indorewala et al the disease was more common in 3rd and 4th decade of life which correlates with our study.^{10,11} The total numbers of males in our study were 23 (41.8%) and females were 32 (58.2%) which were almost comparable. The male-to-female ratio in our study was 1.3:1. Study conducted by Basak et al and Kalyanasundaram et al were also showing female predominance however, in a study done by Abhinav et

al, the disease was more common in males (60.31%). These variations showed that there is no significant gender distribution.¹²⁻¹⁴ There were 80.88% cases of mucosal COM and 19.11% cases of squamosal COM. These figures are comparable with other studies in which 86.02% of the cases were mucosal type and 13.98% were squamosal type.¹² Among the study population, 75% patients fell into the mild MERI category, and only 10.29% patients were categorized as severe MERI group. The majority of patients with severe MERI had squamous type CSOM. Among the mucosal type, only one patient had severe MERI. Squamous type was associated with a greater extent of disease in middle ear cleft as cholesteatoma and ossicular erosion. These findings were comparable with other studies which also showed maximum cases in mild MERI group and minimum in severe MERI group.^{10,15} In our study, the overall success rate was 79% according to graft status which is comparable to the study done by Pinar et al and Sarfaraj et al in which the overall graft uptake was 74.4% and 78% respectively.^{10,16} Successful graft uptake was 84.31% in Mild MERI and 57.14% in Severe MERI group. Our study concluded that there is a higher graft rejection rate for patients with severe MERI scores however the difference in the proportion of the severity of MERI and graft uptake was statistically not significant (p=0.181). Other studies also accorded our findings where they found people with mild MERI have high success rate in comparison with severe MERI.^{13,15,16} Hence, graft with a mild MERI score has fewer chances for rejection, and graft with severe MERI score has higher chances for rejection. In our study 41 (74.5%) patients fell into the mild MERI category, 8 (14.6%) patients were categorized as moderate MERI group and only 6 (10.8%) patients were categorized as severe MERI group. The success rate has been explained concerning two different entities-successful graft uptake and hearing benefit. The overall success rate was 82.9% according to graft status. The squamosal disease had a 61.8% success rate whereas mucosal disease had 37 (84.09%).

These findings were comparable with a study done by Ahmed et al in which they found a 56.7% success rate in COM with cholesteatoma and 84.9% in COM without cholesteatoma.¹⁷ In our study, the overall hearing benefit was observed in 80% patients which is comparable to the study done by Lima et al and Vignadutt et al in which they found overall hearing improvement in 72% cases and 84% respectively.^{18,19} Out of 41 participants who had mild MERI score, 36 (87.8%) participants had an audiological gain. Out of 8 participants who had a moderate MERI score, 6 (75%) participants had an audiological gain. Out of 6 participants who had severe MERI score, 3 (50%) participants had audiological gain. The difference in the proportion of the AB gap across the severity of MERI was statistically significant ($p=0.011$). The audiological gain was highest in mild MERI group and lowest in severe MERI group which was comparable with other studies.¹⁹⁻²¹ Vignadutt et al observed 90% improvement in hearing in mild MERI group and 50% improvement in the moderate MERI group.¹⁹ Hence, patients with a mild MERI score has higher chances of hearing improvement, and patients with severe MERI score has lower chances for hearing improvement. There were several limitations in this study like, the sample size was small, and all the surgeries were not done by a single surgeon.

6. Conclusion

It can be concluded that the MERI score is a very useful and reliable indicator of the outcome of operations in COM. It is inversely proportional to the outcome. The surgical goals should be determined based on the MERI score and the possibility of surgical success and hearing improvement should be explained to the patient. This score can be routinely used as a predictive tool for the outcome of COM surgery in modern ENT practice.

Conflict of Interest: None.

Source of Fund: Nil.

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