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Original Research Article

The role of middle ear risk index on the outcome of surgery for chronic otitis media

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ABSTRACT

Background: Chronic otitis media (COM) is a highly prevalent disease of the middle ear and constitutes a serious health problem worldwide, especially in developing countries. This study was done to evaluate the role of the middle ear risk index (MERI) on the outcome of surgeries for COM in the form of successful graft uptake and improvement in hearing.
Methods: A total of 68 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: 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.
Conclusions: 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

INTRODUCTION

Chronic otitis media (COM) is described as a long-standing irreversible inflammation of the mucoperiosteal lining of the middle ear cleft leading to changes in the tympanic membrane.[1] As it is a highly prevalent disease in developing countries, it's vital to assess the severity of the disease and predict the surgical outcome to counsel patients. The primary aim of the surgery for COM is to eradicate the disease and to give a safe and dry ear and the secondary aim is to restore hearing. Some studies had favoured single-stage surgery for both disease eradication and to restore hearing.[2,3] Whereas others have recommended a two-stage procedure for achieving different objectives.[4,5] The success of surgery is based on the surgical principle as well as the pathophysiological factors associated with the disease. For this purpose, a grading system has been formulated, known as the MERI (Table 1).

Table 1: MERI.

Risk factors							
Otorrhoea	**Perforation**	**Cholesteatoma**	**Ossicle status**	**Middle ear granulation/ effusion**	**Previous surgery**	**Smoker**	**Risk value**
Dry	None	None	M+I+S+	No	No	No	0
Occasional wet	Present		M+S+		Staged		1
Persistent wet		Present	M+S-	Yes	Revision	Yes	2
Cleft palate			M-S+				3
			M-S-				4
			Ossicle head fixation				2
			Stapes fix				3

M: Malleus; I: Incus; S: Stapes.

MERI score of a patient is a numerical grading to stratify the severity of COM. It was initially developed by Becvarovski and Kartush and later on revised in 2001.[6] MERI is calculated by assigning a specific value for each risk factor, and these values are added to derive the MERI score.

The risk factors include Austin/Kartush criteria for ossicular status, Belluci criteria to assess the degree of otorrhoea, presence of perforation, middle ear granulation/effusion, cholesteatoma, history of smoking, and history of 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.

Aim and objective

This study aims to evaluate the prognostic significance of MERI in predicting the postoperative outcome following surgery for COM in the form of successful graft uptake and audiological gain and also to correlate MERI score to the degree of audiological gain and uptake of graft following surgery for COM.

This was a prospective study conducted in the department of otorhinolaryngology and head and neck surgery, at a tertiary health care center from Dec 2018 to Dec 2020. 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.

Statistical analysis

Graft uptake and well-epithelialized cavity were considered as the primary outcome variable. The audiological gain was considered as a secondary outcome variable. The severity of MERI was considered as the primary explanatory variable. 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).

RESULTS

A total of 68 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 Figure 1. The total number of males in our study were 28 (41.18%) and females were 40 (58.82%) which were almost comparable (Figure 2).

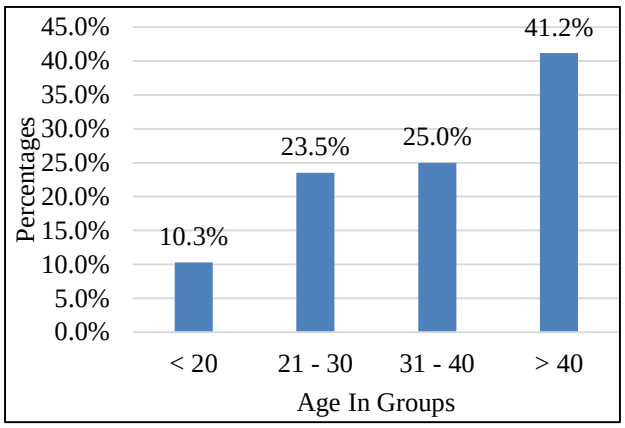

Figure 1: Age in groups in the study population, (n=68).

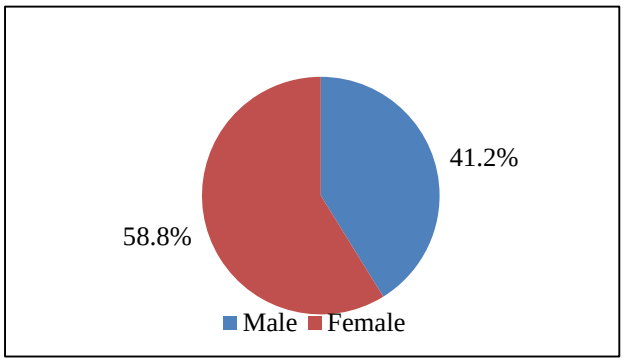

Figure 2: Gender in the study population, (n=68).

Among the patients, 39 had the right-sided disease and 29 had the left-sided disease. There were 55 (80.88%) cases of mucosal COM and 13 (19.11%) cases of squamosal COM. Majority of the cases with mucosal disease underwent tympanoplasty (44.12%) and cortical mastoidectomy with tympanoplasty (36.76%) and cases with squamosal disease underwent combined approach tympanoplasty (5.88%), modified radical mastoidectomy (8.82%) and modified radical mastoidectomy with mastoid obliteration (4.41%) (Table 2).

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 3). The difference in the proportion of pre and postoperative AB gap was statistically significant (p<0.001) (Table 4).

In our study 51 (75%) patients fell into the mild MERI category, 10 (14.71%) patients were categorized as moderate MERI group and only 7 (10.29%) 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 79 % according to graft status. Out of 51 mild MERI, 43 (84.31%) had successful graft uptake. In the moderate MERI group, the success rate was 70% (7 out of 10) and in the severe MERI group, it was 57.14% (4 out of 7) (Table 5). The squamosal disease had a 61.53% success rate whereas mucosal disease had 83.64% (Table 6).

In our study, the overall hearing benefit is observed in 80% patients. Out of 51 participants who had mild MERI score, 45 (88.23%) participants had an audiological gain. Out of 10 participants who had a moderate MERI score, 7 (70%) participants had an audiological gain. Out of 7 participants who had severe MERI score, 3 (42.8%) participants had audiological gain (Table 7). The difference in the proportion of the AB gap across the severity of MERI was statistically significant (p=0.011).

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 8).

Table 2: Descriptive analysis of surgery in the study population, (n=68).

Surgery	N	Percentage (%)
Tympanoplasty	30	44.12
Cortical mastoidectomy with tympanoplasty	25	36.76
MRM (Modified radical mastoidectomy)	6	8.82
MRM with mastoid obliteration	3	4.41
Combined approach tympanoplasty	4	5.88

Table 3: Descriptive analysis of AC, BC and AB Gap in study population, (n=68).

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

Table 4: Comparison of mean preoperative AB gap (dB) and post-operative AB gap (dB) in the study population.

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

Table 5: Correlation of MERI score and graft uptake/epithelization, (n=68).

Severity of MERI	Graft uptake/ epithelization (%)		Chi square	P value
	Yes	No		
Mild, (n=51)	43 (84.31)	8 (15.69)	3.415	0.181
Moderate, (n=10)	7 (70)	3 (30)		
Severe, (n=7)	4 (57.14)	3 (42.86)		

Table 6: Correlation of cholesteatoma and graft uptake/ epithelization.

Cholesteatoma	Total cases (n)	Graft uptake/ epithelization		Failure rate (%)
		Yes	No	
Absent	55	46	9	16.36
Present	13	8	5	38.46

Table 7: Comparison of severity of MERI and number of cases with audiological gain, (n=68).

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	51	19	26	6	9.095	0.011
Moderate	10	1	6	3		
Severe	7	0	3	4		

Table 8: 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

DISCUSSION

COM is a very common disease worldwide, particularly in developing countries.[7] According to the WHO report 2004, the prevalence of COM in the Indian community was 7.8%.[8] It is associated with illiteracy, poor personal hygiene, and lower socioeconomic status and more common in the rural population.[9] 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.

Among the study population (68), 7 cases (10.29%) were <20 years, 16 (23.53%) were between 21-30 years, 17 (25%) were between 31 to 40 years and 28 (41.18%) were >40 years (Figure 1). 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 male-to-female ratio in our study was 1:1.4. 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.

We observed that cholesteatoma was the single most important risk factor for the outcome of COM as the success rate was 61.53% in squamosal disease whereas mucosal disease had success rate of 83.64%. 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 squamosal disease, the success rate of CWU procedures were more (50%) in comparison with CWD procedures (66.6%).

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] However hearing benefit was observed more in mild MERI group (88.2% participants) and less in severe MERI group (42.8% participants) (Table 7). 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.

CONCLUSION

It can be concluded that the MERI score is a very useful and honest predictor of the outcome of surgeries for COM. It is inversely related to the outcome. Based on the MERI score, the goals of surgery should be determined and chances of surgical success and hearing benefit should be explained to the patient. This score can be routinely used as a predicting tool for the outcome of surgeries for COM in modern ENT practice.

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