

Original Research Article

A retrospective study on middle ear risk indices in analysing the post-operative outcome following tympanoplasty

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Received: 01 June 2021

Accepted: 05 August 2021

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ABSTRACT

Background: Chronic otitis media is a highly prevalent disease of middle ear. As tympanoplasty plays an important role in management of otitis media it is important to predict the outcome of surgery and give proper counselling to the patient. The objective of this study was to evaluate the effectiveness of Middle ear risk index (MERI) in determining postoperative graft uptake and postoperative air bone gap closure following tympanoplasty.

Methods: This was a retrospective study conducted to find the correlation between MERI and the result of tympanoplasty outcome and post-operative hearing gain. Ninety-six subjects who underwent tympanoplasty for chronic otitis media were included in the study. MERI score was calculated and was compared with postoperative graft uptake and audiogram.

Results: In this study there was no statistical difference in graft uptake between the MERI categories. There was statistically significant decrease in postoperative air bone gap closure in both mild and moderate categories. Other prognostic factors associated with a favourable outcome were healthy middle ear mucosa and absence of smoking.

Conclusions: MERI did not have a direct impact on the outcome of surgery in terms of graft uptake and hearing results. However certain factors like Belluci's criteria and smoking had an impact on the outcome. Hence MERI can be used for pre-operative counselling of the patients.

Keywords: Chronic otitis media, Middle ear risk index, Post-operative outcome, Tympanoplasty

INTRODUCTION

The goal of successful tympanoplasty is to eradicate the disease from middle ear and to create a sound conducting mechanism in a well aerated mucosal lined middle ear cleft.

The success rate of tympanoplasty is extremely variable, ranging from 60 to 99% in adults.¹

Middle ear risk index (MERI) was revised and updated in 2001 by Becvarovski et al and Kartush et al.^{2,3} It combines the known preoperative and intra-operative risk factors for tympanoplasty prognosis into a numerical value.^{4,7}

The main aim of the study was to evaluate the effectiveness of MERI in determining postoperative graft

uptake and air bone gap closure following tympanoplasty.

METHODS

A 1.5-years retrospective study was carried out in ENT department in a tertiary care medical centre from June 2018 to December 2019 on 96 subjects in the age group of 18-50 years who underwent tympanoplasty for chronic otitis media. Patients with squamosal type of chronic otitis media and previous use of ototoxic drugs were excluded from the study. After obtaining the institutional ethics committee clearance, data was collected from the hospital records. After detailed history and ENT examination, pure tone audiogram was done prior to surgery. All patients underwent tympanoplasty using post aural approach and temporalis fascia as graft material. Following surgery, intra-operative findings was obtained from operative

notes. Based on these MERI score was calculated and categorized as mild, moderate and severe. Tympanic membrane status of operated ear at the end of one month was obtained from case records and postoperative audiogram at the end of 3 months was obtained from audiology database maintained by the department audiologist.

Table 1: Middle ear risk index.

Risk factors	Risk value
Otorrhoea	
I Dry	0
II Occasionally wet	1
III Persistently wet	2
IV Wet, cleft palate	3
Perforations	
Absent	0
Present	1
Cholesteatoma	
Absent	0
Present	2
Ossicular status (Austin et al/ Kartush et al)	
O: M+ I+ S+	0
A: M+ S+	1
B: M+ S-	2
C: M- S+	3
D: M- S-	4
E: Ossicular head fixation	2
F: Stapes head fixation	3
Middle ear: granulations/effusion	
No	0
Yes	2
Previous surgery	
None	0
Staged	1
Revision	2
Smoking	
No	0
Yes	2

Note: M- malleus, S- stapes suprastructure, mild (1-3), moderate (4-6) and severe (7-16).

Statistical analysis

Data obtained were recorded in MS Excel work sheets and statistical analysis was done using IBM SPSS 22 programme running on windows operating system. Fischer’s exact test and Chi square test was used for statistical analysis. Data was expressed in terms of frequency and percentages. Data visualization was done using appropriate charts/graphs. A p value<0.05 were considered as statistically significant.

RESULTS

This was a retrospective study conducted to find the correlation between MERI and the result of tympanoplasty outcome and post-operative hearing gain. 96 patients were

included in the study. The age range of participants in the study was 18-50 years with a mean±SD age was 34.70±10.22 years. There was a female predominance in the study (65.6%) (Figure 1). According to our data majority of the patients fell into the mild category (74%) followed by moderate (26%). There were no patients in severe category. Majority of our patients had mild conductive hearing loss in our study (44.8%). Of the 96 patients in our study graft was taken up in 84 patients (87.5%). There was no statistically significant difference between the various groups in terms of uptake of graft (p=0.073) (Figure 2).

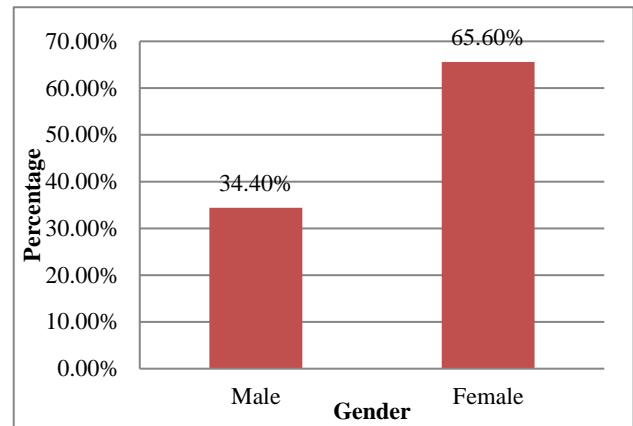


Figure 1: Distribution of gender (n=16).

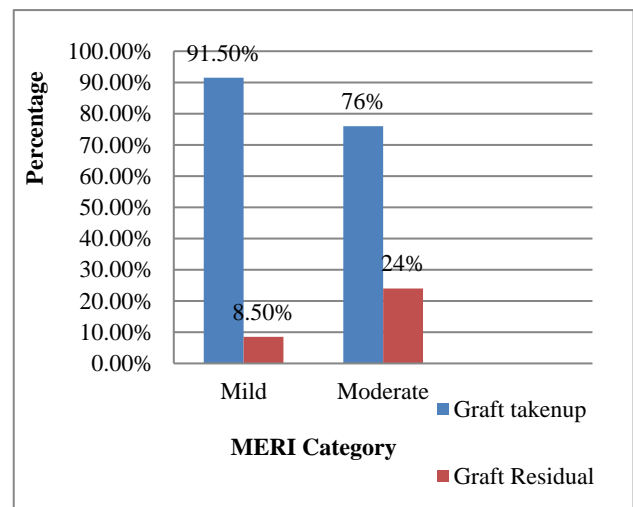


Figure 2: Association between MERI category and graft status (n=16).

According to Belluci criteria, there was no residual perforation in dry ears whereas in persistently wet ears there was 27.8% chance of graft rejection. There was a significant difference between the various groups in terms of distribution of graft status (p=0.004). According to our study patients with bilateral disease did not have a higher chance of graft rejection. Unhealthy middle ear mucosa included presence of congestion or discharge.

There was no granulation tissue in any of the cases. We noted that all the patients who had a residual perforation had unhealthy middle ear mucosa. There was an association between smoking and graft acceptance rate according to our study (p=0.001). According to our study the size of the perforation did not have a bearing on the success of the surgery. Incus was found to be most commonly affected ossicle followed by malleus. There was an improvement in AB gap in both mild (p value<0.001) and moderate categories (p value=0.002). We considered AB gap of less than 10 db as excellent hearing result and 10 to 20 db as successful hearing result as per Committee on Hearing and Equilibrium of the Academy of Otolaryngology- Head and neck surgery. We noticed that excellent hearing results were observed in 36.6% of patients with mild MERI. A successful hearing result was seen in 42.3% of mild MERI and 56% of moderate MERI.

Table 2: Distribution of the participants in terms of MERI category (N=96).

MERI category	Frequency	Percentage (%)
Mild	71	74.0
Moderate	25	26.0
Total	96	100.0

Table 3: Distribution of the participants in terms of hearing loss (N=96).

Hearing loss	Frequency	Percentage (%)
Minimal	19	19.8
Mild	43	44.8
Moderate	30	31.2
Severe	4	4.2
Total	96	100.0

Table 4: Association between Belluci's criteria and graft status (N=96).

Graft status	Dry ear (%)	Occasionally wet (%)	Persistently wet (%)	P value
Taken up	10 (100.0)	48 (96.0)	26 (72.2)	0.004
Residual	0 (0.0)	2 (4.0)	10 (27.8)	

Table 5: Association between graft status and laterality (N=96).

Laterality	Graft status			Fisher's exact test	
	Taken up (%)	Residual (%)	Total (%)	χ ² value	P value
Unilateral	59 (88.1)	8 (11.9)	67 (100.0)	0.064	0.750
Bilateral	25 (86.2)	4 (13.8)	29 (100.0)		
Total	84 (87.5)	12 (12.5)	96 (100.0)		

Table 6: Association between graft status and middle ear mucosa (N=96).

Middle ear mucosa	Graft status			Fisher's exact test	
	Taken up (%)	Residual (%)	Total (%)	χ ² value	P value
Healthy	70 (100.0)	0 (0.0)	70 (100.0)	36.923	<0.001
Unhealthy	14 (53.8)	12 (46.2)	26 (100.0)		
Total	84 (87.5)	12 (12.5)	96 (100.0)		

Table 7: Association between graft status and smoking (N=96).

Smoking	Graft status			Fisher's exact test	
	Taken up (%)	Residual (%)	Total (%)	χ ² value	P value
Yes	7 (53.8)	6 (46.2)	13 (100.0)	15.570	0.001
No	77 (92.8)	6 (7.2)	83 (100.0)		

Table 8: Association between graft status and perforation (N=96).

Graft status	Graft status			Fisher's exact test	
	Taken up (%)	Residual (%)	Total (%)	χ ² value	P value
Large	40 (47.6)	10 (83.3)	50 (52.1)	5.933	0.131
Moderate	35 (41.7)	2 (16.7)	37 (38.5)		
Small	9 (10.7)	0 (0.0)	9 (9.4)		
Total	84 (100.0)	12 (100.0)	96 (100.0)		

Table 9: Status of ossicles.

Ossicles	Intact (%)	Diseased (%)
Malleus	92 (95.8)	4 (4.2)
Incus	88 (91.7)	8 (8.3)
Stapes	94 (97.9)	2 (2.1)

Table 10: Association between MERI score and post-operative AB gap (N=96).

MERI	Pre-op AB gap (mean)	Post-op AB gap (mean)	Absolute change	P value	ABG≤10 db, N (%)	ABG≤20 db, N (%)
Mild	23.26 (10.45)	14.69 (8.80)	8.57 (5.86)	<0.001	26 (36.6)	30 (42.3)
Moderate	26.32 (11.34)	18.36 (11.35)	7.96 (12.73)	0.002	4 (16.0)	14 (56.0)

DISCUSSION

The success of tympanoplasty is most often defined by the graft integration, disease control, an aerated ear and the results of hearing.⁸ There are many studies which discuss the prognostic factors and hearing results in tympanomastoid surgeries. In our study we used the middle ear risk index scale. Our sample size included adults between 18-50 years of age. The effect of age on the success of tympanoplasty is contradictory in different studies. The reason for poorer results in paediatric tympanoplasties was mostly related to continued Eustachian tube dysfunction and a low tympanometric volume.^{9,10} However a study in elderly showed that elderly patients with low/medium MERI had a good surgical outcome.¹¹ There was a female preponderance in our study which was also noted in some of the studies.^{12,13}

A vast majority of our patients fell into MERI mild category (74%) with no patients in severe category. These results were similar to previous studies which showed that mild category of MERI was a majority.^{4,5} The overall graft acceptance rate was 87.5% in our study. The various factors which were significantly associated with graft uptake were Belluci's criteria ($p=0.004$), condition of the middle ear mucosa ($p\leq 0.001$) and smoking ($p=0.001$).

However, the size of the perforation and presence of bilateral disease ($p=0.750$) were found to have no association with graft uptake. In a study by Pinar et al it was found that bilateral disease and type of surgery were significantly associated with graft uptake whereas size and site of perforation had no significant association.¹ In a study conducted to assess the impact of perforation size on the success of tympanoplasty it was concluded that perforation size was not predictive or determinant of successful myringoplasty.¹⁴ The status of the ear (dry or wet) was not statistically related to surgical success in many studies.^{4,8} However some studies showed that there are more likely chances of graft rejection in persistently wet ears.¹⁵

The effect of smoking on the middle ear can be classified as local (due to effect on mucociliary apparatus), regional (due to Eustachian tube obstruction) or systemic (due to immunosuppression).⁸ A study conducted to review the

effects of smoking on the success rate of tympanoplasty revealed that smoking was associated with a threefold increase in chance of long-term failure of graft. MERI was revised to include smoking as a risk factor based on this study.⁷

In our study there was no significant difference in graft uptake between the two categories ($p=0.073$). This is in contrast to other studies which showed that as the MERI score increases there are more chances of graft rejection. In a study by Aggarwal et al and Dev et al it was found that graft uptake was 91% in mild category but it was only 60% in moderate category ($p=0.008$).⁴ There was a 100% chance of graft rejection in ears with MERI score of 7-12 in the study by Nishant et al.⁵ This lack of correlation in our study could be explained by the fact that most of our patients belonged to mild category with no patients being in the severe category of MERI.

In our study the hearing loss was predominantly mild conductive hearing loss (44.8%). Ossicular involvement was seen in 14.5 % of the cases in which incus was the most common ossicle to be diseased (8.3%). When, it comes to the damaged ossicle as a predictor of hearing results in ossiculoplasties the literature data is controversial. Many studies showed that the presence of malleus is a better determinant of hearing results post-surgery regardless of the condition of the stapes.^{16,17} The malleus handle contributes to the stability of the tympanic membrane and the ossicular chain. It further prevents graft lateralization and acts as a catenary lever.^{18,19} However there are some authors who consider that the presence of stapes suprastructure is crucial in the hearing outcome.^{18,20}

There was a significant improvement in AB gap in both mild and moderate categories. This was in contrast to other studies which showed positive correlation between MERI score and hearing results.^{2,4,12} However we noticed that excellent hearing improvement (AB gap <10 db) was seen in 36.6% of patients in mild MERI category.

The limitation of our study was that it was a retrospective study. So, our data was mainly based on the documented evidence. The study can be improved by adding Eustachian tube function tests along with MERI for best results.

CONCLUSION

In our study MERI did not have an overall effect in predicting the outcome of tympanoplasty. However certain components of MERI like otorrhoea and smoking had a positive correlation. We also assessed certain other prognostic factors in addition to the ones included in MERI. The purpose of doing this study is to help us in counselling the patients and give them the realistic expectations from the surgery.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Risvana PP, Mubeena K. A retrospective study on middle ear risk indices in analysing the post-operative outcome following tympanoplasty. *Int J Otorhinolaryngol Head Neck Surg* 2021;7:1468-72.