RESEARCH ARTICLE

# Predictive Value of Middle Ear Risk Index Score in the Outcome of Tympanomastoidectomy and Tympanoplasty

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*Received on:* 31 January 2022; *Accepted on:* 16 May 2023; *Published on:* 16 August 2023

## Abstract

**Background and objectives:** Chronic otitis media (COM) is an otological challenge especially prevalent in developing countries like India for which tympanoplasty with or without mastoidectomy is the treatment of choice. In this study, we aim to assess the predictive value of the middle ear risk index (MERI) score in the outcome of tympanoplasty.

**Subjects and methods:** Fifty patients who underwent surgery at Lok Nayak Hospital for chronic suppurative otitis media received preoperative MERI score assessments. They were subsequently followed, and their results were evaluated based on the MERI score.

**Results:** There is a statistical significance concerning graft uptake and hearing gain based on the MERI score. As the MERI score increased, the chances of graft uptake decreased, and the mean hearing gain also decreased accordingly.

**Conclusion:** All patients undergoing surgery for COM should be assessed preoperatively for MERI score so that appropriate counselling and prognostication can be done about the chances of success of surgery.

**Keywords:** Chronic Otitis Media, Middle ear risk index score, Tympanoplasty.

*Otorhinolaryngology Clinics: An International Journal* (2023): 10.5005/jp-journals-10003-1442

## Introduction

Tympanoplasty is a very common surgery performed by Ear Nose Throat (ENT) surgeons worldwide. There are different techniques and grafting materials used by surgeons. The surgery's outcome also depends on multiple patient and disease factors, such as the severity of the disease, its extent, and various other factors. Multiple studies have been conducted to assess the disease preoperatively and guide the patient accordingly about the prognosis and outcome of the surgery.

Bellucci[1] performed one such study in which he developed a grading system according to symptoms such as ear discharge, eustachian tube dysfunction, and nasal allergy. He attempted to improve the risk factors before the surgery to enhance the surgical outcome.

For ossiculoplasty, Austin[2,3] proposed a system comprising four anatomical situations in 1971. This system was later modified by Kartush[4] in 1994, and three more categories were subsequently added.

The middle ear risk index (MERI) was given by Kartush in 1994.[4] It combines the Austin-Kartush classification of ossicular defects, the Belluci classification of otorrhea, and factors in the presence of tympanic membrane perforation, middle ear granulations, and cholesteatoma. This index generates a numerical score that corresponds to the severity of the disease and helps in predicting the likelihood of a successful outcome after surgery.

### Middle Ear Risk Index Score is Calculated as Shown in Table 1 Placed Here

Based on MERI score the patients are classified as:

- Mild disease category for score 1–3
- Moderate disease category for score 4–6
- Severe disease category for score – more than 6

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**How to cite this article:** Agarwal A, Passey JC, Malhotra V. Predictive Value of Middle Ear Risk Index Score in the Outcome of Tympanomastoidectomy and Tympanoplasty. Int J Otorhinolaryngol Clin 2023;15(1):5–8.

**Source of support:** Nil

**Conflict of interest:** None

This helps in guiding case selection for the surgery, counseling of patients preoperatively, and for research purposes too. It helps to decide intraoperatively whether a canal wall up or canal wall down mastoidectomy needs to be done and if ossicular reconstruction should be done primarily or as a second-stage surgery. The original MERI had scoring from 0 to 12, but was later modified in 2001 to include smoking as a risk factor, and the weightage of granulation and cholesteatoma was increased, thus taking a maximum score up to 16.[5]

Tympanoplasty and tympanomastoidectomy surgeries are being performed in good numbers, and with the increasing awareness of patients, it is imperative to prognosticate the patient according to the disease severity and possible outcome of surgery to avoid any unrealistic expectations and possible medicolegal implications. The present study was conducted to assess the predictive value of the MERI score in the outcome of tympanoplasty among Chronic Otitis Media patients.

**Table 1:** Middle ear risk index scoring

| *Risk factor* | *Finding* | *Value* |
|---|---|---|
| Otorrhea | Dry | 0 |
| | Intermittent wet | 1 |
| | Persistent wet | 2 |
| | Wet with cleft palate | 3 |
| Perforation | Absent | 0 |
| | Present | 1 |
| Cholesteatoma | Absent | 0 |
| | Present | 2 |
| Ossicular chain | All ossicles present | 0 |
| | Defect in incus | 1 |
| | Defect in incus and stapes | 2 |
| | Defect in incus and malleus | 3 |
| | Defect in malleus, incus and stapes | 4 |
| | Ossicular head fixation | 2 |
| | Stapes fixation | 3 |
| Middle ear granulation/ effusion | No | 0 |
| | Yes | 2 |
| Previous surgery | None | 0 |
| | Staged | 1 |
| | Revision | 2 |
| Smoker | No | 0 |
| | Yes | 2 |

## Materials and Methods

After the approval of the Institutional Review Board, this was a comparative study conducted at the ENT Department of Maulana Azad Medical College and Associated Lok Nayak Hospital, Delhi, India. All patients aged from 18 to 60 years with COM who attended ENT OPD of the hospital and were planned for tympanoplasty were included in the study. Patients with systemic diseases making them unfit for surgery were excluded from the study.

The patient's elaborate history was taken which included the demographic details, nature of ear discharge, the period of dryness, hearing loss, any previous ear surgery, history of tobacco smoking, long-term use of ototoxic drugs, and any other medical illness. Then examination with an otoscope was done to assess the tympanic membrane if intact or perforated, any granulation tissue and for the presence of cholesteatoma. Tuning fork tests were conducted to assess the type of hearing loss. Patients with conductive hearing loss alone were included in the study. Those with sensorineural and mixed hearing loss were excluded from the study.

Pure tone audiometry was performed to assess the type and degree of hearing loss. The Hughson and Westlake method modified by Carhart and Jerger was used to calculate the hearing loss. The mean air-bone gap was measured from the air and bone conduction thresholds at 0.5 kHz, 1 kHz, 2 kHz, and 3 kHz.

A High-resolution computed tomography (CT) scan of the temporal bone was obtained for case of the squamosal type of COM to assess the extent of disease and ossicular status. Routine blood investigations like hemogram and serum electrolytes were done before the surgery. The MERI score was calculated for each patient, and then they were stratified into the mild (0–3), moderate (4–6) and severe (>6) categories.

### Procedure

According to the examination and CT temporal scan findings, the type of tympanoplasty and tympanomastoidectomy to be performed was planned but could be modified according to the extent of the disease and the ossicular status intraoperatively. For the graft, temporalis fascia autograft was used in all the patients. An electrical drill and burr was used to drill the mastoid cortex, all the cholesteatoma, and granulation tissue were cleared from the middle ear. Ossiculoplasty was done wherever required and eroded ossicles were refashioned or conchal cartilage was used. The temporalis fascia graft was placed using the underlay technique in all procedures. Oral antibiotics and analgesics were given in the postoperative period and continued for 7 days, and patients were discharged on the next day after surgery, following assessment of the suture line and with mastoid dressing. Patients were reviewed every week for 1 month and then once a month for next 3 months, and afterward, patients were seen every 6 months.

The outcome of surgery was based on two factors:

1. Graft status
2. Pure tone audiometry

Graft status was assessed using otoscopic examination.

- Successful – healed graft
- Graft failure or perforation within graft

Pure-tone audiometry was done at the end of 3 months postoperatively. Hearing benefit was calculated based on the difference between preoperative and postoperative air-bone gaps.

## Results

In our study, the most common age group for COM was 21–30 years of age, comprising 42 percent of the total cases. Among the case, 72 percent had the mucosal type of COM, while the remaining 28 percent presented with the squamosal type. Regarding the required tympanoplasty types, type I tympanoplasty was needed in 70 percent of cases, type II in 2 percent, and the remaining 28 percent required type III tympanoplasty.

As the MERI score increased from mild to severe, the procedure required changed from type I tympanoplasty to type III with *p*-value being very significant. The data showing the type of surgery required according to MERI score has been depicted in Table 2. With an increasing MERI score, the success rate of graft uptake decreased from 96 percent to 63.6 percent as shown in Table 3.

In the Tables 4 and 5, we can observe that with an increasing MERI score, hearing gain is compromised both in absolute terms and mean percentage gain, with *p*-value being significant. Table 4 depicts the absolute hearing gain according to MERI score. Table 5 shows the mean percentage gain in hearing according to the MERI score.

## Discussion

Chronic Otitis Media remains a prevalent and troublesome disease for a significant population. The mainstay of treatment is surgery for most of the cases. Even after improvements in surgical techniques, the use of advanced microscopes, and enhanced sterility, achieving a 100 percent positive outcome after surgery still proves challenging. There are multiple factors which hinder the

**Table 2:** Type of procedure according to MERI score category

| | | | *Procedure* | | | | |
|---|---|---|---|---|---|---|---|
| | | | *Type I Tympanoplasty* | *Cortical Mastoidectomy with Type I Tympanoplasty* | *Cortical Mastoidectomy with Type II Tympanoplasty* | *Modified Radical Mastoidectomy with Type III Tympanoplasty* | *Total* |
| MERI score | Mild | *n* | 24 (96.0%) | 1 (4.0%) | 0 | 0 | 25 |
| | Moderate | *n* | 5 (35.7%) | 5 (35.7%) | 1 (7.1%) | 3 (21.4%) | 14 |
| | Severe | *n* | 0 | 0 | 0 | 11 (100%) | 11 |
| Total | | *n* | 29 (58.0%) | 6 (12.0%) | 1 (2.0%) | 14 (28.0%) | 50 |
| *p*-value | | | <0.0001, S | | | | |

**Table 3:** Graft status according to MERI score category

| | | | *Graft status* | | |
|---|---|---|---|---|---|
| | | | *Rejected* | *Taken up* | *Total* |
| MERI score | Mild | *n* (%) | 1 (4.0%) | 24 (96.0%) | 25 |
| | Moderate | *n* (%) | 3 (21.4%) | 11 (78.6%) | 14 |
| | Severe | *n* (%) | 4 (36.4%) | 7 (63.6%) | 11 |
| Total | | *n* | 8 (16.0%) | 42 (84.0%) | 50 |
| *p*-value | | | 0.041, S | | |

**Table 4:** Hearing gain with respect to MERI score category

| | | | *Absolute hearing gain* | | | | |
|---|---|---|---|---|---|---|---|
| | | | *Hearing loss/ no gain* | *1–10 dB* | *11–20 dB* | *>20 dB* | *Total* |
| MERI score | Mild | *n* | 1 (4%) | 5 (20%) | 19 (76%) | 0 | 25 |
| | Moderate | *n* | 3 (21.4%) | 0 | 10 (71.4%) | 1 (7.1%) | 14 |
| | Severe | *n* | 4 (36.4%) | 0 | 5 (45.5%) | 2 (18.2%) | 11 |
| Total | | *n* | 8 (16%) | 5 (10%) | 34 (68%) | 3 (6%) | 50 |
| *p*-value | | | | | 0.016, S | | |

**Table 5:** Mean percentage gain in hearing according to MERI score category

| *Mean percentage gain in hearing* | | | | | |
|---|---|---|---|---|---|
| *MERI score* | *N* | *Mean* | *Std. deviation* | *p-value* | *Post hoc pairwise comparison by Bonferroni test* |
| Mild | 25 | 47.24 | 12.83 | 0.006, S | 1*2–0.545, NS<br>1*3–0.005, S<br>2*3–0.194, NS |
| Moderate | 14 | 39.26 | 21.00 | | |
| Severe | 11 | 25.80 | 22.27 | | |
| Total | 50 | 40.29 | 19.26 | | |

achievement of a 100 percent mark, which lead to the development of the MERI score which combines multiple factors affecting the outcome of surgery and helps in guiding both the patient and doctor about the chances of success of surgery and what to expect after the surgery. So, in this study, we discuss if MERI scoring is an efficient and effective tool for prognosticating patients of COM.

## Meri Category

According to the preoperative findings, patients were categorized into the mild, moderate, or severe category of the MERI score. In our study, we found that 50 percent of the cases fell into the mild category, 28 percent into the moderate category, and the remaining 22 percent into the severe category of MERI. It was observed that the majority of patients with the mucosal type of COM were placed in the mild MERI category, while most patients with the squamosal type of COM were placed in the moderate or severe category of MERI.

The distribution of the types of intervention required was found to be significantly different among patients with different categories of MERI score. Among patients with mild MERI score, majority underwent type I tympanoplasty. On the other hand, among patients with a severe MERI score, all underwent modified radical mastoidectomy with tympanoplasty.

Similar findings were obtained in the study conducted by Mahmood Shishegar et al.,[6] where they reached a similar conclusion. They observed that with increasing MERI score, there was a statistically significant higher chance of the need for mastoidectomy. Conversely, as the MERI score decreases, the need for mastoidectomy decreases, and only tympanoplasty may be required.

**Table 6:** Comparison of graft status with previous studies

| | *Graft status (%)* | |
|---|---|---|
| | *Mild MERI category* | *Severe MERI category* |
| Our study | 96 | 63.6 |
| N Kumar | 86 | 0 |
| R Kalyansundaram | 92.85 | 58.82 |

## Graft Status

After the surgery, patients were followed up for 3 months. Graft status was considered successful when on otoscopic examination the graft was completely taken up and there was no residual or recurrent perforation during that time period.

Out of the total 50 cases that were operated, there was an overall 84 percent graft uptake rate. The graft status was found to be significantly different among patients with different categories of MERI score. Among patients with a mild MERI score, the majority had a successful graft uptake, while among patients with severe MERI score, the rejection rate was significantly higher compared to those with a mild MERI score.

These results are similar to the study conducted by Nishant Kumar et al.[7] in which there was 86 percent graft uptake rate in mild MERI score category. Additionally, there were only 2 cases in the severe category of MERI score, and in both of them, the graft was rejected.

Another study conducted by Rameshbabu Kalyansundaram et al.[8] also got similar results. In their study, 92.85 percent of the cases belonging to mild category of MERI score had a successful graft uptake, while the success rate in severe category of MERI score was 58.82%. Table 6 presents the comparison of graft status

from our study with the results of previous studies conducted by N Kumar and R Kalyansundaram.

### Hearing Gain

The other factor that we studied was the audiological gain after the surgery. We assessed the amount of audiological gain as compared to the pre-operative level and the variation in the audiological gain if it exists in the different comparison groups that are the mild, moderate and severe categories of MERI score. Hearing gain was calculated by PTA done pre-operatively and at 3 months post-operatively. The mean air-bone gap was measured from the air and bone conduction thresholds at 0.5 kHz, 1 kHz, 2 kHz, and 3 kHz as advised by the Committee on Hearing and Equilibrium of the American Academy of Otolaryngology-Head and Neck Surgery for the evaluation of results for treatment of conductive hearing loss.[9]

The magnitude of hearing gain was found to be significantly different among patients with mild, moderate and severe MERI score. A significantly higher proportion of patients having mild MERI score had a hearing gain of 11–20 dB compared to those with severe MERI score. Additionally, a significantly higher proportion of patients with severe MERI score experienced hearing loss or no gain compared to those with mild MERI score..

Similar results were obtained when the mean hearing gain was calculated with respect to different MERI categories.

The mean percentage gain in the hearing was found to be maximum in the mild MERI score group, followed by moderate and severe MERI score groups in decreasing order. The mean percentage gain in hearing in mild MERI score group patients was found to be significantly high as compared to that in severe MERI score group patients. While the mean percentage gain in hearing in moderate MERI score group subjects did not show any significant difference between the other two groups.

So, as the severity of the disease increased and the MERI score increased, the mean hearing gain decreased with the increasing MERI score.

In the study conducted by Sevim Aslan Felek et al.,[10] they also found a statistically significant difference between the mean hearing gain in the mild MERI group compared to the severe category of MERI. In their study, they also found statistically significant difference in hearing gain between the moderate and severe, as well as the mild and moderate categories. On the other hand, our study, while observing clinically significant differences in hearing gain in all three groups, found statistical significance only between the mild and severe categories.

The study conducted by Khalid Almazrou et al.,[11] which was focused on children, did not find a significant difference in hearing improvement among the different categories made according to the MERI score.

In the study conducted by Aftab Ahmed et al.,[12] they also reported a significant difference in the hearing gain between the mild category and the severe category of MERI.

## Conclusion

- MERI scoring servers as an important tool for assessing the severity of COM cases.
- It allows us to predict the potential surgical outcome before the operation, aiding surgeons in counseling and prognosticating patients.
- Patients with lower MERI scores tend to have more favorable graft uptake results.
- Better hearing gain is observed in patients with lower MERI score.
- Being a simple assessment and prognostic tool, MERI scoring can be made a part of the surgical workup for every case of COM.

## Acknowledgment

The authors would like to thank all the faculty and staff of the Department of Otorhinolaryngology and Head Neck Surgery, Maulana Azad Medical College & Associated Lok Nayak Hospital for their generous help and support.

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