

## CORRELATION BETWEEN MIDDLE EAR RISK INDEX (MERI) AND OUTCOME OF TYMPANOPLASTY – A PROSPECTIVE STUDY

### Otolaryngology

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### ABSTRACT

**Introduction:** Perforations of the tympanic membrane are a feature seen commonly in chronic otitis media (COM). It results in the reduction in the vibrating area of the tympanic membrane. This can lead to conductive hearing loss up to 40-45 dB. Thus tympanic membrane perforations can be disturbing functionally and psychologically to patients.

**Aim:** Our aim was to measure the outcome of patients who underwent tympanoplasty for mucosal type of chronic otitis media (COM) using Middle ear risk index (MERI) score.

**Materials and Methods:** This study was conducted in the Department of Otorhinolaryngology, at a tertiary health care centre from March to July 2019 as a pilot study. We observed the outcomes of tympanoplasty with the Middle Ear Risk Index (MERI) score. A total number of 62 patients were included in this study. Patients diagnosed with COM mucosal disease underwent pre-operative oto-microscopic examination and PTA taken at speech frequencies and MERI score was calculated. Patients were classified as normal, mild, moderate or severe MERI group based on the score.

**Results:** Patients with a high MERI score had lower rate of graft uptake, whereas, patients with mild MERI had greater hearing benefit and those with severe MERI had lesser hearing benefit postoperative.

**Conclusion:** MERI score helps to predict the outcome of tympanoplasty. It has an inverse relation with graft uptake and hearing benefit. Based on MERI score, the chances for surgical success and hearing benefit could be explained to the patient.

### KEYWORDS

Middle Ear Risk Index (MERI) Score, Tympanoplasty, Hearing benefit, Graft uptake, Pure-tone audiometry (PTA), Chronic Otitis Media (COM)

### INTRODUCTION:

Perforations of the tympanic membrane are a feature seen commonly in chronic otitis media (COM). Tympanic membrane perforation is one of the major reasons for hearing loss. It results in the reduction in the vibrating area of the tympanic membrane and round window being more active with sound waves reaching both windows at the same moment cancelling the resultant movements of the perilymph. This can lead to conductive hearing loss up to 40-45 dB. Thus tympanic membrane perforations can be disturbing functionally and psychologically to patients. Ossicular erosion can add to the hearing loss upto 60-65 dB.

The management of tympanic membrane perforation include aural toilet, antibiotic therapy to control infection, surgery of existing pathological conditions, surgical repair of the tympanic membrane with or without reconstruction of the ossicular chain<sup>[1]</sup>.

### AIMS AND OBJECTIVES:

To measure the outcome of patients who underwent tympanoplasty for mucosal type of chronic otitis media (COM) using Middle ear risk index (MERI) score.

### MATERIALS AND METHODS:

This study was conducted in the Department of Otorhinolaryngology, at a tertiary health care centre from March to July 2019 as a pilot study. We observed the outcomes of tympanoplasty with the Middle Ear Risk Index (MERI)<sup>[2]</sup> score (Annexure A). The study was approved by the Institutional Ethics Committee. All patients were explained about the study and a written informed consent was obtained. A total number of 62 patients were included in this study.

### Inclusion criteria:

1. Mucosal type of COM
2. Aged > 18 years.

### Exclusion criteria:

1. Patients with sensorineural hearing loss and mixed hearing loss.
2. Patients with systemic diseases – hypertension, diabetes mellitus.

### Study Design:

Patients diagnosed with COM mucosal disease underwent pre-

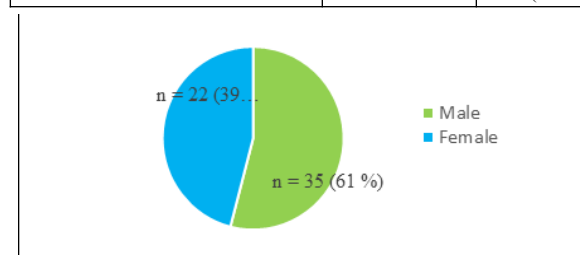
operative oto-microscopic examination and PTA taken at speech frequencies and MERI score was calculated. Patients were classified as normal, mild, moderate or severe MERI group based on the score. Patients who met the inclusion criteria were subjected to medical and general anesthetic fitness. All surgeries were done under GA. Type of tympanoplasty performed was decided pre-operatively. Temporalis fascia graft was done for all patients. Post-operative period was uneventful. Sutures were removed on 7<sup>th</sup> post-operative day. Pure Tone Audiometry was done post-operatively for analysis of improvement in hearing and middle ear status. Otomicroscopic findings were recorded as graft taken up well, presence of retraction or re-perforation. IBM - SPSS v22 was used. Paired t-test was done between pre-op and post-op values.

### RESULTS & DISCUSSION:

62 patients with COM mucosal type were included in this study. 57 patients complied with the study protocol, and completed the study. Drop-out rate- 8.1% (n= 5). Demographic data (Table 1. Fig. 1, 2, 3).

**Table 1. Demographic data**

| Parameter                            | Values                                                                   |
|--------------------------------------|--------------------------------------------------------------------------|
| Male : Female                        | 1.6:1                                                                    |
| Middle Ear Risk Index (MERI) – n (%) | Mild (1-3) 29 (51%)<br>Moderate (4-6) 15 (26%)<br>Severe (7-12) 13 (23%) |
| Drop-out rate                        | 8.1% (n = 5)                                                             |
| Failure rate                         | 5.3% (n = 3)                                                             |



**Figure 1. Gender Distribution**

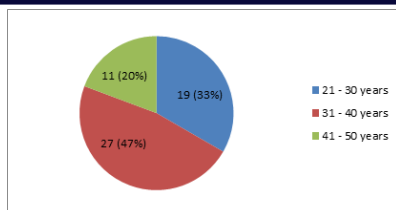


Figure 2. Age distribution

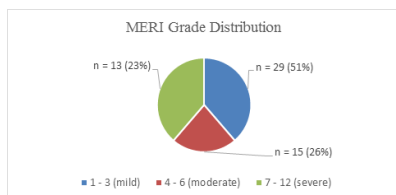


Figure 3. MERI Grade Distribution



Figure 4. Large central perforation with tympanosclerotic patch

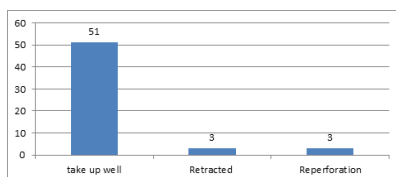


Figure 5. Postoperative MERI graft uptake status

Table 2. MERI score and graft status

| Parameters     | TM uptake grade  |                 |                     | Total |
|----------------|------------------|-----------------|---------------------|-------|
|                | I - take up well | II - retraction | III - reperforation |       |
| MERI grade     |                  |                 |                     |       |
| 1 - 3 Mild     | 29               | 0               | 0                   | 29    |
| 4 - 6 Moderate | 14               | 1               | 0                   | 15    |
| 7 - 12 Severe  | 8                | 2               | 3                   | 13    |
| Total          | 51               | 3               | 3                   | 57    |

Table 3. Paired t-test values

| Parameter     | n  | Pre-op PTA    | Post-op PTA 6 month | P value |
|---------------|----|---------------|---------------------|---------|
| MERI I to III | 57 | 49.17 ± 10.33 | 34.06 ± 8.23        | 0.001   |

Fig. 4 shows the pre-operative tympanic membrane status. Most commonly performed was type I tympanoplasty. The parameters analysed in the study were formation of neotympanum using otoscopy, and improvement of hearing loss using pure tone audiometry/impedance audiometry. Tympanic membrane status was assessed by otoscopic examination at 1 and 6 months of post-operative follow up (Fig. 5). It was classified in to three grades as Grade I – taken up well, Grade II – Retracted and Grade III - reperforation.

COM is a very common Otorhinolaryngeal problem worldwide, especially in developing countries. Around 7.8% of the Indians suffer from this infection according to WHO report, 2004<sup>[3]</sup>. In spite of the availability of wide range of antibiotics, better surgical techniques and newly developed prosthetic materials we are still not able to reach 100% successful outcomes in tympanoplasty in terms of graft uptake and hearing benefit. This is due to the extent of pathology in the middle ear and mastoid which affects the outcome. Hence these are summarised and assigned a numerical value, the MERI index, which helps us to identify the extent of disease and thereby predict the outcome of surgery. Hence this study was done to find if MERI score can be effectively used as a tool for this purpose.

According to Bellucci's classification<sup>[4]</sup> of otorrhoea, in this study, 14% had dry ear, 60% had occasionally wet ear and 26% had persistently

wet ear. There is no patient belonging to wet with cleft palate group. Patients with dry ear had successful graft uptake. Among those with persistently wet ears, 33% had graft failure while 20% graft rejection rate was found in occasionally wet ears. The study conducted by John L. Dornhoffer<sup>[5]</sup> showed that Bellucci classification was not statistically significant overall. However, there was a clear trend towards worse results with Bellucci classifications 1, 2 and 3. Thus otorrhoea alone may not be significant as there are other middle ear factors which can influence the outcome. However, more the severity of otorrhoea, worse is the outcome. Hence appropriate antibiotics should be started based on culture and sensitivity reports to reduce the ear discharge. Studies show that if there is a minimum interval of three months without otorrhea, the success rate of surgery increases to more than 30% when compared to the cases that underwent surgery in an infected site<sup>[6]</sup>. Thus it is preferable to make the ear dry preoperatively to achieve best results<sup>[7]</sup>.

The overall success rate of tympanoplasty is 94.7% (n=54) according to graft status. 5.3% (n=3) patients had re-perforation. Grafts which were rejected or perforated were taken as failures. The main cause for graft failure in our study group was infection (especially upper respiratory infection) in the immediate postoperative period.

Our study concluded that there is higher graft rejection rate for patients with severe MERI scores and vice versa. Viktor Chrobok et al<sup>[8]</sup> concluded that cholesteatoma, tympanic membrane perforation, status of the ossicular chain, history of previous surgery and the overall sum of the MERI were highly significant pre-op negative prognostic factors influencing the outcome of tympanoplasty. Thus our study coincides with the findings of Viktor Chrobok's study.

In our study, there was erosion of incus in 22 patients (38.6%) which was lesser compared to other studies<sup>[9]</sup>. In our study, we have measured the average air conduction threshold level at frequencies (500Hz, 1 kHz, 2 kHz and 3 kHz) based on the guidelines given by the committee on hearing and equilibrium, American academy of otolaryngology head and neck surgery. Our success rates were comparable to other studies<sup>[10]</sup>.

29 (51%) patients had mild MERI score (score 1-3), 15 (26%) patients had moderate MERI score (score 4-6) and 13 (23%) patients had severe MERI score (score 7-12) – Figure 3. Table 2. Reperforations were noted only in MERI severe category. Retraction of tympanic membrane and good healing was noted in both MERI mild and moderate categories.

Table 3 showed that the pre-operative and 6 month post-operative PTA values were statistically significant (p<0.05). The overall hearing threshold shifted from moderate to mild category. Our study results highlighted observations from other studies<sup>[11-13]</sup>.

New tympanic membrane formation occurs after harvested graft placed by underlay techniques. Graft acts as scaffold over which freshened central perforation margins proliferate and migrate their epithelium till physiologically stable epithelialisation occurs. By 2 weeks a thin layer of epithelial sheet develops. By around 1 month neotympanum would have formed. Graft may or may not get observed with in the middle ear cleft tissues. If the graft rejection occurs, it may result in residual central perforation.

After surgery, when the middle ear cavity is ventilated adequately, inflammation decreases and a good neotympanum is formed. The growth rate of tympanic membrane is 1 mm/day. After tympanoplasty, the tympanic membrane repair starts after 12 hours of surgery and the granulation tissue starts appearing after 36 hours. The graft acts as a scaffold to support regenerating mucosa as medial aspect of ear drum and squamous epithelium on lateral side. The graft constitutes the connective tissue portion of the neotympanum.

## CONCLUSION :

To conclude, higher the MERI score, lower is the rate of graft taken up in patients and patients with lower MERI have higher rate of graft uptake. Higher the MERI score, lower is the patient's chances of hearing to improve. MERI score is a useful measure of the extent of disease in the middle ear. Based on the MERI score, the goals of surgery should be determined and the extent to which surgical success and hearing benefit can be obtained should be explained to the patient. Attempts should be made to reduce the middle ear disease whenever

possible (otorrhea and granulation) preoperatively to improve the success rate of tympanoplasty.

| Risk factor                          | Value-assigned risk |
|--------------------------------------|---------------------|
| Otorrhea (Bellucci)                  |                     |
| I—Dry                                | 0                   |
| II—Occasionally wet                  | 1                   |
| III—Persistently wet                 | 2                   |
| IV—Wet, cleft palate                 | 3                   |
| Perforation                          |                     |
| None                                 | 0                   |
| Present                              | 1                   |
| Cholesteatoma                        |                     |
| None                                 | 0                   |
| Present                              | 2                   |
| Ossicular status (Austin/Kartush)    |                     |
| 0) 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 fixation                   | 3                   |
| Middle ear: Granulations or effusion |                     |
| No                                   | 0                   |
| Yes                                  | 2                   |
| Previous surgery                     |                     |
| None                                 | 0                   |
| Staged                               | 1                   |
| Revision                             | 2                   |
| Smoker                               |                     |
| No                                   | 0                   |
| Yes                                  | 2                   |

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