

# Effectiveness of MERI in Outcome of Tympanoplasty

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## ABSTRACT

**Introduction:** Successful outcome of tympanoplasty depends on several factors, including middle ear pathology, ossicular chain status, surgical skill, and technique of ossicular chain reconstruction. The goals of successful tympanoplasty are the removal of the pathology and achievement of a well-aerated mucosa-lined middle ear cleft with an intact tympanic membrane and also to create a sound conducting mechanism for hearing gain. as middle ear risk index (MERI) can be effective for surgeons in order to determine the type of surgical procedure with a view for favourable outcome. The present study has been undertaken to evaluate the efficiency of MERI score in predicting the outcome of tympanoplasty.

**Material and methods:** The proposed one year prospective interventional study was carried out on 42 patients who underwent tympanoplasty for mucosal type of chronic otitis media (COM). The cases were selected as per laid down inclusion and exclusion criteria.

**Results:** The effect of smoking on post-op graft uptake, post-op AB gap and hearing gain was statistically significant. The effect of MERI score was found to be statistically significant on successful graft uptake, reduction of AB gap and hearing gain.

**Conclusion:** The MERI score is a reliable predictor of graft uptake and hearing benefit following tympanoplasty surgery and is a helpful indicator for the degree of illness in the middle ear.

**Keywords:** MERI Score; Smoking; Hearing Gain; Graft Uptake

## INTRODUCTION

The term Chronic Otitis Media (COM) defines as chronic inflammation of middle ear and mastoid cavity, which presents with recurrent ear discharge or otorrhoea through a tympanic membrane perforation. It is an umbrella term for a group of complex infective and inflammatory condition affecting the middle ear.

Chronic otitis media is a one of the commonest otorhinological health problem in India. However, there was decline in the incidence of complications but they still occur due to poor socio-economic conditions, lack of consciousness about health care and accessibility of trained specialist in rural settings. India falls into countries with highest prevalence (prevalence >4%).<sup>1</sup> However, Chronic otitis media severity and incidence remains high, more so in developing countries and among population of low socioeconomic status. Prevalence of Chronic otitis media in the world is around 65-330 million/year<sup>2</sup>.

Mucosal type is associated with central perforation with or without active ear discharge involving middle ear ossicles in

to a variable extent. Squamous disease present as an early acute phase with essentially mucosal and bony pathological changes which continue to a late chronic phase with well-established intractable mucoperiosteal disease. Squamous type is associated with marginal perforation / attic perforation and cholesteatoma. The recurrent episode of otorrhoea and mucosal changes are characterised by osteogenesis and bone erosion which usually followed by involvement of temporal bone and intracranial extension. The risk of complications is high in squamous type in comparison to mucosal type.

Mucosal type is treated with aural toilet and antibiotics followed by tympanoplasty or myringoplasty as a surgical treatment. On the other hand, squamous type cannot be simply stopped by antibiotics, hence various types of mastoidectomy is the treatment of choice depending on extent of cholesteatoma.

Tympanoplasty is a surgical procedure for the removal of infection and restoring the function of the middle ear. The procedure aims to eradicate disease in the middle ear and reconstruct the hearing mechanism with or without tympanic membrane grafting and can be done in three ways on basis of placement of graft in relation to tympanic annulus: overlay, interlay and underlay techniques.

Tympanoplasties are classified as types I-V, wherein type I involves reconstruction of only the tympanic membrane (TM), while types II-V involve reconstruction of the ossicular chain with or without repair of the TM<sup>3</sup>. The choice of incision depends on several factors including the nature of the anticipated pathology and reconstruction, the desired degree of exposure of the tympanic cavity, the state of the patient's ear canal and external auditory meatus, whether additional mastoid or atticotomy procedures are contemplated, and preference of the otologic surgeon.

Successful outcome of tympanoplasty depends on several factors, including middle ear pathology, ossicular chain status, surgical skill, and technique of ossicular chain reconstruction. The goals of successful tympanoplasty

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are the removal of the pathology and achievement of a well-aerated mucosa-lined middle ear cleft with an intact tympanic membrane and also to create a sound conducting mechanism for hearing gain. There are various prognostic factors reported that may influence the surgical success of tympanoplasty. With a large number of patients frequently undergoing tympanoplasty for mucosal type of chronic otitis media, it is important to assess the severity of the disease and predict the outcome of the surgical management whenever done.

Given the high prevalence of otitis media and the need for tympanoplasty for its treatment, using an index such as middle ear risk index (MERI) can be effective for surgeons in order to determine the type of surgical procedure with a view for favourable outcome. The middle ear risk index (MERI) is one of the most reliable indices to assess the reconstruction of ear bones.<sup>3</sup>

In this study, we have used Middle Ear Risk Index (MERI) developed by Austin and Kartush, which generates a numeric indicator of the severity of the middle ear disease to stratify patient groups according to the severity of the disease and evaluated the efficiency of MERI score in predicting the outcome of tympanoplasty.

## MATERIAL AND METHODS

The proposed prospective interventional study was carried out in Department of Otorhinolaryngology and Head & Neck surgery, Rohilkhand Medical College and Hospital, Bareilly, a tertiary care and teaching hospital in western Uttar Pradesh from 1<sup>st</sup> November 2019 to 31<sup>st</sup> October 2020 and included a total of 42 patients who underwent tympanoplasty for mucosal type of chronic otitis media (COM).

The cases were selected as per laid down inclusion and exclusion criteria. Inclusion Criteria included all patients above 18 years of age with mucosal type of COM and willing to participate in this study. Patients with Squamous type of COM, having Sensorineural type of Hearing Loss or with previous history of any Otologic procedure were excluded from the study.

Pure Tone Audiometry (PTA) was performed on all patients before surgery and 3<sup>rd</sup> month post-op. The results were reported using pure tone average air bone gap and hearing gain.

Post-operative follow up were done at 6 week and 3 month and assessment were done as per the MERI scale. The findings were then evaluated and compared.

The results were analysed statistically using SPSS version 22. The results obtained were analysed statistically to find out the role of middle ear risk index (MERI) in outcome of tympanoplasty for mucosal type of chronic otitis media. Each case was evaluated and given score as per the MERI score given below

### MERI scoring system

Overall success of tympanoplasty in our study was decided in terms of Intact and mobile tympanic membrane with no perforation, Post-operative AB gap <25 dB and Post-operative hearing gain >10 dB.

Risk Factor	Risk Value
Otorrhea: (Bellucci)	
Dry	0
Occasionally wet	1
Persistently wet	2
Wet, Cleft palate	3
Perforation:	
None	0
Present	1
Cholesteatoma:	
None	0
Present	1
Ossicular Status: (Austin / Kartush)	
M + I + S +	0
M + S +	1
M + S –	2
M – S +	3
M – S –	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
M- Malleus, I- Incus, S- Stapes	

MERI score	Interpretation
0	Normal
1 – 3	Mild disease
4 – 6	Moderate disease
7 – 12	Severe disease

## RESULTS

There were no cases of cholesteatoma neither cases with revision surgery.

The effect of otorrhoea on hearing gain was found to be not significant.

The effect of status of middle ear mucosa on post-op hearing gain was found to be statistically significant. (Table 1)

The effect of smoking on post-op graft uptake, post-op AB gap and hearing gain was statistically significant. (Table 2 and 3)

The effect of MERI score was found to be statistically significant on successful graft uptake. (Table 4)

The effect of MERI score was found to be statistically significant on post-op AB gap and hearing gain (Table 5) and was found to be inversely related.

The effect of graft uptake on post-op AB gap and hearing gain was found to be statistically significant. (Table 6)

## DISCUSSION

In our study, we found that dry ear had more success rate of graft uptake as well as hearing outcome too. Though, there

Middle Ear Mucosa	<25 DB Post-Op AB Gap	Success Percentage	P Value	Hearing Gain > 10 dB	Success Percentage	P Value
Granulation / Effusion	12	80%	0.005, Significant	10	66.66%	0.009, Significant
Healthy	27	100%		25	92.59%	

Table-1: Middle Ear Mucosa and Post-op AB Gap / Hearing Gain

Smoking Status	Taken Up Graft	Success Percentage	P Value
Smokers	6	66.66%	0.006 Significant
Non-Smokers	32	96.96%	

Table-2: Smoking and Graft Uptake

Smoking Status	<25 dB Post-Op AB Gap	Success Percentage	P Value	Hearing Gain > 10 dB	Success Percentage	P Value
Smokers	7	77.77%	0.041, Significant	6	66.66%	0.065, Not Significant
Non-Smokers	32	96.96%		30	90.90%	

Table-3: Smoking and Post-op AB Gap / Hearing gain

Graft Status	Mild	Moderate	Severe	P Value
Taken Up	26	8	4	0.002 Significant
Success Percentage	100%	72.72%	80%	

Table-4: MERI Score and Graft Uptake

MERI	<25 dB Post-Op AB Gap	Success Percentage	P Value	Hearing Gain >10 dB	Success Percentage	P Value
Mild	25	96.15%	0.001, Significant	26	100%	0.000 Significant
Moderate	11	100.00%		7	63.63%	
Severe	3	60%		3	60%	

Table-5: MERI Score and Post-op AB Gap/ hearing Gain

Graft	<25 dB Post-Op AB Gap	Success Percentage	P value	Post-Op Hearing Gain >10 dB	Success Percentage	P value
Taken-up	37	97.36%	0.01 Significant	36	94.73%	0.000 Significant
Failure	2	50.00%		0	0	

Table-6: Graft Uptake and Post-op AB Gap/Hearing gain

was no statistical significance found between otorrhea and graft uptake as well as hearing outcome of tympanoplasty.

Nakanishi N et al<sup>4</sup>, Kaur M et al<sup>5</sup> and Saha AK et al<sup>6</sup> suggested that if there is a three-month period without otorrhea, the success rate of tympanoplasty has been improved. To obtain the greatest outcomes, it is advisable to make the ear dry prior to surgery. Andersen S et al<sup>7</sup>, Kotzias SA et al<sup>8</sup> and Darouassi Y et al<sup>9</sup> mentioned that otorrhea has significant effect on outcome of tympanoplasty, Whereas Mills R et al<sup>10</sup> and Naderpour M et al<sup>11</sup> concluded that there was no significant difference in outcome of tympanoplasty for dry as well as wet ear.

We observed that status of middle ear mucosa was found to be statistically significant with successful graft uptake, post-op AB gap as well as hearing gain.

Middle ear mucosa, especially mucosa around the tympanic opening of eustachian tube affects the ventilation and drainage of tympanic cavity and mastoid air cells. Thus, abnormal middle ear mucosa can lead to unfavourable results. Song C.I. et al<sup>12</sup> and Martin TP et al<sup>13</sup> concluded with

statistical significance between middle ear mucosa status and post-tympanoplasty audiologic (functional) outcomes. Albu S et al<sup>14</sup> and Ahmed A et al<sup>15</sup> concluded that status of middle ear mucosa has impact on graft uptake as well as hearing outcome.

The result was found to be statistically significant for smoking and successful graft uptake. The graft take-up was more among non-smokers and it was statistically significant, so it suggests that smoking has adverse effect on outcome of tympanoplasty.

Becvarovski Z et al<sup>16</sup>. Al-Jaaf SM et al<sup>17</sup> also observed that smokers had a substantially greater rate of tympanoplasty failure than non-smokers. Kaylie DM et al<sup>18</sup> and Kotzias SA et al<sup>8</sup> stated that smoking has adverse effect on both, graft uptake as well as hearing outcome. Recurrence rate was greater among smokers. Sethi A et al<sup>15</sup> after their conclusion, advised that individuals who are scheduled for tympanoplasty should quit smoking both before and after surgery. According to Hair Krishna P et al<sup>19</sup>, smoking status has little effect on the success of tympanoplasty.

We found that those with a low MERI score had a better hearing result than people with a high MERI score. As a result, hearing status in mild to moderate instances is substantially better than in severe MERI patients. Our study found that patients with high MERI scores have a greater graft failure rate, and vice versa. Individuals with a lesser MERI score had better pre-op and post-op air and bone conduction versus patients with a higher MERI score, according to Becvarovski Z et al<sup>16</sup>.

Sharma A et al<sup>20</sup> stated that lower the MERI score, better is the hearing gain as well as graft uptake. Wasson JD et al<sup>21</sup>, Sousa AC et al<sup>22</sup> and Hayati R et al<sup>23</sup> concluded with giving importance to MERI score to predict better hearing outcomes.

Nallapaneni LS et al<sup>24</sup> stated that lesser post-op hearing gain had been observed with severe MERI score or vice versa. They concluded stating that hearing gain and graft uptake gives realistic expectations to the patients when explained based on MERI score. Sarfaraz M et al<sup>25</sup> observed that patients with higher MERI score were greater chance of graft rejection. We found similar observations in this study.

We discovered a link between wet ear, smokers and an unhealthy middle status with poorer outcome of tympanoplasty in our study.

## CONCLUSION

The MERI score is a reliable predictor of graft uptake and hearing benefit following tympanoplasty surgery and is a helpful indicator for the degree of illness in the middle ear.

To increase the success rate of tympanoplasty we should make every effort to decrease middle ear disease (otorrhoea, granulation, and smoking) prior to surgery.

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