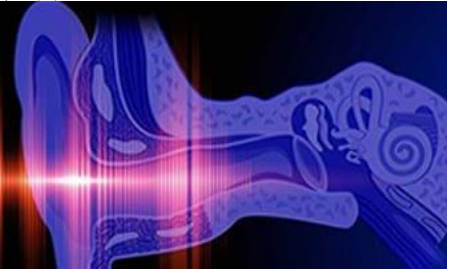


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## Effectiveness of middle ear risk index (MERI) in outcome of tympanoplasty

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### Abstract

**Introduction:** Chronic otitis media is one of the most common ENT health problems in Bangladesh. Although the incidence of complications has decreased, it still occurs due to poor socio-economic conditions, lack of medical awareness, and lack of trained professionals in rural areas. The success of tympanoplasty depends on several factors, including middle ear pathology, status of ossicular chain, surgical technique, and technique of ossicular chain reconstruction. This study was conducted to evaluate the efficiency of MERI score in predicting the outcome of tympanoplasty.

**Methods:** The proposed prospective interventional study was carried out in Department of Otolaryngology-Head & Neck Surgery, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh from January 2023 to March 2024. Total 50 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.

**Results:** Fifty (50) patients who underwent tympanoplasty for mucosal chronic otitis media (COM) were included. Cases were selected according to established inclusion and exclusion criteria. Inclusion criteria included all patients with chronic mucosal otitis media aged 18 years or older who were willing to participate in the study. The effect of otorrhea on hearing improvement was not significant. The effect of the condition of the middle ear mucosa on the increase in hearing after surgery was found to be statistically significant. The effects of smoking on postoperative graft uptake, postoperative AB gap, and hearing gain were statistically significant. The effect of MERI score on graft success was found to be statistically significant.

**Conclusion:** The MERI score reliably predicts graft uptake and hearing improvement after tympanoplasty and is a useful indicator of otitis media severity.

**Keywords:** MERI score, smoking, hearing gain, graft uptake

### Introduction

Chronic otitis media is one of the most common ENT health problems in Bangladesh. Although the incidence of complications has decreased, the disease still occurs due to poor socio-economic conditions, lack of medical education, and lack of trained specialists in rural areas. [1] The term chronic otitis media (COM) defines chronic inflammation of the middle ear and mastoid cavity manifested by recurrent otorrhea or ear discharge due to tympanic membrane perforation. It is a collective term for a group of complex infectious and inflammatory diseases of the middle ear. However, the severity and frequency of chronic otitis media remains high, especially in developing countries and among people of low socio-economic status. The prevalence of chronic middle ear infections is approximately 65-330 million cases per year worldwide. [2] The squamous cell type is associated with marginal/attic perforation and cholesteatoma. Recurrent episodes of otorrhea and mucosal changes are characterized by bone formation and bone erosion, usually followed by temporal bone involvement and intracranial extension. The mucosal type is associated with central perforation with or without active otorrhea affecting the ossicles to various degrees. Squamous cell disease occurs primarily in the early acute phase with pathologic mucosal and bony changes and persists into the late chronic phase with well-established refractory mucoperiosteal disease. Squamous cell carcinoma carries a higher risk of complications than mucosal cancer.

Mucosal cancer is treated with ear irrigation and antibiotics followed by tympanoplasty or tympanoplasty. On the other hand, squamous cell carcinoma cannot be easily stopped with antibiotics, so various types of mastoidectomy are the treatment of choice depending on the severity of the cholesteatoma. Tympanoplasty is a surgical procedure to remove the infection and restore the function of the middle ear. The aim of this operation is to remove the middle ear disease and reconstruct the hearing mechanism with or without a tympanic membrane graft. This can be performed in three ways: overlay technique, interlay technique, and underlay technique, depending on the placement of the graft relative to the tympanic annulus. Tympanoplasty is classified into types I-V, where type I involves only reconstruction of the tympanic membrane (TM), and types II-V involve reconstruction of the ossicular chain with or without tympanic membrane repair [3]. The success of tympanoplasty depends on several factors, including the pathology of the middle ear, the condition of the ossicular chain, the surgical technique, and the technique of reconstruction of the ossicular chain. The aim of successful tympanoplasty is to remove pathological changes and create a well-ventilated mucosa-lined middle ear cleft with an intact tympanic membrane, thereby providing a sound conduction mechanism for improved hearing. There are various prognostic factors that may affect the success of tympanoplasty. The Middle Ear Risk Index (MERI) is one of the most reliable indexes for evaluating ossicular reconstruction [3]. In this study, we used the Middle Ear Risk Index (MERI), developed by Austin and Kartush, which generates a numerical index of the severity of middle ear infection, to stratify patient groups according to the severity of the disease and to evaluate the efficiency of the assessed MERI score in predicting the outcome of tympanoplasty.

### Materials and Methods

The proposed prospective interventional study was carried out in Department of Otolaryngology-Head & Neck Surgery, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh from January 2023 to March 2024. Total 50 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 Otolologic 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.

**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. 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

### Results

Out of 50 patients underwent tympanoplasty for chronic mucosal otitis media (COM). Cases were selected according to established inclusion and exclusion criteria. Inclusion criteria included all patients with chronic mucosal otitis media aged 18 years or older who were willing to participate in this study. There were no cases of cholesteatoma or cases requiring reoperation. The effect of otorrhea on hearing gain was not significant. The effect of middle ear mucosa status on postoperative 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).

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

Middle Ear Mucosa	<25 DB Post-Op AB Gap	Success Percentage	p-value	Hearing Gain > 10 dB	Success Percentage	p-value
Granulation / Effusion	16	32%	0.005 <sup>s</sup>	15	30%	0.009 <sup>s</sup>
Healthy	34	68%		35	70%	

**Table 2:** Smoking and Graft Uptake

Smoking Status	Taken Up Graft	Success Percentage	p-value
Smokers	9	18%	0.006 Significant
Non-Smokers	41	82%	

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

Smoking Status	<25 dB Post-Op AB Gap	Success Percentage	p-value	Hearing Gain > 10 dB	Success Percentage	p-value
Smokers	10	20%	0.041 <sup>s</sup>	11	22%	0.065 <sup>s</sup>
Non-Smokers	40	80%		39	78%	

**Table 4:** MERI Score and Graft Uptake

Graft Status	Mild	Moderate	Severe	P Value
Taken Up	35	10	5	0.002 Significant
Percentage	70%	20%	10%	

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

MERI	<25 dB Post-Op AB Gap	Success Percentage	p-value	Hearing Gain >10 dB	Success Percentage	p-value
Mild	33	66%	0.001 <sup>S</sup>	37	74%	0.000 <sup>S</sup>
Moderate	13	26%		9	18%	
Severe	4	8%		4	8%	

**Table 6:** Graft Uptake 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	46	92%	0.01 <sup>S</sup>	50	100%	0.000 <sup>S</sup>
Failure	4	8%		0	0	

## Discussion

Successful implantation, postoperative closure of the AB gap, and hearing improvement were found to be statistically significant in association with the condition of the middle ear mucosa. The mucosa of the middle ear, especially the mucosa around the tympanic opening of the Eustachian tube, affects the ventilation and drainage of the tympanic cavity and mastoid air space. The aim of a successful tympanoplasty is to remove the lesion and achieve a well-ventilated mucosally covered middle ear cleft with an intact tympanic membrane, creating a sound conduction mechanism that improves hearing. The Middle Ear Risk Index (MERI) helps the surgeon decide which type of surgery will give a favorable outcome. Thus, abnormalities of the middle ear mucosa may lead to unfavorable outcomes. Song C.I. *et al* [12] and Martin TP *et al* [13] concluded that there is statistical significance between the status of the middle ear mucosa and audiological (functional) outcome after tympanoplasty. Albu S *et al* [14] and Ahmed A *et al*. [15] concluded that the condition of the middle ear mucosa influences graft acceptance and hearing outcome. In our study, we found that dry ears had a higher success rate in both graft acceptance and hearing outcome. However, there was no statistical significance between otorrhea and tympanoplasty graft uptake and hearing outcome [5] and Saha AK *et al* [6] suggest that the success of tympanoplasty increases if there is no otorrhea for three months. For optimal results, it is recommended to dry the ears before surgery. Andersen S *et al* [7], Kotzias SA *et al* [8] and Darouassi Y *et al* [9] stated that otorrhea has a significant impact on the outcome of tympanoplasty, while Mills R *et al* [10] and Naderpour M. *et al* [11] concluded that there is no significant difference in the outcome of tympanoplasty between dry and wet ears. The results proved to be statistically significant with regard to smoking and graft success. Non-smokers had a higher graft uptake that was statistically significant, suggesting that smoking adversely affects the outcome of tympanoplasty. Becvarovski Z *et al*. [16]. Al-Jaaf SM *et al*. [17] also observed that smokers had a substantially greater rate of tympanoplasty failure than non-smokers. Kaylie DM *et al*. [18] and Kotzias SA *et al*. [8] 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*. [15] 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*. [19], 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*. [16]. Sharma A *et al*. [20] stated that lower the MERI score, better is the hearing gain as well as graft uptake. Wasson JD *et al*. [21], Sousa AC *et al*. [22] and Hayati R *et al*. [23] concluded with giving importance to MERI score to predict better hearing outcomes. Nallapaneni LS *et al*. [24] 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*. [25] 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 indicator of implant acceptance and hearing improvement after tympanoplasty and a useful indicator of otitis media severity. To increase the success rate of tympanoplasty, every effort should be made to reduce middle ear infections (otorrhea, granulation, smoking) before surgery.

## Author's Contribution

Not available.

## Conflict of Interest

Not available.

## Financial Support

Not available.

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