

ROLE OF MIDDLE EAR RISK INDEX SCORE, DIAGNOSTIC NASAL ENDOSCOPY AND EUSTACHIAN TUBE FUNCTION IN PREDICTING OUTCOME OF TYMPANOPLASTY

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ABSTRACT

AIM

To study the role of middle ear risk index (MERI) score, nasal pathology and Eustachian tube function in predicting the outcome of tympanoplasty.

METHODOLOGY

Patients of age group 5-60 years both male and female with diagnosis of CSOM, planned for tympanoplasty with or without mastoidectomy were taken in the study. Detailed history and examination of all patients fulfilling the inclusion criteria was done. Preop findings were observed and recorded. MERI scoring was obtained. The data collected pre operatively was assessed with surgical outcome based on graft uptake status and PTA. Post op follow up was done at 1.5 and 3 months. This data was evaluated and compared with pre op finding.

RESULTS

The overall success rate of tympanoplasty in the study was 86% based on graft uptake and 85% according to hearing benefit. The number of patients with graft up[take was higher among those with mild MERI score (87.5%) compared to those with moderate and severe MERI scores (83%). The graft uptake is lesser in patients with gross DNS & Eustachian tube dysfunction. Thus MERI is a helpful tool to ascertain the prognosis of tympanoplasty.

CONCLUSION

The study concludes that MERI score, DNE and ET function evaluation in patients with chronic otitis media are very useful methods in predicting the outcome of tympanoplasty.

KEYWORDS

Chronic otitis media, Middle ear risk index, Eustachian tube function, diagnostic nasal endoscopy, tympanoplasty outcome

INTRODUCTION

Chronic suppurative otitis media (CSOM) or as is the current terminology, Chronic otitis media(COM), is defined as a chronic inflammation of the middle ear cleft, which presents with recurrent ear discharge or otorrhoea through a tympanic membrane perforation¹. The middle ear cleft constitutes the Eustachian tube (ET), Tympanic Cavity, Attic, Aditus, Antrum, and Mastoid air cells, lined by epithelium and is in continuity with the atmosphere of nose and nasopharynx.

This condition is managed conservatively and surgically by Tympanoplasty with or without Mastoidectomy. Tympanoplasty is defined as the procedure to eradicate disease in middle ear and to reconstruct the hearing mechanism with or without tympanic membrane grafting².The results of tympanoplasty are measured in terms of success or failure of graft-take and hearing improvement. Graft uptake and hearing results following tympanoplasty depends upon multiple factors. Eustachian tube dysfunction, presence of cholesteatoma or atelectasis, previous tympanoplasty failure, lateralized tympanic membrane, loss of Ossicular chain, severe mucosal disease and smoking are negative prognostic factors³. These factors make it difficult

to compare tympanoplasty results reported in literature. Therefore it is important to assess the severity of disease and to predict the outcome of surgical management whenever done.

Only few scoring systems are there to compare and evaluate the factors influencing COM and the surgical outcome of tympanoplasty. Jack M Kartush presented the MIDDLE EAR RISK INDEX (MERI), which generates a numeric indicator of the severity of middle ear disease, to stratify cases in different prognostic categories.

MERI scoring system includes the factors influencing the pathogenesis of COM as well as the surgical outcome of tympanoplasty. In this study, we are evaluating the efficiency of MERI score in predicting the outcome of tympanoplasty.

The pathogenesis of COM has been related to the presence of prior or concurrent nasal, paranasal or nasopharyngeal diseases, which can involve the Eustachian Tube leading to its obstruction and thereby to the development of COM. Diagnosis and correction of these pathologies, are equally important. Thus Diagnostic Nasal Endoscopy (DNE) and ET function study prior to Tympanoplasty becomes relevant. In this study we assessed the prognostic value of DNE and ET study in the outcome of tympanoplasty

MATERIALS AND METHODS

SOURCE OF DATA:

The study was conducted in the department of ENT, Mayo Institute Of Medical Sciences, Barabanki, UP for a period of 2 years from December 2020 to March 2022.

INCLUSION CRITERIA:

Patients of both sexes in the age group of 18-60, with diagnosis of CSOM, planned for tympanoplasty with or without mastoidectomy.

EXCLUSION CRITERIA:

- Acute otitis media
- Complications of COM such as meningitis, brain abscess or lateral sinus thrombosis.
- Malignant otitis externa.
- Malignancies of the external or middle ear.
- Poor general health with medical co-morbidities like Diabetes Mellitus,
- Immunocompromised status, chronic cardio-pulmonary diseases.

OBSERVATIONS AND RESULTS

The study group consists of 72 patients with chronic suppurative otitis media, who underwent tympanoplasty with or without cortical mastoidectomy. The MERI scoring was done in each patient and compared with the surgical outcomes based on the graft uptake and hearing benefit. The Diagnostic nasal endoscopy and Eustachian tube function were assessed preoperatively, and compared with the surgical outcomes based on the graft uptake.

RESULTS

SOCIO DEMOGRAPHIC CHARACTERISTICS OF THE STUDY SUBJECTS

Age & Gender Distribution of The Study Subjects

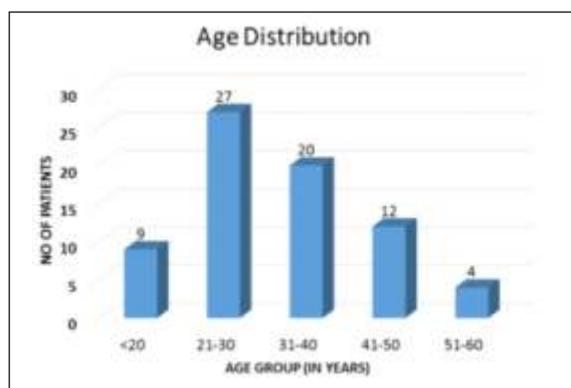


Figure 1- Age Distribution

In our study, the most common age group affected is 21 to 30 years (37.5%) followed by 31 to 40 years (28%). (Figure 1)The study comprises males and

females in equal proportions 36 each (1:1). (Figure 2)

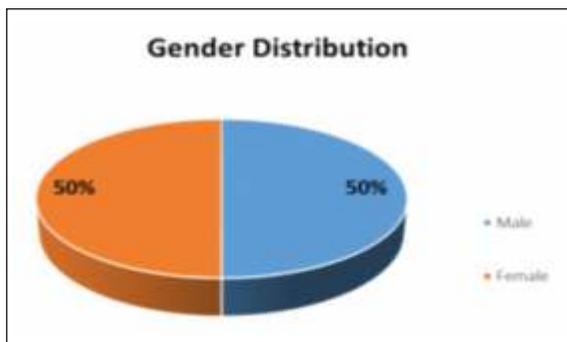


Figure 2- Gender Distribution

CLINICAL CHARACTERISTICS OF THE STUDY SUBJECTS

DIAGNOSIS: TYPES OF CSOM

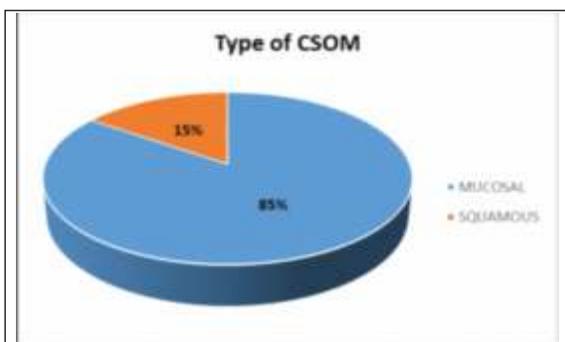


Figure 3– Type of CSOM

All patients in the study had tympanic membrane perforations of different sizes affecting various compartments of pars tensa. 8 patients had small size, 43 had medium/ moderate, 13 with large central perforations, and 8 with subtotal perforations.

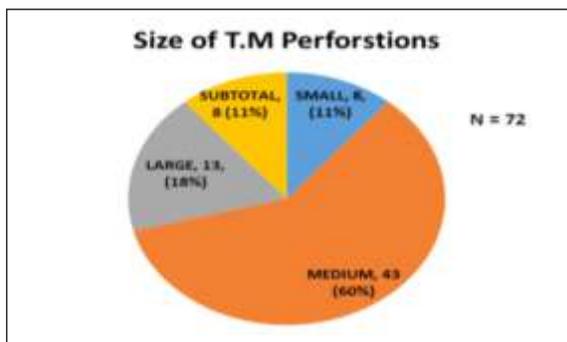


Figure 4- Size of TM

The study group comprises 42 patients with mild (1-3) MERI score, 20 patients with moderate (4-6) MERI score and 10 patients with severe (> 7) MERI score.

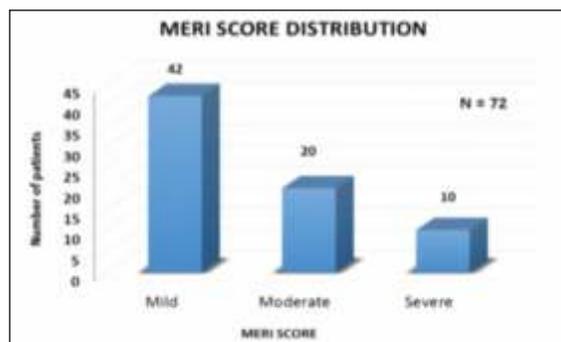


Figure 5- MERI Score Distribution

43(60%) patients had left sided disease and 29 (40%) patients had right sided disease. Thus left ear pathology is more common in our study group

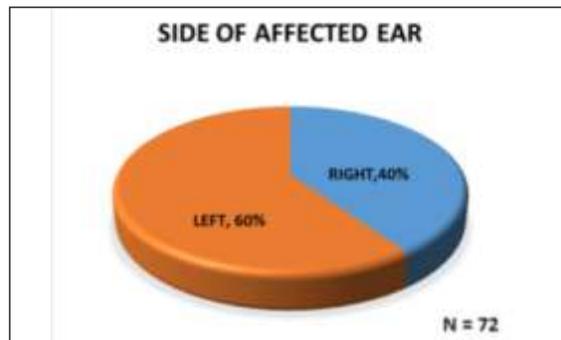


Figure 6- Laterality of Disease

SURGICAL OUTCOME: BASED ON GRAFT UPTAKE AND HEARING IMPROVEMENT

A successful graft uptake was seen in 62 patients (86%) and failed in 10 patients (14%). 61 patients (85%) obtained hearing benefit postoperatively according to this study, indicated by Air-Bone Gap (AB Gap) closure and improvement in hearing threshold noted in PTA.

Thus the overall success rate of tympanoplasty was 86% based on the graft uptake and 85% according to hearing benefit.

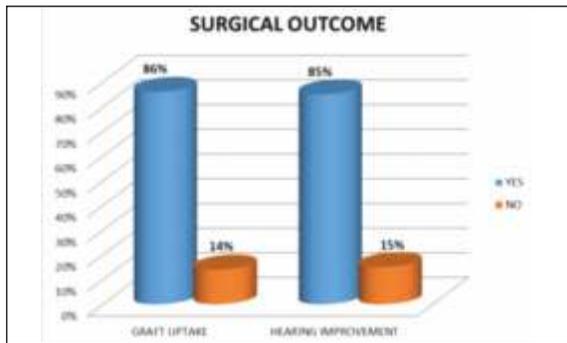


Figure 7- Surgical Outcome

COMPARISON OF GRAFT UPTAKE STATUS WITH MERI SCORE

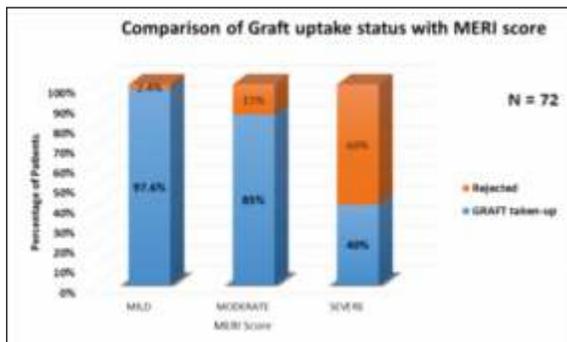


Figure 8- Graft Uptake with MERI score

TABLE 1: Comparison of Graft uptake status with MERI score

		GRAFT STATUS		TOTAL
		REJECTED	UPTAKE	
MERI SCORE	1-3 (mild)	1 (2.4%)	41(97.6%)	42(100.0%)
	4-6 (moderate)	3(15.0%)	17(85.0%)	20 (100.0%)
	≥ 7 (severe)	6 (60.0%)	4 (40.0%)	10 (100.0%)
TOTAL		10 (13.9%)	62 (86.1%)	72 (100.0%)

The data indicates that when the MERI score was mild, a successful graft uptake was observed in 97.6% (41) patients. When the MERI score was moderate, the graft uptake was seen in 85%(17) patients and with severe MERI score, the graft uptake was seen in 40%(4) patients.

Thus when the MERI score is high, the chances of graft uptake among patients are low and rejection rate is high.

COMPARISON OF HEARING STATUS WITH MERI SCORE



Figure 9- PTA with MERI score

In the mild MERI score group, a higher number of patients showed an improvement in PTA, compared to those with moderate and severe MERI scores

DIAGNOSTIC NASAL ENDOSCOPY WITH GRAFT UPTAKE STATUS

DNS was observed in 65 patients, out of which 49 (75.4%) were simple DNS and 16 (24.6%) were gross DNS with nasal obstruction. 14 (21.5%) patients had DNS with obstruction and bilateral ITH. Among patients with simple DNS, a successful graft uptake was seen in 91% (45). However in patients having DNS with obstruction, graft uptake was seen only in 62.5% (10) patients. This implies that the graft up take is lesser in patients with DNS with obstruction compared to simple DNS.

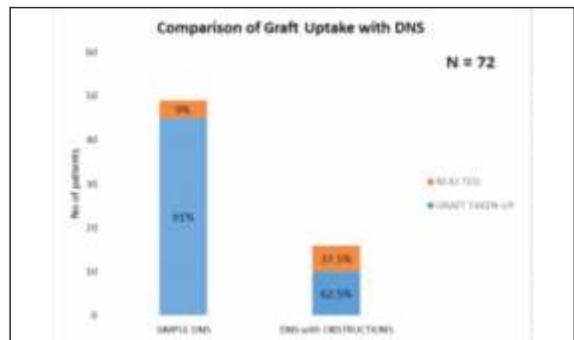


Figure 10- Graft Uptake with DNS

COMPARISON OF GRAFT UPTAKE WITH EUSTACHIAN TUBE STATUS

TABLE 2: Comparison of Graft Status with ET tube opening visualization

		GRAFT STATUS		TOTAL
		Rejected	Taken UP	
Et opening visualization	Normal	3 (5.5%)	52 (94.5%)	55 (100.0%)
	Abnormal	7 (41.2%)	10 (58.8%)	17 (100.0%)
TOTAL		10 (13.9%)	62 (86.1%)	72 (100.0%)

Comparison of Graft Status with EUSTACHIAN TUBE PATENCY

TABLE 3: Comparison of Graft Status with EUSTACHIAN TUBE PATENCY

		GRAFT STATUS		TOTAL
		REJECTED	TAKEN UP	
Et function Tympanometry	dysfunction	9 (36.0%)	16 (64.0%)	25 (100.0%)
	normal	1 (2.1%)	46 (97.9%)	47 (100.0%)
TOTAL		10 (13.9%)	62 (86.1%)	72 (100.0%)

It was found that in patients with normal visualization of the Eustachian tube on nasal endoscopy (Table-2) and in patients with normal Eustachian tube patency and secretory functions (Table-3), the graft uptake was high.

DISCUSSION

DEMOGRAPHIC PROFILE OF THE STUDY POPULATION

AGE GROUP DISTRIBUTION

According to the study conducted by Shrikrishna BH et al⁴, CSOM (COM) is common in the age group of 10 to 30 years. This is comparable with our study, which shows that the most common age group affected is 21 to 30 years (36%), followed by 31 to 40 years (26.4%) and less than 20 (12.5%). Bijan Basak et al⁵ also stated that CSOM (COM) (both tubotympanic and atticofurrow type) is common in the age group of 11 to 30 years.

GENDER DISTRIBUTION

The gender proportion in the current study is 1:1, for males and females. In the literature, gender

proportion varies between different studies. According to the study conducted by Bijan Basak et al.⁵ there is a female predominance. However, according to the study conducted by Abhinav D et al.⁶ the disease is more common in males.

TYPE OF DISEASE

The study group comprises of Chronic Otitis Media patients with 85% mucosal or tubo-tympanic type and 15% of squamous or atticofurrow type. In a study done by Manas Rajan Rout et al.⁷, of the 210 patients with central perforation who underwent different types of procedures, 7 patients had cholesteatoma. This suggests that no perforation in CSOM (COM) is 'safe'. It should be evaluated properly to exclude underlying pathology like cholesteatoma, which may be dangerous later on if not identified.

MIDDLE EAR GRANULATION TISSUE

In our study, 15 patients had granulation tissue, seen in tympanic cavity as well as mastoid air cells. Veysel Yurttafli et al⁸ stated that the presence of granulation in middle ear had a negative effect on the hearing improvement after tympanoplasty Bernard⁹ suggests that granulation tissue and cholesteatoma should be dissected away from the underlying bone using fine hooks and small gauze balls. This prevents chances for remnants and hence recurrence.

EAR DISCHARGE

In our study, 44 patients had more than 3 months of discharge-free period before the surgery and 28 had less than 3 months. In patients with discharge free period of more than 3 months, 100% of graft uptake was noted. This is in accordance with the study by Onal K et al.¹⁰ and Gersdorff M et al.¹¹ in which, longer duration of dry period of the diseased ear is a prognostic factor which positively influences the success rate of tympanoplasty.

MIDDLE EAR OSSICULAR STATUS

In our study, according to Austin-Kartush classification for middle ear ossicular status, 63 patients (87.5%) had an intact ossicular chain. Defects of incus alone were observed in 6 patients (8.3%) and defects in both malleus and incus were seen in 3 patients (4.2%). This is comparable to the

studies conducted by Ghodrat Mohammadi¹² where he observed that incus is the most commonly eroded ossicle. In his study, total erosion of the incus is more common than partial erosion.

SMOKING

In this study, there were 16 patients with history of active or passive smoking. 25% of them had graft failure. Only 10% of the non-smokers had graft failure. Smoking is associated with reduced graft uptake. Zoran Becvarovski¹³ stated that delayed failure of the graft was more commonly seen in smokers (60%) than non-smokers (20%).

REVISION OR STAGED SURGERY

In our study, one patient had history of previous tympanoplasty and presented with recurrent ear discharge and hearing loss following a type 1 tympanoplasty, and underwent revision surgery (Cortical mastoidectomy with Type 3 tympanoplasty). On revision surgery, cholesteatoma was seen and removed completely with intact canal wall mastoidectomy. His graft was taken up and hearing improved. In a study by Wilson K.F et al.¹⁴ 156 patients with CSOM (COM) with cholesteatoma who underwent ICW mastoidectomy with tympanoplasty were followed up. 92% cases were done by a staged procedure.

OUTCOME- GRAFT UPTAKE

In our study success rate has been explained with reference to two different entities - graft status and hearing benefit. The overall success rate of tympanoplasty is 86 % according to graft status. Grafts which are rejected or perforated are taken as failures, which is 14%. This is comparable with the results of the conducted by Andersen SA, Aabenhuis K, Glad H, Sorensen MS¹⁵ which showed that the graft uptake rate after the tympanoplasty was 86.6% at the end of 12 months

OUTCOME- HEARING BENEFIT

In our study, 61 patients (85%) obtained hearing benefit postoperatively, indicated by Air-Bone Gap (AB Gap) closure and improvement in hearing threshold noted in PTA. According to the studies conducted by Ashok K Saha et al.¹⁶, Type 1 tympanoplasty

with simple mastoidectomy provides excellent surgical outcomes (100%), but gives less improvement of hearing (closure of A-B gap= 3.3dB). In type I tympanoplasty alone (without mastoidectomy) surgical success rate drops to 80-75% but it offers more improvement of hearing (closure of A-B gap = 6.708 dB).

COMPARISON of MERI Score with OUTCOME of SURGERY

The current study group comprises of 42 patients (58%) with mild MERI score, 20 patients (28%) with moderate MERI score and 10 patients (14%) with severe MERI score. The number of patients with graft uptake was higher among those with mild MERI score compared to those with moderate and severe MERI scores. Studies conducted by Viktor Chrobok et al.¹⁷ showed that patients with a generally lower MERI had better pre op and post-op air and bone conduction than patients with a higher MERI. Thus our study coincides with the findings of Viktor Chrobok's study. In a study done by Sevim Aslan Felek et al.¹⁸ an air-bone gap of 20 dB or less is observed in 91% of low risk MERI, 84% of moderate risk MERI and 59% of high risk MERI. Thus more hearing benefit is observed in low risk MERI group compared to moderate and high risk group.

NASAL ENDOSCOPY VS GRAFT STATUS

DNS was observed in 65 patients, out of which 49 were simple DNS and 16 were gross DNS with nasal obstruction. In our study, the graft up take is lesser in patients with gross DNS with obstruction compared to simple DNS.

In a study done by Maier W et al.¹⁹ ET dysfunction frequently occurs in patients with DNS and the turbinate hypertrophy. A study done by M Tan et al.⁴⁷ after acoustic rhinometry, concludes that DNS may not affect the success of tympanoplasty surgery, and septoplasty may not be necessary.

EUSTACHIAN TUBE STATUS VS GRAFT UPTAKE

It was found in our study, that in patients with normal visualization of the Eustachian tube on nasal endoscopy and in patients with normal eustachian tube patency and secretory functions, the graft uptake was high. These observations

were found to be statistically significant. In a study by Kumar et al.²⁰ a good correlation exists between the functional status of eustachian tube and success of tympanoplasty. The success rates of tympanoplasty in normal E.T. function (81.8%) and in mild E.T. hypofunction (72.7%) are significant as compared to failures in the presence of moderate and severe E.T. hypofunction, whatever may be the technique. In a study by Takahashi H et al.²¹ a significantly higher incidence of poor outcome was seen when the Eustachian tube functional status was poor.

CONCLUSION

The overall success rate of tympanoplasty was 86% based on the graft uptake and 85% according to hearing benefit.

- In patients with discharge free period of more than 3 months, 100% of graft uptake was noted.
- MERI is a useful tool to ascertain the prognosis of tympanoplasty.
- The number of patients with graft uptake was higher among those with mild MERI score compared to those with moderate and severe MERI scores.
- In the mild MERI score group, a higher number of patients showed an improvement in PTA, compared to those with moderate and severe MERI scores.
- The graft uptake is lesser in patients with gross DNS with obstruction compared to simple DNS. This difference was found to be statistically significant.
- In patients with normal visualization of the Eustachian tube on nasal endoscopy and in patients with normal eustachian tube patency and mucociliary functions, the graft uptake was high.

BIBLIOGRAPHY

1. Jose Acuin. Chronic suppurative otitis media Burden of Illness and Management Options. Geneva: World Health Organisation; 2004. Child and Adolescent Health and Development Prevention of Blindness and Deafness.
2. Committee on Conservation of Hearing, American Academy of Ophthalmology and Otolaryngology. Standard Classification for

surgery of chronic ear disease. Arch Otol 1965; 81:204.

3. Aristides Athanasiadis-Sismanis. Tympanoplasty : Tympanic membrane repair. A. In: Julianna Gulya, Lloyd B. Minor, Dennis S. Poe. (eds) Glasscock-Shambaugh surgery of the ear. 6th Edn. Connecticut: People's medical publishing house; 2010.p.482.
4. Shrikrishna BH, Jyothi AC, Sanjay G, Sandeep Samson G. Age and Gender Differences in the Incidence of Non-Cholesteatomatous Chronic Suppurative Otitis Media. International Journal of Research in Pharmaceutical and Biomedical Sciences. 2013;4(4):1172-4
5. Bijan Basak, Ganesh Chandra Gayen, Munmun Das, Gautam Dhar, Ritam Ray, Atanu Kumar Das. Demographic profile of CSOM in a rural tertiary care hospital. IOSR Journal Of Pharmacy. June 2014;4(6):43-46.
6. Abhinav D Wankar, Sanjiv Golhar. To Determine Prevalence of Chronic Suppurative Otitis Media with Reference to Unsafe Otitis Media in Primary School Going Children of Rural Setup of Wardha District. Global Journal of Medical research: J Dentistry and Otolaryngology. 2014;14(1):27-35.
7. Rout M, Susritha K, Das P, Jyothi BS, Mohanty D, Rao V. Ossicular chain defects in safe type of chronic suppurative otitis media. Indian Journal of Otology. 2014;20(3):102.
8. Veysel Yurttaf, Ahmet Ural, Ahmet Kutluhan. Factors that may affect graft success in tympanoplasty with mastoidectomy. ENT Updates 2015;5(1):9-12.
9. Ars B, Ars-Piret N. Tympano-Ossicular, Allograft Tympanoplasty: A Manual of Techniques. Kugler Publications; 1993. 76 p.
10. Onal K, Uguz MZ, Kazikdas KC. A multivariate analysis of otological, surgical and patient related factors in determining success in myringoplasty. Clin Otolaryngol.2005; 30:115-20.
11. Gersdorff M. Garin P. Decat M, Juantegui M. Myringoplasty: long-term results in adults and children. Am J Otol 1995;16(4):215-8.
12. Ghodrat Mohammadi, Masoud Naderpour, Mehrnoosh Mousaviagdas. Ossicular Erosion in Patients Requiring Surgery for Cholesteatoma. Iran J Otorhinolaryngol. 2012;

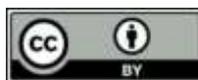
-
-
- 24(68):125-8.
13. Becvarovski, Zoran; Kartush, Jack M. Smoking and Tympanoplasty: Implications for Prognosis and the Middle Ear Risk Index (MERI). *Laryngoscope*. 2001;111(10):1806-11.
 14. Wilson KF, Hoggan RN, Shelton C. Tympanoplasty with intact canal wall mastoidectomy for cholesteatoma: long-term surgical outcomes. *Otolaryngol Head Neck Surg*. 2013 Aug;149(2):292–5
 15. Andersen SA, Aabenhus K, Glad H, Sorensen MS. Grail take-rates after tympanoplasty: results from a prospective ear surgery database. *Otol Neurotol*. 2014 Dec;35(10):e292-7.
 16. Asok K. Saha, D. M. Munsii, S. N. Ghosh. Evaluation of improvement of hearing in type I tympanoplasty & its influencing factors. *Indian Journal of Otolaryngology and Head and Neck Surgery*. July 2006;58(3):253-7.
 17. Viktor Chrobok, Arnost Pellant, Milan Meloun, Karel Pokorny. Prognostic Factors for Hearing Preservation in Surgery of Chronic Otitis Media. *Int. Adv. Otol*. 2009; 5:(3) 310-317.
 18. Sevim Aslan Felek, MD,, Hatice Celik, MDa, Ahmet Islam, MDa, Atilla H. Elhan, PhDb, Munir Demirci, MDa, Erdal Samim, MD : Type 2 ossiculoplasty: prognostic determination of hearing results by middle ear risk index *American Journal of Otolaryngology–Head and Neck Medicine and Surgery* 31 (2010) 325–331.
 19. Maier W, Krebs A. Is surgery of the inner nose indicated before tympanoplasty? Effects of nasal obstruction and reconstruction on the eustachian tube. *Laryngorhinootologie*. 1998 Dec; 77(12):682–8.
 20. Kumar N, Madkikar NN, Kishve S, Chilke D, Shinde KJ. Using middle ear risk index and et function as parameters for predicting the outcome of tympanoplasty. *Indian J Otolaryngol Head Neck Surg*. 2012 Mar; 64(1):13-6.
 21. Takahashi H, Sato H, Nakamura H, Naito Y, Umeki H. Correlation between middle-ear pressure-regulation functions and outcome of type-I tympanoplasty. *Auris Nasus Larynx*. 2007 Jun; 34(2):173-6.

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