

Original Research Article

A Hospital Based Study on Impact of Otorrhoea and Ossicular Status on the Effect of Tympanoplasty

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Abstract

Background: The surgical treatment of chronic otitis media primarily aims at complete removal of disease from the middle ear cleft, which is achieved in many of the cases nowadays. Each patient is assigned a numerical score based on the risk factors. The total score is 12. Based on MERI score, the patients are classified as mild disease (1-3), moderate disease (4-6) and severe disease (7-12). **Aim:** To study the effect of otorrhoea, ossicular and middle ear status on anatomical and functional results in patients undergoing tympanoplasty with or without mastoidectomy for chronic otitis media mucosal disease. **Materials and Methods:** A prospective study involving 100 patients of COM being treated surgically at the department of ENT at Nimra Institute of Medical Sciences during the time period February 2019-January 2020. The patients attending the OPD with otological complaints (otorrhoea, hearing loss) were evaluated clinically. On diagnosis of the case of COM mucosal disease, these patients were counselled for surgery. Patients undergoing surgical correction by tympanoplasty with or without mastoidectomy were assessed pre and intraoperatively by MERI scoring in order to classify and identify the disease category. The patients considered for surgery for COM mucosal disease underwent a detailed general physical and otoneurological evaluation. They also underwent hearing assessment by Pure-Tone Audiometry prior to surgery. Air and bone conduction at frequencies of 0.5, 1, 2, 3 kHz were recorded and a 4 tone average will be calculated. **Results:** In our study of 100 patients, 52% were females and 48% males with majority of patients in the group of 21-30 years. The most common presenting complaint amongst these patients was otorrhoea followed by hearing impairment. 33% had Right sided disease, 57% had left sided disease and 10% had Bilateral disease. Left sided pathology was more common in our study group. Aural swab was done for culture sensitivity of the organisms in all patients and the most common organism isolated in aural swab culture was *Pseudomonas* (26%). Maximum number of patients 52% had a dry ear, 48% had occasionally wet ears and 8% had persistently wet ears. Patients presented with history of ear discharge of varying duration ranging from 1 year to 30 years. 50 patients (50%) had an intact ossicular chain. Defects of the Incus alone were seen in 36 patients (36%). Defects in both malleus and incus was seen in 7 patients (7%) and stapes and incus was noted in 7 patients (7%). Of the total number of patients (n=100), majority of the patients 79% had normal middle ear status while 21% of them had middle ear effusion present, 20 of the total patients were smokers and 80 of them were non-smokers. Majority of the patients belonged to the group of Mild risk MERI(1-3) which was 69 patients, 26 patients came under the Moderate risk category MERI(4-6) and 5% patients had Severe risk (7-12). Of the total 100 patients being studied, the graft uptake was successful in 78 patients (78%) and there was a failure in 22% of them. Otorrhoea proved to be a significant factor in the success of surgery as dry ears had a better graft uptake compared to wet ears. 'p' value less than 0.05 at 5% level of significance shows there is significant relationship between otorrhoea and graft uptake. Of the total of 100 patients, 21 of them had non patent Eustachian tube with middle ear effusion of which 10 of them had graft failure, whereas in case of patent Eustachian tube and normal middle ear cleft the success rate was higher (68 out of the 79 were successful). Those patients with a lower MERI score had successful outcome of surgery whereas those with a higher score had lesser chances of successful surgery. Out of 100, 60 patients belonging to the mild MERI and 17 from the moderate risk group had a successful surgery whereas only 1 patient out of the severe category had a successful surgery. **Conclusion:** Otorrhoea and status of middle ear cleft proved to be significant factors in the graft uptake and success of Tympanoplasty whereas ossicular status did not play a significant role in the result of surgery. Middle Ear Risk Index proved to be very valuable tool in predicting the outcome of surgery.

Keywords: Middle Ear Risk Index; Outcome of surgery; factors affecting tympanoplasty

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Introduction

Chronic Otitis Media (COM) is an inflammatory condition of the middle ear cleft associated with persistent tympanic membrane perforations and otorrhea and can lead to thickening of middle ear

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Chronic Otitis Media (COM) is an inflammatory condition of the middle ear cleft associated with persistent tympanic membrane

perforations and otorrhea and can lead to thickening of middle ear mucosa and mucosal polyps. It may be classified COM squamous and COM mucosal. COM when left untreated can lead to various morbidities and in certain cases may cause serious temporal and intracranial complications. COM mucosal disease is a rather common entity in our country and a large number of patients are suffering from the disease. Optimal treatment of COM would entail surgical correction which would be tympanoplasty with or without mastoidectomy. The results of the patients undergoing surgical correction would depend on various host, agent, environmental and surgical factors. These factors have been evaluated in the literature

Suresh and Bukya

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and certain risk scoring has been formulated. The Middle Ear Risk Index(MERI) developed by Becvarovski and Kartush[1] is one such method by which the success of a surgery (including graft uptake and hearing benefit) can be predicted. The factors evaluated in MERI include otorrhea, perforation of the eardrum, cholesteatoma, ossicular status, middle ear granulations or effusions, previous surgery and smoking. The success and failure of surgical correction and the factors affecting it are an important part of counselling a patient undergoing surgery[2]. Certain factors like otorrhea and middle ear status has been considered to have adverse impact on the success of ear surgery. The middle ear mucosal hyperaemia/ hyperplasia and discharge suggest persistent infection leading to poor aeration and poor result in ear surgery[3,4]. In contradiction to these various authors have shown that the presence of persistent otorrhea have no impact on the results of surgery[5-7]. Our study evaluates the results of ear surgery in cases of active mucosal disease with inactive cases to identify the impact of otorrhea, ossicular status and middle ear status. The functional result of ear surgery in addition to graft take up is also dependant on the ossicular status. Various classification of ossiculoplasty have described the importance of malleus/incus/stapes in the hearing result of tympanoplasty. MERI in their risk stratification classifies higher risk factor for Malleus loss as compared to Stapes. We hypothesise that the relative importance of malleus handle may not be more than the stapes superstructure in determining hearing results in ear surgeries as enumerated by MERI.

The present study was undertaken to study and analyse the risk factors associated with the structural and functional benefit of surgery and to study the relation between MERI score and success of tympanoplasty with or without mastoidectomy.

Aim of the Study

To study the effect of otorrhea, ossicular and middle ear status on anatomical and functional results in patients undergoing tympanoplasty with or without mastoidectomy for chronic otitis media mucosal disease.

Objectives of the Study

- To assess the effect of MERI scoring on the anatomical and functional results in patients undergoing tympanoplasty with or without mastoidectomy for COM mucosal disease.
- To study the effect of otorrhea on the anatomical and functional results in patients undergoing tympanoplasty with or without mastoidectomy for COM mucosal disease.
- To study the effect of ossicular status on the anatomical and functional results in patients undergoing tympanoplasty with or without mastoidectomy for COM mucosal disease.
- To study the effect of middle ear cleft status during surgery on the anatomical and functional results in patients undergoing tympanoplasty with or without mastoidectomy for COM mucosal disease.

Materials and Methods

Source of Data

All patients attending the out-patient Department of ENT, NIMRA Institute of Medical Sciences, Vijayawada with otological complaints (otorrhea, hearing loss) were evaluated clinically. On diagnosis of the case of COM mucosal disease, these patients were counselled for surgery. Patients undergoing surgical correction by tympanoplasty with or without mastoidectomy will be assessed pre and intraoperatively by MERI scoring in order to classify and identify the disease category. MERI Scoring (Table 1)

Table 1: MERI Scoring

Otorrhea	Dry - 0 Occasionally wet - 1 Persistently wet - 2 Wet, Cleft palate - 3
Perforation of Eardrum	None - 0 Present - 1
Cholesteatoma	None - 0 Present - 2
Ossicular Chain Status	Malleus, Incus and Stapes Present - 0 Defect of Incus - 1 Defect of Incus and Stapes - 2 Defect of Incus and Malleus - 3 Defect of Malleus, Incus and Stapes - 4 Ossicular Head Fixation - 2 Stapes Fixation - 3

Inclusion criteria:

- Age above 10 years
- Those willing for surgery
- COM mucosal disease

Exclusion criteria:

- Squamous disease
- Unwilling for surgery
- Medically unfit for surgery
- Revision tympanoplasty cases
- Complicated otitis media

Sample size- 100

Method of Collection of Data

The patients considered for surgery for Chronic otitis media mucosal disease underwent a detailed general physical and otoneurological evaluation. They also underwent hearing assessment by pure-tone audiometry prior to surgery. Air and bone conduction at frequencies of 0.5, 1, 2, 3 kHz were recorded and a 4 tone average was calculated. As per MERI the patients were evaluated for factors preoperatively and intraoperatively (Table 1). Tympanoplasty with or without mastoidectomy were planned after patient obtained pre-anesthetic fitness. Informed consent was taken from each patient in their own vernacular.

Postoperatively the patients were followed up at 3 and 6 months to ascertain the structural (graft take up) and functional (hearing improvement) success.

Study Area: Hospital based study (Nimra Institute of Medical Sciences & Hospital)

Study Design: A prospective interventional study with follow up of patients for 3 and 6 months.

Study Period: February 2019-January 2020

Pre-Operative Work Up

All subjects fulfilling the inclusion criteria were taken into consideration. In history, importance was given to conditions such as hearing loss, otorrhea, previous otology procedures, tinnitus, otalgia, vertigo and facial paralysis. General physical examinations, ear examinations with otoscope and tuning fork tests with 256, 512, and 1024 Hz were done. Pure tone Audiometry test was performed by a certified trained Audiologist within 1 week before surgery, 3rd month after surgery and 6th month after surgery. It was tested in a sound treated room. Hugson and Westlake technique was used for audiometric evaluation. Test was performed through air conduction and bone conduction. Air conduction included frequencies at 250Hz, 500Hz, 1000Hz, 2000Hz, 4000Hz and 8000Hz. Four frequencies pure tone average was calculated from 500Hz, 1000Hz, 2000 Hz and 3000 Hz. It was documented both pre- and post - operatively.

The findings were noted in the audio logical evaluation sheet. Pre-operatively patency and mucociliary clearance of the Eustachian tube were assessed by instillation of antibiotic ear drops through the tympanic membrane perforation. The perception of taste by the patient was perceived as a positive response with normal patency of the Eustachian tube. Patients were admitted or called on OPD basis according to the availability of bed in the ward. Oral antibiotic were prescribed the day before surgery and continued for 10 days postoperatively. Part preparation was done on day before surgery. All cases were done under general anaesthesia. Patients were admitted 2 days prior to surgery, detailed history and clinical examination of ear, nose, throat was done as per the attached proforma. Written/informed consent was taken. All the cases were done under general anaesthesia. Based on pre-operative and intra-operative findings, the middle ear risk index was calculated for each patient and they were stratified into three categories of mild, moderate and severe categories. All patients with discharging ears or unhealthy middle ear status underwent cortical mastoidectomy.

Preparing and Positioning the Patient

The patient was positioned and prepared in the same manner as for conventional ear surgery. The patient was placed in the otologic position, with the head slightly elevated using a folded towel or blanket. The patient was draped in the usual sterile manner.

- Temporalis fascia graft placed using underlay technique
- Abgel placed in the middle ear to support the graft.
- Tympanomeatal flap repositioned and EAC filled with medicated gel foam
- Post aural incision closed in 2 layers, mastoid dressing applied
- Surgeries of all the patients included in the study were performed by the same surgeon

Postoperative care

Post-operative instructions given to patients

1. Nil by mouth for 6 hrs
 - a. Inj. Cefixime 1gm iv BD for 2 days
 - b. Inj. Rantac 2cc I.V Bd for 2 days

2. Tab. Levocitrizine Od for 10 3rd days
3. Keep operated ear up.

Alternate day dressing was done and patients were discharged on post-operative day 2 and asked to review after 10 days to check for wound integrity. Thereafter the patients were called at the end of 1st, 3rd and 6th month. The 3rd and 6th month follow up findings were taken up for the analysis. Postoperative audiometry was done at 3rd and 6th month. The patients were studied for the following parameters.

- Graft acceptance at sixth month or longer - Categorized as either intact tympanic membrane or failure. An intact neotympanum was considered as a successful graft uptake and any perforation of the graft was considered as failure.
- Post-operative hearing levels at third and sixth month. According to Belfast Rule of Thumb, post operative hearing benefit is significant if air conduction threshold in speech frequencies is ≤30 dB or if it is within 15dB of the contralateral ear.

Statistical Analysis:Data was entered into Microsoft excel data sheet and was analyzed using SPSS 22 version software. Categorical data was represented in the form of Frequencies and proportions. Chi-square was used as test of significance. Continuous data was represented as mean and SD. Independent t and Man Whitney test were used as test of significance to identify the mean difference between two groups. p value <0.05 was considered as statistically significant.

Observations and Results

This study was conducted in the department of ENT and head & neck surgery, Nimra Institute of Medical Sciences & Hospital, Vijayawada for a period of two years from February 2019 to January 2020. The study group consists of 100 patients with chronic suppurative otitis media of mucosal type.

Sociodemographic Characteristics of the Study Subjects

Table 1: Distribution of subjects according to Age groups.

Age – groups	Frequency	Percentages (%)
Below or 20 years	7	7
Between 21 – 30 years	46	46
31 – 40 years	37	37
Above 40 years	10	10
Total	100	100

The above table and graph gives information about the various age groups among which the patients were distributed. Maximum number of patients were in the age group of 21-30 years (46%)

followed by 31-40 years (37%) and 10 % above 40 years and the least among those less than 20 years (7%).

Table 2: Distribution of subjects according to Gender.

Gender	Frequency	Percentages (%)
Males	48	48
Females	52	52
Total	100	100

Among the total number of patients (n=100), majority of the patients were females, 52% and males were 48%.The male: female ratio being 0.92:1.

All study subjects were diagnosed cases of Chronic Otitis Media mucosal type. Amongst the presenting complaints, otorrhoea was the most common followed by hearing impairment, tinnitus, pain in the ear and itching in the ear being the least common complaint.

Clinical Characteristics of Study Subjects

Table 3: Distribution of patients according to chief complaints

Complaint	No. of Patients
Otorrhoea	48
Hearing Impairment	36
Tinnitus	8
Pain in the Ear	6
Itching in the Ear	2

Patients were grouped according to the Laterality of the disease as Right or Left sided and also Bilateral ear disease.

Table 4: Distribution of subjects according to TM perforated side.

TM perf side	Frequency	Percentages (%)
Right	33	33
Left	57	57
Bilateral	10	10
Total	100	100

The above table and graph gives information about the laterality of the disease. 33 % had Right sided disease, 57 % had left sided disease and 10% had Bilateral disease. Left sided pathology was more common in our study group.

All patients in the study has tympanic membrane perforations of different sizes affecting various compartments of the Pars Tensa.

Table 5: Distribution of subjects according to TMP size and site

Age – groups	Frequency	Percentages (%)
Medium Size AI&PI	2	2
Large central	55	55
Small Central AI	7	7
Medium Size AI&AS	1	1
Medium central AI&PI	11	11
Small Cental PI	6	6
Medium central AS&AI	17	17
Small central AS	1	1
Total	100	100

Aural swab was done for culture sensitivity of the organisms in all patients. The most common organism isolated in aural swab culture was Pseudomonas (26%). The other organisms were Proteus, Escherichia coli, Staphylococcus aureus, Enterococcus, Enterobacter and Acinetobacter. No growth was obtained in 20 patients.

Meri Score Variables

According to Bellucci’s classification of otorrhoea, patients were classified as dry ear, occasionally wet persistently wet and lastly persistently wet with cleft palate.

Table 6: Bellucci’s Classification of Otorrhoea

Category of Otorrhoea	No. of Patients
Dry	52
Occasionally Wet	40
Persistently Wet	8
Persistently PalateWet WithCleft	0

From the above table the information we get is that none maximum number of patients 52% had a dry ear ,48% had occasionally wet ears and 8% had persistently wet ears. None of the patients presented with a persistently wet ear with cleft palate. Patients presented with history of ear discharge of varying duration ranging from 1 year to 30 years The duration since last discharge was noted .While 62 of them had more than three months discharge free period before the surgery, 35 of them had less than three months. 3 of them had active

discharge at the time of surgery. In patients with discharge free period of more than three months ,100% graft uptake was seen. According to Austin-Kartush classification for middle ear ossicular status, 50 patients (50%) had an intact ossicular chain. Defects of the Incus alone were seen in 36 patients (36%). Defects in both malleus and incus was seen in 7 patients (7%) and stapes and incus was noted in 7 patients (7%).

Table 7: Distribution of patients according to ossicular status

Ossicular Status	No. of Patients
Malleus, Incus & Stapes Intact	50
Defect of Incus	36
Defect of Incus and Malleus	7
Defect of Incus and Stapes	7

The following graph shows the middle ear status of the patients. Of the total number of patients (n=100), majority of the patients 79% had

normal middle ear status while 21% of them had middle ear effusion present.

Table 8: Distribution of subjects according to middle ear status

Status of Middle Ear	No. of Patients	Percentage
Normal	79	79%
Effusion	21	21%

Table 9: Distribution of subjects according to smoking status.

Smoking status	Frequency	Percentages (%)
Yes	20	20
No	80	80
Total	100	100

Of the total no of patients, 20 of them were smokers and 80 of them were non- smokers.

Among the smokers, only 7 (35%) of them had a graft rejection, 13 of them (65%) had a successful surgery.

Meri Score Distribution

Table 10: Distribution of subjects according to MERI score.

MERI score	Frequency	Percentages (%)
Normal	0	0
Mild	69	69
Moderate	26	26
Severe	5	5
Total	100	100

The study group comprises of 100 patients diagnosed as Chronic Otitis Media mucosal type Majority of the patients belonged to the group of Mild risk MERI(1-3) which was 69 patients,26 patients came under the Moderate risk category MERI(4-6) and 5 % patients had Severe risk (7-12)

Surgical Outcome: Based on Graft Uptake and Hearing Improvement

Of the total 100 patients being studied,the graft uptake was successful in 78 patients (78%) and there was a failure in 22 of them which was further divided into graft failure which was seen in 16 patients and reperforation in 6 patients.

Table 11: Distribution of subjects according to Graft uptake.

Graft Uptake	Frequency	Percentages (%)
Success	78	78
Graft failure	22	22
Total	100	100

Hearing Improvement in our study group was assessed based on Belfast rule of Thumb which states that post operative hearing benefit is significant if (operated ear hearing brought to 30 dB or

better or to within 15 dB of contralateral ear).Based on this the number of patients who had hearing benefit were 78.

Table 12: Distribution of subjects according to Belfast rule of thumb for hearing improvement

Belfast rule	Frequency	Percentages (%)
Success	78	78
Failure	22	22
Total	100	100

Table 13: Difference between preop PTA and PTA at 6 months using Paired T-test.

PTA	Mean	Standard Deviation	Mean Difference	95% Confidence Interval of the difference		T	P
				Lower	Upper		
Pre-op	43.770	9.40541	10.56000	8.90773	12.21227	12.682	
6months	33.210	7.96621					.000 (HS)

Table 14: Otorrhoea and success

Otorrhoea	Success	Z	p
Dry	44	-8.775	.000 (HS)
Wet	34		
Total	78		

Otorrhoea proved to be a significant factor in the success of surgery as dry ears had a better graft uptake compared to wet ears. P value

less than 0.05 at 5% level of significance shows there is significant relationship between otorrhoea and graft uptake.

Table 15: Ossicular status and success

Ossicular chain status	Success		Total	X2	P
	Yes	No			
Malleus, incus, stapes present	10	40	50	2.135	.545 (NS)
Defect of incus	8	28	36		
Defect of incus and stapes	1	6	7		
Defect of incus and malleus	3	4	7		
Total	22	78	100		

Ossicular status in our study does not have a significant (p value more than 0.05) role to play in the successful outcome of surgery. Nevertheless adequate assessment of the ossicular status is important

to plan the surgery and to give adequate hearing benefit for the patient post-operatively.

Table 16: Middle ear condititon and success

Middle ear condition	Success		Total	X2	P
	Yes	No			
Effusion/unhealthy middle ear	68	11	79	14.298	.000 (HS)
Yes	10	11	21		
Total	78	22	100		

The status of the middle ear is an important factor which decided the outcome of surgery. Adequate clearance of the middle ear disease is important to have a disease free post –operative status which in turn helps in adequate graft uptake. Pre-operative assessment of the Eustachian tube patency is important in assessing the middle ear cleft

status which in turn predicts the outcome of surgery. Those with patent Eustachian tube had better outcome of surgery, due to better ventilation and adequate drainage of middle earsecretions. Of the total of 100 patients,21 of them had non patent Eustachian tube with middle ear effusion of which 10 of them had graft failure, whereas in

case of patent Eustachian tube and normal middle ear cleft the success rate was higher (68 out of the 79 were successful). The Middle Ear Risk Index is an important and useful tool in predicting the outcome of surgery as indicated by the table above. Those patients with a lower MERI score had successful outcome of surgery whereas

those with a higher score had lesser chances of successful surgery. Out of 100, 60 patients belonging to the mild MERI and 17 from the moderate risk group had a successful surgery whereas only 1 patient out of the severe category had a successful surgery.

Table 17: Graft uptake and MERI score

Graft Uptake	MERI Score			Total	X ²	p
	Mild	Moderate	Severe			
Success	60	17	1	78	15.439	.000 (HS)
Failure	9	9	4	22		
Total	69	26	5	100		

Discussion

Chronic suppurative otitis media 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[8]. It is more common in rural areas than urban areas and is associated with poor hygiene, illiteracy and is common among the middle and low income groups. It is the chronic inflammation of the middle ear cleft which presents with recurrent otorrhoea through a tympanic membrane perforation. Long standing disease can also cause hearing impairment. The management of COM is mainly based on two principles, eradication of infection and the closure of the tympanic membrane perforation. This is achieved surgically by Tympanoplasty with or without Mastoidectomy. In spite of the availability of a wide range of antibiotics, advanced surgical techniques and newly developed prosthetic materials we are unable 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. Austin in 1972 classified four groups A to D based on the presence or absence of malleus handle and stapes suprastructure in cases where the incus was partially or completely eroded. In some patients, though all ossicles are intact, malleus head is fixed to attic by ankylosis or there may be stapes fixation. Kartushin 1994 added these two groups E and F respectively to Austin's classification. Another category, "nonclassifiable" was added by Moretz in 1998 to include rare conditions such as congenital anomalies and lateralised drumhead. Black in 1992 introduced the SPITE system[9]. According to the study conducted by Bijan Basak et al the most common age group for occurrence of Chronic Otitis Media is 11-30 years[10]. This is comparable with our study which shows the most common age group affected is 21-30 years (46%), followed by 31-40 (36%) and least in the age group of less than 20 years. Nishanthkumar et al also in his study concluded that the most common age group was 21-30 years (38%) [2]. According to Glasscock, though otitis media is a disease which occurs commonly in paediatric age group, the mean age at which the disease manifests is 20-29 years.

Gender Distribution

According to the study by Bijan Basak et al, [10] there is a female predominance in case of COM. Khan Feroze K et al in his study found a female predominance, out of 113 patients, 69 were female (61%) and 49 were males (39%). This is in accordance with our study which shows a female predominance with 52% females and 48% males [11].

Otorrhoea

Khushboo Jain et al in their study proved that out of 26 cases who had dry ear for less than 6 weeks 21 cases showed graft take up (80.76%) 19 cases who had dry ear for more than 6 weeks, 18 cases showed graft take up (94.73%). This showed that graft uptake and dry status of the ear were directly related [12]. Pinar E et al studied the role of middle ear risk index and other factors such as age, sex,

systemic diseases, site and size of perforation, period of dryness on the outcome of tympanoplasty. They concluded that more than 3 months dryness were good prognostic factors [13]

Ossicular Status

The success of hearing reconstruction of the hearing mechanism depends on the pre-operative ossicular status. An intact ossicular system with only a perforation in the tympanic membrane gives the best results. The most common ossicle to be eroded is the long process of incus due to the nature of blood supply to the incudostapedial joint. In our study, there is erosion of incus in 36 patients (36%). There was erosion of incus and stapes and incus and malleus in 7% each. An intact ossicular chain was seen in 50 patients (50%) according to the studies conducted by Ghodrat Mohammadi [14]

Middle Ear Status and Eustachian Tube Function

In our study, 21 patients had unhealthy middle ear mucosa with effusion noted in the tympanic cavity. 11 out of these patients had an unsuccessful surgery which can be attributed to the presence of middle ear infection and inadequate removal of this during surgery. This also correlated with the finding of a non-patent Eustachian tube in these patients. Nishanth Kumar et al [2] in his study observed that out of 50 ears, 38 ears had normal ETF. It was observed that out of 38 ears with normal Eustachian tube function, graft was accepted in 34 (89.47%) of cases and rejected in 4 (10.52%) of cases probably because of severe URTI and in compliance of the patient to proper post-operative care advised on discharge.

Smoking: Controversy exists in the results of tympanic membrane closure rate and hearing improvement in smoker and nonsmoker patients. In a study of 132 patients, performed by Cantrell, success rate in nonsmokers was 92.5% and 43.7% in smokers [15]. Becavarovski, in the study of 74 tympanoplasty surgeries, showed that delayed complications of surgery, such as severe atelectasis or delayed perforation after 6 months, was 20% in non-smokers and 60% in smokers ($P < 0.5$) [1].

Outcome of Surgery-Graft Uptake and Hearing Benefit: Our study found that 78% patients had a successful graft uptake and 21% had a failure. The number of patients who had an audiological improvement was 78 out of the 100 patients. This is in comparison with various studies. Hearing benefit is assessed by various methods. According to Belfast rule of thumb, postoperative hearing benefit is significant if air conduction threshold in speech frequency range is = 30 dB or if interaural difference is = 15 dB. Some authors define success as postoperative air-bone gap within 20 dB. In some studies, only the air conduction threshold is taken into account. In our study, we have measured the average air-bone gap closure at speech 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.

Comparison of Meri Score and Outcome of Surgery: In our study, 60 patients belonging to the mild MERI and 17 from the moderate risk group had a successful surgery whereas only 1 patient out of the severe category had a successful surgery. This is comparable with

various other studies. Kalyanasundharam and Gitanjali in their study observed that when the MERI score is mild graft is taken up by 13 patients and rejected for only 1 patient. When the MERI score is moderate the graft is taken up by 15 patients and rejected for only 4 patients when the MERI score is high the chances of graft taken up among patients is low & rejection rate is high [16].

Conclusion

It is concluded in our study that otorrhoea and status of the middle ear cleft have an impact on the success of the surgery, while ossicular status did not have a significant effect on the outcome. Middle Ear Risk Index (MERI) is a very important scoring system which helps in assessing and analyzing the patient pre-operatively and intra operatively which helps in predicting the outcome of surgery.

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