

Clinical Study of Influence of Prognostic Factors on the Outcome of Tympanoplasty Surgery

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Abstract: Myringoplasty is the operation specifically designed to close tympanic membrane defects the main aim of surgery of chronic ear disease is to eliminate disease process and reconstruct middle ear to give the patient a dry safe and functioning ear. In this study a clinical study of myringoplasty underlay technique in the management of central perforations done. Main emphasis is laid on evaluation of prognostic factors like Eustachian tube function, middle ear mucosa at operation and audiometric evaluation pre and post operatively. A series of patients treated in the Department of ENT, Government General Hospital, Kurnool during the period of two years is taken for the study. Relevant literature regarding anatomy, physiology, pathophysiology, clinical features and various methods of medical and surgical management are reviewed.

Keywords : Chronic suppurative otitis media, Tympanoplasty, Eustachian tube function, middle ear mucosa, audiometric evaluation.

I. Introduction

Myringoplasty is the operation specifically designed to close tympanic membrane defects. A perforation in the tympanic membrane can result from physical injury, scalds, burns, pressure effects, head injuries or infection process; out of this suppurative process is the most common cause. Most of these perforations usually heal spontaneously. But this spontaneous healing is hampered by chronicity of infection and certain pathophysiological changes at the perforated margin, leading to a non healing permanent perforation. It leads to constant exposure of middle ear for reinfection hearing disability and danger of certain intracranial and extracranial complications. The main aim of surgery of chronic ear disease is to eliminate disease process and reconstruct middle ear to give the patient a dry safe and functioning ear. In this journey towards the aim, the first milestone is reconstruction of tympanic membrane. In this study a clinical study of myringoplasty underlay technique in the management of central perforations done. Main emphasis is laid on evaluation of prognostic factors like Eustachian tube function, middle ear mucosa at operation and audiometric evaluation pre and post operatively. A series of patients treated in the Department of ENT, Government General Hospital, Kurnool during the period of two years is taken for the study. Relevant literature regarding anatomy, physiology, pathophysiology, clinical features and various methods of medical and surgical management are reviewed.

II. Materials And Methods

A prospective study was carried out at Dept. of ENT and HN Surgery KMC, Kurnool, as part of thesis submission, during period 2006-08. Fifty cases of CSOM with deafness aged between 15-45 yrs age group and all cases with Middle ear risk index between 1 to 3, were taken up for type I Tympanoplasty, with temporalis fascia as graft material. Simple Mastoidectomy was done in cases where mucosa was found abnormal.

Exclusion criteria

1. Infection in nose sinuses, nasopharynx and oropharynx.
2. Deviated nasal septum enlarged inferior turbinate, polyp in the nose.
3. Sensori neural hearing loss.
4. Atticoantral disease cholesteatoma.,

Preoperative evaluation

Duration of Otorrhea, duration of deafness, size of perforation, webers lateralization, Eustachian tube mucociliary clearance by dye test, status of middle ear mucosa pathology at operation, were assessed. Pre and post operative pure tone audiograms were taken to assess pure tone average hearing gain air bone gap closure. Postoperative follow up:-

Graft uptake was assessed by otoscopy at eight weeks postoperatively. Postoperative audio -grams were taken to assess the improvement in hearing. Patients are categorized for each variable, to be assessed and the base line data thus obtained is analyzed. The analyses of results obtained are represented in a tabular form.

Tympanoplasty reporting protocol

Deafness grading Mild = 21 to 40db loss, Moderate = 41 to 55db loss, Severe = More than 55db loss,

1. Size of perforation :Large = More than 50% of T.M surface area, Small = Small than 50% of T.M surface area
2. Mucociliary clearance of Eustachian tube : Abnormal = dye not seen within 10min Normal= dye seen within 10min
3. Middle Ear risk Index: Normal = 0, Mild pathology = 1-3, Moderate pathology = 4-6, Severe pathology = 7-12
4. Air bone gap closer Brackmann criterion: Excellent = 0-10db, Good = 10-20db, Fair = 20-30db Poor = More than 30db

Assessment of Eustachian tube function

Just prior to operation, Eustachian tubal function was tested by nasal endoscopy following instillation of 15 drops of fluorescein sodium dye (one in five dilution of 20% solution – sterile) into external auditory canal of the ear with perforated tympanic membrane. Cases in which, the dye was seen at nasopharyngeal end of tube within 10 min of its instillation into the ear were classified as having normal patent Eustachian tubes and others as having abnormal blocked eustachian tubes.

III. Observations

64% of the patients presented with duration of Otorrhea for more than 5yrs 86% of the patients presented with duration deafness for more than 5yrs. 54% of the patients presented with age more than 25yrs. 64% of the patients are females. 58% of the patients are mildly deaf 34% moderately deaf 8% were severely deaf. 58% of the patients presented with small tympanic membrane perforation and 42% presented with large perforation. Eustachian tube mucociliary clearance assessed by dye test showed that the test is abnormal in 54%. Middle Ear mucosa Pathology was assessed at operation and in 58% of the cases it was found normal. Simple Mastoidectomy was done in cases showing abnormal middle Ear mucosa Pathology. Postoperatively graft uptake was assessed at 8 weeks and found that in 78% of the cases it is successful. Postoperative hearing evaluation by pure tone audiometry revealed that the serviceable hearing that is air bone gap closer achieved in db was 54% up to 10db, up to 15db 12%, more than 30db 22%. When Belfast rule of thumb (Gordon Smyth) was applied, postoperative air threshold gain or improvement by less than 30db was observed in 38% and more than 30db in 62% of patients. The average hearing gain in db observed in the study population is 7.7db. The average air bone gap closure achieved in the study population is 9.75db. Master chart showed the observations in patients in table no.1

IV. Discussion

Analysis of results showed in table no. 2. The present study was undertaken, 1) to evaluate patients undergoing type –I tympanoplasty for Chronic Suppurative Otitis Media with Deafness in terms of Graft uptake and Hearing gain or improvement , 2) to evaluate the relative incidence of the following factors viz., a) duration of otorrhea b) duration of deafness c) Eustachian Tube mucocilliary clearance function, d) Middle ear mucosa pathology at operation in patients undergoing Type –I Tympanoplasty 3) The surgical outcome measures and relative incidence of these factors will be compared with that of similar studies .The final objective in myringoplasty is to achieve a safe, dry ear, with an intact tympanic membrane .Most authors agree that preoperative abnormalities indicative of severity of underlying Eustachian tube dysfunction and Infection have a significant influence on prognosis . Black noted that good risk patients had a 67% chance of obtaining hearing within 10 db versus only a 25 % chance if they were considered poor risk. In the present study 54% of the patients are of more than 25yrs of age. 46% of them were in the age group of less than 25yrs. where as in a study conducted by Ajmal (Ref.2) 66% of the patients belonged to the age group of more than 25yrs and 33% of them belonged to less than 25 years. The sex distribution in the present study showed 36% of males and 64% Females, where as Ajmal in Ref.2- Showed 58.4% of males and 41.6 females, Saeed in Ref.24- Showed 59% males 40.95 females. In the present study Eustachian tube mucocilliary function as assessed by fluorescein dye test showed abnormal patency in 54% and normal in 46% where as Sethi in Ref.26- Showed abnormal patency in 32% and normal in 68%. Gimenz (Ref.9) showed abnormality in 22% and 50% normal patency. The present study showed abnormal middle ear mucosal pathology such as polyoidal mucosa, granulations, tympanosclerosis in 42% of patients and normal mucosa in 58%. Whereas Debora in (Ref. 5) has shown 13.4 % of his patients showed middle ear mucosal pathology and normal mucosa in 81.4%. Sethi in Ref 26- has shown 20% abnormal mucosa and 80% of them having normal mucosa. The present study showed that in 58% of patients there was small central perforation and in 42% large perforation was present. In the study done by Ajmal in Ref. 2- there were patients with small perforations in 33.3% and 25% large , Sethi in Ref. 26- 16% were small perforations and 66% were large Saeed in Ref.24- 66% were large perforation, Debora in Ref.5- 42.2% were small perforations and 57.7% were large perforations. The present study showed successful graft

uptake in 78% and failure of graft in 22% of patients. In the review literature various authors have reported the successful Graft uptake and closure rate as follows, viz., Ajmal in Ref.2- 60% Debora in Ref.5- 80.4%, Frade in Ref.6-73.6%, Kageyama in Ref.14- 82%, Kotecha in Ref. 15- 82.2% Saeed in Ref.24- 73.2%, Sheehy in Ref.25- 97%, Sethi in Ref.26- 76%, Yaor in Ref.28- as 89%. In the present study Air-Bone Gap closure upto 10db was achieved in 54% and up to 15db in 12% of patients. In a similar study by Yaor in Ref.28- reported air - bone gap closure to 10db in 40.5% of patients and upto 15db closure in 2.7%, Dr.Mahadevaiah Ref.17- reported 10 db closure in 26% and upto 15db closure in 32% of his patients. In the present study the average hearing gain observed among study population is 7.7db. Whereas Pala & Ramsay in Ref.19- reported 8.0db in their studies. This is in coincidence with the above authors. In the present study, when Belfast rule of thumb (Gordon Smyth) was applied post-operative air threshold gain or improvement in hearing was less than 30db in 38% and more than 30db was observed in 62%. From the above discussion it is apparent that even though the middle ear mucosa was normal only in 58% of patients when compared to similar studies by Debora (81.4%) Sethi (80%), the successful graft uptake observed in the present study is 78% when compared to Graft uptake by Debora (80.4%) and by Sethi (76%). Thus uniform data may not be obtained in all of the variables studied because of observer variation in various studies. The variables are analyzed separately by various authors but in clinical practice all these factors are interconnected and act concomitantly in disease morbidity.

V. Conclusions

Chronic suppurative Otitis media still remains an important health problem in the society. The incidence of chronic suppurative Otitis media, 29.7% in the general populations shows the demand for the availability of medical services. The incidence of reporting of the disease is more common in the females and willingness to undergo surgery is also found more common in them. It may be because of the improved social interaction of females in the present day situations. It is represented in the present study that is 64%. Tubotympanic type of CSOM is more common than the Attico-antral type (5.7%). This is evident in the present study. Thorough clinical examination, history taking and the requirement of the patient in relation to hearing impairment is mandatory to plan the surgery. It is also necessary to have audiological evaluation for both prognostic evaluation and medico-legal aspect. The condition of the middle ear mucosa determines the outcome of the surgery. It also helps in predicting post-operative hearing gain. Patent Eustachian tube is required in tympanoplasty. Patency test like flurecin dye instillation is a simple and effective method of assessing the mucociliary clearance function of the E.T. tube. Cortical Mastoidectomy in those patients who have a middle ear disease in the form of hypertrophy, mucosal edema and granulations helps in clearing the auditus and disease from the mastoid air cells, which is a pre-requisite of a successful Tympanoplasty. Post-operative audiological evaluation after 8 weeks showed hearing gain of 7.7dB on the average is similar to studies compared in the literature. Serviceable hearing that is air bone gap closure to less than 10 dB was achieved in majority of the patients (54%). Long term follow-up for more than 2 years is prescribed to declare the successful tympanoplasty and serviceable hearing, which was not possible in this study. The study has made an attempt to show that careful selection of patients might play a role in obtaining better results, in terms of graft uptake or closure rate and also in interpreting hearing gain results after Tympanoplasty, as well as good technical expertise.

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Clinical Study Of Influence Of Prognostic Factors On The Outcome Of Tympanoplasty

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TABLE No. 1: MASTER CHART

Sl. No	Sex/ Age	I.P.No.	DOA	DOS	Otorrhea duration	Deafness Duration	Size of perforation		Webers Lateralisation	Eustachian tube function Dyetst	Middle Ear Mucosa	Graft uptake	Hearing Gain in decibels	Air bone gap in db	Air bone gap closure achieved db	Pre-operative pure tone average in db	Post-operative pure tone average db	Belfast rule of thumb Air threshold db
							Large/ Small	Side										
1	M-30	39404	10/3/2007	10/4/2007	5 Years	3 Years	Small	Right Ear	Left Ear	Abnormal	Normal	Good	6.7	Pre OP: 20 Post OP:10	10.0	40.0	33.3	>30
2	F-26	39462	10/3/2007	10/9/2007	5 Years	2 Years	Small	Right Ear	Right Ear	Abnormal	Polypoidal	Good	8.4	Pre OP: 20 Post OP:10	10.0	40.0	31.6	>30
3	F-27	40183	10/8/2007	10/11/2007	7 Years	5 Years	Small	Right Ear	Right Ear	Abnormal	Normal	Good	10.0	Pre OP: 20 Post OP:10	10.0	33.3	25.0	<30
4	F-27	41211	10/15/2007	10/16/2004	5 Years	2 Years	Small	Left Ear	Left Ear	Normal	Normal	Good	8.5	Pre OP: 20 Post OP:10	10.0	33.3	25.0	<30
5	F-20	42217	10/22/2007	10/23/2007	10 Years	10 Years	Large	Left Ear	Left Ear	Abnormal	Normal	Good	8.3	Pre OP: 20 Post OP:10	10.0	36.6	28.3	<30
6	F-21	42223	10/22/2007	10/25/2007	5 Years	2 Years	Small	Left Ear	Left Ear	Normal	Normal	Good	8.3	Pre OP: 20 Post OP:10	10.0	31.6	23.3	<30
7	F-30	42255	10/22/2007	10/25/2007	10 Years	5 Years	Large & Bilateral	Left Ear	Left Ear	Abnormal	Granulations	Failure	0.0	Pre OP: 20 Post OP:20	0.0	40.0	40.0	>30
8	F-14	42521	10/24/2007	10/30/2007	5 Years	2 Years	Large & Bilateral	Left Ear	Left Ear	Abnormal	Polypoidal	Good	1.7	Pre OP: 20 Post OP:20	0.0	43.3	41.6	>30
9	F-32	42252	10/22/2007	10/30/2007	10 Years	5 Years	Small	Right Ear	Right Ear	Abnormal	Normal	Good	6.7	Pre OP: 20 Post OP:10	10.0	33.3	26.6	<30
10	F-20	42235	10/22/2007	11/1/2007	3 Years	3 Years	Small	Right Ear	Right Ear	Normal	Normal	Good	5.0	Pre OP: 20 Post OP:10	10.0	30.0	25.0	<30
11	F-30	43315	10/29/2007	11/1/2007	11 yr	5yr	Large	left Ear	Left Ear	Abnormal	Granulations	Failure	0.0	Pre OP:20 Post OP :20	0.0	43.3	43.3	>30
12	M-39	43676	10/30/2007	11/8/2007	10 yr	5yr	Large	Right Ear	Right Ear	Abnormal	Granulations	Failure	0.0	Pre OP:20 Post OP :20	0.0	50.0	50.0	>30
13	F-45	43679	10/31/2007	11/8/2007	3yr	1yr	Large	Left Ear	Left Ear	Normal	Granulations	Good	8.4	Pre OP:20 Post OP :10	10.0	40.0	31.6	>30
14	F-40	43323	10/31/2007	11/6/2007	10yr	5yr	Large	Right Ear	Right Ear	Abnormal	Granulations	Failure	0.0	Pre OP:20 Post OP:20	0.0	46.6	46.6	>30
15	F-20	43730	10/31/2007	11/6/2007	5yr	2yr	Large	Left Ear	Left Ear	Abnormal	Polypoidal	Good	5.0	Pre OP:20 Post OP :10	10.0	40.0	35.0	>30
16	F-15	43322	10/20/2007	11/8/2007	7yr	2yr	Large & Bilateral	Right Ear	Right Ear	Abnormal	Tympanosclerosis	Failure	0.0	Pre OP:20 Post OP:20	0.0	43.3	43.3	>30
17	F-25	44358	11/5/2007	11/6/2007	1yr	1 yr	Small	Left Ear	Left Ear	Normal	Normal	Good	8.4	Pre OP:20 Post OP:10	10.0	30.0	21.6	<30
18	M-30	44368	11/5/2007	11/6/2007	1Yr	1 Yr	Small	Right Ear	Right Ear	Normal	Normal	Good	8.4	Pre OP:10 Post OP:05	5.0	35.0	26.6	<30
19	M-23	45369	11/12/2007	11/13/2007	10 Yr	10 Yr	Large	Right Ear	Right Ear	Abnormal	Polypoidal	Good	8.3	Pre OP:20 Post OP:10	10.0	36.6	28.3	<30
20	M-30	45683	11/14/2007	11/15/2007	3 Yr	1 Yr	Small	Right Ear	Right Ear	Abnormal	Polypoidal	Good	8.4	Pre OP:20 Post OP:10	10.0	45.0	36.6	>30
21	F-27	47780	11/28/2007	11/29/2007	1 yr	1 yr	Small	Left Ear	Left Ear	Abnormal	Normal	Good	8.3	Pre OP:20 Post OP:10	10.0	43.3	35.0	>30
22	F-45	47727	12/3/2007	12/6/2007	15 Yr	5 Yr	Large	Right Ear	Right Ear	Abnormal	Tympanosclerosis	Failure	0.0	Pre OP:20 Post OP:20	0.0	53.3	53.3	>30
23	M-23	48472	12/3/2007	12/6/2007	10 yr	5 yr	Large	Left Ear	Left Ear	Abnormal	Polypoidal	Good	8.4	Pre OP:20 Post OP:10	10.0	45.0	36.6	>30
24	M-28	72376	12/10/2007	12/11/2007	6 yr	2 yr	Large	Right Ear	Right Ear	Normal	Normal	Good	10.0	Pre OP:40 Post OP:30	10.0	60.0	50.0	>30
25	F-17	6437	12/10/2007	12/11/2007	3 Yr	1 Yr	Small	Right Ear	Right Ear	Normal	Normal	Good	8.3	Pre OP:10 Post OP:05	5.0	43.3	35.0	>30
26	F-27	49494	12/10/2007	12/11/2007	5yr	1 Yr	Small	Right Ear	Right Ear	Abnormal	Normal	Good	10.0	Pre OP:25 Post OP:10	15.0	43.3	33.3	>30
27	F-34	48777	12/5/2007	12/6/2007	7 yr	1 yr	Small	Left Ear	Left Ear	Abnormal	Normal	Good	11.7	Pre OP:20 Post OP:10	10.0	48.3	36.6	>30
28	F-22	49776	12/12/2007	12/13/2007	5 Yr	3 Yr	Small	Left Ear	Left Ear	Abnormal	Normal	Good	6.7	Pre OP:15 Post OP:05	10.0	38.3	31.6	>30
29	F-30	49784	12/12/2007	1/22/2008	10 Yr	2 Yr	Large	Right Ear	Right Ear	Normal	Normal	Good	6.7	Pre OP:20 Post OP:15	5.0	63.3	56.6	>30
30	F-31	49785	12/12/2007	12/20/2007	10 Yr	5 Yr	Large	Right Ear	Right Ear	Normal	Normal	Good	6.7	Pre OP:20 Post OP:10	10.0	53.3	46.6	>30
31	M-16	59685	12/26/2007	12/27/2007	10 Yr	5 Yr	Small	Right Ear	Right Ear	Abnormal	Polypoidal	Failure	0.0	Pre OP:10 Post OP:10	0.0	23.3	23.3	<30
32	M-35	2692	1/21/2008	1/24/2008	5 Yr	2 Yr	Small	Left Ear	Left Ear	Normal	Normal	Good	6.6	Pre OP:20 Post OP:10	10.0	36.6	30.0	>30
33	M-22	50637	2/13/2007	2/14/2007	8 Yr	3 Yr	Small	Left Ear	Left Ear	Normal	Normal	Good	10.0	Pre OP:20 Post OP:10	10.0	33.3	23.3	<30
34	F-30	52234	12/31/2007	1/2/2008	10 Yr	5 Yr	Small	Right Ear	Right Ear	Abnormal	Polypoidal	Failure anterior perforation	0.0	Nil	Nil	35.0	35.0	>30
35	F-38	52342	1/1/2008	1/2/2008	15 Yr	5 Yr	Large	Right Ear	Right Ear	Abnormal	Polypoidal	Failure anterior dehiscence	11.7	Pre OP:20 Post OP:20	0.0	78.3	66.6	>30
36	F-33	14684	4/21/2008	4/22/2008	10 Yr	5 Yr	Small	Right Ear	Right Ear	Normal	Polypoidal	Good	0.0	Pre OP:30 Post OP:15	15.0	76.6	76.6	>30
37	M-55	3756	1/30/2008	1/31/2008	10 Yr	5 Yr	Small	Right Ear	Right Ear	Normal	Normal	Good	6.7	Pre OP:20 Post OP:10	10.0	35.0	28.3	<30
38	M-25	18268	5/7/2008	5/8/2008	5 Yr	4 Yr	Large	Left Ear	Left Ear	Normal	Normal	Good	8.3	Pre OP:20 Post OP:10	10.0	43.3	35.0	>30

Clinical Study Of Influence Of Prognostic Factors On The Outcome Of Tympanoplasty

39	M-23	18369	5/7/2008	5/8/2008	10 Yr	5 Yr	Small	Left Ear	Left Ear	Abnormal	Polypoidal	Failure anterior dehiscence	0.0	Pre OP:10 Post OP:10	0.0	25.0	25.0	<30
40	M-20	9694	3/17/2008	3/18/2008	7 Yr	3 Yr	Small	Right Ear	Right Ear	Normal	Normal	Good	6.6	Pre OP:20 Post OP:10	10.0	36.6	30.0	30
41	F-45	9928	5/7/2008	5/8/2008	10 Yr	5 Yr	Small	Left Ear	Left Ear	Normal	Normal	Good	1.7	Pre OP:10 Post OP:05	5.0	38.3	36.6	>30
42	F-19	16942	4/30/2008	5/1/2008	5 Yr	2 Yr	Small	Right Ear	Right Ear	Abnormal	Normal	Good	8.3	Pre OP:20 Post OP:05	15.0	31.6	23.3	<30
43	F-36	7716	3/3/2008	3/4/2008	8 Yr	2 Yr	Small	Left Ear	Left Ear	Normal	Normal	Good	8.4	Pre OP:20 Post OP:10	10.0	45.0	36.6	>30
44	M-20	23545	6/11/2008	6/12/2008	6 Yr	1 Yr	Large	Left Ear	Left Ear	Abnormal	Granulations	Failure	11.7	Pre OP:20 Post OP:10	10.0	45.0	33.3	>30
45	M-19	13639	4/16/2008	4/17/2008	10 Yr	5 Yr	Small	Right Ear	Right Ear	Normal	Normal	Good	10.0	Pre OP:25 Post OP:10	15.0	33.3	23.3	<30
46	F-25	3517	1/26/2008	1/28/2008	10 Yr	7Yr	Small	Right Ear	Right Ear	Normal	Normal	Good	16.1	Pre OP:25 Post OP:10	15.0	48.3	31.6	>30
47	M-20	21172	5/26/2008	6/3/2008	14 Yr	10 Yr	Large & Bilateral	Left Ear	Left Ear	Abnormal	Normal	Good	3.4	Pre OP:10 Post OP:05	5.0	35.0	31.6	>30
48	F-26	23523	6/11/2008	6/12/2008	20 Yr	7 Yr	Large & Bilateral	Left Ear	Left Ear	Normal	Polypoidal	Good	10.0	Pre OP:20 Post OP:10	10.0	38.3	28.3	<30
49	M-20	24656	6/19/2008	6/20/2008	15 Yr	5 Yr	Large	Left Ear	Left Ear	Normal	Polypoidal	Good	8.3	Pre OP:10 Post OP:05	5.0	28.3	20.0	<30
50	F-18	16310	4/24/2008	5/2/2008	7 Yr	6 Yr	Small	Left Ear	Left Ear	Normal	Normal	Good	8.4	Pre OP:25 Post OP:10	15.0	30.0	21.6	<30

TABLE No. 2: ANALYSIS OF THESIS RESULTS - GOVT GENERAL HOSPITAL KMC, KURNOOL, DEPT.OF ENT

Incidence of CSOM with Deafness	ENT - Dept	OP Census	38125	CSOM with Deafness	11343	%	29.7 %	Study period 2006-08	Study Size 50	Study Age Group	15-45 yrs	
Duration of Otorrhea	>5 yrs	32/50	64%	< 5yrs	18/50	36 %						
Deafness grading	Mild	29/50	58%	Moderate	70/50	34 %	Severe	4/50	8%			
Size of perforation	Large	21/50	42%	Small	29/50	58 %						
Eust. Tube function Dye test	Abnormal		54%	Normal		46 %						
	Abnormal		32%	Normal		68 %	Sethi A, Singh I,IJOHNS -2005 vl 57 Is4 Pg - 283					
Middle ear mucosa	Abnormal	21/50	42%	Normal	29/50	58 %						
			20%			80 %	Sethi A, Singh I,IJOHNS -2005 vl 57 Is4 Pg - 283					
Simple Mastoidectomy		21/50	42%			Nil						
Duration of deafness	>5yrs	7/50	14%	<5yrs	43/50	86 %						
Sex distribution	Males	18/50	36%	Females	32/50	64 %						
Age distribution	>25yrs	27/50	54%	<25yrs	23/50	46 %						
Graft uptake at 8 wks POP	Failure		22%	Good		78 %						
			24%			76 %	Sethi A, Singh I,IJOHNS -2005 vl 57 Is4 Pg - 283					
Belfast- rule of thumb	>30 db	31/50	62%	< 30 db	90/50	38 %						
Average hearing gain db	7.7 db											
	8.0 db	Palva & Ramsay: - Clinic oto 1995, 20: 329-35.										
Average air bone gap closure achieved db	9.75 db											
Serviceable hearing - air bone gap closure achieved db	15 db	6/50	12%	10 db	27/50	54 %	< 10 db	6/50	12 %	>30db	11/50	22 %
	Dr.Mahadevaiah		32%			26 %			17 %		09 %	
Middle ear risk Index	Mild Pathology	1to3		All cases								
MER : Normal =0, Mild Pathology = 1to3, Moderate = 4 to 6, Severe=7 to 12, (UNIFORM REPORTING PROTOCOL)												