

## Clinical And Audiological Assessment of Patients Undergoing Various Types of Tympanomastoid Surgeries

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### Abstract

**Objective:** To assess the hearing improvement and healing in the patients who have undergone various Tympanomastoid surgeries for different causes basing on the recording of the pure tone audiometry.

**Setting:** Study was conducted in the Department of ENT & Head Neck Surgery, VSS Medical College & Hospital, Burla, Odisha.

**Patients:** Study conducted in 260 patients, who presented with different complaints and undergone various tympanomastoid surgeries for varied tympanic membrane and middle ear pathologies. They were evaluated Pre operatively, Postoperatively and 3months follow up by clinical assessment and Pure tone audiometry for hearing. The hearing improvement was measured in terms of A-B gap and pure tone average.

**Results:** Out of 260 patients, 240 cases were followed up ; hearing improvement was found in 199 (82.91%) cases, no improvement in 11 (4.58%) cases, deterioration in 30 (12.5%) cases. 6-10 dB improvement in A-B gap was seen in maximum no of cases i.e in 98 (49.24%) cases whereas 11-15 d B improvement in 59 (29.64%)cases.

**Key words:** Tympanoplasty, ossicles , conductive hearing loss, audiometry, tympanomastoid surgeries.

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### I. Introduction

Among all the chronic ear diseases the commonest is CSOM. Chronic ear discharge is very frequent to be found, which creates much morbidity and mortality. It accounts for 28000 deaths & more than 20 lakh DALYs. The prevalence is very high in developing countries like India (>4%) and in the states like Odisha, Bihar, West Bengal. Low socioeconomic status, poor hygiene and overcrowding are the common predisposing factors for CSOM. Nearly 80% of the CSOM patients do have significant hearing impairment mostly of conductive type. The severity of the hearing loss depends on the size & position of the defect in tympanic membrane and the breach in the continuity of the ossicular chain as well as on the pathology of middle ear mucosa. Looking into the disease burden there is optimum progress in the medical and surgical interventions for CSOM. The cornerstones in this progress are newer antimicrobial agents, newer oto-imaging techniques and advanced surgical equipments. These days, the middle ear surgeries for CSOM are more of reconstructive than destructive. The surgical outcomes may be assessed in terms of hearing & healing of middle ear pathology.

Our study- "Clinical And Audiological Assessment Of Patients Undergoing Various Types Of Tympanomastoid Surgeries" Aims At Assessing the healing and hearing improvement in patients undergoing various tympanomastoid surgeries.

### II. Aims And Objectives

1. To assess the pre and post operative clinical status in CSOM cases planned for various types of tympanomastoid surgeries.
2. To do detailed hearing assessment in pre-op and 3months post-op follow up.
3. To assess the status of tympanic membrane, ossicular chain, middle ear & mastoid during and after tympanomastoid surgeries.
4. To analyse the outcome of the surgeries.

### **III. Materials & Methods**

Our study was carried out in the Department Of ENT and Head & Neck Surgery, VSS Medical College, Burla, Odisha, a tertiary care center in Eastern India. It included 260 consecutive patients of CSOM who were admitted with various presenting symptoms and various degrees of hearing loss. They were selected irrespective of age, sex & complications. We excluded those patients having middle ear neoplasm and those who had pathologies of external auditory canal e.g. tumors, active infections. We also excluded those who didn't give consent. After taking detailed history, they were thoroughly examined clinically.

Preoperative hearing assessment was done by using both serial tuning fork tests (256Hz, 512Hz, 1024Hz) and Pure Tone Audiometry. AB- gap & pure tone average (at 500, 1000, 2000 Hz) were calculated from the pure tone audiogram by ALPS Pure Tone Audiometer done in our department lab. All patients included in the study were subjected to imaging investigations like X-ray of mastoid, CT of temporal bone and MRI in selected cases. Then all the cases were subjected to surgery. The type of surgery was decided basing on the pathology found during the surgical procedure correlating with the clinical examination and imaging findings. In addition to healing, the aim of the surgical procedure was to preserve maximum possible hearing. The patients were treated preoperatively and post operatively with proper antibiotics. All the patients were followed up after 3 months. Hearing assessment was done by serial tuning fork test & A-B gap and gain/loss of air conduction in pure tone audiogram. Preoperative, intraoperative, postoperative & follow-up data were recorded in a systematic manner in a proforma. They were analyzed in respect to age, gender, clinical features, type of surgeries and outcome.

### **IV. Results**

Out of 260 patients we studied 166 (63.85%) were male and 94 (36.15%) were female showing male predominance (1.76:1). Maximum patients operated were in the range of 11-20 yrs i. e. 132 (50.77%) followed by the age range of 21-30yrs i.e. 70 (26.92%). In our series oldest patient was 48 years and youngest patient was 7 years old (TABLE-1). Among them 183 cases (70.38 %) belong to rural areas in comparison to 77 (29.61 %) patients from urban areas.

Ear discharge is the most common presenting complain seen in 252 (96.92%) patients followed by hearing loss which is seen in 231 (88.85%) cases. Otorrhoea alongwith deafness was the 3rd most common type of clinical presentation seen in 208 (80%) cases, followed by pain in and around ear in 74 (28.45%) cases and tinnitus in (21.54%) cases (TABLE-2). Out of 260 patients though 231 patients complained some degree of hearing impairment but on clinical and audiological assessment it was found that almost all of them were having some degree of hearing loss. 212(81.54%) cases were having pure conductive and 48 (18.46%) cases having mixed type of hearing loss. None of them had pure sensory loss.

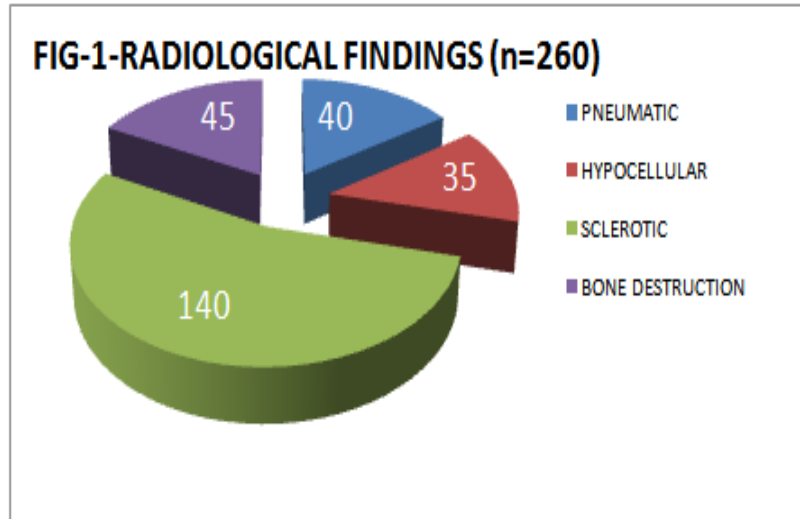
Most common type of perforation in tympanic membrane was central type found in 208 (80%) cases followed by attic in 22 (8.46%) cases, posterior superior retraction pocket in 10 (3.85%) cases and marginal in 6 (2.31%) cases (TABLE-3). X Ray Mastoid shows Sclerotic mastoid in 140(53.85%) cases, cellular mastoid in 40(15.38%)cases, decreased cellularity in 35(13.46%) cases and cavity was seen in 45(17.31%) (FIG-1) Intraoperatively, on microscopic examination of ear, cholesteatoma alone was found in 68 (26.15%) cases, cholesteatoma with granulation was found in 46 (17.69%) cases, granulation was found in 40 (15.38%) cases, healthy middle ear mucosa was found in 106 (40.76%) cases (FIG-2). The ossicles were intact in 118 (45.39%) cases. The ossicular erosion was most commonly found in incus in 68 (26.15%) cases, followed by the combination of incus and malleus in 46 (17.49%) and all 3 ossicles in 28 (10.77%) cases (FIG-3).

Among the various surgical procedures done, the Combined Approach Tympanoplasty was done in maximum 82 (31.53%) cases, followed by Type I Tympanoplasty done in 67 (25.76%) cases. Type II Tympanoplasty in 32 (12.30%), Type III Tympanoplasty in 26 (10%) cases. Modified Radical Mastoidectomy with Canal Wall Down technique alongwith Tympanoplasty was done in 28 (10.76%) cases (TABLE-6). Temporalis fascia was taken as graft material in most of the cases whereas tragal perichondrium and conchal cartilage were also taken in some cases. Post operative hearing assessment was done in 3months follow-up in 240 out of 260 patients because 20 patients didn't turn up for follow-up. Out of 240 patients, 199 (82.91%) cases showed hearing improvement, 30 (12.5%) cases showed hearing loss and 11 (4.58%) cases showed no change in hearing status (TABLE-6).. The improvement in AB-gap was maximum in the range of 6-10 dB seen in 98 (49.24%) cases followed by in 11-15 dB range in 59 (29.64%) cases (FIG-4).

The most common complication was post-mastoidectomy otorrhoea, which was observed in 23 (9.58%) cases. Post-mastoidectomy cavity problems seen in 21 (8.75%) cases, graft rejection in 11 (4.58%) , partial Graft uptake in 12 (5%) cases (TABLE-7).]

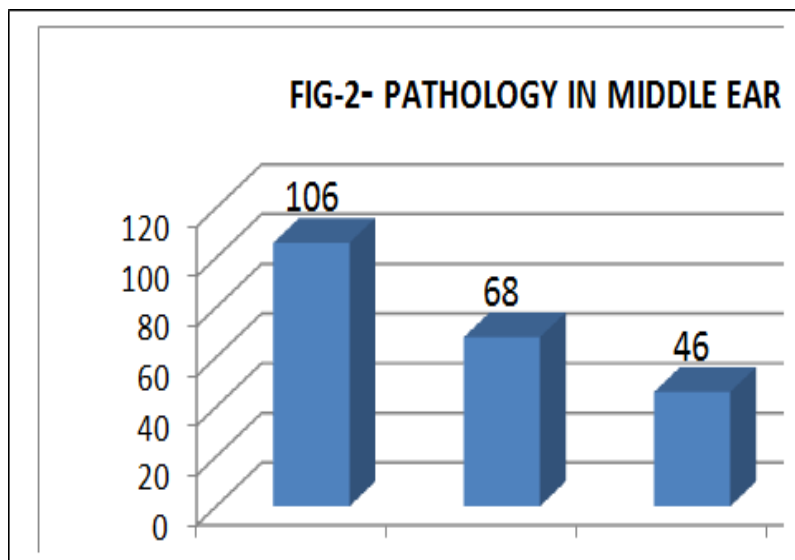
**Table-1-age & sex distribution in patients(n=260)**

Age (in years)	Patients operated for CSOM		PERCENTAGE
	MALE	FEMALE	
0-10	25(9.61)	16(6.15)	15.77
11-20	82(31.53)	50(19.23)	50.77
21-30	48(18.46)	22(8.46)	26.92
31-40	8(3.08)	4(1.54)	4.61
41-50	3(1.15)	2(0.77)	1.92
>50	0(0)	0(0)	0
TOTAL	166(63.85)	94(34.15)	100

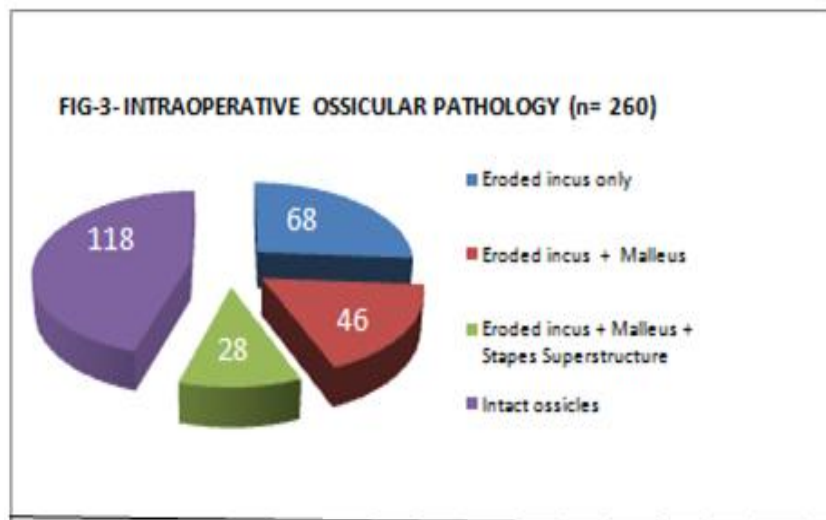


**Table-2-Clinical Presentations**

Chief Complains	No Of Patients	Percentage
Otorrhoea	252	96.92
Deafness	231	88.85
Deafness+ Otorrhoea	208	80
Tinnitus	56	21.54
Vertigo	10	3.85
Pain	74	28.45
Headache	34	13.08
Fever	42	16.15
Discharge Behind Ear	23	8.85
Swelling Behind Ear	32	12.3
Mass In The Ear	12	4.62



Type Of Perforation	No Of Cases	Percentage
Central	208	80
Small	72	27.69
Large	100	38.46
Subtotal	28	10.77
Total	8	3.08
Attic	22	8.46
-Retraction	16	6.15
-Perforation	6	2.31
Posterior Superior Retraction Pocket	10	3.85
Marginal	6	2.31
Tympanic Membrane Not Visible Due To Granulation And Polyp	14	5.38
Total	260	100



Rinne Test	256 Hz	512 Hz	1024 Hz	No Of Cases (Pre-Op)	%Age	No Of Cases (Post Op)	%Age
	-	+	+	8	3.07	63	26.25
-	-	+	81	31.15	123	51.25	
-	-	-	171	65.76	54	22.50	
<b>Total</b>			<b>260</b>	<b>100</b>	<b>240</b>	<b>100</b>	

A-B GAP		Pure Tone Average							
dB HL	Pre-op cases		Post-op cases		dB HL	Pre-op cases		Post-op cases	
	No	%	No	%		No	%	No	%
0-20	0	0	15	6.25	< 40	0	0	13	5.41
21-40	48	18.46	137	57.08	40-60	39	15.0	136	56.66
41-60	187	71.92	76	31.66	61-80	199	76.53	74	30.83
61-80	25	9.61	12	5.0	>80	22	8.46	17	7.08
<b>TOTAL</b>	<b>260</b>	<b>100</b>	<b>240</b>	<b>100</b>	<b>TOTAL</b>	<b>260</b>	<b>100</b>	<b>240</b>	<b>100</b>

Type Of Surgery	No Of Patients	No Of Patients Followed Up	Hearing Gain	Hearing Loss	No Change	% Of Patients Showing Hearing Gain
Type I Tympanoplasty	67 (25.76)	65	65	0	0	100
Type Ii Tympanoplasty	32(12.30)	29	25	2	2	86.20
Type Iii Tympanoplasty	26(10)	23	17	2	4	73.91
Mrm(Cwd) Tympanoplasty +	28(10.76)	26	15	6	5	57.69
Combined Approach Tympanoplasty	82(31.53)	79	77	2	0	97.46
Radical Mastoidectomy	25(9.64)	18	0	18	0	0
Total	260	240	199 (82.91%)	30 (12.5%)	11 (4.58%)	

Type Of Complication	No Of Patients	Percentage
Postmastoidectomy Otorrhea	23	9.58
Graft Rejection	11	4.58
Partial Graft Uptake	12	5
Postmastoidectomy Cavity Problem	21	8.75
Delayed Facial Palsy	0	0

### V. Discussion

Among the 260 patients, there is male preponderance showing M : F ratio of 1.76. Majority of them (202) were in the age group of 11-30 yr (77.69%). Among the presenting complaints, ear discharge was the commonest, found in 252 (96.92%) cases followed by hearing loss in 231(88.85%) cases. In 80% cases there were presence of both otorrhea and hearing loss. Similar observations were made by Gulati et al 2002 and Behera et al 2012. Almost all patients had hearing loss of different degrees. Among them, 212 (81.54%) had pure conductive and 48(18.46%) had mixed hearing loss. Conductive hearing loss was due to the local pathology of TM, middle ear mucosa and/or breach in the continuity of the ossicles. Long standing pathology had progressed to involve the inner ear to produce some degree of SNHL giving rise to mixed hearing loss. Conductive type was found in 77.5% cases by Behera et al 2012 and in 76% cases by Kaur et al 2003.

In our study , central perforation was found in 208 (80%) cases. Mastoid was sclerotic in 140(53.85%) , pneumatic in 40 (15.38%) and hypocellular in 35 (13.46%) cases. Our observation is comparable with Gulati et al and Behera et al. Intraoperative examination of the middle ear showed healthy mucosa in nearly 40% cases(106), whereas cholesteatoma in 68 (26.15%), cholesteatoma & granulation in 46 (17.69%) cases and granulation in 40 (15.38%) . This finding is similar to Wadhwa et al 2003 and Behera et al 2012. Ossicular affection was observed in 142 (54.61%) cases out of 260. Though incus was eroded in all 142 cases, only incus was eroded in 68 (26.15%) cases, whereas both incus and malleus were eroded in 46 (17.69%) cases and incus, malleus & stapes-superstructures were eroded in 28(10.77%) cases. These findings were at par with Quaranta et al 1995 and Behera et al 2012.

In serial tuning fork test (TABLE-4), Rinne test was negative for all 3 frequencies (256, 512, 1024Hz) in 171 (65.76%) out of 260 pre-op cases whereas in post-op follow up, it was negative in 54 (22.50%) out of 240 cases. In hearing assessment in terms of A-B gap, maximum cases were having hearing loss in 41-60 dB range .i.e. in 187 (71.92%) out of 260 pre-op cases, whereas in post-op follow up, maximum no of patients i.e. 137 (57.08%) out of 240 were having hearing loss in 21-40 dB range. When hearing assessment was done in terms of pure tone averages (TABLE-5), maximum no of pre-op patients i.e. 199 (76.53%) out of 260 had hearing loss in 61-80dB range whereas, maximum no of post-op patients i.e. 136 (56.66%) out of 240 had hearing loss in 40-60 dB range. This finding was obviously due to the significant improvement of hearing status after surgery. This observation is comparable to that of Gupta et al 2002 and Behera et al 2012. Out of 65 follow-up cases of Type I Tympanoplasty, all patients showed hearing improvement. Similar other studies like Raveendran et al 2000 found hearing improvement in 92.3% cases, Gupta et al found in 86.5% and Behera et al found in 100% cases. In regards to hearing gain, the next best procedure found to be combined approach tympanoplasty showing hearing gain in 77 (97.46%) out of 79 cases (TABLE-6). This gain was maximum 33.33% in 4 cases with AB gap closure 15dB, 63.29% cases had AB gap closure between 10-15 dB. Krishna et al 2002 found hearing gain in 75% cases. It is plausible that postop hearing gain is not significantly contributed by mastoidectomy.

Analysis of the overall hearing gain in our study, 199(82.91%) cases showed improvement, deterioration in 30(12.5%) cases and no change in hearing status in 11(4.58%) cases. If we analyze the previous studies chronologically, Ahad et al in 1979 studied 25 cases and found hearing gain in 60% cases. Taguchi et al in 1999 studied 37 cases and found improvement in 89.2% cases. Behera et al in 2012 studied 120 cases and found hearing gain in 81.66% cases. This increase in success rate over decades can be attributed to the introduction of newer imaging modality and newer microsurgical techniques. Postmastoidectomy otorrhoea was the commonest postop complication in our study seen in 23(9.58%) cases followed by postmastoidectomy cavity problems in 21(8.75%) cases. Graft rejection found in 11(4.58%) and partial graft uptake in 12 (5%) cases. This finding is comparable to Behera et al in which, otorrhoea found in 8.33%, cavity problem in 7.5%, graft rejection in 3.33% and partial uptake in 4.16% cases. Radical mastoidectomy is no more a very commonly followed approach these days. Still we had to do radical mastoidectomy in 25 cases who were having extensive cholesteatoma and granulation tissue so as to achieve a dry and safe ear. But in all the 18 cases who came for follow up, we found deterioration in hearing after surgery. This was also a similar observation by Behera et al.

## VI. Conclusion

There is a revolution in achieving higher success in hearing as well as healing in CSOM patients by employing various tympanomastoid surgeries. This can be attributed to introduction of newer antibiotics, antifungal in preop period, newer imaging techniques for preop assessment and newer surgical equipments and above all improvement in the skills of ENT surgeons. Hearing improvement is best (100%) achieved by Type I Tympanoplasty followed by Combined Approach Tympanoplasty (97.6%). But the decision regarding which surgical procedure to be employed entirely depends on the patients' clinical, otoimaging findings, hearing status and intraoperative findings. However as the famous quote says-“A stitch in time saves nine”, treatment or intervention in the early phase of CSOM will give better result as regards to hearing improvement as well as healing of the pathology.

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