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Original Research Article

Audiological profile of pre-operative and post-operative results in mucosal diseases of the ear: a comparative study

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ABSTRACT

Background: The Objectives of the study were to study pre-operative audiological results in mucosal diseases of ear; to study post-operative audiological results in mucosal diseases of ear and to compare pre-operative and post-operative audiological results in mucosal diseases of ear.
Methods: A prospective study was done on 60 patients presenting to out-patient department of Otorhinolaryngology and Head and Neck Surgery, S.Nijalingappa Medical College and H.S.K Hospital and Research Centre, Bagalkot from May 2018 to April 2020 with CSOM-mucosal disease. Audiological evaluation was done and compared using pure tone audiometry (Amplaid311TypeIEC645) before and after tympanoplasty with cortical mastoidectomy and mean air conduction (AC) threshold improvement and mean air-bone gap (AB gap) closure was analyzed.
Results: Out of 60 patients, 27(45%) patients had medium sized central perforation. Mean pre-operative AC threshold was 44.5958±10.64639 dB HL which improved to 30.100±10.41056 dB HL at 1month and 21.8125±8.6928 dB HL at 3months post-operatively which was statistically significant with $p<0.001$*. Mean AB gap closure at 1-month was 10.175±6.01098 dB HL and at 3-months was 11.0416±6.3458 dB HL.
Conclusions: AC threshold gain and AB gap closure at 1month and 3 months post-tympanoplasty with cortical mastoidectomy for CSOM-mucosal disease are significant. Hence surgery is main basic tool which results in improvement of audiological results in mucosal diseases of ear.

Keywords: Chronic suppurative otitis media, Mucosal disease, Air-bone gap, Pre and post-operative audiometry

INTRODUCTION

Chronic suppurative otitis media is inflammation of middle ear and mastoid with recurrent ear discharge through a chronic perforation of tympanic membrane and hearing loss. It is believed that chronic otitis media often starts with episodes of acute otitis media or otitis media with effusion.[1] Incidence of CSOM varies from 0.5% to 2.0% in developed countries, whereas in developing countries it ranges from 3% to 57%. In India incidence of CSOM ranges up to 30%, with a prevalence rate of 16/1000 population in urban and 46/1000 in rural areas.[2,3] In mucosal disease, the size of the perforation in the pars tensa is relevant to the hearing loss with thresholds of upto 30-40dB HL for which the patient appears to be adapted., but other important factors such as presence of granulation tissue, mucus, adhesions and tympanosclerosis are also important in determining the hearing level. Continuing activity of chronic suppurative otitis media results in damage to ossicular chain and potentially to the inner ear. The damage to ossicular chain particularly long process of incus is more commonly seen. The inflammatory reaction in the middle ear associated with granulation tissue is agreed to be the most likely factor for ossicular damage. With the loss of ossicular chain continuity there may be substantial increase in hearing impairment with thresholds

increasing upto 50-60 dB HL. Pure tone audiometry assesses the magnitude of conductive hearing impairment due to the disease. The degree of air-bone gap depends on (1) the size of the perforation, (2) erosion of ossicular chain, (3) significant granulation tissue around the ossicular chain which can reduce its mobility, (4) tympanosclerosis around the ossicular chain. Pure tone audiometry is done post-operatively to evaluate whether surgery may improve hearing levels and to rule out sensorineural hearing loss after surgery that can occur due to trauma to ossicular chain or drill-related injury to the ossicular chain. Surgery is indicated for recurrent or persistently active chronic otitis media and those with significant hearing loss.[4] Tympanoplasty with cortical mastoidectomy is defined as an operation to eradicate disease in both the mastoid process and middle ear cavity and to reconstruct the middle ear conducting mechanism with or without tympanic membrane grafting.[5]

METHODS

A non-randomized pre and post-operative study was done on 60 patients presenting to the out-patient department of Otorhinolaryngology and Head and Neck Surgery, S.Nijalingappa Medical College and H.S.K Hospital and Research Centre, Bagalkot from May 2018 to April 2020 over a period of 24 months with chronic suppurative otitis media(CSOM)-mucosal disease.

Inclusion criteria

Patients of all age group and sex with otorrhea persisting for more than 3 months with diagnosed CSOM-mucosal disease and patients willing to give informed consent for the study.

Exclusion criteria

Patients not willing to give informed consent and patients with CSOM- squamosal disease or intra-cranial complications were excluded from the study.

Sample size

Sample size calculation was done using open epi ver 2. At 95% confidence interval and 80% power of the study

Sample size was calculated according to study conducted by Atal A et al. 2019 in which post-operative mean air conduction threshold at 3 months is 26.77±3.48 dB HL with 5% decrease in the anticipated mean of the study group.[6]

Sample size was calculated using formula:

$$n = \frac{2(Z_{\alpha} + Z_{(1-\beta)^2})\sigma^2}{d^2}$$

With a drop-out rate of 10% to follow-up.
Total sample size= 53 approximated to 60.

All patients underwent detailed clinical, otoscopic, microscopic examination. Hearing assessment was done by pure tone audiometry (PTA) in all patients using amplaid 311 Type 1 IEC 645 audiometer pre-operatively. All routine investigations including blood investigations, pus culture and sensitivity, X-ray mastoid Schuller's view were done. All the patients underwent tympanoplasty (either type 1, type 2 or type 3) with cortical mastoidectomy. Hearing assessment was also done post-operatively using PTA at 1 month and 3 months. Patient demographics, presentation, clinical course, hearing assessment pre-oeratively, intraoperative findings and postoperative hearing outcomes at 1 month and 3 months were analyzed and presented in tables and figures.

Data collected was analysed using SPSS software version 22. Means and Standard deviations were applied and simple proportions were calculated for the descriptive variables and ANOVA test was used to compare the means.

RESULTS

Mean age of presentation was 27.23±9.826 years. Youngest patient in the study was 14 years and oldest patient in the study was 59 years. Patients between the age groups of 10-30 years were more commonly seen in the study.

Out of the 60 patients 26(43.33%) were males and 34(56.66%) were females. The disease was seen in 22 patients (36.66%) in the left ear, 18(30%) in the right ear and bilateral in 20(33.33%) cases.

Ear discharge and decreased hearing was the main presenting symptom seen in almost all the patients. Ear discharge was unilateral in 40 patients and bilateral in 20 patients. Other presenting symptoms such as otalgia was seen in 12(20%) patients, decreased hearing in 48(80%) patients and tinnitus was seen in 26(43.33%) patients.

Perforations in the pars tensa seen most commonly was medium sized central perforation in 29(48.33% of cases), followed by subtotal perforation in in 13(21.66%) and large sized central perforation in 12(20%) cases (Table 1).

AC threshold levels of the operated ear pre-operatively and post-operatively at 1 month and 3 months are shown in table 6. 24 (40%) of cases had pre-operative AC threshold of 26-40 dB HL and 11(18.33%) cases had AC threshold of 56-70 dB HL indicating involvement of ossicles. Improvement in AC thresholds is seen post-operatively with 26(43.33%) patients having AC threshold of 0-25 db HL at 3 months post-operatively. Mean pre-operative AC threshold levels in the operated ear is 44.5958±10.64639 dB HL which improved to 30.1000±10.41056 dB HL at 1 month post-operatively and to 21.8125±8.6928 dB HL at 3 months post-operatively which was statistically significant with $p<0.001$. Mean AC threshold gain was 14.4958±6.376016314 dB HL at 1

month and 15.9583±6.74696521 dB HL, at 3 months post-operatively.

Mean AB gap pre-operatively was 24.2083±8.0974 dB HL which improved to 14.0417± 6.31067 dB HL at 1 month and 13.1042±5.22021 dB HL at 3 months post-operatively which was statistically significant with a p value of <0.001. Mean AB gap closure at 1 month was 10.175±6.01098 dB HL and 11.0416±6.3458 dB HL at 3 months post-operatively.

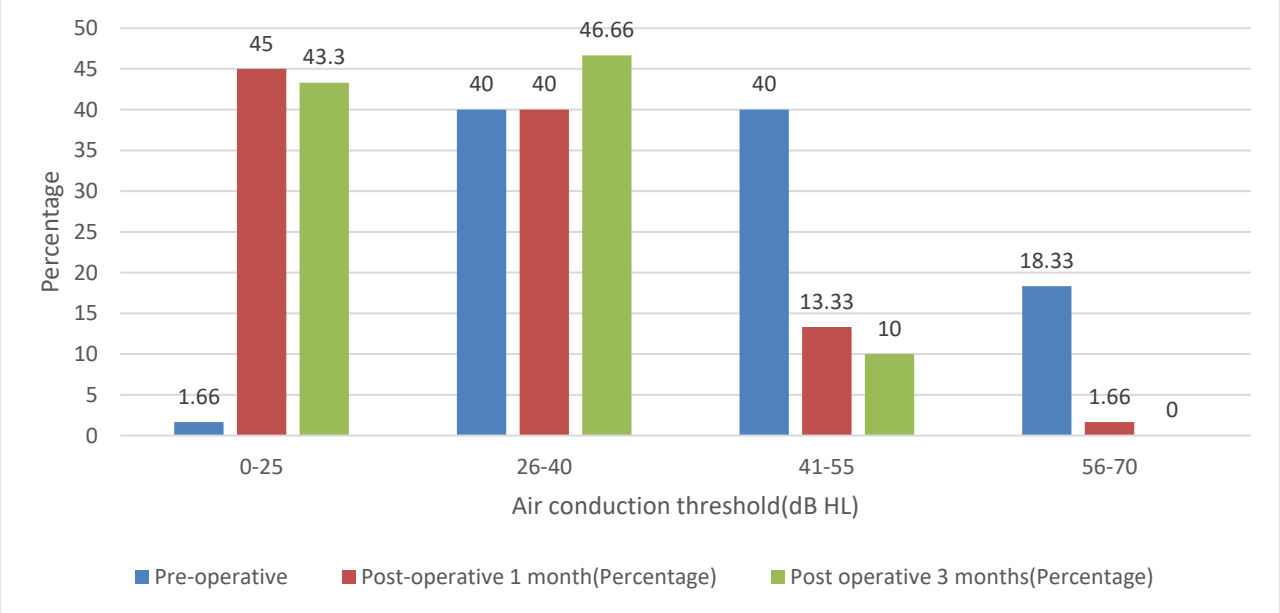

Figure 1: Air conduction thresholds.

Table 1: Size of perforation.

Size of perforation	Frequency	Percentage
Small central	6	10
Medium central	29	48.33
Large central	12	20
Subtotal	13	21.66
Total	60	100

Table 2: Air conduction threshold level pre-operative and post-operative at 1 month and 3 months.

Air conduction threshold(dB HL)	Frequency		
	Pre-operative	**Post-operative 1 month**	**Post-operative 3 months**
0-25	1(1.66%)	27(45%)	26(43.3%)
26-40	24(40%)	24(40%)	28(46.66%)
41-55	24(40%)	8(13.33%)	6(10%)
56-70	11(18.33%)	1(1.66%)	0
Total	60	60	60

Table 3: Hearing gain.

Air threshold levels	Mean (dB HL)	SB (dB HL)	P value
Pre-operative	44.5958	10.64639	<0.001*
Post-operative 1 month	30.1000	10.41056	
Post-operative 3 months	21.8125	8.6928	
Mean air threshold gain (1 month)	14.4958	6.376016314	
Mean air threshold gain (3 months)	15.9583	6.74696521	

Table 4: Mean air bone gap closure.

Air bone gap	Mean (dB HL)	SD (dB HL)	P value
Pre-operative	24.2083	8.0974	<0.001*
Post-operative 1 month	14.0417	6.31067	
Post-operative 3 months	13.1042	5.22021	
Mean air-bone gap closure (1 month)	10.175	6.01098	
Mean air-bone gap closure (3 months)	11.0416	6.3458	

Table 5: Comparison of size of perforation with the AC thresholds.

AC thresholds	Small Sized perforation (Mean±SD)	Medium sized perforation (Mean±SD)	Large sized perforation (Mean±SD)	Subtotal perforation (Mean±SD)
Pre-op AC threshold	38.3750±6.2406	41.7759±10.23744	48.5208±12.32397	50.1346±8.34517
Post-op AC threshold 1 month	27.7083±7.08240	26.9224±9.52349	34.7917±13.8352	33.9615±7.70947
Post-op AC threshold 3 months	26.6667±5.62731	25.4310±8.87823	33.0208±9.37626	33.4615±7.11062
P-value (Friedmann test)	0.04*	<0.001*	<0.001*	<0.001*

DISCUSSION

In a study done by Atal et al out of 60 cases, 32 patients were male and 28 were female with age group varying between 12 to 50 years, which is similar to our study.[6] In a study done by Mahajan et al, out of the 50 patients with mucosal disease most common presentations were ear discharge and decreased hearing seen in 98% patients, whereas tinnitus was seen in 21(42%) patients which is similar to our study.[7]

The study done by Batni et al, out of 100 patients, it comprised of 48% cases of unilateral left sided disease, 34% of unilateral right sided disease and 18% cases of bilateral disease, similar to our study.[8] Maharjan et al observed that patients having larger perforations (involving all four quadrants) showed greater hearing loss with large air bone gap. Smaller perforations involving single quadrant showed lesser loss. They found significant relationship between hearing loss and size of perforation, with strong trend for hearing loss to increase as the perforation size increases.[9]

In our study perforations in the pars tensa seen most commonly was medium sized central perforation in 27 (45% of cases), followed by subtotal perforation in in 13(21.66%) and large sized central perforation in 12 (20%) cases and showed similar results to the study by Maharjan. 24 (40%) of cases had pre-operative AC threshold of 26-40 dB HL mild conductive hearing loss and 24 (40%) cases had AC threshold of 41-55 dB HL moderate conductive hearing loss and 11 (18.33%) cases had AC-threshold of 56-70 dB HL moderately severe conductive hearing loss indicating involvement of ossicles. In a study done by Atal A, 70% patients had mild conductive hearing loss and 30% patients had moderate conductive hearing loss.[6]

In a study done by Kabdwal et al out of the 61 patients with mucosal disease 23 patients had minimal conductive hearing loss, 28 patients had mild conductive hearing loss and 7 patients had moderate conductive hearing loss.[10]

Tympanoplasty type 1 was done in majority of the patients i.e. 51 patients along with cortical mastoidectomy. Type 2 tympanoplasty was done in 5 patients and type 3 tympanoplasty was done in 4 patients along with cortical mastoidectomy.

In our study, we have used AC threshold gain and AB gap closure as a measurement of hearing improvement. In a study done by Atal A et al, average pre-operative air threshold in 60 cases of CSOM was 39.16±2.82 dB. Postoperatively, at 3rd month and 6th month of surgery average air threshold in 60 cases was 26.77±3.48 dB and 22.55±5.08 dB respectively. Average pre-operative Air Bone gap in 60 cases of CSOM was 28.24±3.58 dB. Postoperatively, at 3rd month and 6th month of surgery average Air- Bone gap in 60 cases was 16.44±3.83 dB and 12.00±5.56 dB respectively. Average Air- Bone closure of 16.04±6.40 dB was observed in their study.[6] In our study mean pre-operative AC threshold levels in the operated ear is 44.5958±10.64639 dB HL which improved to 30.1000±10.41056 dB HL at 1 month post-operatively and to 21.8125±8.6928 dB HL at 3 months post-operatively which was statistically signifant with p<0.001. Mean AC threshold gain was 14.4958±6.376016314 dB HL at 1 month and 15.9583±6.74696521 dB HL. At 3 months post-operatively. Mean AB gap pre-operatively was 24.2083±8.0974 dB HL which improved to 14.0417±

6.31067 dB HL at 1 month and 13.1042±5.22021 dB HL at 3 months post-operatively which was statistically significant with a p value of <0.001. Mean AB gap closure at 1 month was 10.175±6.01098 dB HL and 11.0416±6.3458 dB HL at 3 months post-operatively.

Similarly, Vybhavi MK and Mudhol RS conducted an RCT in which the mean pre- and post-operative air-bone gap was 32.27±11.53 dB and 23.75±9.91 dB respectively and with improvement in air-bone gap of 8.52±9.13 dB following tympanoplasty with cortical mastoidectomy.[11] Preoperative mean Air conduction (for speech frequencies) in a study by Saha et al was 44.68 dB and post operatively it was 34.56 dB. A mean gain of Air threshold of 10.118 dB was achieved and after tympanoplasty type I (6-12 weeks) closure of A-B gap of 5.5294 dB was achieved.[12]

Size of perforation was compared with the AC thresholds, which showed significant improvement in AC threshold from pre-op to post-operatively in small, medium, large and subtotal perforations with p value of 0.004 for small sized perforation and <0.001 for medium, large and subtotal perforations, which suggests surgery helps in improvement of mean AC threshold in all sizes of central perforation and hence surgery is the main basic tool which results in improvement of audiological results in mucosal diseases of ear.

CONCLUSION

AC threshold gain and AB gap closure at 1 month and 3 months post tympanoplasty with cortical mastoidectomy for chronic suppurative otitis media (CSOM)-mucosal disease are significant. Surgery gives good improvement in hearing in mucosal diseases of ear irrespective of the size of perforation. Hence surgery is main basic tool which results in improvement of audiological results in mucosal diseases of ear.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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