

Assessment of Hearing by Pure Tone Audiometry in Patients with Chronic Otitis Media Undergoing Myringoplasty

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ABSTRACT

BACKGROUND

Chronic Otitis Media is a permanent abnormality of the pars tensa or flaccida, most likely a result of earlier acute otitis media, negative middle ear pressure or otitis media with effusion.

METHODS

In our study, we evaluated the hearing status by means of a Pure Tone Audiometry in patients with inactive mucosal chronic otitis media undergoing myringoplasty with a temporalis fascia underlay procedure.

RESULTS

At the end of the study, the mean improvement in the air bone gap was found to be 7 dB (36.16%) and the mean improvement in the air conduction threshold was found to be 10 dB (25.23%). It was noted that there is a significant hearing improvement.

CONCLUSIONS

A diseased ear which is diagnosed early and operated early produces better results than a long-standing diseased ear. Also, a long-standing disease produces more hearing loss because of reasons like bone erosion and mucosal change.

KEYWORDS

Chronic Otitis Media, Central Perforation, Conductive Hearing Loss, Myringoplasty, Pure Tone Audiometry

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BACKGROUND

Chronic Otitis Media is one of the commonest conditions encountered in the Outpatient Department of Otorhinolaryngology. The most common presenting complaints include hearing loss and ear discharge. Chronic otitis media is divided into two types mucosal disease and squamous disease. Mucosal disease is further classified as Chronic otitis media mucosal inactive type and chronic otitis media active mucosal type.¹ Squamous disease is classified as Chronic otitis media squamous inactive type and chronic otitis media active squamous type.¹ Inactive mucosal type of Chronic otitis media with permanent perforation of pars tensa is taken up for our study. The perforation of the tympanic membrane without other lesions of the middle ear transformer has two different effects on hearing- Loss of effective vibrating area of the tympanic membrane and Loss of sound protection to the round window. The larger the perforation, the greater the hearing loss. Myringoplasty is a surgical procedure in which the reconstruction is limited to closure of the Tympanic Membrane perforation. It is now accepted that the connective tissue temporalis fascia graft, if used, has the highest take rate and success rate. The total graft acceptance rate was poor in cases where skin graft was used and quantitative results of myringoplasty were best with Temporalis fascia.² Temporalis fascia is an excellent graft material which gives high success rate as far as closure of tympanic membrane perforation and improvement of hearing is concerned.³ Hearing assessment by pure tone audiometry is done before and after the surgery.

We wanted to evaluate the hearing status by means of pure tone audiometry in patients with dry mucosal chronic suppurative otitis media undergoing myringoplasty with a temporalis fascia underlay procedure.

METHODS

This is a prospective study carried out in the Department of Otorhinolaryngology and Head & Neck Surgery, Meenakshi Medical College Hospital & Research Institute, Kanchipuram among 60 patients. All the patients were put through a detailed and complete clinical examination of Ear, Nose and Throat. Special attention was given to otoscopic examination, tuning fork tests & audiometry. The hearing level was recorded with a pure-tone audiometer. The pre-operative audiogram was compared with post-operative audiogram to know the hearing improvement.

Inclusion Criteria

1. Perforation was of central type.
2. Mucosal type Chronic Suppurative Otitis Media.
3. Dry ear for at least 5 weeks pre-operatively.
4. Pure conductive deafness by audiometry.
5. Good cochlear reserve.
6. Absence of granulation, oedema, hyperaemia or polyp.
7. Eustachian Tube was patent.

Exclusion Criteria

1. Evidence of septic foci in nasopharynx, paranasal sinuses or throat.
2. Squamous type Chronic Suppurative Otitis Media.
3. Patients with complications of Chronic Suppurative Otitis Media.
4. Patients with Mixed or pure Sensorineural Hearing Loss in the affected ear.
5. Disease present in the only hearing ear.

Parameters for Assessment

1. Duration of the disease
The duration of the disease is divided into the following categories to aid in a detailed study-
 - <1 Year
 - 1-2 Years
 - 2-3 Years
 - >3 Years
2. Size of the Perforation.
Based on the size and location of the tympanic membrane quadrants (or) complete absence of Pars tensa with intact annulus.
3. Success of Surgery
After a period of 3 months, all patients were assessed and if there was no evidence of any residual perforation (small or big), the surgical procedure was considered to be a success.

Procedure

Under general anaesthesia and under aseptic precautions patient was placed in a supine position with the head turned towards the normal side. Parts were painted and draped. Infiltration of 2% lignocaine with 1: 100000 adrenaline was given on the post aurial region, temporal region and in the four quadrants of the external auditory canal using a snugly fitting aural speculum. Temporalis fascia graft was harvested. Tympanic membrane and middle ear were visualized under a microscope or endoscope. The following sub types were noted.⁴

- Small - Perforation involving only one quadrant.
- Moderate - Perforation involving up to two quadrants.
- Large - Perforation involving up to three quadrants.
- Subtotal - Perforation involving more than three

Freshening of the margin of perforation was done using a straight pick, and the margin remnant was removed using alligator forceps. An incision was given from 12 o'clock to 6 o'clock position which is called as the Rosen's transcanal incision. Tympanomeatal flap was elevated up to the annulus. In case of a narrow canal, canaloplasty was done. The flap is elevated till the handle of malleus, and it is pushed anteriorly until the handle of malleus was seen. Skeletonisation of the handle of malleus was done. The graft was placed according to the underlay technique, medial to tympanic membrane remnant and handle of malleus. The middle ear was packed with gel foam, and the tympanomeatal flap was repositioned. The external auditory

canal was packed with gel foam, and framycetin impregnated wick. Graft wound was closed using 3-0 silk.

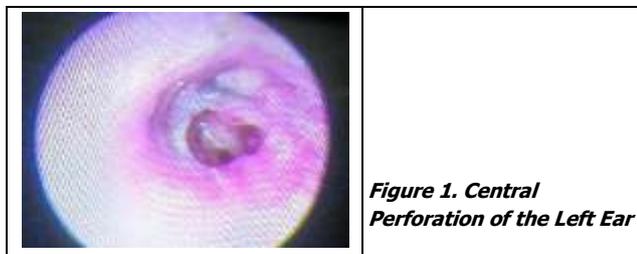


Figure 1. Central Perforation of the Left Ear

A firm mastoid bandage was applied. Post operatively the patient was put-on broad-spectrum antibiotics, analgesics and antihistamines. The mastoid bandage was removed after 24 hours following which a simple dressing was applied twice a day after cleaning the wound with Betadine and Normal Saline. The patient was discharged after 3-5 days once it was confirmed that there is no infection in the EAC or post aural wound. One week after the surgery, sutures of post aural wound were removed. Two weeks after the surgery, the ear was examined and the gauze from the EAC was removed. Gel foam pieces (if present) were removed gently. If there was no infection and the graft had taken well, Rinne’s Test and Pure Tone Audiometry were done to look for any improvement in the hearing status. Thereafter, patients were advised to come for follow up after 3 months, 6 months and 1- year duration. In this study, the post-operative audiogram taken after a period of 3 months or 12 weeks to assess the status of hearing and condition of the ear. Results were analysed with Paired Student T - Test.

RESULTS

Perforation	Number	Percentage
Small	19	31.7
Medium	20	33.3
Large	12	20
Subtotal	9	15
	60	100

Table 1. Distribution Based on Size of Perforation

Reperforation	Number	Percentage
Yes	9	15
No	51	85
	60	100

Table 2. Distribution Based on Success Rate

Operated Ear	Number	Percentage
Right	38	63.3
Left	22	36.6
	60	100

Table 3. Distribution Based on Operated Ear

Air Bone Gap	Mean	S.D.	Standard Error Mean
Pre-Operative	21.115	7.6999	0.9941
Post-Operative	13.463	6.6373	0.8569

Table 4. Paired T Test Sample Statistics of Changes in Air Bone Gap in Audiogram before and after Surgery

Air Conduction	Mean	S.D.	Standard Error Mean
Pre-Operative	43.048	12.7252	1.6428
Post-Operative	32.190	9.3581	1.2081

Table 5. Paired T Test Sample Statistics of Changes in Air Conduction Threshold in Audiogram before and after Surgery

	Correlation	Significance
Pre-Operative Air Bone Gap vs Post-Operative Air Bone Gap	0.812	0.001
Pre-Operative Air Conduction vs Post-Operative Air Conduction	0.936	0.001

Table 6. Paired Sample Correlations of Air Bone Gap and Air Conduction before and after Surgery

	Paired Differences				t	df	
	Mean	S.D.	Standard Error Mean	95% Confidence Interval of The Difference			
				Lower			Upper
Pre-Operative Air Bone gap to Post-Operative Air Bone Gap	7.6517	4.5068	0.5818	6.4874	8.8159	13.151	59

Table 7. Paired Sample Correlations of Air Bone Gap before and after Surgery

	Paired Differences				t	df	
	Mean	S.D.	Standard Error Mean	95% Confidence Interval of the Difference			
				Lower			Upper
Pre-Operative Air Conduction to Post- Operative Air Conduction	10.8583	5.1581	0.6659	9.5259	12.1908	16.306	59

Table 8. Paired Sample Correlations of Air Conduction Threshold before and after Surgery

DISCUSSION

In this study, the age of the patient who underwent surgery varied from 15 years to 60 years. The average age of the patient at the time of surgery was about 34.61 years. In the J. B. Booth’s series, the youngest patient undertaken in the study was 8 years and oldest was 67 years with an average of 33.7 years.⁵ This means that except for very young and very old patients, all age groups were operated. The patients in the prime of their life i.e., between 15-40 years are more likely to seek advice and undergo operations.

Dov. Ophir, Porat, Marshak of Israel conducted a series of Myringoplasties in paediatric population. They concluded that myringoplasty has a good chance of success rate in children regardless of the age.⁶ Lorenzo, Berta, Capaccio and Zaghis conducted a retrospective study of the anatomical and functional results of 41 myringoplasties in children aged between 8 years to 14 years (mean 10.8 years).⁷ The overall success rate was 80.5% after a mean follow-up of 39 months with a mean audiological improvement of 11 dB. They showed that the surgical outcome was not affected by the patients age, size/site of perforation, surgical technique or status of contralateral ear. They also stated that the status of middle ear i.e. presence of dry ear, significantly improves the surgical outcome.

The gender of the patient and the operated ear was found to be insignificant in the study when the same procedure is performed with the same precautions. M. Ilangovan (1986) of Kerala has achieved 97.5% of success using double layered graft for total and subtotal perforation.⁸ Alan, Gibb and Chang Sing-Kiat showed a success rate of 92.4% for small perforation and 87% for larger perforation.⁹ It is generally accepted that hearing loss increase is with increase in the size of perforation and hearing loss is generally less marked in anterior than posterior perforations.

Sharankumar Shetty (2012) concluded in his study that the site of perforation affects the degree of hearing loss. Big central and central malleolar perforation were found to be having a greater hearing loss than other perforation sites.¹⁰ In this study, 19 cases had a small central perforation where the hearing loss was between 23 - 43 dB, 20 cases had a moderate central perforation where the hearing loss was between 30-56 dB, 12 cases had a large central perforation with hearing loss between 45-68 dB and 9 had a subtotal perforation with hearing loss between 48-68 dB.

Mohammed Radeef Dawood (2017) reported that the mean AC hearing gain was 22.373 dB and mean ABG reduction was 20.733 dB. The maximum AC hearing gain was 25.93 dB for subtotal perforation and 26.24 dB for big central perforation, and the maximum ABG reduction was 25.63 dB for subtotal perforation and 24.20 for big central perforation. Mean AC hearing gain was 23.01 dB, 22.72 dB, and 21.39 dB for 500, 1000, and 2000 Hz, respectively, and mean ABG reduction was 21.52 dB, 20.79 dB, and 19.86 dB for 500, 1000, and 2000 Hz, respectively. Patient age, gender, mastoid status and aetiology did not seem to have any bearing on postoperative hearing improvement.¹¹

Girish Thakur et al. (2015) reported that the mean A-B closure for central, marginal and attic perforation were 13.93 dB, 5.41 dB and 4.36 dB respectively. 67 cases (55.83%) showed hearing improvement of 0 - 10 dB, 39 cases (32.50%) showed 11 - 20 dB and 14 cases (11.67%) reported audiological gain between 21 - 30 dB.¹² Mohana Karthikeyan (2017) reported that out of 50 patients, 42 (84%) had successful graft uptake. Out of these 42 patients, 11 (26.19%) patients had 0 - 25 dB Air Bone Gap, 18 (42%) patients had 26 - 40 dB Air Bone Gap and 13 (30.95%) patients had 40 - 50 dB Air Bone Gap preoperatively. Post operatively out of these 42 patients, 27 (64.28%) patients had 0 - 25 dB Air Bone Gap, 13 (30.95%) patients had 26 - 40 dB Air Bone Gap and 2 (4.76%) patients had 40-50 dB Air Bone Gap.¹³

Arvind Sangavi (2015) reported that the pre-operative Air Bone gap increased as the size of perforation increased and that there was no worsening of hearing or sensorineural loss in any case postoperatively.¹⁴ R.J. Bennett (1971), in reviewing the post-operative hearing of his 85 type I tympanoplasties reports that 72 cases (84.3%) achieved socially adequate hearing level post operatively. There was marginal improvement in 12 cases (14.1%) and 1 case had post-operative worsening of hearing.² In this study, the mean improvement in the Air Bone Gap was found to be 7 dB (36.16%) and the mean improvement in the Air

Conduction Threshold was found to be 10 dB (25.23%). Regarding the graft take rate, the results vary according to technique and graft material used. According to various literatures, graft take rate is maximum when Temporalis fascia is used.

In R.J. Bennett's series (1971), the graft take rate was 93.3% and total failures were 0.55% cases.² Alan, Gibb and Chang Sing-Kiat showed that success rate was highest with Temporalis fascia 88.2%, and vein 77.8% while miscellaneous (fat, connective tissue, periosteum, perichondrium) was 82.6%.⁹ In this study we used only underlay technique and Temporalis Fascia as the graft with a success rate of 85%. Certain studies showed that achievement of socially acceptable hearing was better with underlay than overlay.¹⁵ The mean air bone gap pre-operatively for a diseased ear of less than one-year duration was found to be 14.82 dBHz and post operatively it was found to be 8.79 dBHz, an improvement of 40.68%. The same values for a diseased ear between 1 - 2 years were found to be 21.17 dBHz and 13.76 dBHz, an improvement of 35%. The values for a diseased ear between 2 - 3 years were found to be 21.56 dBHz and 12.72 dBHz, an improvement of 41%. The corresponding values for a diseased ear of more than 3 years were found to be 31.08 dBHz and 23.01 dBHz, an improvement of 25.96%.

The mean air conduction threshold pre-operatively for a diseased ear of less than one-year duration was found to be 31.93 dBHz and post operatively it was found to be 24.49 dBHz, an improvement of 23.3%. The same values for a diseased ear between 1 - 2 years were found to be 42.3 dBHz and 31.64 dBHz, an improvement of 25.2%. The values for a diseased ear between 2 - 3 years were found to be 43.84 dBHz and 32.19 dBHz, an improvement of 25.45%. The corresponding values for a diseased ear of more than 3 years were found to be 64.13 dBHz and 48.56 dBHz, an improvement of 24.29%.

Thus, a diseased ear which is diagnosed early and operated early produces better results than a long-standing diseased ear. Also, long-standing disease produces more hearing loss because of reasons like bone erosion and mucosal change.

CONCLUSIONS

Myringoplasty for the closure of a perforation in patients with dry mucosal type of chronic suppurative otitis media is an effective procedure and can produce good results in terms of hearing improvement, closure of defect and psychosocial betterment if diagnosed and treated early.

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