

Influence of Tympanosclerosis on Graft Uptake and Hearing Status in Patients Undergoing Underlay Myringoplasty

Prasad PL,¹ Bhattarai H²

¹Department of ENT, Head and Neck Surgery, National Academy of Medical Sciences, Bir Hospital, Kathmandu, ²Department of ENT, Head and Neck Surgery, Tribhuvan University Teaching Hospital, Kathmandu, Nepal

ABSTRACT

Background: To assess the influence of tympanosclerosis on graft uptake and hearing status in patients undergoing underlay myringoplasty.

Methods: Patients ≥ 12 years of age with the diagnosis of chronic suppurative otitis media tubo-tympanic type were included in this study. All patients participated in the study had undergone pre and postoperative pure tone audiometric evaluation and were divided into two groups, a study and a control, depending on the presence or absence of tympanosclerotic plaques. All patients underwent underlay myringoplasty and follow up was done after 10 weeks to note graft uptake and postoperative hearing evaluation.

Results: Graft uptake was noted to be 96.1% in study group and 94.9% in control group. Similarly, graft uptake was noted in 96.36% where tympanosclerotic plaques were completely removed and in 95.23% where tympanosclerotic plaques were either partially removed or left as such. Post Operative average hearing gain in study and control group was 12.1dB and 15.9dB respectively. While comparing postoperative hearing gain in cases where tympanosclerotic plaques were completely removed to those in whom tympanosclerotic plaques were either completely removed or left as such, it was 12.31dB in former and 13.67dB in later group, which was statistically non significant with P value of 0.83.

Conclusions: Tympanosclerotic plaques, if removed as far as practicable, has no effect on either graft uptake and post operative hearing results in patient under going underlay myringoplasty.

Key words: chronic suppurative otitis media tubo tympani type, puretone, audiogram, tympanosclerosis.

INTRODUCTION

Chronic suppurative otitis media (CSOM TT) is one of the commonest ear diseases in developing countries. Its prevalence in Nepal is 7.2%.¹ So far there is no universally accepted definition of tubo-tympanic disease. CSOM tubo-tympanic is a stage of ear disease in which there

is chronic infection of the middle ear cleft or non intact tympanic membrane and discharge, otorrhoea for at least preceding two weeks.²

CSOM TT is classified into tubo-tympanic and attico-antral disease.³ It is a benign chronic middle ear infection where there is no danger of developing intracranial

Correspondence: Dr. PL Prasad, Department of ENT, Head and Neck Surgery, National Academy of Medical Sciences, Bir Hospital, Kathmandu, Nepal. Phone: 9803471236, Email: prasadpannal@yahoo.com

complications and is characterized by perforation in the tympanic membrane and infection is limited to the middle ear mucosa.

CSOM TT of longer duration is associated with a condition called tympanosclerosis which incidence varies from 3-43%.⁴⁻⁷ It is characterized by hyaline degeneration of fibrous layer of tympanic membrane and middle ear mucosa.^{8,9}

The exact aetiopathogenesis of this condition is unknown. Different hypothesis regarding its development are repeated middle ear cleft infection, immunological response of lamina propria of tympanic membrane and middle ear mucosa to its infection.

METHODS

This prospective longitudinal study was done from December 2004 to June 2006 at the Department of ENT, HNS, Tribhuvan University Teaching Hospital, Maharajgunj Kathmandu Nepal. Ethical approval and patient consent was taken. Patient aged 12 years or more with either sex having chronic suppurative otitis media - tubo-tympanic (inactive stage) already planned for myringoplasty, were included in the study. The cases of tubo-tympanic disease in active stage, having sensory neural hearing loss and revision myringoplasty were excluded from the study.

One day prior to surgery, all patients underwent pre operative work for otoscopic evaluation of ear. Pure tone audiogram (PTA) for air conduction threshold of hearing taking an average of 500, 1000, 2000 HZ frequencies was done by a senior audiologist in a sound treated room. PTA done one week prior to surgery by the same audiologist was also taken into consideration. Postoperative PTA to evaluate air conduction hearing threshold was performed after 10 weeks of operation. Total 176 patients were included in the study and divided into a study and a control group depending on the presence and absence of tympanosclerosis respectively. Total number of patients in study group was 81 and 95 in control group.

All patients underwent underlay myringoplasty by consultant otologists, mostly by permeal approach and were discharged on fifth day of operation with an advice of oral Amoxicillin for total of 10 days. Ear pack removed on 10th day followed by Betnor ear drop and aural precautions. In some of the cases surgery was done on out patient department (OPD) basis as well. All patients were strictly advised to come for follow up at 10th week of operation. During operation, extent of tympanosclerotic plaques in tympanic membrane were noted but those in middle ear cavity were ignored and not included in the study. During procedure, tympanosclerotic plaques were

excised as much as practicable and tympanic membrane perforation grafted with temporalis muscle fascia.

On follow up immediately after ten weeks of operation, tympanic membrane was evaluated otoscopically for graft uptake. The grafted ear with pus and residual perforation was considered as graft failure. PTA was done to know the post operative air conduction hearing threshold taking an average of 500, 1000, 2000 HZ frequencies. PTA was done by the same audiologist if not, by other senior audiologists.

RESULTS

During one year and six months period, total number of myringoplasty done at the centre was 349, out of which 257 were the patients of CSOM tubo-tympanic disease without tympanosclerosis and 92 with tympanosclerosis.

Total 176 patients were included in the study among which 95 were enrolled as control group and 81 as study group. Follow up rate in control group was 78 (82.10%) and 76 (93.82%) in study group. The average age of patients in control group was 23±8 years with the range 13 - 48 years where as in the study group; it was 24±8.5 years with the range 12 - 45 years. Regarding sex distribution male to female ratio was 1.4:1 in control group and 0.72:1 in study group.

The average pre and postoperative air conduction threshold in control group was 34.3dB and 18.4dB respectively with a net hearing gain of 15.9dB. In study group, it was found to be 31.0dB and 18.9dB respectively with net hearing gain of 12.1dB. The difference in net hearing gain was not significant (Table 1).

Pre operative and post operative air conduction threshold was measured and compared between cases in whom tympanosclerotic plaques completely removed to those cases in whom tympanosclerotic plaques were either partially removed or left as such.

Pre operative and post operative hearing threshold was 31.76dB and 19.45dB respectively with net hearing gain of 12.31dB in former cases where as pre and post operative air conduction threshold was 31.19dB and 17.52dB respectively with net hearing gain of 13.67dB in the latter. The observed difference was found non significant (Table 2).

Graft uptake was seen in 74 (94.9%) cases under control group and in 73 (96.1%) study group. The difference was statistically not significant (Table 3, Figure 1).

Comparing graft uptake rate in cases in whom tympanosclerosis was completely removed to those in whom it was either partially removed or left as such and

Table 1. Comparison between Study and Control Group in Relation to Preoperative and Post-operative Air Conduction Threshold.

Group		Pre-operative pure tone audiogram (dB)	Post-operative pure tone audiogram (dB)	Net gain (dB)
Study	Mean ± SD	31.0 ± 12.9	18.9 ± 15.0	12.1 ± 13.4
Control	Mean ± SD	34.3 ± 16.1	18.4 ± 13.4	15.9 ± 13.5
P value from Z test		0.17 (NS)	0.81 (NS)	0.08 (NS)

SD = standard deviation, NS = not significant

Table 2. Comparison between Pre-operative and Post-operative Air Conduction Hearing Threshold after Partial or Complete Removal of Tympanosclerotic Plaques

Removal of tympanosclerotic plaques		Pre-operative pure tone audiogram (dB)	Post-operative pure tone audiogram (dB)	Net gain (dB)
Complete	Mean ± SD	31.76 ± 11.98	19.45 ± 15.52	12.31 ± 13.29
Partial or left as such	Mean ± SD	31.19 ± 16.31	17.52 ± 13.64	13.67 ± 14.11
p value from Z test		0.87 (NS)	0.62 (NS)	0.83 (NS)

SD = standard deviation, NS = not significant

was found successful in 53 (96.36%) in the former and in 20 (95.23%) in the later with P value 1.0. (Table 4).

Table 3. Graft Uptake in Study and Control Groups.

Graft	Group		P value
	Study	Control	
Taken up	73 (96.1%)	74 (94.9%)	1.0 (NS)
Not Taken up	3 (3.9%)	4 (5.1%)	
Total	76 (100%)	78 (100%)	

NS = not significant

Table 4. Graft Uptake Rates after Complete and Partial Removal of Tympanosclerotic Plaques

Tympanosclerotic plaques	Graft uptake rate	P value
Completely removed (n=55)	53 (96.36%)	1.0 (NS)
Partially removed or left as such (n=21)	20 (95.23%)	

NS = not significant

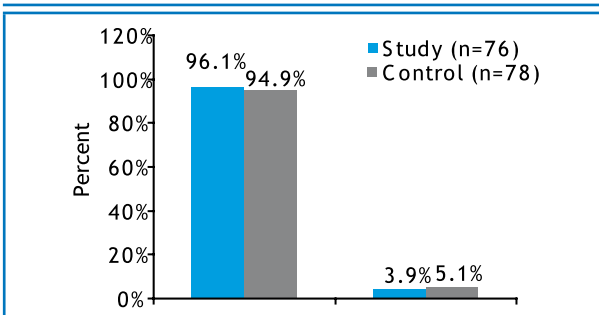


Figure 1. Graft Uptake in Study and Control Groups

DISCUSSION

The minimum calculated sample size was 75 and analysis done for 154; 76 patients from study group and 78 from control group completing the follow up. Patients of CSOM TT type without tympanosclerosis were enrolled as control group and those with tympanosclerosis as study group. The sampling method used for this study was non probability convenient sampling.

The average age of patients in study group was 24±8.5 years, the range being 12 to 45 years, while the average is of patients in control group was 23.4±8 years, ranging between 13 to 48 years. Majority of patients in both the study 82.89% and the control 83.33% groups were below 30 years of age.

Regarding sex distribution, in study group there was preponderance of female with male to female ratio of 0.72:1, where as in control group male to female ratio was 1.43:1.

Analysis of pure tone audiometric data showed that in study group, pre operative pure tone average air conduction threshold of 31.0dB improved to 18.9dB after 10 weeks of operation with an average hearing gain of 12.1dB. In control group, pre operative pure tone average air conduction threshold of 34.1dB improved to 18.3dB after 10 weeks of operation with an average hearing gain of 15.8dB. The observed differences in both groups were statistically not significant. They reported an average hearing gain of 10dB and 11dB in ears with tympanosclerosis and without tympanosclerosis respectively.⁷ Comparing the hearing results of ears in which tympanosclerotic plaques were completely removed to the hearing results

of those ears in which tympanosclerotic plaques were either partially removed or left as such, statistically no significant difference was noted. The ears with complete removal of tympanosclerotic plaques had an average post operative hearing gain of 12.31dB; where as in ears with partial removal of tympanosclerotic plaques or tympanosclerotic plaques left as such had an average post operative hearing gain of 13.6dB. Tympanosclerotic plaques removal was done as far as possible and no attempt was done to remove it; if it was far away from the margin of perforation. The mobility of tympanic membrane is greatly reduced leading to marked hearing loss when tympanosclerotic plaques had involve large area of tympanic membrane or adherent to the bony annulus, handle of malleus or promontory.¹⁰ The degree of hearing loss associated with tympanosclerosis depends on the extent of tympanosclerotic involvement of the ossicular chain.¹¹ All of the patients included in the study were operated by consultants only. Mostly the operation were done by permeal approach but in few cases, it was done by post aural or end aural approach as well depending upon surgeons choice or else anterior margin of perforation was not seen.

Invariably, temporalis muscle fascia was used as graft materials in all the cases. The technique used for operation was underlay, the most popular technique of myringoplasty worldwide nowadays. All operations were done in dry ears only. Moist ears or ears with pus in middle ear cavity were not included in the study.

Comparing graft uptake rate in the study and the control group, it was 96.1% and 94.7% respectively, the difference being statistically non significant with P value of 1.0. Similarly, graft uptake rate in cases; where tympanosclerotic plaques were completely removed was 96.36% and it was 95.23% in those cases where tympanosclerotic plaques were either partially removed or left as such. There was no significant difference in the graft uptake rate between tympanosclerotic and non tympanosclerotic groups, in contrast to our study findings, they had reported graft uptake rate of 53.5% and 84.4% in patients of CSOM TT type disease with tympanosclerosis and without tympanosclerosis respectively.¹⁰ This difference was highly significant ($P < 0.05$). However, they have not mentioned that whether the TS plaques

were left as such or were removed. However a more robust and long term research study may reveal further information about the study.

CONCLUSION

Tympanosclerotic plaques, if removed as far as practicable, has no effect on either graft up take or post-operative hearing status in patient undergoing underlay myringoplasty.

REFERENCES

1. Little P, Bridges A, Guragain RPS, Prasad R, Weir N, Friedman D. Hearing Impairment and ear pathology in Nepal. *J Laryngol Otol*. 1993 May;107(5):395-400.
2. World Health Organization. Prevention of hearing impairment from chronic otitis media. [Online]. [cited on Sep 10, 2009] Available from: URL:http://www.who.int/pbd/deafness/en/chronic_otitis_media.pdf
3. Mills RP. Management of chronic suppurative otitis media. Scott Brown's otolaryngology. 6th ed. Mumbai: Butterworth Heinemann; 1997.
4. Kroon DF, Strasnick B. Disease of the auricle, external auditory canal and tympanic membrane. Glasscock-Shambaugh Surgery of the ear. 5th ed. India: Elsevier; 2003. p. 345-65.
5. Sheey JL, House WF. Tympanosclerosis. *Arch Otolaryngology*. 1962 Aug;76:151-157.
6. Tos M, Bak-Pedersen K. Middle ear mucosa in tympanosclerosis. *J Laryngol Otol*. 1974;88:119-26.
7. Wielinga EW, Kuijpers W, Tonnaer EL, Jap PH. An experimental model for tympanosclerosis. A preliminary report. *Acta Otolaryngol*. 1988 May-Jun;105(5-6):537-42.
8. Bhaya MH, Schachern PA, Morizono T, Paparella MM. Pathogenesis of tympanosclerosis. *Otolaryngol Head Neck Surg*. 1993 Sep;109(3 Pt 1):413-20.
9. Teufert KB, De La Cruz A. Tympanosclerosis: long-term hearing results after ossicular reconstruction. *Otolaryngol Head Neck Surg*. 2002 Mar;126(3):264-72.
10. Wielinga EW, Kerr AG. Tympanosclerosis. *Clin Otolaryngol Allied Sci*. 1993 Oct;18(5):341-9.
11. Kamal SA. Surgery of tympanosclerosis. *J Laryngol Otol*. 1997 Oct;111(10):917-23.