

PREOPERATIVE AND POSTOPERATIVE AUDIOLOGICAL EVALUATION OF VARIOUS FACTORS INFLUENCING TYPE 1 TYMPANOPLASTY

Dantuluri Ramakrishna Laxmi Narasimha Raju¹

¹Assistant Professor, Department of ENT, GVP Institute of Healthcare and Medical Technology, Visakhapatnam, Andhra Pradesh.

ABSTRACT

BACKGROUND

Study of various factors influencing the outcome of type 1 tympanoplasty like size of the perforation, active ear discharge and presence of tympanosclerotic patch and comparing the respective preoperative and postoperative audiological results.

In early centuries, ear infection with complication was a life-threatening condition. The introduction of antibiotic and use of operative microscope in surgical field were revolutionary advances in the control of disease. Chronic suppurative otitis media is still a major problem in our country. It is a common condition seen in patients attending the otolaryngology clinic. The discharging ear presents the otologist with the dilemma of operating it or not. This is due to the widespread belief that the success rate while doing tympanoplasty on discharging ears is decidedly inferior.

MATERIALS AND METHODS

A total of 106 patients with CSOM tubotympanic disease who underwent type 1 tympanoplasty in the Department of ENT, KS Hegde Medical Academy were studied in the period of two years. A detailed pro forma was filled for each patient with regard to history, clinical examination, investigations, surgical procedures, postoperative period and follow up visits. Audiological evaluation (pure tone audiometry) done preoperatively, 3 months and 6 months after surgery and the results were tabulated.

RESULTS

Audiological benefit was found to correlate with the size of perforation. As the size of perforation increases, the hearing gain was found to improve postoperatively. In our study of 106 cases, 101 (95.2%) cases showed improvement in speech frequency and 83 cases (78.3%) in high frequency; hearing decreased in 3 cases (2.83%) in speech frequency and 19 cases (17.9%) in high frequency. The rest remained unchanged audiological. Active discharge does not make statistically significant change in the audiological outcome in type 1 tympanoplasty provided it must be mucoid, scanty and culturally negative. Out of 106 cases in 27 cases with tympanosclerosis, the postoperative speech frequency benefit is less (8.393 dB) than those without tympanosclerosis (13.949 dB), which is statistically significant. In high frequency, there is better audiological benefit in cases without tympanosclerosis (7.872 dB) when compared to cases with tympanosclerosis (7.143 dB), which is statistically insignificant.

CONCLUSION

Size of perforation, presence of tympanosclerosis and status of middle ear at the time of surgery were found to have a major effect on the final outcome of surgery.

KEYWORDS

CSOM, Type 1 Tympanoplasty, Hearing Gain.

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BACKGROUND

In early centuries, ear infection with complication was a life-threatening condition. The introduction of antibiotic and use of operative microscope in surgical field were revolutionary advances in the control of disease. Chronic suppurative otitis media is still a major problem in our country. It is a common

condition seen in patients attending the otolaryngology clinic. The discharging ear presents the otologist with the dilemma of operating it or not. This is due to the widespread belief that the success rate while doing tympanoplasty on discharging ears is decidedly inferior.

Tympanic Membrane (TM) perforations lead to recurrent ear infections in hearing loss. If the perforations are bilateral, hearing handicap becomes more evident (Adkins WY, White B 1984).¹ Air conduction audiometric gains following successful myringoplasty directly correlate with preoperative perforation size (Wasson JD et al, 2009).² Persistent perforations occur either due to improper treatment of recurrent middle ear infections or infected traumatic perforation. Repair of TM perforation was attempted since many years.

The tympanosclerosis is a hyaline degeneration of the submucosal layer of TM and it may be a factor for the

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Corresponding Author:

Dr. Dantuluri Ramakrishna Laxmi Narasimha Raju,

Door No. 2-346/11/10, B1-502,

Paras Paradise, Indira Gandhi Nagar,

Old Dairy Farm, Visakhapatnam-40, Andhra Pradesh.

E-mail: dantuluri_rajur91@yahoo.co.in

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myringoplasty failure. Ears with tympanosclerosis had worst results than the ones with normal TM. This way we can observe that the presence of tympanosclerosis may harm the cicatrization of the TM. Patients with less impact on ossicular chain and limited localisation of sclerotic plaques have better hearing gain. Although, surgery is still controversial in tympanosclerosis; it is the most effective treatment till new effective medication is discovered (Mutlu F et al, 2015).³

Myringoplasty is an operation in which the reconstructive procedure is limited to the repair of tympanic membrane perforation assuming that the middle ear ossicles are functioning normally, Eustachian tube is patent and patient has a good cochlear reserve. On the other hand, tympanoplasty is an operation in which inspection and repair of middle ear sound conductive apparatus is done with reconstruction of tympanic membrane (Michael E. Glasscock, 1990).⁴ Thus, we planned to study the various factors like status of the middle ear, size of the perforation, presence of tympanosclerotic patch influencing the outcome of type 1 tympanoplasty and compared the respective preoperative and postoperative audiological results.

Aims and Objectives

Study of various factors like status of the middle ear, size of the perforation, presence of tympanosclerotic patch influencing the outcome of type 1 tympanoplasty and compared the respective preoperative and postoperative audiological results.

MATERIALS AND METHODS

A total of 106 patients with CSOM tubotympanic disease who underwent type 1 tympanoplasty in the Department of ENT, K.S. Hegde Charitable Hospital were studied in the period of two years.

Inclusion Criteria

- The patients with CSOM tubotympanic type with conductive hearing loss.
- Dry ear or discharging ear who underwent type 1 tympanoplasty.
- Graft is taken up completely and remain intact for 3 months after surgery.

Exclusion Criteria

- Patients who do not turn up for postoperative audiological evaluation.
- Patients having sensory neural hearing loss.
- Patients having discontinuity of ossicular chain.
- Patients with atticotympanic type of CSOM.

A detailed pro forma was filled for each patient with regard to history, clinical examination, investigations, surgical procedures, postoperative period and follow up visits. Audiological evaluation (pure-tone audiometry) was done preoperatively, 3 months and 6 months after surgery and the results were tabulated.

Statistical Analysis- Statistical comparisons were performed using Student's t-test, Chi-square test and ANOVA test. There is significance in the statistical difference, if the 'p' value is <0.05.

RESULTS

Statistical comparisons of the tabulated results were performed using the Student's t-test, Chi-square test and ANOVA test and there is significance in the statistical difference, if the 'p' value is <0.05.

Audiological benefit was found to correlate with the size of the perforation. As the size of the perforation increases, the hearing gain was found to improve postoperatively.

In our study of 106 cases, 101 (95.2%) cases showed improvement in speech frequency and in 83 cases (78.3%) in high frequency; hearing decreased in 3 cases (2.83%) under speech frequency and in 19 cases (17.9%) under high frequency. The rest remained unchanged audiotically.

Active discharge does not make statistically significant change in the audiological outcome in type 1 tympanoplasty provided it was mucoid, scanty and culturally negative.

Out of 106 cases in the 27 cases with tympanosclerosis, the postoperative speech frequency benefit is less (8.393 dB) than those without tympanosclerosis (13.949 dB), which is statistically significant. In high frequency, there is better audiological benefit in cases without tympanosclerosis (7.872 dB) when compared to cases with tympanosclerosis (7.143 dB), which is statistically insignificant.

Duration of Ear Discharge (in yrs.)	Number of Cases	Audiological Benefit	
		Speech Frequency	High Frequency
<10	65	11.308 dB	7.462 dB
11-20	29	13.724 dB	6.655 dB
>20	12	15.833 dB	11.333 dB
Total	106		

Table 1. Duration of Ear Discharge and Audiological Benefit

Size of Perforation	Number of Cases	Audiological Benefit	
		Speech Frequency	High Frequency
Small	13	4.692 dB	0.385 dB
Medium	40	10.825 dB	7.050 dB
Large	53	15.642 dB	9.943 dB
Total Cases	106		

Table 2. Size of Perforation and Audiological Benefit

Hearing Results	Audiological Benefit	
	Speech Frequency	High Frequency
Improvement	101 (95.2%)	83 (78.3%)
No change	2 (1.89%)	4 (3.77%)
Worsened	3 (2.83%)	19 (17.9%)
Total Cases	106	106

Table 3. Audiological Assessment in Type 1 Tympanoplasty

Ear Discharge	Number of Cases	Speech Frequency	High Frequency
Active	43	11.512 dB	5.953 dB
Inactive	63	13.143 dB	8.857 dB
Total Cases	106		

Table 4. Effect of Active Ear Discharge on Audiological Improvement in Type 1 Tympanoplasty

Tympanosclerotic Patch	Number of Cases	Speech Frequency	High Frequency
Present	27	8.393 dB	7.143 dB
Absent	79	13.949 dB	7.872 dB
Total Cases	106		

Table 5. Tympanosclerotic Patch and its Effect on Audiological Improvement

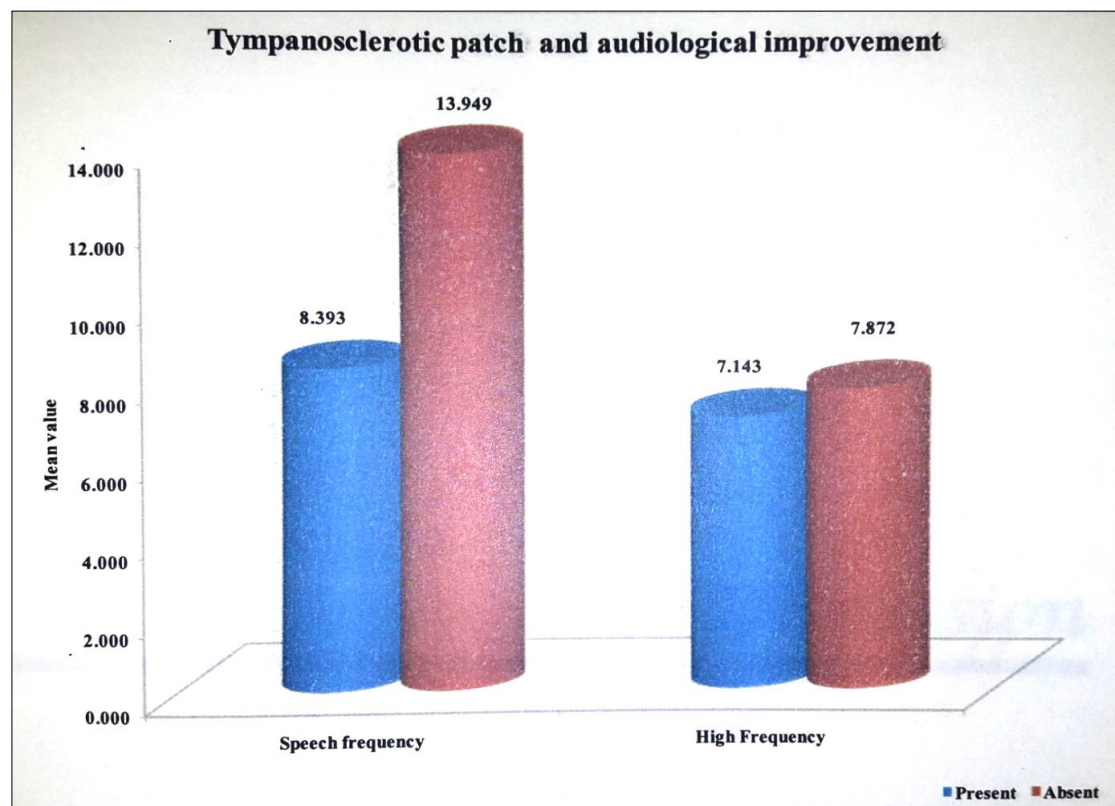


Figure 1. Tympanosclerotic Patch and Audiological Improvement

DISCUSSION

According to Wullstein classification, type 1 tympanoplasty is an operation in which the reconstruction procedure is limited to the repair/retraction of tympanic membrane perforation alone. Implicit in the definition is that the ossicular chain is intact and mobile and that there is no middle ear disease such as infected mucosa or in growth of skin. The present study describes various parameters in assessing the hearing improvement after successful type 1 tympanoplasty. Postoperative audiological evaluations were done after 3 months and 6 months following the surgery.

In this series, we did not find any comparable relation between the duration of ear discharge and audiological benefit at speech frequencies as well as high frequencies (Table 1). Statistically, a longer duration of ear discharge showed more audiological benefit, contrary to the common thinking that a longer disease process reduces the audiological benefit due to more pathological changes. Patients with shorter duration of ear discharge must have probably continuous discharge or more number of attacks of acute exacerbations when compared to the patients with

longer duration of ear discharge. However, audiological improvement is independent of the duration of the disease and depends on the extent of the middle ear damage due to the disease.

In our study, the audiological benefit was found to correlate with the size of the perforation. As the size of the perforation increases, the hearing gain was found to improve postoperatively (Table 2). There are not many studies done on the relationship between the size of the perforation and the audiological benefit. This study supports Packer's findings in which it was found that those with a larger hearing deficit preoperatively, obviously benefited more than those with a minimal preoperative hearing loss.⁵

In our study, 95.2% cases showed improvement in speech frequency and 78.3% in high frequency; hearing decreased in 2.83% under speech frequency and in 17.9% under high frequency.

The rest remained unchanged audiological (Table 3). The most likely explanation for lack of complete success from a hearing standpoint is that in most cases of CSOM, even though ossicular chain may appear normal, there is

some factor of scar tissue that prevents total restoration of hearing (Sheehy et al 1980).⁶ Saeed Ghamdi et al⁷ 1994 reported a permanent hearing loss in 3% of the patients. Vartiainen and Nauutinene⁸ (1993) in their series had 11 audiological failures. The cause of persistent hearing loss was found to be due to fixation or erosion of ossicles overlooked by the surgeon. The unchanged audiological status in tympanoplasty can be explained by disorders that can interfere with the ventilator or conducting function of the middle ear, viz. tympanosclerosis, stiffness of ossicles and Eustachian tube dysfunction that have not been dealt during the surgery (Rance W. Rance in 1995).⁹

Active discharge does not make statistically significant change in the audiological outcome in type 1 tympanoplasty in our study (Table 4). This is comparable to the study done by S.K. Nagle et al¹⁰ in which type 1 tympanoplasty was done on 7 cases of active chronic otitis media, dry tympanoplasty on 43 cases and wet tympanoplasty method on the rest of 29 cases. The criteria of successful myringoplasty and tympanoplasty 1 surgery was a positive graft taken followed by improvement in hearing.

The successful result of myringoplasty and tympanoplasty-1 with dry method was 93.02% and with wet method was 89.65%. The statistical analysis showed that there is no significant difference in the success between the dry and wet method. The discharge should be mucoid, scanty and culture must be negative.

The tympanosclerosis is a hyaline degeneration of the submucous layer of TM and it may be a factor for the myringoplasty failure. Ears with tympanosclerosis had worst results than the ones with normal TM, statistically significant. This way, we can observe that the presence of tympanosclerosis may harm the cicatrization of the TM. In our study, there was a significant postoperative speech frequency benefit in cases without tympanosclerosis than the cases with tympanosclerosis (Table 5). Kageyama-Escobar AM¹¹ in his study presented 82% of closing of tympanic perforation and observed that tympanosclerosis was among the factors for surgical failure, mainly when it diffusely involved TM. However, when Wielinga EW et al¹² evaluated the influence of tympanosclerosis in the myringoplasties, he studied 555 myringoplasties and concluded that there is no relation between the presences of absence of it in the final result, even if it is diffuse. When possible, we recommend the focus be removed in order to facilitate the epithelial migration in the closing of TM perforation.

CONCLUSION

Tympanoplasty provides the patient with chronic suppurative otitis media of tubotympanic type with a dry ear as well as improvement in hearing. To achieve these dual purposes, a proper selection of cases is essential. The anticipated audiological benefit can be hampered by a number of factors, namely middle ear pathologies, which can

interfere with ossicular function and middle ear ventilation. However, it is to be noted that careful evaluation of middle ear in all cases during surgery may give better hearing results, because any ossicular pathology or fibrous adhesions or tympanosclerotic patches can be corrected during surgery.

In this series, we have achieved considerable improvement in hearing in majority of cases. Age of the patient, status of the middle ear, size of the perforation and the presence of tympanosclerosis at the time of surgery were found to have a major effect on the final outcome of surgery.

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