

## Anatomical and audiological outcome of type I Tympanoplasty in Sub Himalayan region: Our experience

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### Abstract

Type I tympanoplasty (myringoplasty) is commonly performed procedure for chronic otitis media, mucosal type involving the repair of tympanic membrane perforation. We conducted the present study on 64 patients (71 ears) and evaluated post-operative hearing status (functional outcome) and post-operative intake of graft (anatomical outcome) 3 months after surgery. On pre-operative audiometry, 70% of patients were having hearing threshold between 26-40dB, 14% had 0-25dB, 16% had more than 40dB. The graft uptake was present in 87.3% patients. Graft uptakes were maximum in small perforations (92.5%) followed by posterior perforations (90.9%) and least in large and subtotal perforations (66.6%). On post-operative audiometry, 73.5% of patients had hearing threshold <25dB, 17.4% had 26-40dB and 8.9% had threshold >40dB. The present study concludes that type I tympanoplasty when performed in a dry ear with best surgical technique yields better success rate both in terms of anatomical and functional outcome.

### Introduction

Tympanoplasty involves the repair of tympanic membrane with or without ossicular chain reconstruction in conductive deafness.<sup>(1)</sup> It improves hearing loss due to tympanic membrane perforation with or without ossicular discontinuity and recurrent ear discharge. The indication of type I tympanoplasty (myringoplasty) is repair of tympanic membrane perforation where there is no ossicular chain involvement. Myringoplasty was first established by Berthold in 1879 by transferring free skin flap onto the tympanic membrane perforation.<sup>(2)</sup> Later in 1957, Wullstein was first to use temporalis muscle fascia in myringoplasty which is the most commonly used graft presently.<sup>(3)</sup> Perforation of tympanic membrane results from middle ear infection, trauma and iatrogenic causes although upto 80% of these perforation may undergo spontaneous closure.<sup>(4)</sup> Tympanic membrane perforation reduces the effective area of the membrane in contact with the sound waves and pressure differential across the membrane. This in combination with the position of perforation reduces mechanical coupling between the remaining tympanic membrane and the malleus bone.<sup>(5)</sup> There are several factors affecting the outcome of myringoplasty including size and site of perforation, cause of perforation, active infection at the time of surgery, status of ossicles and middle ear mucosa apart from age of patient and surgical techniques.<sup>(6)</sup> The current literature reports variable success rate for closure of tympanic membrane perforation ranges from 60-99%.<sup>(7)</sup> However, best results can be achieved both in terms of closure of tympanic membrane perforation and functional point of view although the percentage of failures are high in cases with near total perforations and active ears.

The purpose of this study is to evaluate the graft acceptance and hearing improvement (audiological benefit) after type I Tympanoplasty in dry perforations.

### Materials and Method

A prospective study was conducted in a multispeciality hospital in department of Otorhinolaryngology at MGMSC Khaneri, Rampur. The period of study was between September 2014 and April 2017 including procedure, data collection and interpretation. The study was performed on 64 patients (71 ears) in age group of 18-53 years of both the sexes in chronic mucosal otitis media inactive type ears.

**Inclusion criteria:** Chronic otitis media (COM) mucosal type, inactive for atleast 6 weeks, perforations with conductive hearing loss and good cochlear function.

**Exclusion criteria:** COM mucosal type with active infection, COM with complications, COM with ossicular chain involvement, COM squamosal type, pediatric patients, infection of nose, paranasal sinuses and nasopharynx

Assessment of the patients was done in outpatient department including history, general physical examination, and examination of ear (otoendoscopy and or otomicroscopy), nose and throat.

On otoendoscopy, perforations were classified as following:

1. Size of perforation (grades: small (less than 50%), medium (50-75%) and large (more than 75%))
2. Site of perforation (anterior if the entire perforation is anterior to handle of malleus, posterior if perforation is posterior to handle of malleus, central if anterior or posterior perforation extends beyond the handle of malleus and subtotal if only fibrous annulus is present.

Hearing assessment was performed with pure tone audiometry with or without masking using 500, 1000, 2000 and 3000 Hz frequencies (average pure tone obtained). Patients included in the study were subjected to routine blood tests, chest x ray, electrocardiogram and pre anaesthetic checkup. Informed consent was obtained from all the patients.

**Type of interventions:** All surgeries were performed under local anaesthesia (2% lignocaine with 1:80000 adrenaline) and diluted intra venous pentazocine. Standard surgical procedure of post aural approach using temporalis fascia graft, total 360 degree tympanomeatal flap elevation and underlay technique was adopted. Gel foams pieces impregnated with ofloxacin and dexamethasone drops were placed over graft and repositioned tympanomeatal flap. No pack was placed in external auditory canal.

Types of outcome measurement: outcomes were documented after 3 months following surgeries

1. Intact neo-membrane after 3 months following surgery (closure rate)
2. Pure tone audiometry (postoperative audiograms air conduction calculated on 500, 1000, 2000 and 3000 Hz) after 3 months of surgery

**Observation and Results**

We included 71 ears of 64 patients divided in 33 male and 38 females. Patients were in age group between 18 years to 53 years with majority of patients in age group of 25-35 years (Table 1). The main presenting symptoms in our study were hearing loss 67/71 (94.3%), recurrent ear discharge 64/71 (90%) and tinnitus 9/71 (12.6%). On otoendoscopy, 15/71 (21.1%) had anterior perforation, 11/71 (15.5%) has posterior perforation, 39/71 (54.9%) central perforation and 6/71 (8.5%) had subtotal perforation. Thirty eight percent (27/71) of patients had small, 49.2% (35/71) medium and 12.6% (9/71) large perforations (Table 2). On pre operative audiometry, 70% of patients were having hearing threshold between 26-40dB, 14% had 0-25dB, 16% had more than 40dB. The graft uptake was present in 87.3% (62/71) patients. Graft uptakes was maximum small perforation (92.5%), posterior perforations (90.9%), central perforation (89.7%), medium sized perforations (88.5%), anterior perforation (86.6%) and 66.6% in large and subtotal perforations. On post-operative audiometry, 73.5% of patients had hearing threshold <25dB, 17.4% had 26-40dB and 8.9% had threshold >40dB (Table 3).

**Table 1: Demographic data**

	Male	Female	Total	Recurrent ear discharge (no of patients)	Hearing loss (no of patients)	Tinnitus (no of patients)
18-25 years	13	8	21	19	21	1
26-35 years	15	23	38	33	35	5
36-45 years	2	6	8	8	7	2
46-53 years	3	1	4	4	4	1

**Table 2 (characteristics of perforations)**

Perforation size (no of patients)			Perforation site (no of patients)			
Small (<50% of surface area),	Medium (50-75%)	Large (>75%)	Anterior	Posterior	Central	Subtotal
27	35	9	15	11	39	6

**Table 3: Anatomical and audiological results)**

Characteristics of perforations	Preoperative hearing (dB)			Post operative hearing (dB)			Graft Uptake 62/71 (87.3%)
	0-25	26-40	41-60	0-25	26-40	41-60	
Small	2/27 (7.5%)	19/27 (70.3%)	6/27 (22.2%)	21/27 (77.7%)	5/27 (18.5%)	1/27 (3.7%)	25/27 (92.5%)
Medium	1/35 (3%)	26/35 (74.2%)	8/35 (22.8%)	26/35 (74.2%)	6/35 (17.1%)	3/35 (8.5%)	31/35 (88.5%)
Large	0/9 (0%)	7/9 (77.8%)	2/9 (22.2%)	6/9 (66.6%)	1/9 (11.1%)	2/9 (22.2%)	6/9 (66.6%)
Anterior	5/15 (33%)	9/15 (60%)	1/15 (6.7%)	11/15 (73.3%)	3/15 (20%)	1/15 (6.6%)	13/15 (86.6%)
Posterior	3/11 (27%)	7/11 (63.6%)	1/11 (9%)	9/11 (81.8%)	2/11 (18.2%)	0/11 (0%)	10/11 (90.9%)
Central	11/39 (28%)	24/39 (61.5%)	4/39 (10.2%)	29/39 (74.3%)	8/39 (20.5%)	2/39 (5.1%)	35/39 (89.7%)

Subtotal	0/6 (0%)	5/6 (83.3%)	1/6 (16.7%)	4/6 (66.6%)	1/6 (16.6%)	1/6 (16.6%)	4/6 (66.6%)
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**Discussion**

The incidence of chronic otitis media is very high in developing countries like India and the tubotympanic type of otitis media is commonest among the two types. Other causes of hearing loss are glue ear, traumatic perforation and eustachian tube dysfunction. Myringoplasty is a commonly performed procedure for the repair of perforated tympanic membrane. The technique of myringoplasty varies from institution to institution including per meatal or post aural route, endoscopic or microscopic myringoplasty. The results of tympanoplasty varies from institution to institution and the difference in results may be due to different inclusion and exclusion factors.<sup>(8,9)</sup>The aim of this procedure is to close the perforation with a stable graft and improvement in post operative hearing level. There is a significant relationship between the sizes of perforation with the hearing loss. Small perforations usually produce 10-15dB of hearing loss usually below 3000 Hz frequency whereas large perforations produces severe degree of hearing loss over wide range of frequencies. In large perforations, sound waves strikes directly on the round and oval windows therefore causes severe degree of hearing loss. Small and medium sized perforations cause more severe degree of loss when placed posterosuperiorly as compared to those in anteroinferior part of tympanic membrane. Non marginal perforation with intact ossicular chain usually causes hearing loss of approximately 10-30dB.<sup>(10)</sup>Success rate is higher in small perforation (<50% surface area) as compared to medium and large size perforation and is in agreement with study conducted by Agarwal et al.<sup>(11)</sup>Site of the perforation is another important parameter affecting the outcome of the myringoplasty. The success rate of posterior perforation (90.9%) is better than anterior (86.6%) and subtotal perforations (66.6%) and is in agreement with the study of J. Sade who stated that posterosuperiorly located small perforations have better results in terms of graft uptake as compared to those located anteriorly or subtotal perforations.<sup>(12)</sup>

Surgical outcome is measured in terms of graft uptake and post-operative hearing improvement. In the present study, graft uptake is 87% which is similar to the other studies with success rate of 60-99% for closure of perforation in adults.<sup>(7)</sup> Most of author’s reports relatively lower success rate in active ears. There are various criteria’s for the assessment of hearing improvement after myringoplasty including hearing gain method and mean air bone gap.<sup>(13,14)</sup>In the present study, majority of the perforations were medium sized (35/71) followed by small (27/71) and large perforations (9/71). Pre-operative audiometry, 70% of patients were having hearing threshold between 26-40dB, 14% had 0-25dB, 16% had more than 40dB. Post operatively, 73.5% of patients had hearing threshold <25dB, 17.4% had 26-

40dB and 8.9% had threshold >40dB. These results are comparable to a study conducted by Lee P et al.<sup>(15)</sup>Successful outcome of myringoplasty depends upon number of factors including the type of graft material used, technique, nature of the perforation and the experience of the surgeon.

Eustachian tube dysfunctioning is another important factor influencing the outcome of type I tympanoplasty however eustachian tube dysfunctioning can be suspected pre operatively in cases with bilateral perforation. Middle ear diseases, post-operative restoration of middle ear integrity and hearing improvement are related to eustachian tube functioning in chronic otitis media cases.<sup>(16)</sup>

**Conclusion**

Type I tympanoplasty when performed in properly prepared patients with dry ear yields good success rate in terms of both graft uptake as well as post-operative hearing status.

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