

Tympanoplasty With Or Without Cortical Mastoidectomy

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Abstract

Tympanoplasty is the treatment of choice for non-cholesteatomatous (granulomatous) otitis media. Otolgists have long debated the importance of mastoid in determining the success or failure of tympanic membrane reconstruction. All the patients of non-cholesteatomatous otitis media during one year were included in the study group. Patients of the study group were divided into 'dry' ears and 'wet' ears. Both 'dry' and 'wet' ears were divided into two groups, Group 1 (patients who are subjected to tympanoplasty alone) and Group 2 (patients who are subjected to tympanoplasty with cortical mastoidectomy). In 'dry' ears, the graft uptake rates of both tympanoplasty alone and tympanoplasty with cortical mastoidectomy were similar with success rate at 85.71%. In 'wet' ears, the success rate of tympanoplasty with cortical mastoidectomy was 80% whereas in tympanoplasty alone, there was 100% failure in this study. Tympanoplasty with cortical mastoidectomy gave better results. 75% of the patients had a post-operative hearing of < 20 dB air-bone gap as compared to 63.64% in tympanoplasty alone. In tympanoplasty alone, post-operative hearing levels of 27.27% and 9.09% were found in 20-30 dB and >30 dB, respectively, thus better results were obtained in tympanoplasty with cortical mastoidectomy in which 16.67% fell under 20-30 dB and 8.33% under >30 dB. None of the grafts failed in patients with mastoid size of 5-10 sq.cm and > 10 sq.cm, irrespective of the surgery performed whereas all failures were seen in patients with mastoid size of <5 sq.cm. In 'dry' ears, tympanoplasty alone may suffice because of no difference in graft uptake rates. Whereas in 'wet' ears, cortical mastoidectomy seems to be a good adjunct to tympanoplasty because it resulted in better graft uptake and better hearing results. Pre-operative assessment of mastoid size seems to give fairly good idea as regarding the success rate.

Key Words

Tympanoplasty, Chronic Otitis Media

Introduction

Chronic otitis media is an inflammatory process of the mucoperiosteal lining of the middle ear cleft. It includes cholesteatomatous chronic otitis media and granulomatous chronic otitis media. Granulomatous chronic otitis media is characterized by purulent otorrhea and is associated with presence of granulation tissue in the middle ear cleft. Pathogenesis of chronic otitis media can be influenced by anatomic variants or by pathological sites of obstruction in the middle ear cleft including protympanum, mesotympanum, isthmus tympani anticus and posticus, attic, aditus and antrum and mastoid air cells (1,2). Granulomatous chronic otitis media is more difficult to manage than cholesteatomatous chronic otitis

media. Most of the available literature lacks description of results of surgery in granulomatous chronic otitis media. Although much has been written about the pathology, treatment modality and outcome of cholesteatoma, little has been mentioned about management of non-cholesteatomatous chronic otitis media (3,4).

Tympanoplasty not only implies reconstruction of the tympanic membrane but also deals with pathology within the middle ear cleft, such as chronic infection, cholesteatoma, granulation, or an ossicular chain problem. Successful tympanoplasty, according to Sheehy and Shelton (5), is dependent on the achievement of a threefold goal: the eradication of disease, if present, an

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intact tympanic membrane; and a secure connection between the mobile drum and the inner ear. Initially, staged operations for tympanoplasty were preferred, the disease was removed in stage 1 and a second operation was carried out later to reconstruct the sound pressure transfer mechanism. Although some others believe that although staged operations may produce highly better results, they are often unnecessary.

Many factors contribute to the success or failure of surgery to correct tympanic membrane perforations. These may be conveniently divided into 'mastoid' and 'non-mastoid' factors. Mastoid factors include: (1) extent of mastoid pneumatization, and (2) presence of inflammatory disease. The non-mastoid causes of graft failure include general debility, technical error, and most importantly- Eustachian tube dysfunction (6).

The pneumatic space within the mastoid represents the "air reservoir" which can be drawn upon during periods of Eustachian tube dysfunction and buffer the middle ear against the development of detrimental negative pressure. With this view in mind, simple Mastoidectomy is combined with tympanoplasty in selected cases of chronic otitis media in hopes of surgically creating an air reservoir and removing the sequestered mastoid disease. Working on this theory, Jackler and Schindler (6) found that simple Mastoidectomy when combined with tympanoplasty and myringoplasty may negate the ill effects of a small mastoid volume. Holmquist (5) reported that the results of tympanoplasty increased from 22% in individuals with cell system below 5 sq. cm. to 71% in those with cell system above 10 sq. cm. Individuals having a cell system of a size between 5-10 sq. cm. healed in 57% of the cases.

In this study, an attempt has been made to analyze the results of various tympanoplastic procedures with or without cortical Mastoidectomy in ears without cholesteatoma.

Material and Method

This study was conducted in the Department of ENT and Head & Neck Surgery, SMGS Hospital, Government Medical College, Jammu. All the patients of non-cholesteatomatous chronic suppurative otitis media underwent tympanoplasty alone and tympanoplasty with cortical Mastoidectomy during the period from 1st Nov, 2012 to 31st Oct, 2013. Ears with cholesteatoma were excluded from the study. All the patients with discharging ears were managed conservatively and then were taken up for surgery. The patients included in the study were

divided into 'DRY' ears (ears which remained dry for six months) and 'WET' ears (ears discharging at the time of surgery). Both dry and wet ears were divided into two groups. Group 1 (patients who are subjected to tympanoplasty alone) and Group 2 (patients who are subjected to tympanoplasty with cortical Mastoidectomy).

The patients were assigned to each group randomly. A thorough work up of the patients was done. Patients above the age of 15 years were taken up for surgery. All patients underwent surgery under general anaesthesia by post aural approach. Temporalis fascial graft / conchal perichondrium was used for the repair of tympanic membrane perforation and sculpted autologous ossicles were used for ossiculoplasty. All the patients were regularly followed up weekly for one month and then biweekly for 3 months. At follow up, the study of parameters was the intactness and mobility of the graft, the dryness of the ear, post-operative pure tone average and air-bone gap. The post-operative audiograms were obtained one month after the surgery in all the patients.

The size of the mastoid cavity was roughly assessed from the lateral oblique radiographs of the mastoids. The graph paper was superimposed on the X-ray film/ CT scan and the area of the mastoid air cell system was directly measured. Accordingly, the mastoids were classified into: small mastoids: < 5 sq. cm., medium mastoids: 5-10 sq. cm. and large mastoids: > 10 sq. cm. based on Diamant' planimetric method.

Results

A total number of 34 patients attending the ENT out patient department of SMGS hospital, Government medical college, Jammu, who underwent surgery, were selected for this study. The following observations were made:

Out of a total of 34 patients of CSOM studied, 14 (41.18%) were males and 20 (58.82%) females. The most of the patients included in the study were in the age group of 15-20 years for both the sexes.

Out of the 34 patients in the study, only 6 ears (17.65%) were found to be 'wet' while remaining 28 ears (82.35%) were 'dry' at the time of surgery.

Most of the patients had more than 30 dB conductive hearing loss i.e. 27 (79.41%), whereas a hearing loss of 20-30 dB was seen in 6 (17.65%) of the patients. 1 patient had hearing loss of < 20 Db.

As shown in *table 1*, most of the patients included in the study (24) had a mastoid size < 5 sq.cm, 6 (17.65%) of the patients had a mastoid size of 5-10 sq.cm. while

size > 10 sq.cm. was seen only in 4 (11.76%) patients. Mean size of mastoid cavity in the present study was 5.2 sq.cm.

In the present study, out of 28 'dry' ears, TWCM (Tympnooplasty with cortical Mastoidectomy) was performed in 7 (25%) patients and tympnooplasty alone was done in 21 (75%) patients. In the category of 'wet' ears, TWCM was performed in 5 (83.33%) patients and tympnooplasty alone was done in 1 (16.67%) patient out of 6 patients as shown in *table 2*.

Overall success rate following TWCM was 82.35% i.e. 28 out of 34 patients. Failure rate was 17.65% (6 of 34 patients) as shown in *table 3*.

Table 1. Showing Size of Mastoid Cavity on X-ray (Planimetry)

S.no	Size of Mastoid Cavity	No. of patients	Percentage
1	<5 sq.cm	24	70.59
2	5-10 sq.cm	6	17.65
3	>10 sq.cm	4	11.76
	Total	34	100

Table 2. Showing the Type of Surgery Performed in 'Dry' and 'Wet' Ears

Type of surgery	Dry ears		Wet ears	
	TWCM	TWOCM	TWCM	TWOCM
No. of patients	7	21	5	1
Percentage	25	75	83.33	16.67

Table 3. Showing Success and Failure Rates

Surgery performed	Success	Failure
TWCM	10 (83.33%)	2 (16.67%)
Tympnooplasty alone	18 (81.82%)	4 (18.18%)
Total	28 (82.35%)	6 (17.65%)

Table 4. Showing Success Rate of Graft Uptake with the Type of Surgery (TWCM or TWOCM) in dry and wet ears.

GRAFT UPTAKE							
DRY				WET			
TWCM (n=7)		TWOCM (n=21)		TWCM (n=5)		TWOCM (n=1)	
Success (%)	Failure (%)	Success (%)	Failure (%)	Success (%)	Failure (%)	Success (%)	Failure (%)
6 (85.71)	1 (14.29)	18 (85.71)	3 (14.29)	4 (80)	1 (20)	0 (0)	1 (100)

Table 5. Showing Failure Rates Following TWCM and Tympanoplasty Alone in Relation to Mastoid Air Cell Volume

MACV	No. of patients	TWCM	TWOCM	FAILURE RATES	
				TWCM	TWOCM
<5 sq.cm	24 (70.59%)	6 (25%)	18 (75%)	2 (33.33%)	4 (22.22%)
5-10 sq.cm	6 (17.65%)	2 (33.33%)	4 (66.67%)	0 (0%)	0 (0%)
>10 sq.cm	4 (11.76%)	4 (100%)	0 (0%)	0 (0%)	0 (0%)

Table 6. Comparison of Pre and Post-operative Hearing Levels

Hearing loss	No. of patients	
	Preoperative	Postoperative
<20 dB	1(2.94%)	23(67.65%)
20-30 dB	6(17.65%)	8(23.53%)
>30 dB	27(79.41%)	3(8.82%)
Total	34(100%)	34(100%)

Table 7. Showing Post-Operative Hearing Levels with Respect to Type of Surgery

Post-operative hearing level	TWCM (n=12)	Tympanoplasty alone (n=22)
<20 dB	9(75%)	14(63.64%)
20-30 dB	2(16.67%)	6(27.27%)
>30 dB	1(8.33%)	2(9.09%)

In the present study, as shown in table 5, failure rates in patients with MACV (< 5 sq.cm.) were 2 (33.33%) and 4 (22.22%), with TWCM and TWOCM, respectively. While in patients with MACV (5-10 sq.cm.) and MACV (>10 sq.cm.), who underwent TWCM and TWOCM, showed 100% success rates.

The post-operative hearing level below 20 dB was recorded in 23 (67.65%) patients, between 20-30 dB in 8 (23.53%) patients and above 30 dB in 3 (8.82%) patients. Comparison of pre and post operative hearing levels is notified in table 6. As shown in table 7, post-operative hearing levels in patients, who underwent TWCM, were recorded < 20 dB in 9 (75%), 20-30 dB in 2 (16.67%) and > 30 dB in 1 (8.33%) patients, whereas in tympanoplasty alone category, <20 dB post-operative hearing levels were recorded in 14 (63.64%), 20-30 dB in 6 (27.27%) and > 30 dB in 2 (9.09%) patients.

The complications of tympanoplasty were observed in 1 patient out of a total of 34 patients. Facial nerve palsy was seen which recovered completely during the follow up period.

Discussion

Chronic suppurative otitis media is typically a persistent disease, insidious in onset, often capable of causing severe destruction and irreversible sequelae and clinically manifests with deafness and discharge. Chronic non-cholesteatomatous granulation otitis media produces chronically discharging ears in which the middle ear mucosa is often granulating, thickened and secretory. Non-cholesteatomatous chronic otitis media is further divided into chronic suppurative otitis media, indicating an active condition with a discharging ear and sequelae of chronic otitis indicating a non-active condition and a dry ear. The goals of tympanoplasty are:- elimination of disease and permanent restoration of hearing. The overall success of tympanic membrane repair varies greatly. Ventilation of middle ear is an essential predictor of the functional results following middle ear reconstruction. It is a complex and dynamic process depending upon a number of factors, most important of which include the functional status of the Eustachian tube, the degree of pneumatization of mastoid cells and condition of middle ear mucosa. The

role of coupling cortical mastoidectomy with myringoplasty in dry tubotympanic disease with no obvious mastoid reservoir is controversial but simple mastoidectomy is found to be an effective means of re-pneumatizing the sclerotic mastoid and eradicating mastoid sources of infection. Besides complete elimination of the disease, the modified technique of intact canal wall tympanomastoid surgery also attempts to preserve the normal anatomy and function of middle ear by providing a well ventilated middle ear cleft.

Tumarkin (7) and others have stressed the importance of early childhood middle ear infection in the arrest of mastoid pneumatization and resultant mastoid sclerosis. It is now widely held that small mastoid air cell volume (MACV) is the direct result of childhood otitis media.

Several studies by support the contention that the mastoid system functions as a pressure buffer. The presence of a pneumatized mastoid greatly increases the volume of the middle ear / mastoid system, which, in accordance with Boyle's Law, can minimize the effect of pressure changes in the middle ear cleft. They believed that the additional effective volume created by the expanded mastoid should restore the buffer effect in chronically draining ears, thus, optimizing the surgical results. Thus, a poorly pneumatized air cell system lacks this buffering capacity and is therefore, more prone to tympanic membrane retraction and chronic inflammatory condition. Paparella reported the important observation that most patients with COM and mastoiditis have mastoids that are sclerotic and hypocellular (3).

Diamant (8) made the first systematic study of mastoid air cell volume in normal and diseased temporal bones (Diamant's planimetric method). Based on lateral mastoid radiographs (Schuller's view), he found an unbroken sequence of sizes ranging from 0-30 sq.cm for adults. The measurement errors are less than 3% according to Diamant.

Holmquist (9) reported the importance of reduced MACV in tympanic membrane reconstruction. He found that myringoplasty success directly correlates with mastoid air cell volume (MACV) noting only 22% successful closure of tympanic membrane perforations when the MACV was < 5 sq.cm. The success rate rose to 57% when MACV increased to 5-10 sq.cm and 71% when MACV was > 10 sq.cm. These clinical observations by Holmquist (9) and others (Siedentop *et al.*, 1972) suggest that small mastoid air cell size is a poor prognostic indicator in tympanoplastic surgery.

As in our study, according to Sonkhya *et al.* (10) aerating mastoidectomy is beneficial in patients with granulomatous chronic otitis media as it restores the connection between the middle ear and mastoid and creates a physiological buffer. 212 patients of granulomatous chronic otitis media were managed by tympanoplasty with aerating mastoidectomy using modified intact canal wall technique and were followed for a minimum period of 12 months.

Nayak *et al* (11) conducted a prospective study of 40 patients of chronic suppurative otitis media tubotympanic disease in quiescent or inactive stage who underwent myringoplasty with or without cortical mastoidectomy. They compared the results of myringoplasty alone with that of combined cortical mastoidectomy and myringoplasty and found that size of the mastoids directly influence the take up rate of the graft as well as the hearing gain following myringoplasty in dry tubotympanic disease ears.

Mishiro *et al* (2001)(12) conducted a retrospective analysis of 251 ears with non-cholesteatomatous chronic otitis media, operated in an 11 year period. Patients in Group A (n= 147) were treated by tympanoplasty with cortical mastoidectomy. Patients in Group B (n= 104) were operated on without mastoidectomy. The objective of the study was to determine whether mastoidectomy is helpful when combined with tympanoplasty for these conditions. They reported an air-bone gap of 0-20 dB in 81.6% who underwent tympanoplasty with cortical mastoidectomy and 90.4% tympanoplasty without cortical mastoidectomy and recorded 90.5% overall graft success rates in patients with tympanoplasty with cortical mastoidectomy. In discharging ears, 90% success rates were obtained whereas in dry ears, 90.7% success rates were recorded. 93.3% overall graft success rates were obtained in patients who underwent tympanoplasty alone with 85.7% in discharging ears and 94.4% in dry ears. They concluded that mastoidectomy is not helpful in tympanoplasty for non-cholesteatomatous chronic otitis media, even if the ear is discharging which was against our findings.

Krishnan *et al* (2002)(13) recorded that in 'dry' ears (n= 76), who underwent tympanoplasty with cortical mastoidectomy (n= 40), 32 (80%) had dry, intact, mobile graft and 8 (20%) had dry retracted drum which is immobile. No perforation was found in this group. In patients with 'dry' ears, in whom tympanoplasty alone (n= 36) was performed, 20(55%) had dry, intact, mobile

graft and 8(22%) had retracted, immobile, dry graft and 8(22%) had perforations. In Quiescent ears (n=40), patients who underwent tympanoplasty with cortical mastoidectomy (n=36), 32 (89%) had intact, mobile, dry drum, 4 (11%) had residual perforation and none of the ears had retracted drum in this category. Patients with Quiescent ears, who underwent tympanoplasty alone (n=8), 4(50%) had intact, mobile, dry drum and 8 (100%) had retracted drum with no perforation. These results matched our results.

Balyan *et al* (1997) (14) presented a retrospective analysis of 323 patients with non-cholesteatomatous chronic otitis media. They separated the cases into three groups 1 (n=53) consisted of cases of chronic suppurative otitis media treated by tympanoplasty without mastoidectomy (TLWOM). Group 2 (n=28) included cases of chronic suppurative otitis media treated by tympanoplasty with mastoidectomy (TLWM). The ears in both these groups were discharging severely at the time of surgery. Group 3 (n=242) included patients whose ears were dry at the time of surgery but who had previous recurrent episodes of suppuration and were treated by tympanoplasty without mastoidectomy. They observed that tympanoplasty without mastoidectomy is the preferable treatment.

Eliades and Limb (15) conducted a study on 26 patients to review surgical outcomes for patients with perforations resulting from CSOM without cholesteatoma and concluded that there was no additional benefit to performing mastoidectomy with tympanoplasty for uncomplicated tympanic membrane perforations. Patients with more complicated disease benefitted from addition of a mastoidectomy

Conclusion

In 'dry' ears, tympanoplasty alone may suffice because of no difference in graft uptake rates. Whereas in 'wet' ears, cortical Mastoidectomy seems to be a good adjunct to tympanoplasty because it resulted in better graft uptake and better hearing results. Pre-operative assessment of mastoid size seems to give fairly good idea as regarding the success rate.

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