

## Original Research Article

# Audiological evaluation in between patients with type 1 tympanoplasty alone and type 1 tympanoplasty with cortical mastoidectomy

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## ABSTRACT

**Background:** Chronic otitis media is an inflammation of the middle ear cleft. Infection represents the single major cause for the failure of tympanoplasty to affect result of hearing. Cortical mastoidectomy is an effective mode in eradicating the mastoid source of infection. The effect of mastoidectomy on patients without evidence of active infection remains highly debated and unproven. So this study was conducted with the following objectives. This study was undertaken to evaluate the outcome of hearing of type I tympanoplasty with cortical mastoidectomy and type I tympanoplasty alone and to compare the results between these two.

**Methods:** The comparative study comprises of 60 patients with CSOM safe type operated over a period of 2 years. Patients were reviewed after 1 and 3 weeks. The second and third postoperative reviews were done at 3<sup>rd</sup> and 6<sup>th</sup> month respectively for clinicoaudiological assessment of the operated ear with respect to graft status, ear discharge and hearing improvement.

**Results:** The graft take up rates was high in large mastoids. Better results were obtained by performing a type I tympanoplasty with cortical mastoidectomy than with a type I tympanoplasty alone. Out of the sixty cases, 47 had an average audiological improvement of 10.7 dB in the speech frequencies.

**Conclusions:** A simple mastoidectomy is an effective means of repneumatizing the mastoid air cell system as well as eradicating the mastoid source of infection. Our study proves that type I tympanoplasty along with a cortical mastoidectomy gives better results than type I tympanoplasty alone.

**Keywords:** Type I tympanoplasty, Cortical mastoidectomy, Audiological evaluation

## INTRODUCTION

Chronic otitis media is an inflammation of middle ear cleft. It is well accepted that the main purpose of operation is to obtain permanently dry ear and to close the perforation and improve the hearing.<sup>1</sup> The use of mastoidectomy is a means to establish drainage of a complicated infection of the ear, sparks little controversy. Well trained, experienced otologists currently remain divided as to the importance of mastoidectomy in the treatment of chronic non-cholesteatomatous suppurative otitis media. However, the use of mastoidectomy to treat

chronic drainage or suppuration from otitis media remains an issue of debate.<sup>2</sup>

Ventilation of middle ear is an essential predictor of functional results following middle ear reconstruction which depends on the functional status of the eustachian tube, the degree of pneumatization of mastoid air cells and the condition of middle ear mucosa.<sup>3</sup>

The purpose of this study is to examine the role of the mastoid air cells in the tympanic membrane reconstruction and hearing. The goal is to determine

whether mastoidectomy is an effective means of eradicating mastoid sources of infection, to analyse the post-operative hearing for CSOM treated by tympanoplasty with or without mastoidectomy and to determine whether mastoidectomy is helpful or not.

### Aims and objectives of study

- To study the outcome of hearing in type I tympanoplasty alone in CSOM safe type.
- To study the outcome of hearing in type I tympanoplasty with cortical mastoidectomy in CSOM safe type.
- To compare the results between these two.

### METHODS

This study comprises of 60 patients with chronic suppurative otitis media safe type in quiescent stage. All the cases were operated during a period of 2 years between March 2012-March 2014 in the department of ENT, JJMMC, Davangere: 30 of these cases were selected for type I tympanoplasty alone (Group A) and 30 cases were selected for type I tympanoplasty with cortical mastoidectomy (Group B).

The work up for these cases consisted of a detailed history and a complete general physical, systemic and ear, nose and throat examination. In all the patient a routine blood and urine examination, X-ray of paranasal sinuses and mastoids, examination under microscope and puretone audiometry were done. Eustachian tube function was assessed clinically.

Patients with a history of long standing allergy or any systemic diseases, which might influence the operative results, were excluded from the study. Preoperatively all the patients had a discharge free period of 4-6 weeks.

Most of the group B patients were selected on the basis of presence of a quiescent ear with sclerotic mastoids. Cortical mastoidectomy was done in these patients, this was followed by a type I tympanoplasty in the same

sitting using autologous temporalis fascia. Patients were reviewed after 1 week and 3 weeks, for inspection of the operated ear. The second and third postoperative reviews were done at 3 months and 6 months respectively for a clinico-audiological assessment of the operated ear with respect to graft status, ear discharge and hearing improvement. The postoperative audiograms were recorded on the 2<sup>nd</sup> and 3<sup>rd</sup> visits.

### RESULTS

Sixty cases of type I tympanoplasty were studied during a period of two years from March 2012-March 2014 in the department of ENT, JJMMC, Davangere. The study group comprised of 55 patients, five of whom operated on both the ears, thus making the total number of operated cases sixty.

**Table 1: Graft take-up rates in patients with bilateral CSOM.**

| CSOM-safe type    | No. of cases | Failures  | Take-up rates (%) |
|-------------------|--------------|-----------|-------------------|
| <b>Unilateral</b> | 26           | 4 (15.4%) | 22 (84.6)         |
| <b>Bilateral</b>  | 34           | 6 (17.6%) | 28 (82.4)         |
| <b>Total</b>      | 60           | 10        |                   |

$\chi^2_{(1)}=0.054$ ;  $p=0.816$  (Not significant).

In present study, number of patients were seen in the age group of 20-29 years (38.2%), ( $p=0.001$ ) with a mean age of 26.4 years. The youngest patient was 14 years and the oldest 55 years. Presence of bilateral CSOM at the time of Type I tympanoplasty did not seem to have any influence on the graft take up. In present study, 29 patients had bilateral ear disease, but the graft take up rates were similar to that with unilateral CSOM (Table 1).

Higher failure rates were noticed with increasing size of perforation, irrespective of the surgical approach. However, in successful cases of type I tympanoplasty, patients with subtotal and medium sized perforations showed a better audiological improvement (13.4 dB) as shown in Table 2 and 3.

**Table 2: Size of perforation with regard to graft up-take and audiological benefit.**

| Size of perforation | No. of cases | Failures (%) | Take-up rates (%) | Average hearing gain |
|---------------------|--------------|--------------|-------------------|----------------------|
| <b>Medium</b>       | 19           | Nil          | 19 (100)          | 6.8 dB               |
| <b>Large</b>        | 29           | 3 (4)        | 26 (89)           | 12.6 dB              |
| <b>Subtotal</b>     | 12           | 7 (58)       | 5 (42)            | 13.4 dB              |

Adjusted  $\chi^2_{(2)}=18.476$ ;  $p=0.0001$  (significant)

**Table 3: Audiological benefits between the types of perforations.**

|                 | N  | Mean  | Std. deviation | 95% confidence interval for mean |       | Minimum | Maximum |
|-----------------|----|-------|----------------|----------------------------------|-------|---------|---------|
| <b>Medium</b>   | 19 | 6.84  | 4.682          | 4.59                             | 9.10  | 0       | 18      |
| <b>Large</b>    | 26 | 11.85 | 6.044          | 9.40                             | 14.29 | 0       | 28      |
| <b>Subtotal</b> | 5  | 13.40 | 3.507          | 9.05                             | 17.75 | 8       | 17      |
| <b>Total</b>    | 50 | 10.10 | 5.877          | 8.43                             | 11.77 | 0       | 28      |

$F_{(2,47)}=5.808$ ;  $p=0.006$  (Significant).

**Table 4: Postoperative clinicoaudiological evaluation.**

| Procedure      | No. of cases | Take up rates | Failures  | Freedom from discharge | Audiological benefit |
|----------------|--------------|---------------|-----------|------------------------|----------------------|
| <b>Group-A</b> | 30           | 24 (80%)      | 6 (20%)   | 25                     | 10.4 dB              |
| <b>Group-B</b> | 30           | 26 (86.7%)    | 4 (13.3%) | 30                     | 9.7 dB               |

$\chi^2_{(1)}=0.480$ ;  $p=0.488$  (Not significant).

**Table 5: To test the significant difference between the two groups with respect to audiological benefit.**

| Procedure      | No. of cases | Medium | Maximum | Mean  | Std. Deviation |
|----------------|--------------|--------|---------|-------|----------------|
| <b>Group-A</b> | 24           | 0      | 28      | 10.46 | 6.547          |
| <b>Group-B</b> | 26           | 0      | 18      | 9.77  | 5.294          |

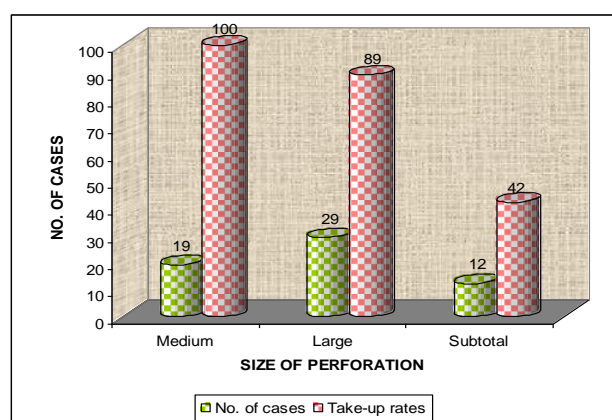
$T_{(48)}=0.41$ ;  $p=0.685$  (Not significant).

**Table 6: Audiological assessment.**

| Hearing            | No. of cases | Percentage (%) |
|--------------------|--------------|----------------|
| <b>Improvement</b> | 47           | 78.33          |
| <b>No change</b>   | 12           | 20             |
| <b>Worsened</b>    | 1            | 1.7            |
| <b>Total</b>       | 60           | 100            |

$\chi^2_{(1)}=21.6$ ;  $p=0.0001$  (Significant).

According to multiple comparison test significant difference observed between large and medium central perforations, medium and subtotal perforations.

**Figure 1: Size of perforation and take-up rates.**

In group A (type I tympanoplasty only) patients the graft take-up rates were 80% compared to 86.7% of group B (type I tympanoplasty with cortical mastoidectomy). Although there was failure of the graft to take up in 4 cases of Group B, all the patients were free from ear discharge post operatively. However in the failed cases of Group A, there was no clinical improvement in five cases and ear discharge persisted even after surgery. The audiological improvement was found to be almost equal in both Group- A and Group- B.

In our study of 60 cases, there was an average hearing improvement of 10.74 dB in speech frequencies in 78.3% of cases. Ten cases were not taken into account, as there

was failure of graft take up. Two cases showed no postoperative audiological benefit inspite of graft take up. In one case there was deterioration from moderate conductive hearing loss to moderately severe mixed hearing loss after surgery.

## DISCUSSION

Type I tympanoplasty is an operation in which the reconstructive procedure is limited to repair of tympanic membrane perforation. 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 the skin. Exploration of the middle ear and ossicular chain is a routine part of most type I tympanoplasty operations.

### Size of perforation and results of type I tympanoplasty

The results of type I tympanoplasty with regard to the size of perforation were found to vary in different studies. Jackler and Schindler the graft take up rates were found to be 86.7% for subtotal perforations and 76.5% for medium sized perforations.<sup>4</sup>

In contrast to the above, a study by Adkin et al showed only 61% take-up rates with subtotal perforations compared to 98% in medium sized perforations.<sup>5</sup> Our study results were similar to Adkin et al, series showing poor take up rates with subtotal perforations (42%) compared to medium sized perforations (100%).<sup>5</sup> The higher failure rates in subtotal perforations have been attributed to a larger area, which has to be vascularized and epithelialized and also due to the technical difficulty in surgery.

### Size of mastoids and take up rates

Jackler and Schindler in their study divided cases according to the size of mastoids on radiography and found that large mastoids ( $>10 \text{ cm}^2$ ) had a 100% take up rates, compared to small mastoids ( $<5 \text{ cm}^2$ ) which had a success rate of only 84.6%.<sup>4</sup> Our study showed similar results with a 100% take up in cases with large mastoids and 73.6% take up rates with small mastoids.

The association of reduced mastoid pneumatization to chronic middle ear infection and tympanic membrane reconstruction has been reported by Holmquist.<sup>6</sup> The success of type I tympanoplasty has been directly correlated with the mastoid air cell volume. A small mastoid air cell size is a poor prognostic indicator in tympanoplastic surgery. This is based on the "air reservoir" theory, which states that the mastoid air cell system provides a pneumatic reservoir upon which the middle ear can draw upon during period of transient eustachian dysfunction.

There was no definite study in the literature depicting the relationship between the duration of ear discharge and the success rates of type I tympanoplasty. In our study most of the cases in both groups had a history of prolonged ear discharge, which however did not seem to influence the success rates. The other important factor presumed to influence the results of type I tympanoplasty is the period of dryness of the ear to be operated. There seems to be a difference of opinion regarding the period of dryness required prior to surgery.

Booth in his series observed that long periods of dryness do not appear to make a significant difference but emphasized that the ear should be dry at the time of surgery, for better results.<sup>7</sup> Packer et al in their study concluded that no minimum qualifying period with a dry ear was deemed necessary for a successful type I tympanoplasty.<sup>8</sup>

### Audiological assessment

Audiological evaluation was done by taking the average of recording in three consecutive speech frequencies of 500 Hz, 1000 Hz and 2000 Hz. There was an overall average hearing improvement of 10.7 dB in 47 cases (78.3%). There was no change in 12 cases (20%), of which 10 cases were failed type I tympanoplasties and 2 cases showed no audiological improvement in spite of successful graft take up (Table 4 and 5).

In our study, successful cases showed a better hearing gain in larger perforations. Our patients had an average gain of 13.4 dB, 12.6 dB and 6.8 dB in subtotal, large and medium perforations respectively in the speech frequencies.

It also shows that the pre-operative pure tone average is 30.56 in type I tympanoplasty whereas in cortical

mastoidectomy with type I tympanoplasty is 29.33. Postoperatively pure tone average is 16.53 in type I tympanoplasty whereas in cortical mastoidectomy with type I tympanoplasty is 16.46 (Table 6). This shows that there is a mild difference of hearing gain in cortical mastoidectomy patients which is insignificant. Similar study conducted by Krishnan et al, shows that the pre-operative pure tone average in type I tympanoplasty alone was 52.72, whereas in cortical mastoidectomy with type I tympanoplasty was 53.26.<sup>9</sup>

Postoperative pure tone average is 35.59 in type I tympanoplasty whereas in cortical mastoidectomy with type I tympanoplasty is 34.84. This shows that the mean air conduction threshold is found to be almost the same irrespective of the fact whether a cortical mastoidectomy was performed or not.

### CONCLUSION

Infection represents the single most important cause of graft failure and can result from a hidden mastoid disease. A simple mastoidectomy is an effective means of eradicating the mastoid source of infection. Our study proves that type I tympanoplasty along with a cortical mastoidectomy gives better results in hearing and graft uptake than type I tympanoplasty alone

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