

# A Study of Surgical Outcomes of Tympanoplasties with and Without Cortical Mastoidectomy.

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## ABSTRACT

**Background:** In treatment of mucosal type of Chronic, suppurative otitis media, even well experienced otologists, remain divided in terms of combining mastoidectomy with tympanoplasty. Here we evaluate the surgical outcomes of tympanoplasties with and without cortical mastoidectomy and discuss the various pre-operative factors and post-operative subjective functional benefit of the patient. **Aim:** To evaluate the surgical outcomes of tympanoplasties with and without mastoidectomies in terms of graft uptake and hearing improvement. **Study design:** Prospective study. **Methods:** A total of 67 patients undergoing tympanoplasties with and without mastoidectomy were included and followed up for a period of one year. **Statistical Analysis:** Chi square test. **Results:** There was no significant difference in the surgical outcomes of both the surgeries in terms of graft uptake and hearing improvement. In unilateral cases Belfast rule of thumb application enables the actual hearing benefit of the patient. **Conclusion:** The addition of cortical mastoidectomy to tympanoplasty did not improve the outcome of surgeries done for mucosal type of chronic suppurative otitis media.

**Keywords:** Tympanoplasty, cortical Mastoidectomy, Belfast rule.

## INTRODUCTION

Auditory sensation is one of the vital sensations for existence. When such a great sensation is lost, life naturally loses its charm. Our country, being a developing nation with poor socio-economic status, chronic diseases of ear accounts for nearly 5% of population. Chronic suppurative otitis media is found to be the single major cause of recoverable conductive deafness. Surgery for tubotympanic type of chronic suppurative otitis media is the commonest otological surgical procedure in our country.

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The goal of otologists performing middle ear surgery is to make the patient free of ear discharge, correct the conductive hearing loss, to improve hearing, as well as to provide functional benefit to the patient. Unilateral conductive hearing loss is associated with various disabilities including difficulty in sound localization, hearing & understanding speech. This is because, listening is a binaural task, while benefit to the patient is determined by factors such as hearing in the non operated ear. Hence, the subjective evaluation of the surgical results speaks better than

the objective methods, which provide only the technical success of the operation.

This study discusses the various pre-operative factors which play a major role in the post-operative success of two various surgeries – myringoplasty and cortical mastoidectomy with type 1 tympanoplasty conducted in the Department of ENT in Tertiary care Medical College Hospital for patients presenting with chronic suppurative otitis media – tubotympanic disease. The hearing benefit is determined by Air bone gap closure and also subjective evaluation of hearing is done by applying Belfast rule of thumb.

## MATERIALS AND METHODS

A prospective study was conducted in about 67 patients attending ENT OPD with chronic suppurative otitis media – mucosal disease in a Tertiary care Medical College for a period of one and half years and the patients were followed up for a period of one year. Among them, 7 patients did not turn up for follow up and they were excluded from the study. The inclusion criteria being the patients between 15 to 50 years of both sexes, after elimination of focal sepsis, having either wet or dry ears and pure tone audiometry showing conductive hearing loss. Patients with congenital or acquired abnormalities of ear, unsafe ear, undergone ear surgeries previously and with pure tone audiometry showing mixed and sensorineural hearing loss were

excluded from the study.

### Methodology:

Minimum duration of discharge for the patients under study was 1 year and maximum was 15 years. Minimum duration of hearing impairment was 6 months and maximum was 10 years. For all patients, under study with wet ears, ear swabs were taken from middle ear and for patients with culture positive results, treated with specific antibiotics prior to surgery.

All cases were admitted, pre-operative examination done under microscopy, subjected to endoscopic eustachian tube evaluation (those with normally looking pharyngeal end of eustachian tube orifice were taken up for study) and hearing assessment done with tuning fork tests and pure tone audiogram. All patients were informed about their need for a follow up period of one year. Informed written consent to undergo surgery was obtained from all patients. Mastoid shaving and local preparation was done in the ward prior to surgery. All cases were done under GA. Premedication and local infiltration was same for all cases.

About 30 patients with dry ear for more than 6 weeks and with only conductive hearing loss, were subjected to myringoplasty and considered as Group A. About 22 patients with unilateral disease and 8 patients with bilateral disease were taken up for study. For patients with bilateral disease, worse ear was taken up for surgery. All patients were taken up for surgery under GA. Trans canal approach was followed in 21 cases and in 9 cases with narrow external auditory canal post-aural approach was followed. 4 quadrant local infiltration was given with 2% xylocaine with adrenaline premixed solution. Temporalis fascia graft harvested by a separate incision over supra auricular region for patients done through trans-canal approach & in patients done through post-aural approach, graft was harvested via the same incision. Temporalis fascia graft kept by underlay technique. All cases were followed up for 3,6 months and one year for graft uptake and postoperative hearing evaluations done at 3,6 months and one year. Results of hearing benefit, compared with pre-op and post-op air bone gap and for unilateral disease Belfast rule of thumb applied.

About 30 patients with wet ear and with no active infection as per microbiological report & with conductive hearing loss were subjected to cortical mastoidectomy with type 1 tympanoplasty and considered as Group B. About 18 patients with unilateral disease and 12 patients with bilateral disease were taken up for study. For patients with bilateral disease, worse ear was taken up for surgery. All patients were taken up for surgery under GA. Post-aural approach was followed in all cases. Post aural incision made, temporalis fascia graft harvested through the superior aspect of the incision as the first step, incision deepened and mastoid

cortex exposed. Pinna retracted anteriorly, incision made in the posterior canal wall skin from 6 o'clock to 12 o'clock position and tympanomeatal flap was elevated. Granulations if present in the tympanum were removed, mobility of ossicular chain were checked. Mastoid cortex was drilled out in all cases, patency established. For about 21 patients granulations noted in antrum removed and in 9 patients antrum found free of disease. For all patients, temporalis fascia graft kept by underlay technique, tympanomeatal flap repositioned and post-aural wound closed in layers. All cases were followed up for 2, 6 months and 1 year for graft uptake and post-operative hearing evaluations done at 3, 6 months and 1 year. Results of hearing benefit, compared with pre-op and post-op air bone gap and for unilateral disease, Belfast rule of thumb applied. Even though socio-economic status does influence the disease, all the patients attending Stanley Medical College Hospital belongs to lower socio-economic group. Hence this parameter is not included in this study.

## RESULTS

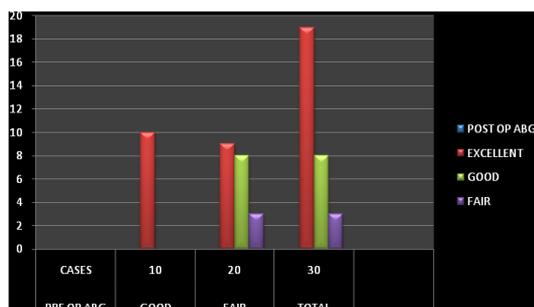
Total number of cases registered in this study was 67 patients, who came to the ENT Department with Chronic suppurative otitis media – tubotympanic disease. Among them 7 patients did not turn up for follow up and hence they were not included in the study.

The overall graft take up rate in both the surgeries was 88.33%. The overall hearing benefit was 90%, excellent with < 10dB ABG in 51.67% and Good with < 20dB in 38.33%. There was no postoperative complications, deterioration in hearing or sensorineural hearing loss in all 60 patients.

In Group A, 18 were females & 12 were males, 22 patients had unilateral and 8 had bilateral disease, 23 had medium sized central perforation and 7 had subtotal perforation, 10 had good pre-op Air bone gap of 10 to 20 dBHL. 20 patients had a fair pre-op Air bone gap of 20 to 30 dBHL.

1. Overall graft take up rate was 86.6%.
2. Otoscopic evaluation of 23 patients with medium sized perforation at the end of 2 months, revealed 18 to be intact, 5 residual perforation in the antero - inferior quadrant. In 7 patients with subtotal perforation, 4 were intact, 1 with residual perforation & 2 grafts got rejected because of post-op wound infection. Otoscopic examination at the end of 6 months & 1 year revealed – for all 23 patients with medium size perforation, tympanic membrane was intact and out of 7 patients with subtotal 2 were with residual perforation & 2 with rejection of graft. Hence the size of the perforation does have a role in graft take up rate. This is statistically significant by applying chi square test with p value < 0.05.

- In 10 patients with good pre-op ABG, the post-op ABG was excellent. In 20 patients with fair pre-op ABG, the post-op ABG results were, excellent in 9, good in 8 and fair in 3 patients accounting for 63.3% in excellent, 26.7% in good and 10% in fair groups. By applying Chi square test, these results are statistically significant [Figure 1]. Hence, for the patients with lesser pre-operative Air bone gap have a better post-operative hearing.



**Figure 1: Relationship between Pre OP ABG and post OP ABG in Group A patients.**

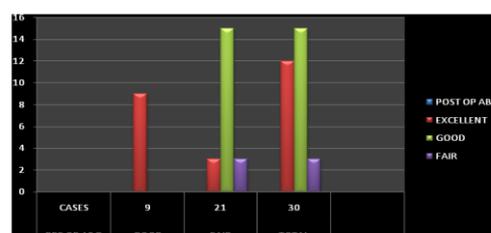
- When Belfast rule of thumb was applied to 22 patients with unilateral disease, 19 of them with medium sized perforation, felt subjectively better and out of 3 of them with subtotal perforation, 2 felt better & 1 patient felt hearing same as the pre operative status. These results are statistically significant with p value < 0.05, implies that Belfast rule of thumb interpret the post-operative hearing benefit in a better way than the Air bone gap, which tells about only the technical success.
- The correlation coefficient between the duration of discharge and the pre-op ABG is 0.4172 and that between the duration of hearing impairment with pre-op ABG is 0.3821 and is statistically significant. The correlation coefficient between the duration of discharge and the post-op ABG is 0.4544 and that between the duration of hearing impairment with post-op ABG is 0.4489 and is statistically significant, implies that the patients with lesser duration of discharge and hearing impairment had better post-operative hearing than the patients with longer duration of disease and hearing impairment.
- The other parameters, such as age, sex, weight does not have influence on the outcome of results in this study.
- The type of approach does not have a significant p value with graft intake in this study. Applying chi square test, the Pearson value is 0.

In Group B, 16 were females & 14 were males, 18 patients had unilateral and 12 had bilateral disease. 18 had medium central perforation and 12 had subtotal perforation, 9 had good pre-op Air bone gap of 10 to 20 dBHL 21 patients had a fair pre-op Air bone gap of 20 to 30 dBHL.

- Overall graft take up rate was 90%.
- The relationship between Graft take up rate and size of the perforation is statistically significant by applying chi square test with person value of 0.02535.

Otoscopic evaluation of 18 patients with medium sized perforation at the end of 2 months, revealed 17 to be intact, 1 residual perforation in the antero-inferior quadrant. In 12 patients with subtotal perforation, 8 were intact, 4 with residual perforation. Otoscopic examination at the end of 6 months & 1 year revealed – for all 18 patients with medium size perforation, tympanic membrane was intact and out of 12 patients with subtotal 3 were with residual perforation. Hence the size of the perforation do have a role in graft take up rate even when cortical mastoidectomy is done along with repair of tympanic membrane.

- In this study, out of 18 patients with medium sized perforation, 8 had a good & 10 had fair pre-op ABG. Out of 12 patients with subtotal perforation, 1 patient had good & 11 had fair pre-op ABG, implies that 91.7 % of the patients with subtotal perforation had pre-op ABG of 20 to 30 dB.
- Out of 30 patients, included in this procedure, 50% had excellent, 50% had good & 10% had fair post-op ABG. Those with medium sized perforation had better results than those with subtotal perforation.
- On comparison of pre-op ABG & post-op ABG, all 9 patients with good pre-op ABG improved to excellent, out of 21 with fair ABG, 3 were excellent, 15 were good and 3 were fair post-operatively. This result is highly statistically significant with pearson value of 0.00006 [Figure 2].



**Figure 2: Relationship between Pre OP ABG and post OP ABG in Group B patients.**

- Graft intake in 9 patients with disease free antrum mucosa is 100%.
- Out of 30 patients, 21 patients had disease in the antrum & 9 had a healthy antrum. 77.85% of the patients with healthy antrum and 9.5% of the patients with diseased antrum had good pre-op Air bone gap 90.5% with diseased and 22.2% with healthy antrum had fair preop Air bone gap.
- In patients with healthy antrum, the post-op ABG was excellent in 88.9% and 66.7% of the patients

- with diseased antrum had a good ABG post-operatively.
9. On applying Belfast rule of thumb to 18 patients with unilateral disease, 83.3% had better hearing, implies the post-operative hearing benefit better than assessment with Air bone gap.
  10. The correlation coefficient between the duration of discharge and the pre-op ABG is 0.3803 and that between the duration of hearing impairment with pre-op ABG is 0.3776. The correlation coefficient between the duration of discharge and the post-op ABG is 0.3794 and that between the duration of hearing impairment with pre-op ABG is 0.3729 and are statistically significant, implies that the patients with lesser duration of discharge and hearing impairment had better post-operative hearing than the patients with longer duration of disease and hearing impairment.
  11. The other parameters, such as age, sex, weight does not have influence on the outcome of results in this study.

## DISCUSSION

Analysis of 60 cases undergone surgery for tubotympanic disease is presented here and the same is compared with similar and related studies available in literature.

### 1. Graft Take Up Rate:

The overall graft take up rate in Myringoplasty in this study was 86.6%, which is within the range to the studies available. The graft take up rate in various studies were [Table 1];

**Table 1: Graft take up rate.**<sup>[1]</sup>

Study	No of cases	year	Graft take up rate
Gibb, Chang et al	365	1982	91.4%
Black, PJ Wormald	261	1995	78%
Raj A Vedit	50	1999	84%
Kotecha et al	107	1999	82.2%
Yasuo, Mishiro et al	104	2001	94.4%
Kageyama et al	290	2001	82.1%
Alberra et al	85	2006	86%

The graft take up rate in Cortical mastoidectomy with type 1 tympanoplasty is 90% which is also within the range to the studies available in literature [Table 2].

**Table 2: Graft take up rate.**<sup>[2]</sup>

Studies	No of cases	Graft take up rate
Yasuo, Mishiro et al	147	90%
Adnan saleem et al	85	92.95%
McGrew et al	100	91%
Rehl CM et al	135	90.4%

In this study, the graft take up rate is better in medium sized perforations when compared to the

subtotal perforation. In Myringoplasty series, the take up rate in medium sized perforation was 100% and in subtotal perforations the take up rate was 42.9%, rejection rate was 28.6%, re-perforation rate was 28.6%. In mastoidectomy with type 1 tympanoplasty series, the graft take up rate in medium sized perforation was 100% and in subtotal perforations the rate was 75% and re-perforation rate was 25%. These studies are similar to the results quoted by the study of Vartianien et al and Alberra et al.<sup>[2,15]</sup>

### 2. Graft Failure Rate:

Graft failure rate in various studies were [Table 3];

**Table 3: Re-perforation Rate %.**<sup>[1]</sup>

Studies	Re-perforation Rate %
Alberra et al	7 to 21
Vartianien et al	10.6
Adnan, saleem et al	7.05

In this study, in myringoplasty series the rate of residual perforation is 6.7% and the rate of rejection of graft is 6.7%. The probable cause of residual perforation is the slippage of the graft from its position and the cause for rejection is the post operative infection of the operated site, which is same as the reason cited by the study of Vartianien et al and Kotecha et al.<sup>[7,14]</sup> Study of Alberra et al also includes the efficiency of the surgeon and the surgical techniques.<sup>[2]</sup>

### 3. Pre-operative Hearing

In this study the pre operative pure tone average in Myringoplasty series was between 30 to 40 dB with average being 38 dB and in Cortical mastoidectomy with type 1 tympanoplasty series between 30 to 55 dB with average being 42.16 dB. As the perforation size increases, the preoperative hearing threshold also increases – this is consistent with the study conducted by Mehta et al, Bhusal et al Nepal A Bhandary et al, Kageyama et al, Aiberra et al and Saeed et al.<sup>[1,2]</sup>

### 4. Post Operative Hearing Benefit

Hearing improvement in various studies quoted in literature were [Table 4];

**Table 4: Hearing Improvement.**<sup>[2,3]</sup>

Study	Hearing Improvement
Adnan et al	85.88%
Rizer et al	84.9%
Raj A Vedit et al	68%
Kotecha et al	67%

In this study, the overall post operative hearing benefit based on Air bone gap was 90% with <10 Db in 51.67% and <20db in 38.33%. As hearing benefit is better assessed with the subjective evaluation, in this study we have applied Belfast rule of thumb in patients with unilateral disease. In 23 patients with

unilateral disease in Myringoplasty series, 95.7% felt significant improvement in hearing and 4.3% felt no improvement. In 18 patients with unilateral disease in Mastoidectomy with type 1 tympanoplasty series, 83.3% felt significant improvement in hearing and 16.7% felt no improvement.

### 5. Role of Cortical Mastoidectomy in Chronic Suppurative Otitis Media – Tubotympanic Disease.

- Sheehy pointed out that cortical mastoidectomy is necessary for all tympanoplasty –it is ‘A good practice’ and ‘it is better to be safe than sorry’.<sup>[13]</sup>
- TOS recommended Mastoidectomy for all discharging ears.<sup>[9]</sup>
- Role of adjuvant cortical mastoidectomy:

Many authors suggest that a cortical mastoidectomy should be carried out at the same time as myringoplasty in active ears. Mishiro et al compared 104 ears treated by tympanoplasty alone with a previous group of 147 ears treated by tympanoplasty with mastoidectomy<sup>[10]</sup> There was no significant difference in the tympanic membrane closure rates between groups (94% in tympanoplasty, alone and 91% in tympanoplasty with mastoidectomy) Balyan et al reported 81 ears that were actively discharging at the time of surgery treated with tympanoplasty without mastoidectomy(53 ears) and tympanoplasty with mastoidectomy (28) ears. There was no significant difference in the graft success rates between these groups (91 &86% respectively). There is no evidence that mastoidectomy increases the success rate.

- Mc Grew et al in their paper on ‘Impact of mastoidectomy on simple TM Perforation repair’ concluded that mastoidectomy impacts clinical course of disease in patients by reducing number of patients requiring future surgery and disease progression.<sup>[8]</sup>
- In this study, graft take up in 9 patients with disease free antrum is 100% in patients undergone cortical mastoidectomy with type 1 tympanoplasty with wet ears. Type 1 Tympanoplasty alone could be a preferable option, in these cases. But 21 out of 30 cases with wet ear had diseased antrum. As assessment of disease in antrum is difficult pre-operatively, mastoidectomy in wet ears will be a safer option.

### CONCLUSION

1. The success of Myringoplasty in terms of graft uptake and hearing improvement is better in patients with lesser duration of disease, less pre-operative Air bone gap and with medium sized perforations when compared to subtotal perforations.

2. The success of Cortical mastoidectomy with type 1 tympanoplasty in terms of graft uptake and hearing improvement is better in patients with lesser duration of disease and less pre-operative Air bone gap. The results are better with medium sized perforations when compared to subtotal perforations and in patients with disease free mucosa of mastoid antrum.
3. In post-operative evaluation of patients with unilateral hearing loss, application of Belfast rule of thumb enables the actual hearing benefit of the patient.

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