

## Original Research Article

# Endoscopic tympanoplasty in subtotal perforations: conventional versus circumferential subannular grafting technique

Bindu Sara Varghese, Nivee Narayanan\*

Department of ENT and Head and Neck Surgery, KMCT Medical College, Manassery, Calicut, Kerala, India

**Received:** 05 September 2019

**Revised:** 17 October 2019

**Accepted:** 25 October 2019

### \*Correspondence:

Dr. Nivee Narayanan,

E-mail: [sunnex76.sa@gmail.com](mailto:sunnex76.sa@gmail.com)

**Copyright:** © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

### ABSTRACT

**Background:** Tympanoplasty is a surgical procedure to reconstruct hearing mechanism impaired by chronic ear disease. Endoscopic technique has advantage of being minimally invasive, having better surgical view of the field, lesser postoperative pain and shorter duration of surgery. The aim of this study was to compare surgical outcomes of two techniques of endoscopic tympanoplasty in subtotal perforations.

**Methods:** This prospective, comparative study was carried out between October 2016 to October 2018, in the Department of ENT, KMCT Medical College. 40 patients were randomly allocated to 2 groups of 20 each, to avoid selection bias and sample size calculated using the sample size formula. Group A underwent endoscopic tympanoplasty by conventional technique and Group B by circumferential subannular graft technique.

**Results:** Post-operative evaluation of the patients for graft status showed 75% had successful graft uptake in Group A and 95% in Group B both groups had comparable, significant hearing improvement post operatively.

**Conclusions:** Our study showed that, in all cases of subtotal perforations, the circumferential sub annular graft technique yielded a superior result with regards to the graft uptake compared to the conventional technique. The closure of the mean air-bone gap were significant, and similar among both the groups.

**Keywords:** Endoscopic tympanoplasty, Subtotal perforation, Conventional graft technique, Circumferential subannular graft technique

### INTRODUCTION

Tympanoplasty is a surgical procedure to reconstruct hearing mechanism impaired by chronic ear disease.<sup>1</sup> Tympanoplasty type 1 is a surgical procedure in which the tympanic membrane is reconstructed with nil manipulation of ear ossicles. Even though endoscopy was introduced in 1967 by Mer and his colleague, it was still in infancy, being used mainly for diagnostic otoendoscopy as well as for academic purposes.<sup>2</sup>

In the past few years, otologists all over the world has taken a giant leap in the field of endoscopic middle ear surgeries. Transcanal endoscopic approach has its own advantages like a wide angled visualisation of the middle

ear anatomy which helps in understanding mucosal folds, ligaments and the functioning of different anatomical spaces.<sup>3</sup>

In this study, we did a comparative study of 2 techniques of tympano meatal flap elevation, while performing endoscopic tympanoplasty type 1 for subtotal central perforations and its effects on graft uptake and hearing improvement.

### METHODS

This prospective, comparative study was carried out between October 2016 to October 2018 in the Department of Otorhinolaryngology, KMCT Medical

College, after obtaining prior approval from the institutional ethical committee.

Inclusion criteria were chronic otitis media (mucosal type) with subtotal perforation, ear should be dry at least for the past 1 month, age group 12 years to 50 years and pure tone audiometry (PTA) showing conductive hearing loss less than or equal to 40 dB with good cochlear function.

Exclusion criteria were patients whom on endoscopy showed ossicular necrosis, mucosal adhesions or granulations, patients with more than 40 dB air-bone gap on PTA and all cases with marginal perforation and cholesteatoma.

A total of 40 patients were selected, who fulfilled the above criteria. They were examined endoscopically with 0 and 30 degree 4 mm endoscope, to assess the ossicular chain status and integrity. The middle ear mucosa and eustachian tube area were also examined. Perforations involving 75% to 90% of the tympanic membrane was identified as subtotal perforation.

Any associated allergic rhinitis/sino nasal problems were dealt with prior to surgery. Hearing evaluation was done in the OP with tuning fork of 256, 512 and 102 Hz. Patient then underwent audiological evaluation and eustachian tube function test. Pre-operative and post-operative records of all patients with regards to their age, gender, detailed clinical history, investigation reports, surgery details were maintained. All patients were counselled pre operatively about the surgery, techniques and complications. Written and informed consent were taken for surgery and anaesthesia.

Patients were randomly allocated into 2 groups of 20 cases each. In Group A, patients underwent tympanoplasty by the conventional grafting technique and Group B by the circumferential subannular grafting (CSG) technique.

Endoscopic tympanoplasty was done by permeal route using a 0° and 30° angled, 4 mm, 18 cm long storz rigid endoscopes were used. Standard microscopic ear surgery instruments were used.

All 40 patients underwent endoscopic tympanoplasty Type I under general anaesthesia. After painting and draping, temporalis fascia which was harvested from a 2 cm supra aural hairline incision was prepared. EAC was flushed with normal saline multiple times. Infiltration done in 4 quadrants. Margins of the perforation were freshened and under surface curetted. Tympanomeatal flap was then raised by 2 techniques. In Group A, meatal incision was put at 6'o clock and 12'o clock position and a 180° tympanomeatal flap was elevated as done conventionally. In Group B, incisions were made at 1'o clock and 11'o clock positions and tympanomeatal flap raised. Middle ear was thoroughly examined. The

ossicular integrity and mobility were confirmed by eliciting the round window reflex. Temporalis fascia was placed as underlay graft medial to the handle of malleus. In Group A, the anterior margins were tucked under the annulus and in Group B, the graft rested circumferentially on the bony canal wall, subannular. After confirming the appropriate positioning of the graft, the tympanomeatal flap was repositioned. Medicated gel foam was placed medial and lateral to the graft for support. The sharp anterior tympanomeatal angle was adequately maintained after the CSG technique. All patients had an uneventful intraop and postop period. They were discharged the next day and reviewed on day 5 for suture removal. We reviewed the patients weekly for the first month, then at the second and finally at the third month for assessing graft uptake and pure tone audiometry. Surgical outcome was rated successful if the ear gets dry, with an intact mobile neotympanum.

**Statistical methods**

Demographic data was compared using chi square test. Unpaired t-test was used for assessing the mean hearing improvement in each group and also to compare the mean hearing gain between Group A and Group B.

**RESULTS**

Out of the 40 patients, 22 were females and 18 males. 4 patients were less than 20 years of age and the remaining between 20-50 yrs. Age and male to female ratio among the groups were not statistically significant (p>0.01) (Table 1).

**Table 1: Demographic data.**

Variable	Group A	Group B	P value
<b>Sex</b>			
Male	11	8	0.342178
Female	9	12	
<b>Age in years</b>			
<20	1	3	0.291841
20-50	19	17	

p>0.01 statistically not significant.

**Table 2: Mean hearing improvement in Group A (n=20).\***

Group A	Pre-operative	Post-operative
<b>Mean (PTA)</b>	37.135 dB	24.96 dB
<b>SD</b>	1.15	1.21
<b>SEM</b>	0.25715	0.27056

\*unpaired t-test; p<0.00001. The result is significant at p<0.05.

All patients had subtotal perforations (involving 75-90%). In group A the preoperative pure tone average was 37.135 dB and in Group B 37.3 dB. Out of the total 40 patients, 6 patients had graft failures (15%). In Group A, 5 patients (25%) and in Group B, 1 patient (5%) had graft failure (Table 5). The remaining 34 patients (85%) had a

perfect graft uptake. We faced no other complication or sequelae. Post-operative audiometry showed an average hearing gain of 12.175 dB in Group A and 12.09 dB in Group B.

**Table 3: Mean hearing improvement in Group B (n=20).\***

Group B	Pre-operative	Post-operative
Mean PTA	37.3 dB	25.21 dB
SD	1.05	1.12
SEM	0.2348	0.2504

\*unpaired t-test; p<0.00001. The result is significant at p<0.05.

**Table 4: Comparison of hearing gain between Group A and Group B (n=20).**

	Group A	Group B
Mean (PTA)	12.175 dB	12.09 dB
SD	1.21	1.12
SEM	0.27056	0.25049

p=0.8187. The result is not significant at p<0.05.

**Table 5: Percentage of graft failure.**

Groups	Number of graft failure	% graft failure
Group A (n=20)	5	25
Group B (n=20)	1	5
Total (n=40)	6	15

## DISCUSSION

The term tympanoplasty was introduced by Wullstein in the year 1953 for describing the surgical technique of reconstruction of hearing mechanism, impaired by chronic ear disease.<sup>4</sup> He classified it into 5 types: tympanoplasty type 1 is performed to repair tympanic membrane perforation and thereby improve the hearing. Success of the procedure depends on various factors like eustachian tube function, graft placement techniques and the experience of the surgeon. The most common area of graft failure is usually the anterior margin and it is more commonly seen in subtotal/ large central perforations due to lack of residual remnant of the tympanic membrane to support the graft anteriorly and also due to poor visibility.<sup>5</sup> To improve the surgical outcomes, surgeons all over the world have come out with newer techniques. Palva's swing door technique enhanced visualisation of the anterior tympanum.<sup>6</sup>

Primrose and Kerr were able to improve graft tension by an anterior tunnel created under the annulus.<sup>7</sup> Fariol has described elevation of the flap from 12'o clock to 3'o clock position.<sup>8</sup> In our technique of circumferential subannular grafting, flap was elevated from 11'o'clock to 1'o'clock position (270°) which permitted the graft to be easily tucked medial to the handle of malleus and the

edges positioned circumferentially over the bony annulus, which resulted in a better graft uptake.

In a prospective study conducted by Murugendrappa et al concluded that sub annular grafting technique was superior in post-operative hearing improvement (11 dB) compared to the conventional method (8 dB). They had a successful graft uptake of 96% in CSG technique compared to 76% by the conventional method.<sup>9</sup>

In our study of 40 cases with subtotal perforation CSG technique achieved 95% success rate and 75% by the conventional technique. Post-operative hearing gain (mean) in Group A (conventional) was 12.175 dB and in Group B 12.09 dB which was not statistically significant (p=0.40059) (Table 4). Improvement of air conduction thresholds in all frequencies and closure of the mean air-bone gap in both the groups were statistically significant (p<0.00001) (Table 2 and 3).

Dhanapala et al in their prospective study have concluded to have a success rate of 94% by CSG technique.<sup>10</sup> In the study done by Mokhtarinejad et al reported 97% success rate by CSG technique. They reported no significant difference in the post-operative hearing improvement between the CSG technique and conventional technique, which was similar to the findings in our study.<sup>11</sup>

We did not encounter any case of anterior blunting, medialisation or lateralisation of the graft.

## CONCLUSION

In all cases of subtotal perforations, the CSG technique yielded a superior result with regards to the graft uptake compared to the conventional technique. The closure of the mean air-bone gap was significant, and similar among both the groups.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: The study was approved by the Institutional Ethics Committee*

## REFERENCES

1. Tarabichi. Endoscopic middle ear surgery. *M Ann Otol Rhinol Laryngol.* 1999;108(1):39-46.
2. Mer SB, Derbyshire AJ, Brushenko A, Pontarelli DA. Fiberoptic endoscopes for examining the middle ear. *Arch Otolaryngol.* 1967;85(4):387-93.
3. El Guindy A. Endoscopic transcanal myringoplasty. *J Laryngol Otol.* 1992;106(6):493-5.
4. Wullstein H. Theory and practice of tympanoplasty. *Laryngoscope.* 1956;66(8):1076-93.
5. Schraff S, Dash N, Strasnick B. "Window shade" tympanoplasty for anterior marginal perforations. *Laryngoscope.* 2005;115(9):1655-9.

6. Palva T. Middle ear surgery in northern europe. *Arch Otolaryngol.* 1963;78:363-70.
7. Primrose WJ, Kerr AG. The anterior marginal perforation. *Clin Otolaryngol Allied Sci.* 1986;11:175-6.
8. Farrior BJ. Tympanoplasty in 3-D. Volume 3. Tampa. FL. American academy of Ophthalmology and Otolaryngology: 1968.
9. Murugendrappa MA, Siddappa PN, Shambulingegowda A, Basavaraj GP. Comparative Study of Two Different Myringoplasty Techniques in Mucosal Type of Chronic Otitis Media. *J Clinical Diag Res.* 2016;10:MC01-3.
10. Dhanapala N, Hussain SM, Reddy LS, Bandadka R. Comparative study of clinical and audiological outcome between anterior tucking and circumferential flap methods of type I tympanoplasty in large central perforation. *Indian J Otol.* 2018;24(3):190-3.
11. Mokhtarinejad F, Okhovat SA, Barzegar F. Surgical and hearing results of the circumferential subannular grafting technique in tympanoplasty: a randomized clinical study. *Am J Otolaryngol.* 2012;33(1):75-9.

**Cite this article as:** Varghese BS, Narayanan N. Endoscopic tympanoplasty in subtotal perforations: conventional versus circumferential subannular grafting technique. *Int J Otorhinolaryngol Head Neck Surg* 2020;6:128-31.