International Journal of Otorhinolaryngology and Head and Neck Surgery
Prakash MD et al. Int J Otorhinolaryngol Head Neck Surg. 2018 Jul;4(4):1049-1052
http://www.ijorl.com
pISSN 2454-5929 | eISSN 2454-5937

Original Research Article

DOI: http://dx.doi.org/10.18203/issn.2454-5929.ijohns20182711

Effect of canalplasty in tympanoplasty

M. D. Prakash, Priya Badkar*

Department of Otorhinolarygology, Sri Venkateswara ENT Institute, Bangalore Medical College and Research Institute, Bengaluru, Karnataka, India

Received: 25 April 2018
Revised: 13 June 2018
Accepted: 14 June 2018

***Correspondence:**
Dr. Priya Badkar,
E-mail: priyabadkar@gmail.com

ABSTRACT

Background: Objective of the study was to analyse the role of canalplasty in tympanoplasty in terms of intra operative ease, complete visualisation of tympanic membrane, graft uptake rates and hearing improvement.
Methods: 100 patients with chronic otitis media presenting to our institution from August 2016 to July 2017 were included in this study. Group I consisted of 50 patients who underwent tympanoplasty with canalplasty and Group II had 50 patients who underwent tympanoplasty without canalplasty. Both groups were followed up for 3 months, compared and analysed for hearing improvement and graft uptake.
Results: Our results showed that Group I achieved 98% graft uptake rates compared to group II which achieved 92%. In Group II gain in air bone gap was 11.26 dB where as in Group I was about 13.48 dB. Group I had significant hearing improvement compared to Group II.
Conclusions: It is advisable to combine canalplasty with tympanoplasty as it gives better visualisation of tympanic membrane facilitating the placement of graft and prevents lateralization of the graft.

Keywords: Chronic otitis media, Tympanoplasty, Canalplasty

INTRODUCTION

Chronic otitis media (COM) is an inflammatory process in the middle-ear space that results in long term, or more often, permanent changes in the tympanic membrane including atelectasis, dimer (formerly "monomer") formation, perforation, tympanosclerosis, retraction pocket development, or cholesteatoma.[1] COM is a major cause of acquired hearing impairment especially in developing countries. According to WHO, prevalence rate of COM in India accounts for 7.8% which is high.[2] Perforation in tympanic membrane leads to hearing loss and recurrent ear infections. Persistent perforations occur either due to improper treatment of recurrent otitis media or infected traumatic perforation. Tympanoplasty is a procedure to eradicate disease in the middle ear to reconstruct hearing mechanism with or without tympanic membrane grafting.[3]

Canalplasty is circumferential enlargement of bony external auditory canal by removing the bony overhanging canal bulge to visualise the entire ring of tympanic annulus using one position of anatomically narrow canals. The operation can be an end in itself (to widen a stenosed canal) or to gain access for another procedure (tympanoplasty, stapedotomy).[4]

This study aims to analyse if combining canalplasty with tympanoplasty influences the rate of graft uptake and rate of hearing improvement.

METHODS

Source of data

Patients taking treatment at our hospital were included in this study.

Study design: Prospective study.

Study period: August 2016 to July 2017.

Place of study

Sri Venkateswara ENT Institute, Victoria Hospital attached to Bangalore Medical College & Research Institute, Bangalore.

Sample size

Total of 100 patients who were randomly categorised into two groups, 50 in each.

Inclusion criteria

Inclusion criteria were patients aged 15 to 60 years; medium and large dry central perforation; patients who have given written informed consent.

Exclusion criteria

Exclusion criteria were granulation tissue, cholesteatoma, or polyp in the ear prior to surgery; patients with sensorineural hearing loss; patients undergoing revision tympanoplasty; patients who are not willing for surgery.

Methods of collection of data

A total of 100 patients were enrolled into the current study and were randomly categorised into 2 groups. Group I (study group) comprised of 50 patients who underwent cortical mastoidectomy with tympanoplasty and canalplasty whereas Group II (control group) underwent cortical mastoidectomy with tympanoplasty only. Preoperative and postoperative Pure Tone Audiometry (PTA) was done by Carhart and Jerger technique. Hearing impairment was classified as per Clark's classification (Table 1).

Table 1: Clark's classification.

Normal	0 – 15
Minimal	16 – 25
Mild	26 – 40
Moderate	41 – 55
Moderately severe	56 – 70
Severe	71 – 90
Profound	>91

Procedure

All patients in this study were taken up for surgery under local anaesthesia in whom post aural approach was followed. William wilde's post aural incision was made, temporalis fascia graft harvested by hydro dissection. Later mastoid cortex was exposed by an incision along the linea temporalis and the line perpendicular to it which is parallel to posterior wall of external auditory canal (EAC). Posterior meatotomy was done following which mastoid drilling commenced in Mc Ewen's triangle to open the antrum for all cases. Following which tympanomeatal flap was elevated. Upto this step, the procedure was same for both the groups.

Group I: In this group, additional canalplasty was done. Bony hump which was obscuring the view of tympanic annulus was removed by drilling till the annulus was visualised completely.

Only in patients belonging to Group I canalplasty was done until annulus visualised completely.

In both the groups depending on the status of ossicular chain, reconstruction was done in indicated patients. Temporalis fascia graft was placed by underlay technique. Tympanomeatal flap was placed back over the graft. Pieces of gel foam placed in middle ear till annulus. Antibiotic soaked gel foam with medicated wick kept in EAC to prevent stenosis. Post aural wound sutured. Mastoid pressure dressing was placed. Suture removal was done after one week. Antibiotic coverage was given for three weeks till the pack was removed.

Post operatively all patients were followed up for minimum of 3 months. Intact mobile tympanic membrane was considered as successful graft uptake. Air Bone Gap was calculated pre operatively and 3 months postoperatively by taking average of Air Bone Gap at 500 Hz, 1, 2, 4 KHz.

Analysis of results

The results obtained during the study were statistically analyzed using SPSS Version 16.0. Data was summarised using descriptive statistics. Comparison between groups was performed using independent sample t-test. P value less than 0.05 was considered statistically significant.

RESULTS

The present study consisted of 100 patients, 50 each in both Groups. Mean age of Group 1 was found to be 29±10.36 years and that of Group II was 31±11.07 years. In Group I there were 19(38%) Males and 31 Females (62%), with male:female ratio 1:1.6 while in Group II there were 30 (60%) males and 20 (40%) females, giving ratio of 1.5:1 (Figure 1).

Table 2: Age related distribution.

Age	Group I	%	Group II	%
0-20	8	16	9	18
21-30	23	46	20	40
31-40	12	24	12	24
41-50	4	8	6	12
51-60	3	6	3	6
Total	50	100	50	100

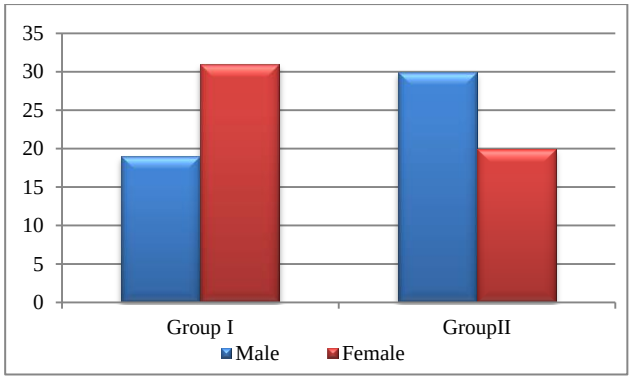

Figure 1: Gender distribution.

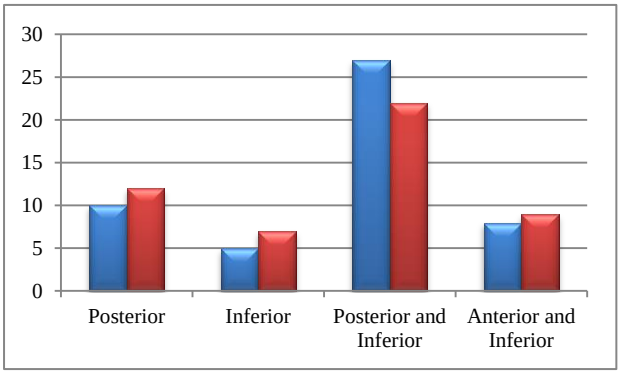

Figure 2: Position of canal hump.

Postero inferior bony overhang (Figure 2) was the commonest finding in both groups. Almost equal numbers of patients with large and medium sized perforation were included in both groups (Table 3).

Table 3: Perforations based on size.

Perforation	Group I	Group II
Medium	25	24
Large	25	26

Type of surgery

Among the 50 patients in Group I, 44 patients underwent type 1 tympanoplasty and the rest 6 patients underwent type 3 tympanoplasty. In Group II, 47 patients underwent type 1 tympanoplasty and 3 patients with type 3 tympanoplasty (Table 4).

Table 4: Type of tympanoplasty (based on Wullstein and Zollner classification).

	Group 1 N=50	Group 2 N=50
Type 1	44	47
Type 3	6	3

In Group I, graft was taken up in 49 (98%) cases, while one patient had residual perforation where as in group II graft uptake rate was 92% (46 cases). Three patients had residual perforation and one patient had medialisation of the graft.

Hearing assessment

Preoperative pure tone average was 39.86dB in Group I and 38.46 dB in Group II. Hearing assessment in terms of air bone gap (ABG) was done in all cases. Preoperative average air bone gap was 30.96 in the group with canalplasty and 28.44 in the group without canalplasty. Postoperative audiometry was performed after 3 months in all cases. Postoperative pure tone average was 28.78 dB and in Group II was 29.26 dB. There was closure in air bone gap of 13.48 dB in the group with canalplasty and 11.26 dB in the group without canalplasty which is statistically significant (p value 0.001) (Table 4).

Success rate

Group I achieved 98% (49 cases) graft uptake. One patient had residual perforation. In group II graft uptake rate was 92% (46 cases). Three patients had residual perforation and one patient had medialisation of the graft.

Table 5: Audiometry findings preoperative and postoperative.

Parameters	Group I (n=50)	Group II (n=50)	P value
Preoperative ABG (dB)	30.96±8.84	28.44±4.97	0.083
Postoperative ABG (dB)	17.57±7.52	17.20±4.90	0.771
Air Bone Gap closure (dB)	13.48±2.58	11.26±2.23	0.001
Preoperative PTA (dB)	39.86±10.70	38.46±7.20	0.443
Postoperative PTA (dB)	28.78±8.96	29.26±6.85	0.766
Improved PTA (dB)	11.08±4.80	9.20±3.26	0.024

DISCUSSION

Tympanoplasty is a procedure to eradicate disease in the middle ear to reconstruct hearing mechanism with or without tympanic membrane grafting. Canalplasty is a procedure to remove bony overhanging in the external auditory canal to facilitate grafting by visualising the tympanic annulus completely. Tympanoplasty in combination with canalplasty provides additional hearing gain.

In our study, maximum number of patients belonged to 21-30 yrs of age group (46%) in Group I and (40%) in Group II (Table 2). Patients below 14 years were excluded from our study. Children are considered to be poor candidates for tympanoplasty as they are more prone to recurrent respiratory tract infections, immaturity of immune system and Eustachian tube physiology. There was no effect of age of the patient on the pre-operative hearing loss or the hearing gain following surgery in our study. In a study by Verma et al maximum number of patients were in the age group 20-30 years (37.5%) which is similar to our study.[4]

In our study group (n=100) 51% comprised of females. However, separately, Group II had a slight male preponderance (60%) while in Group I, females formed the majority (62%). This is similar to the study by Taneja where females (58%) were predominated than males.[6]

The most common sites of bony overhang were the posterior and inferior walls of the EAC.

On comparing the degree of hearing loss in both groups, mean pre-operative AB gap in group I was 39.86 dB while group II was 38.46 dB. Postoperative audiometry was performed after 3 months in all cases. Patients who underwent canalplasty had a mean hearing gain of 11.08 dB compared to Group II (9.20 dB) which was statistically significant (p=0.024). Vijayendra et al reported additional 9 dB hearing gain 3 months post-operatively on combining canalplasty with type 1 tympanoplasty than with tympanoplasty alone.[5]

In our study average gain in ABG in the group without canalplasty is 11.26 dB and with canalplasty is 13.48 dB which is statistically significant (p<0.001) which matches with the study of Ajay et al which has significant improve in ABG (11.26 dB) in the group with canalplasty (p=0.005).[6]

Graft uptake was analysed at the end of 3 months in terms of intact and mobile graft. 98% of cases in Group I achieved success in comparision with Group II (92%).

CONCLUSION

It is advisable to combine canalplasty with tympanoplasty as it gives better visualisation of tympanic membrane facilitating the placement of graft, prevents lateralization of the graft. This improves overall graft uptake and hearing improvement.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Gopen Q. Pathology and Clinical Course of the Inflammatory Diseases of the Middle Ear, Chapter 25: Glasscock-Shambaugh's Surgery of the Ear, 6th edition. Philadelphia: Saunders WB Co.; 2010: 427.
2. World Health Organization. Chronic suppurative Otitis Media Burden of Illness and Management. Geneva: World Health Organisation; 2004: 17.
3. Aristedes AS. Tympanoplasty: Tympanic Membrane Repair. In: A Julianna Gulya, Lloyd B. Minor/ Dennis S Poe editors. Glasscock Shambhaugh Surgery of the ear. 6th ed. USA: People's Medical Publishing House; 2010.
4. Verma R, Singh HP, Kumar S, Verma V, Agarwal SP. Comparative analysis of functional outcomes of canalplasty in ear surgeries. Int J Current Med Pharm Res. 2015;10:164-9.
5. Vijayendra H, Ittop CJ, Sangeetha R. Comparative study of hearing improvement in type 1 tympanoplasty with and without canalplasty. Indian J Otolaryngol Head Neck Surg. 2008;60:341-4.
6. Taneja MK. Role of canaloplasty. Indian J Otol. 2013:19:159-63.
7. Mallick A, Bhalla V, Roy R. Effect of canalplasty on outcome of results in type I tympanoplasty. Bengal J Otolaryngol Head Neck Surg. 2016;24(1):15-20.

Cite this article as: Prakash MD, Badkar P. Effect of canalplasty in tympanoplasty. Int J Otorhinolaryngol Head Neck Surg 2018;4:1049-52.