

Effect of Canalplasty on Outcome of Results in Type I Tympanoplasty

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ABSTRACT

Background

The aim of the surgical procedure of tympanoplasty is to strive to achieve an intact neo tympanum with normal hearing acuity. Widening of the external auditory canal, called canalplasty, helps in better visualization and hence better placement of the tympanic membrane graft. Aim of this study was to compare effect of canalplasty on the outcome of results of type I tympanoplasty.

Methods

50 cases of patients diagnosed with chronic otitis media mucosal disease with a central dry perforation involving two or more quadrants of the tympanic membrane were included in the study. One group of 25 cases underwent tympanoplasty with canalplasty and was grouped under Group I while the other group of 25 cases underwent tympanoplasty without canalplasty and was called group II.

Results

Analysis was done for graft uptake, hearing improvement and time taken for the surgery. Group I achieved a success rate of 92% graft uptake as compared to group II, which achieved 84%. There was statistically significant improvement in post-operative hearing in cases with canalplasty. Time taken was between the two groups were not statistically significant.

Discussion

33.33% of congenital deaf population detected by UNHS belong to the Non High Risk group. Studies across the world suggest at least 50% chance of missing out a congenital deaf child if Universal Neonatal Hearing Screening is not practiced.

Conclusion

Anatomical and technical factors diversely affect the functional outcome of tympanoplasties. Canalplasty helps in better visualization and placement of the graft. Time spent on drilling in canalplasty is compensated by the time gained in grafting of the neo tympanum. The procedure prevents lateralization of the graft due to the accurate exposure of the annulus. Post operative care is also easier in cases of tympanoplasty with canalplasty.

Keywords

Tympanoplasty; Canalplasty; Ear Canal; Operative Time

Otitis media is a commonly prevalent disease of the middle ear especially in developing countries. Lack of specialized medical care, poverty, poor hygiene, overcrowding and ignorance are some of the common factors in the etiology of this disease. One of the sequel of Chronic Otitis Media (COM) is a persistent perforation of the tympanic membrane. The exposed middle ear mucosa predisposes to exogenous sources of infection and may produce a conductive hearing loss.

As described by Wullstein, surgical procedures to replace the tympanic membrane defect along with assessment of ossicular chain is called as type I tympanoplasty.¹ Tympanoplasty nowadays is of one the common ear surgeries to be performed. The aim is to strive to achieve an intact neo tympanum with normal hearing

acuity. Many modifications in approach and procedures are performed to achieve this goal. The widening of the external auditory canal called canalplasty, is one such procedure. Widening of the canal removes the bony overhangs in the external canal wall providing complete visibility of the tympanic membrane and annulus. This helps in better placement of the graft material.

In this study, an attempt has been made to study the effectiveness of canalplasty in results of type I tympanoplasty. In all cases, temporalis fascia has been

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used as the graft material. Effectiveness of results has been measured by post - operative graft uptake, hearing improvement achieved and time taken for the surgery.

Materials and Methods

Methodology

Inclusion criteria - Fifty patients diagnosed with chronic otitis media mucosal disease with a central dry perforation involving two or more quadrants of the tympanic membrane were included in the study. Only cases wherein the annulus could not be seen completely, due to bony elevations or humps, were considered in the study. (Fig. 1) Canal wall deformities may not affect the visibility of small perforations, hence single quadrant small perforations were excluded from the study.

Patients aged between 15 to 60 years were included in the study. The cases were assigned into two groups. The group which underwent tympanoplasty with canalplasty were designated Group I. The group which underwent tympanoplasty without canalplasty were labeled Group II. Both groups were assigned 25 cases each. Cases were alternatively assigned to each group. Written and informed consent was taken from all the patients.

Exclusion criteria - Small central perforations of the tympanic membrane, perforations with active discharge, marginal or attic perforations, otitis externa, and revision cases were criteria for exclusion from the study. Patients with hearing loss of more than 50dB which usually indicate ossicular chain discontinuity in a perforated drum were also excluded from the study. Those patients who were found per-operatively to have ossicular discontinuity were also excluded from the study.

Preoperative assessment – All patients were subjected to detailed pre operative history taking and clinical examination including otomicroscopic examination. Tuning fork tests were done to determine type of hearing loss. Degree of hearing loss was determined by the pure tone audiometry. Air bone gap at frequencies 500, 1000, 2000 and 3000 Hz were noted and the 4 tone average was used to calculate the average hearing loss. All patients underwent a pre operative anaesthesia checkup. Patients were admitted to the hospital one day prior to

surgery.

Operative procedure - Type I tympanoplasty was done in all the cases. Forty five patients underwent the procedure under local anaesthesia while the rest 5 cases underwent surgery under general anaesthesia. Autologous Temporalis facial graft was used in all cases. All cases were done by the post aural route. All cases were done by the underlay technique with the graft being placed under the annulus and the handle of malleus. Gel foam was placed in the middle ear after placement of the graft.

Technique of canalplasty

Posterior canal wall meatotomy was done by the post aural route and tympanomeatal flap raised from lateral to medial after making incisions at 12' o clock to 6' o clock of the canal wall skin. The bony external canal was widened by removing all bony overhangs with suitable sized cutting and diamond burrs. The annulus

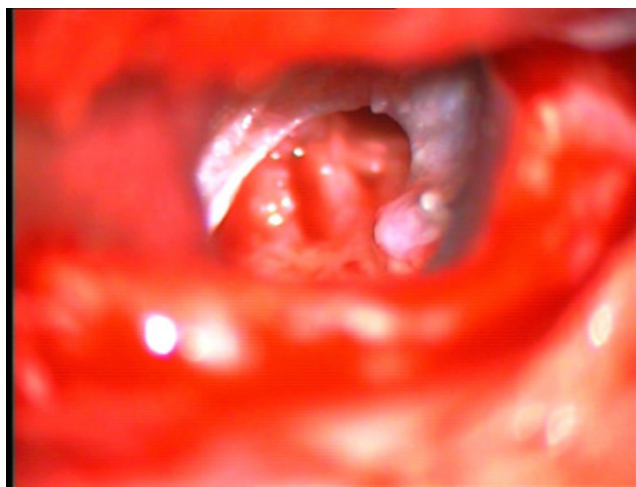


Fig. 1 Preoperative picture showing canal wall obstructing view of annulus and perforation

was raised and middle ear entered. In cases of an anterior bony bulge obstructing the anterior annulus, the skin of the anterior canal was elevated lateral to medial till nearest to the annulus. Then using a diamond burr the anterior bony bulge was gradually reduced avoiding

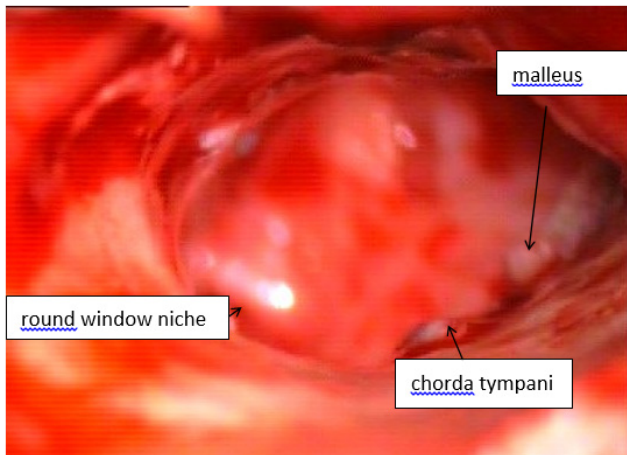


Fig. 2 Post canalplasty picture showing clear of annulus

exposure of the temporomandibular joint. The shape of the EAC appears as an inverted cone at the end of canalplasty. The aim of the canalplasty was to expose and visualize the entire tympanic annulus in one view of the microscope. (Fig. 2)

Wound was closed in two layers and mastoid dressing applied to provide pressure. Antibiotic was given for a period of one week to all patients.

Follow up – Sutures were removed seven days post operatively. First post operative check up done after 21 days for pack removal, subsequent check ups at 2nd, 3rd and 6th month. Patients in both the groups were followed up with PTA at 6 months post surgery and otoscopic examination of the neotympanum for its intactness as criteria for formulation of the results. An intact neotympanum with air bone gap closure of 15dB at six months post operative, was considered as a successful result. Presence of a defect in the tympanic membrane or air bone gap more than 15 dB was considered as failure of outcome.

Findings - 50 patients were enrolled in the study. Age of the patients ranged from 15 to 60 years of age. Maximum patients were in the age group 30- 45 years. Group I had 11 males and 14 were females and in group II there were 10 males and 15 females.

Duration of symptoms in Group I cases were, 12 cases had symptoms for 0-6 months, 9 cases for 6-12 months, and 4 patients had symptoms for more than 12 months. In Group II, out of the 25 cases, 14 had symptoms for 0-6 months, 6 for 6-16 months and 5 cases had symptoms for more than 12 months.

Results

Analysis was based on graft uptake, hearing improvement and time taken for the surgery.

Graft uptake - At 6 month follow up 92% (23 out of 25 cases) had a successful outcome in the group I while the success rate in the group II was 84% (21 out of 25 cases).

Hearing assessment – Preoperative pure tone average was 36.16dB in Group I and 36.2dB in Group II. Hearing assessment in terms of the air bone gap (ABG) was done in all cases. Preoperative average air bone gap was 28.64dB in the group with canalplasty and 24.04dB in the group without canalplasty. Post-operative audiometry was performed after 6 months in all cases. Post operative pure tone average was 23.24dB in Group I and 24.08dB in Group II. Postoperatively, average ABG in Group I was 17.40dB and in Group II it was 13.68 dB. There was a closure in the air bone gap of 11.4 dB in the group with canalplasty and 10.36 dB in the group without canalplasty. Maximum ABG closure, were in the range of 26-75% (moderate air bone gap closure) in both groups.

Time taken - Average time taken in group I was 54.2min (range 50-70 min) while in group II it was 52 min (range 45- 70 min).

Discussion

The fundamental principles of tympanoplasty were described by Wullstein and Zollner in 1956 and the classification of tympanoplasty was based on type of ossicular chain reconstruction performed.¹

The present study was conducted on 50 cases of chronic otitis media (mucosal type). All the 50 patients underwent type I tympanoplasty with the post aural approach. A group of 25 patients were randomly

designated tympanoplasty with canalplasty as group I and another group II for tympanoplasty without canalplasty. Temporalis fascia was used as the graft

advantages and disadvantages of canalplasty on the results of type I tympanoplasty. Variations of the external auditory canal anatomy such as bony

Table I : Summary of findings and results

CRITERIA	GROUP –I (WITH CANALPLASTY)	GROUP –II (WITHOUT CANALPLASTY)
Age (in years)		
15-30	07	05
30-45	10	12
45-60	08	08
Duration of symptoms (in months)		
0-6	14	12
6-12	06	09
>12	05	04
Hearing assessment in dB		
Preop pure tone average	36.16	36.20
Post op pure tone average	23.24	24.08
Preop air bone gap (average)	28.64	24.04
Post op air bone gap(average)	17.40	13.68
Improvement in air bone gap	11.24	10.36
Graft take up		
Taken up	23	21
Not taken up	2	4
Time taken (avg. in min)	54.2	52

material. These patients were followed up for a period of 6 months and were evaluated for graft uptake and hearing improvement.

The objective of the study was to determine the

overhangs, stenosis, or tortuosity etc impede the view of the tympanic membrane. Even with manipulation of the patients head and microscope, sometimes margins of the perforation are not well delineated. Canalplasty

helps to remove the distortions in the anatomy of the external canal and improve the view of the operative field. In a properly done canalplasty, the complete tympanic annulus can be viewed in one frame. There is no time wasted in manipulating the patients head, the microscope or the table. However there is a need for more bony dissection and drill work as compared to the non canalplasty procedure at the cost of extra operative time.

Age and sex

While otitis media is primarily considered to be a disease of childhood, the average age in our series was 31.87 years. Studies by other authors varied from approximately 30 years by McGrew et al and 33.2 years by Webb.^{2,3} Males are more commonly affected by the disease. In our case there was a female preponderance of 29 :21. Prasad et al. in their study of 86 cases had 52% males and 48% females.⁴ However, age does not significantly affect the outcome of the results in the study.

60 cases) in subtotal perforations.⁸ B.K.Roychaudhuri showed that failure rates are more in large or subtotal perforations. He achieved 94.44% graft uptake with the three flap technique.⁹ However Wasson et al. did not find any correlation of size of perforation to graft uptake.¹⁰ In our study group I had an uptake of 92% and group II an uptake of 84%. Though there was an 8% difference in the graft uptake, the result was not significant statistically.

Hearing result

The American Otosclerosis Study Group has recommended that hearing improvement is best evaluated by the percentage degree of closure of the ABG when calculated as a percentage.¹¹ Wang et al. and Collins et al. reported 90% and 83% in their study respectively.^{12,13} In our study, we could achieve moderate improvement in the percentage closure of ABG. In a study comparing 100 cases of tympanoplasty with canalplasty and 100 cases without canalplasty, Vijendra et al achieved a 9 dB improvement in hearing in cases with canalplasty when compared to cases without canalplasty.¹⁴ Our study

Table II : Statistical Analysis- Independent Sample Tests

	t test	p value	Test of significance(p< 0.05)
Improvement in ABG	2.929	0.005	Significant
Graft take up	-0.859	0.394	Not significant
Time taken	1.249	0.217	Not significant

Graft uptake

Narrow external ear canals and small middle ear structure are known factors which lower the success of tympanoplasty.⁵ Bhat reported a success rate of closure of 67% in anterior based perforations and 90% in posterior and inferior quadrant perforations.

A difficult surgical manipulation was one of the major factors in poor success rates in anteriorly based perforations.⁶ Certain studies have shown that size of the perforation may affect the graft uptake with large and near total perforations having a lesser success rate.⁷ Khan, et al reported a success rate of 88% (65 out of 74 cases) in medium sized perforations and 67% (40 out of

achieved approximately 4 dB difference between the two groups which was statistically significant.

Time taken for surgery

In our study, though there is more bone work involved in tympanoplasty with canalplasty, there was no statistical significant difference in time taken for surgery when compared with cases of tympanoplasty without canalplasty. Time spent on drilling in canalplasty is compensated by the time taken in manipulating the patients head, the microscope or the table when canalplasty is not done.¹⁴

Technique and effects of canalplasty

The annulus should be visualized all around in one view of the microscope. Taneja reported an increase of graft uptake to 91.3% in cases when tympanoplasty was combined with canalplasty.¹⁵ Thermal injury transmitted from the burr may cause transient facial injury. In a study of 100 cases by Lavy and Fegan, 2% cases had partial, transient and delayed facial palsy.¹⁶ A full, spontaneous recovery of facial function occurred in each case.

Conclusion

Anatomical and technical factors diversely affect the functional outcome of tympanoplasties. This study was carried out to compare effect of canalplasty on the outcome of results of type I tympanoplasty. Canalplasty helps in better visualization and hence facilitates better placement of the graft. Time spent on drilling in canalplasty is compensated by the time gained in grafting of the neo tympanum. It prevents lateralization of the graft due to the accurate exposure of the annulus. Post operative care is also easier in cases of canalplasty.

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