

Original Research Article

Prospective study on technique of graft fishing with anterior tucking in type 1 tympanoplasty and its hearing outcome

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ABSTRACT

Background: Chronic otitis media (COM) is a common health problem in developing world and has a major impact on patient in the form of hearing loss. Temporalis fascia is commonest graft material used for tympanoplasty as it is readily available through same post aural incision. The study was conducted with an aim to find out the effectiveness of fishing technique and anterior tucking in terms of graft stability, graft uptake, hearing improvement and complications.

Methods: The present study is prospective study conducted on patients with complains of otorrhea and hearing loss, of age between 15 to 60 years, during the period January 2017 to June 2018. Patients with inactive mucosal COM and pure conductive hearing loss who underwent type-I tympanoplasty were included. Patients with cholesteatoma, ossicular pathology, trauma, mixed or sensorineural hearing loss, were excluded. Paired 't' test was applied to compare preoperative and postoperative mean air-bone gap.

Results: In our study total 123 patients were analysed for the follow-up period of 6 months and it was observed that graft was well accepted in 93.5% patients while in 4.8% patients residual anterior perforation was found and in 1.7% patients the graft was completely rejected, showing an overall success rate at the end of 6 months follow-up to be 93.5%. There was a statistically significant improvement in hearing gain at the end of 6 months follow-up ($p < 0.05$).

Conclusions: Tympanoplasty with temporalis fascia graft using fishing and anterior tucking technique gave good dimensional stability to graft, preventing lateralization / medialization of graft. The superiorly based circumferential flap allowed for 360 degree placement of graft and anterior tucking, with overall high success rate and lower rate of complications and graft rejection.

Keywords: Tympanoplasty, Temporalis fascia, Post aural incision, COM, Air bone gap, Anterior tucking tympanoplasty

INTRODUCTION

Chronic otitis media (COM) is characterized by recurrent aural discharge, hearing loss, tympanic membrane perforation due to chronic/long standing infection of middle ear cleft. COM is a common health problem in developing world and has a major impact on patient in form of hearing loss.¹ COM is common among young and adult population in the developing countries due to malnutrition, lack of hygiene, respiratory tract infections and over population, associated with lack of healthcare

facilities.² Tympanoplasty is the most common surgery for correction of mucosal type of COM, with either tympanic membrane reconstruction done alone or in combination with ossicular reconstruction.^{3,4} In order to prevent recurrent otorrhea and restoration of hearing loss, tympanoplasty is indicated. Wullstein and Zollner modified the technique of tympanoplasty. Various surgical approaches described for tympanoplasty are post-aural, end-aural and endo-meatal routes.^{5,6} In the underlay and overlay technique, graft placement is medial or lateral to fibrous layer of the tympanic membrane respectively.

Underlay graft placement is relatively easy to perform and is placed medial to the remaining drum and malleolus.^{7,8} Underlay technique has its own disadvantage as placement of graft medially reduces the mesotympanic space with lower success rate in anterior perforation.⁹ In overlay technique, the graft is placed lateral to the fibrous layer of tympanic membrane after elevating squamous epithelium. There is increased risk of graft lateralization, anterior blunting, delayed healing and epithelial pearls formation. Various graft materials including temporalis fascia, perichondrium, cartilage and fascia lata are used for tympanoplasty.¹⁰ Temporalis fascia is the commonest used graft material, as it is readily available through same post aural incision. It has a better functional outcome in terms of hearing and but there have been some cases reported with poor dimensional stability, which may contribute to residual perforation in anterior quadrant, more commonly seen in large or sub-total perforation.^{11,12} The outcome of palisade cartilage and cartilage island technique in terms of hearing restoration is poor, as it may interfere with sound conducting mechanism.⁷ On the other hand fascia lata has a better dimensional stability and better hearing improvement.¹³

The aim of the study was to assess the dimensional stability and functional outcome of temporalis fascia as a graft material, by technique of fishing and anterior tucking in cases of type I tympanoplasty in terms of graft stability, graft uptake, hearing improvement and complications.

METHODS

This is a prospective, observational study conducted over a duration of 2 years at tertiary health centre. Total 140 patients who were operated by anterior tucking and graft fishing in study duration were included in study. Out of these 17 patients were lost during follow-up and 123 patients also 123 ears who completed 6-month follow-up duration were finally analysed.

Patients falling between the age group of 15 to 60 years, who presented to the outpatient department of otorhinolaryngology with, complaint of otorrhea and hearing loss was examined. Screening was done by taking a detailed clinical history and complete ENT examination along with otomicroscopy. The inclusion criteria consisted of patients with inactive mucosal type of COM associated with central perforation and pure conductive hearing loss whereas the exclusion criteria consisted of patients with cholesteatoma, ossicular pathology, trauma, mixed or sensory neural hearing loss.

A detailed explanation about the procedure, associated risk/benefits and possible outcome were discussed with the patients included in the study. After obtaining consent for participation, a written voluntary informed consent was obtained from the patient and/or his/her legally acceptable representative. Pre-operative workup included blood investigations (complete blood count (CBC), BSL, Viral markers, blood urea/creatinine, serum electrolyte), urine

examination, audiometry (puretone audiometry), pre anaesthetic check-up and consent for surgery.

The study was conducted after obtaining the approval from the Ethics Committee of the institution. The study posed no financial implication on the institution or on the patients. Also, this study was not funded by any pharmaceutical company or institution.

Methodology

A customized proforma was designed for the purpose of the study, which included data on affected ear (right /left or bilateral), site of perforation (according to number of quadrants involved) and size of perforation (small, medium, large), air-bone gap, ear operated (right / left or bilateral) and graft uptake. Total 123 patients diagnosed with inactive mucosal type of COM were observed. About 62% of patients had medium size perforation i.e., involving 2-3 quadrant of pars tensa and 38% of patients had large size perforation i.e., involving 4 quadrants of pars tensa. The pre and postoperative pure tone audiometry (PTA) of all patients was performed in sound-proof room using Elkon 3N3 multi audiometer (Elkon, India; calibrated to ISO standards). Through PTA, air conduction (AC) and bone conduction (BC) values were obtained by calculating mean value of hearing threshold at various frequencies; 500 Hz, 1 KHz, 2 KHz, 4 KHz. Both the pre-operative and post-operative (at end of 6months after surgery) air bone gap (ABG) was obtained by calculating the difference as a difference between AC and BC values thus derived. Patients were followed for 6 months and observed for, complete graft uptake, residual perforation and hearing gain was assessed. Hearing gain was obtained by calculating the difference between post- operative ABG (at end of 6 months) and pre-operative ABG.

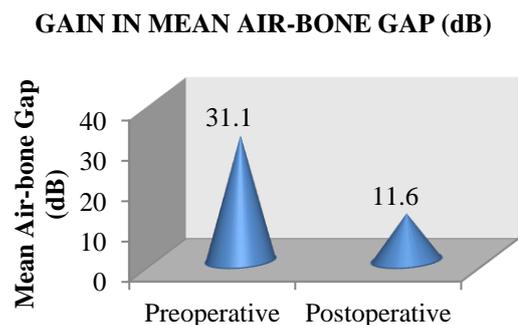


Figure 1: Gain in mean air-bone gap (dB).

Surgical approach and preparation of graft

The surgeries included in this study were done under local anaesthesia (2% lignocaine with 1:200000 adrenaline) and sedation. Surgical site was prepared by applying anti-septic solution on post-aural region and incision placed in post-aural groove. Further the soft tissue over fascia was dissected off and temporalis fascia identified. The

temporalis fascia was separated from underlying muscle through hydro dissection by infiltration with 1cc of local anaesthetic solution. Following which the fascia graft was harvested measuring approximately 20×16 mm. Further graft was prepared by removing bits of soft tissue, fat and muscle tissue adhered to it along with trimming of its border. Graft was then placed on glass slide and 2-3 mm slit was made approximately 10 mm above the margin and 2mm away from superior margin towards the centre of graft. The purpose of making the slit in the graft is, to sleeve the graft through the slit on the handle of malleus (fishing) which intum improve stability of graft and prevent medial/lateral displacement of graft (Figure 2).

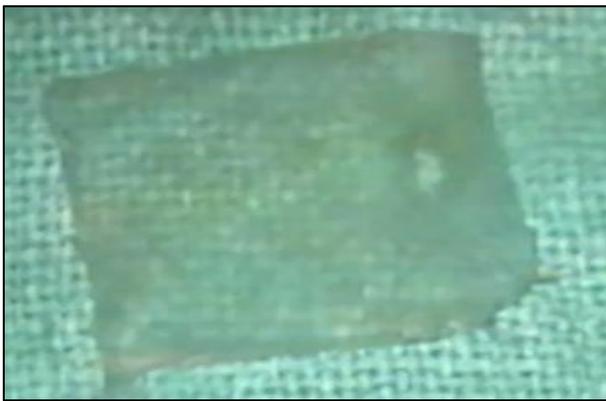


Figure 2: Temporalis fascia graft with slit for fishing graft over malleus handle.

Further by performing meatotomy, the external auditory canal was exposed. A circular canal incision was placed just medial to junction between bony and cartilaginous canal wall from 11'o clock till 1'o clock position (in case of right ear) or reverse (for left ear) followed by elevation of superiorly based circumferential tympanomeatal flap along with complete annulus of tympanic membrane (Yung's technique). The covering of mucosa over handle of malleus was removed and the ossicular chain status and Eustachian tube orifice were examined.

Placement of graft-technique of fishing and anterior tucking

After the graft preparation is complete, it is placed in middle ear under handle of malleus in such a way to ease the slit on graft to sleeve over the handle of malleus (Fishing) and enhance the spread of superior border of graft 2 mm over superior canal wall, inferior border of graft 2-3 mm over inferior canal wall, posterior border of graft 3-4 mm over posterior canal wall. And in order to avoid fall of graft in pro-tympanum, the anterior border of graft was spread over the anterior canal wall by 3-4 mm (Anterior tucking) and the superior based tympanomeatal flap was repositioned back over canal wall (Figures 3 and 4).

After ensuring the appropriate extension and secure placement of graft, the external auditory canal was packed with antibiotic soaked gel foams. Incision was sutured in

two layers and sterile mastoid dressing was done. No gel foam or any other material was placed under graft or middle ear in any case. Patients were discharged on 3rd post-operative day. All patients received two weeks of antibiotic (amoxycillin clavulanic acid two times a day), anti-histaminic (levocetirizine 5 mg once a day). Analgesics like diclofenac sodium 50 mg twice a day for 7 days. Patients were called for follow up on a weekly basis up to one month and every 15th day for next 2 months. The suture removal was done on 10th post-operative day and a combination of antibiotic steroid ear drop was advised for 1 month. Patients were assessed under microscope on each follow up to examine graft uptake and post-operative complications (if any).

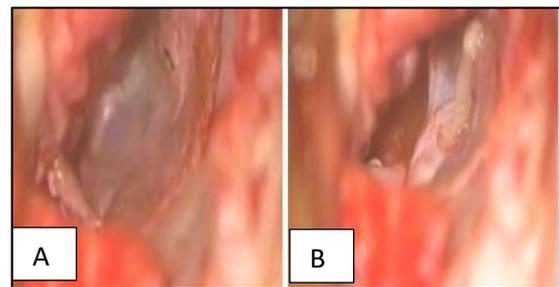


Figure 3: Fishing of graft. (A) slit visible in graft for fishing (B) graft fished over handle of malleus.

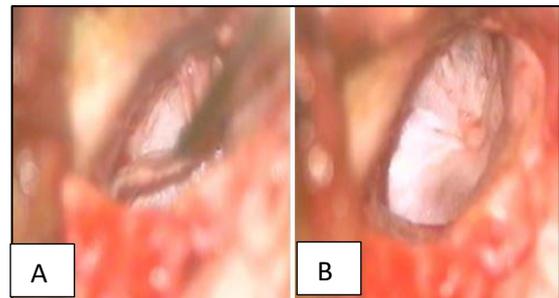


Figure 4: Graft anterior tucking and placement. (A) Anterior tucking of graft (B) Final placed graft (360 degree placement).

On 6 month follow-up, pure tone audiometry was performed to evaluate the improvement in hearing as compared to the pre-operative PTA recorded. All the operated patients came for follow up for 1 month however lost follow up of 6% patients by end of 6th month.

Statistical analysis

The analysis of data was done by using Microsoft excel. To calculate p-value an online statistical software 'Graphpad' was used. A comparative analysis of the mean air-bone gap between pre-operative and post-operative reading derived from the audiogram was performed using paired t-test. p<0.05 was taken as statistically significant.

RESULTS

In this study, there was a male preponderance i.e., out of 123 patients also 123 ears, 67 were males and 56 were females. In these 123 patients included, 36% patients had right ear disease, 43% patients had left ear disease and 21% patients had bilateral ear disease.

Pre-operative air bone gap of 15% patients range more than 40 dB, in 32% patients range between 31-40 dB, in 43% between 21-30 dB and 10% between 11-20 dB. After 3 months, 71% patients were in the air-bone gap within 10 dB, 21% patients were in the air-bone gap range of 11-20 dB, 6% patients were in range 21-30 dB and 2% patients were in the range 31-40 dB (Table 1).

Table 1: Comparison of preoperative and postoperative air-bone gap.

Air-bone gap	Pre-operative ABG		Post-operative ABG	
	No.	%	No.	%
<10 dB	0	0.00	87	71
11-20 dB	12	10	26	21
21-30 dB	54	43	07	6
31-40 dB	39	32	03	2
>40 dB	18	15	0	0.00
Total	123	100.00	123	100.00

Table 2: Mean gain in hearing (air-bone gap).

Air-bone gap (mean±SD)	‘t’ value	P value
Preoperative value 31.1±8.8 dB	30.6, df=122	0.001*
Postoperative value 11.6±7.2 dB		

Paired ‘t’ test applied. P value = 0.001, significant

Table 3: Complications observed during 6-month follow-up post operatively.

Complications	No. of patients	Percentage
Graft rejection	02	1.6
Residual perforation	06	4.8
Granular myringitis	06	4.8
Post-aural wound Infection	01	0.8
Taste alteration	03	2.4

Table 4: Graft acceptance at 6-month follow-up.

Graft status	No. of patients	Percentage
Graft accepted	115	93.5
Residual perforation	06	4.8
Graft failure	02	1.7%

Residual perforation (4.8%) and granular myringitis (4.8%) were the most common complications seen in our study. Patients with myringitis were treated with corticosteroids and antibiotics, which healed in 4-6 weeks of treatment. In 2 patients who had discharge with graft oedema, myringitis still persisted despite treatment and regular ear cleaning. These patients later developed graft necrosis due to middle ear infection and at the end of 3 months, large central perforation was seen. Post-aural wound infection and gaping was seen in 1 patient, who was treated conservatively which later healed completely within 2-3 weeks of treatment (Table 3).

Analysis at end of 6 months shows good graft acceptance in 93.5% patients, in 4.8% patients’ residual anterior perforation was seen and in 1.7% patients graft was rejected completely, showing an overall success rate of 93.5% (Table 4).

DISCUSSION

Patients with inactive mucosal COM were included in this study. There is a permanent perforation of tympanic membrane with no evidence of infection or discharge. Surgery is the mainstay of treatment of COM. Factors such as patients age, perforation size and site, presence of tympanosclerosis, middle ear mucosa condition, eustachian tube function, type of graft material and operating surgeon experience are not reported to influence the success rate in some studies.²¹⁻²⁴

The purpose of developing the technique of fishing and anterior tucking is to minimize the disadvantage of both underlay and overlay technique of tympanoplasty. In our study, the tympanomeatal flap was elevated as described by Yung.²³ Temporalis fascia was used as graft material in all cases. The male to female ratio in our study was 1.2:1 i.e., there is a male preponderance, which is similar to other studies published.^{5,7}

In our study, the technique of fishing and anterior tucking with temporalis fascia as a graft material showed good dimensional stability. Study by Indorewala showed fascia lata has better dimensional stability than temporalis fascia.¹² They carried out tympanoplasty with fascia lata graft and reported 98% successful graft uptake. Post-operative hearing improvement of 75.6% from 25.2% pre-operative. Study by Batni used temporalis fascia graft and reported graft uptake of 88% with hearing gain of 14.55 dB and mean air bone gap reduction of 11.9 dB.¹⁴ In a study by Patil et al using temporalis fascia for interlay type I tympanoplasty showed 96% success rate.¹⁶ The mean pre-operative air bone gap from 36.42±12 dB reduce to 9.7±6.71 dB post-operatively. Hosmani, in their study, showed graft uptake of 96.6% who underwent anterior tagging of graft while 81.5% in those who did not.¹⁷ Murugendrappa used circumferential sub-annular grafting technique with 96% graft uptake, while 76% where conventional underlay technique was used.¹⁸ In our study, with technique of fishing and anterior tucking, the overall

graft uptake rate was 93.5%. The mean pre-operative air bone gap from 31.1±8.8 dB reduced to 11.6±7.2 dB post-operatively. The difference in mean air bone gap pre-operatively and post-operatively was statistically significant ($p < 0.05$). Thus, results of our study is comparable to above mentioned studies.

In a study by Sengupta, reported that overall wound infection rate of 7.5%, granular myringitis in 10%, medialization and lateralization of graft in 7.5% each, and graft rejection in 12.5% patients.¹⁹ Whereas in study by Mishra, complications like graft lateralization was found in 1%, graft failure, otitis media with effusion, myringitis and graft rejection was observed in 2% cases each.⁸ In our study, residual perforation and granular myringitis was seen in 4.8% patients each, about 1.6% patients had graft rejection by end of 3 months. Taste alteration was seen in 2.24% and post aural wound infection in 0.81%.

Thus, in our study, the technique of graft preparation, fishing and anterior tucking showed good graft uptake rates at end of three months. The results of our study are comparable with the above-mentioned studies.

CONCLUSION

Tympanoplasty using temporalis fascia graft with above described technique of fishing and anterior tucking gave good dimensional stability to graft, preventing lateralization or medialization of graft. The superiorly based circumferential tympanomeatal flap allows graft to be fished over handle of malleus and with anterior tucking it could be placed 360 degree, showed overall high success rate, lower rate of complications and graft rejection and fairly well acceptable hearing outcome in terms of reduction in air-bone gap.

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Conflict of interest: None declared

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

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