

Comparisons of Results of Type 1 Tympanoplasty Using Temporalis Fascia and Tragal Perichondrium: A Prospective Study

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ABSTRACT

Introduction: Type 1 tympanoplasty is one of the commonest operations done by an ENT surgeon. There are a number of choices regarding the graft material that one uses in this operation. Among those, temporalis fascia and tragal perichondrium are the most common. The aim of the study was to compare the results of tympanoplasty between two groups of patients- one using temporalis fascia as the graft material and the other using tragal perichondrium.

Material and methods: This prospective study group consisted of 46 patients between the ages of 10 to 49 years. Only patients with dry safe central perforations and pure conductive hearing loss were included. Success was defined as ear-drum closure with no residual perforation. Hearing improvement was defined as air-bone gap less than 10dB.

Results: We had included 46 patients in our study. Of them, 23 had tympanoplasty with temporalis fascia and the other 23 had tympanoplasty with tragal perichondrium.

Conclusion: The study showed that both temporalis fascia and tragal perichondrium gave more or less the same results with regard to successful drum closure and hearing improvement- there was little to choose between these two.

Keywords: Underlay Tympanoplasty, Temporalis Fascia, Tragal Perichondrium

INTRODUCTION

Perforations of the tympanic membrane are very common in our country. The most common causes are chronic suppurative otitis media and trauma. Low socioeconomic conditions, poor living standards, overcrowding with poor hygiene and inadequate access to proper medical facilities in the periphery contribute to the picture. Most perforations require surgical intervention in the form of tympanoplasty. If the perforation persists, the middle ear is exposed to the external allergens and infections. Patients generally have a hearing loss as the round window protection effect is lost and also due to reduction in the vibratory area of the tympanic membrane. So to restore the vibrating area of the tympanic membrane, to increase hearing and to protect the middle ear and round window from external allergens and infection the surgical repair of the ear drum is required.

Since the introduction of tympanoplasty in the fifties by Zoellner and Wullstein, numerous graft materials have been used for the closure of the defective membrane: skin, fascia lata, temporalis fascia, vein, cartilage, perichondrium, duramater. To date, temporalis fascia remains the most commonly employed material for tympanic membrane reconstruction.

Biological graft materials act as a scaffold of tissue matrix when applied in tympanoplasty. This graft subsequently revascularises in readiness for migration of fibroblast and epithelium. The materials usually vary regarding their ease of harvesting, preparation time, placement ease, viability, graft take up rate and hearing improvement. The otologists prefer temporalis fascia, perichondrium, cartilage, cartilage and perichondrium as graft material due to its anatomic proximity, translucency and easy availability.

The aim of the study was to compare the efficacies of temporalis fascia and tragal perichondrium as graft materials in underlay tympanoplasty with regard to successful closure of the perforations and hearing improvement.

MATERIAL AND METHODS

The study was conducted in the department of otorhinolaryngology and head and neck surgery, of a tertiary hospital at Kolkata, in the period between August 2017 and January 2019 (18 months). The study group consisted of 46 patients: 22 males(47.8%) and 24 females(52.2%) between the ages of 10 to 49 years. Patients with dry safe central perforations and pure conductive hearing loss were included in our study. Patients having cholesteatoma flakes, with obvious ossicular dysfunction or with external ear pathology were the exclusion factors. Patients with ear discharge were initially treated conservatively and were included in this study when their ear became dry for at least 4 weeks. Patients were randomly allotted to two groups of 23 each. One group underwent tympanoplasty with temporalis fascia and the other group with tragal perichondrium. Success was defined as ear-drum closure with no residual perforation. Hearing improvement was defined as air-bone gap less than 10dB.

Pre-Operative Assessment

Preoperatively all the patients underwent a thorough clinical examination of ear, nose and throat with special reference to the ear. After otoscopic assessment of the site and size of perforation, all the findings were confirmed with

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examination under microscope. All the patients underwent haematological tests include total count, differential count, erythrocyte sedimentation rate, haemoglobin percentage, blood sugar tests, radiological tests including X-ray lateral oblique view of mastoids and chest x-ray posteroanterior view and audiological tests to assess the hearing status by tuning fork tests and pure tone audiometry.

Surgical procedure

All the patients were operated using either endaural or post aural route. The preferred analgesia was achieved with local anaesthesia, except for younger and uncooperative patients, where general anaesthesia was preferred. Graft placement was done by underlay technique and medial to the manubrium in both the groups.

Post operative care

Dressing and suture removal were done on the seventh postoperative day. Gelfoam removal was done in the same sitting. Patients were called for follow up every week upto one month and then monthly for six months. After three months pure tone audiometry was done after assessing the status of the neotympanum.

STATISTICAL ANALYSIS

The statistical analysis was done with SPSS using Z test and chi square test to assess significance.

RESULTS

We had included 46 patients in our study. Of them, 23 had tympanoplasty with temporalis fascia and the other 23 had tympanoplasty with tragal perichondrium. The age distribution is shown in table 1 and gender distribution in table-2.

Drum Closure

The incidences of successful closure and residual perforation in the two groups are shown in table 3.

The results show that the difference in success rate between

Years	Temporalis fascia group	Tragal perichondrium group	Total
< 19	5	7	12
20-29	8	6	14
30-39	6	7	13
40-49	4	3	7
total	23	23	46

Table-1: Age distribution

	Temporalis fascia group	Tragal perichondrium group
Male	10	12
Female	13	11

Table-2: Sex distribution

	Temporalis fascia group	Tragal perichondrium group
Successful closure	20	19
Residual perforation	3	4

Table-3: Drum closure

A-B gap	Pre-operative	Post- operative
<10	0	18
10-20	2	3
21-30	7	1
31-40	10	1
41-50	4	0

Table-4: Temporalis fascia group

A-B gap	Pre-operative	Post- operative
<10	0	17
10-20	1	2
21-30	7	2
31-40	9	2
41-50	6	0

Table-5: Tragal perichondrium group

the two groups were not statistically significant (SE= 0.11, Z= 0.41, P value 0.68 i.e.>0.05).

Audiometric results

The pre-operative and post-operative air-bone gaps in the two groups are shown in table 4 and 5 respectively. The two groups were statistically similar (P value 0.619 i.e.> 0.05). The difference in the post-operative results between the two groups is not statistically significant (P value 0.668 i.e.> 0.05).

DISCUSSION

Otitis media¹ is a general term used to describe any inflammatory disease of the mucous membrane lining the middle ear cleft and is caused by multiple interrelated factors including infections, Eustachian tube dysfunction, barotrauma. Chronic otitis media is the more advanced disease state and is associated with some irreversible pathologic condition like tympanosclerosis, tympanic membrane perforation, ossicular change, cholesteatoma. Traditionally chronic otitis media is classified into atticofacial disease characterized by the presence of a cholesteatoma and tubotympanic disease characterized by the presence of a central perforation.

Tympanoplasty is the main surgical treatment for tubotympanic disease. It is defined² as any operation involving reconstruction of the tympanic membrane and/ or the ossicular chain. The ideal tympanoplasty restores sound protection for the round window by constructing a closed, air containing middle ear against the round window membrane. This also restore sound transfer for the oval window by connecting tympanic membrane or substitute membrane with stapes footplate via either an intact or a reconstructed ossicular chain.

To accomplish the two physiologic principles of tympanoplasty, sound protection for the round window must first be provided by means of a tissue graft to repair the tympanic membrane defect, and the middle ear must be lined with mucosa and must contain air to protect the window. Then sound pressure transformation for the oval window must be provided by the mobile ossicular continuity between the large tympanic membrane and the small oval window.¹

Over the years different grafting materials have been introduced right from pig's bladder membrane by Benzer in 1640 to canal wall skin by William House and Sheehy.³ In 1952 the procedure was publicized and popularized by Wullstein⁴ using split-thickness skin grafts. Zollner⁵ began his work in 1952 and finished it a year later. Hermann⁶ described the use of temporalis fascia as a graft in 1960. Storrs⁷ performed the first fascia graft in the United States in 1960. The superior qualities of fascia, its ready availability in the operative field, and its ideal handling qualities made it the standard for drum grafting, as it is today. To date, temporalis fascia remains the most commonly employed material for tympanic membrane reconstruction with a success rate of 93-97% in primary tympanoplasties⁸

Goodhill⁹ used perichondrium for grafting the tympanic membrane in the 1960s. His results were similar to those of others using fascia. The perichondrium and cartilage also readily available in the operative field.

In 1957 first medial grafting was done by Shea using a vein graft. Between 1961-1967, House, Glasscock and Sheehy described the overlay technique. The overlay technique provides optimal exposure of the tympanic plane and is particularly suggested for large perforations. Although it guarantees an adequate middle-ear volume, this technique is time consuming, requires increased healing time, and risks graft lateralisation or blunting and formation of cholesteatoma pearls if removal of the squamous epithelium is incomplete. Underlay myringoplasty is generally preferred to the overlay technique due to its relative simplicity, requiring placement of the graft under the annulus and the manubrium without the need for de-epithelialisation. On the other hand, there is the risk of graft collapse, middle-ear volume reduction and adhesion of the graft to the promontory, especially when the malleus is rotated medially.¹⁰ The most accepted and widely used method is underlay graft of temporalis fascia or sometimes perichondrium.²

In this study we have compared the results of temporalis fascia and tragal perichondrium for the repair of perforated tympanic membrane in tubotympanic disease of the ear. The graft material is accessible near the operative site, available in adequate amount, has excellent contour, can be thinned down and possesses excellent survival capacity. Thus they fulfil all the criteria of excellent graft tissue.

In our study, most patients were in the 20-29 age group. Of the operated ears, 20 were right ear (43.4%) and 26 were left ear (56.6%).

In the study conducted by Gibb using temporalis fascia as graft material by underlay technique the percentage of graft take rate was 87.5%¹¹

Strahan achieved graft uptake success rate of 87% by underlay method¹²

Mishra et al performed 100 underlay tympanoplasties with superiorly based circumferential flaps using temporalis fascia graft for dry subtotal perforation. They underwent this study during the period August 2001- Feb. 2004. used temporalis fascia graft to close subtotal perforations and could achieve good results both in terms of drum healing (97%).¹³

Karela et al did a 6 year prospective audit study using temporalis fascia graft. Their purpose was to determine the success rate of myringoplasty in adults and children and to examine whether the hearing improvement is a potential indication for surgery. They performed a 6-year prospective audit study in a cohort of patients undergoing myringoplasty at the University Teaching Hospital, Department of Otolaryngology and Head and Neck Surgery. Two hundred and eleven patients who underwent myringoplasties were included in the study. All were performed by a postaural approach using autologous temporalis fascia and underlay technique. The total success rate, in terms of graft uptake at 3-6 months, was 91.5%.¹⁴

Dhabolkar et al performed a comparative study between temporalis fascia and tragal perichondrium where he achieved a success rate of 84% in respect to drum closure by temporalis fascia underlay method.¹

Timothy Jung et al., reported medial graft tympanoplasty (100 cases) at community and tertiary care medical centers from 1995 to 2006. All patients underwent preoperative and postoperative audiograms. Temporalis fascia is harvested, semidried, and grafted medial to the TM perforation and malleus with Gelfoam packing supporting the graft. There were four failures (96% success rate) in medial graft method for posterior TM perforation due to infection and re-perforation.¹⁵

In our study we got the success rate of underlay tympanoplasty using temporalis fascia graft was 86.95%. In 20 patients out of 23 patient grafts were taken. There were only 3 failure cases.

Goodhill⁹ used perichondrium for grafting the tympanic membrane in the 1960s. His results were similar to those of others using fascia.

Strahan recorded a 86% tragal perichondrium graft uptake rate.¹⁶ Eviator noted that graft take rate with tragal perichondrium by underlay method was 90.47%.¹⁷

Dhabolkar et al performed a comparative study between temporalis fascia and tragal perichondrium where he achieved a success rate of 80% graft uptake rate in tragal perichondrium underlay tympanoplasty.¹

In 2008 Engin Dursun et al of Turkey underwent a comparative study using tragal perichondrium, paper patch and fat to repair the tympanic membrane perforation less than 3 mm diameter. They made a skin incision on the posterior side of the tragus. The skin and subcutaneous tissues were dissected off and the posterior tragal perichondrium was elevated. Small squares of gelfoam were placed in the middle ear cavity through the perforation to form a bed for the graft. The perichondrial graft was then removed and placed on gelfoam bed by using underlay technique. The ear canal was then packed with compressed gelfoam. By this procedure they showed that the closure rates of the perichondrium graft were 80%, 80%, and 100% for 1-mm, 2-mm, and 3-mm perforations, respectively. The overall closure rate was 86.7%.¹⁸

In our study we got the success rate of underlay tympanoplasty using tragal perichondrium graft was 82.6%. In 19 patients

out of 23 patient grafts were taken. There were 4 failure cases.

The hearing improvement by temporalis fascia graft in underlay tympanoplasty by Strahan was 82%.¹⁶

Mishra et al reported by temporalis fascia closure of (A-B) gap achieved in 95% of patients. They showed closure of A-B gap to 10-30dB.¹³

According to Karela et al. an overall hearing improvement was achieved in 91.5% of cases.¹⁴

Dabholkar et al achieved 76% hearing restoration by temporalis fascia.¹

Our results were quite similar in respect of hearing improvement. When we used temporalis fascia as graft material about 78.2% patients achieved the desired level of air bone gap. 18 patients out of 23 patients had A-B Gap below 10 dB post operatively. 3 patients had air bone gap postoperatively between 10-20 dB. Other 2 patients had air bone gap above 20 dB.

Dornhoffer showed an average postoperative A-B gap 6.8 dB achieved in 22 patients by using tragal perichondrium graft.¹⁹

According to Dabholkar et al study report of 25 patients who underwent perichondrial graft tympanoplasty 75% had hearing improvement.¹

The hearing improvement by perichondrium graft according to the study conducted by Engin Dursun et al., Hearing improvement was assessed using the audiogram results obtained at the end of third month, postoperatively. Hearing parameters were the change in air bone gap. Air bone gap was calculated as the average difference between air conduction and bone conduction at 0.5, 1, 2, and 4 kHz. that 10.2 dB (± 2.03 dB) in the perichondrium group.¹⁸

When we used tragal perichondrium as graft material we got that in tragal perichondrium graft tympanoplasty we observed that in 17 patients post operative air bone gap was below 10 dB. Two patients had A-B Gap between 10 – 19 dB, two patients between 20- 29 dB and two patients between 30 to 39 dB. Our aim of post operative air bone gap below 10 dB was achieved in 73.9% of cases.

CONCLUSION

The success rate of tympanoplasty using temporalis fascia and tragal perichondrium graft in terms of drum closure and air-bone gap closure were found to be similar in our study.

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