Comparative study of underlay tympanoplasty with temporalis fascia and tragal perichondrium

Jyothi P. Dabholkar • Krishna Vora • Abhik Sikdar

Abstract

The perforations of the tympanic membrane maybe of traumatic origin or due to chronic suppurative otitis media. If the perforations fail to heal conservatively, they require surgical closure. Autologous graft materials have stood the test of time in repairing tympanic membrane perforations. In our tertiary care institution we conducted a prospective randomized control trial on 50 subjects to evaluate the comparative efficacy of temporalis fascia and tragal perichondrium as grafting material in underlay tympanoplasty. In this study surgical success was evaluated in terms of intact drum membrane during the follow up period and closure of A-B gap within 10 dB. Temporalis fascia achieved a graft uptake of 84% and a satisfactory hearing improvement in 76% of the patients. Tragal perichondrium achieved a success rate of 80% graft uptake and 75% hearing gain. The rates are comparable with no statistical significance of the difference between them.

Keywords Tympanoplasty • Temporalis Fascia • Tragal Perichondrium

Introduction

The perforations of the tympanic membrane maybe of traumatic origin or due to chronic suppurative otitis media. If the perforations fail to heal spontaneously or by conservative therapy, they require surgical closure. The repaired perforation restores the vibratory area of the tympanic membrane and affords round window protection, thus improving hearing. It also prevents exposure of the middle ear to external infection and allergens.

Biological graft materials act as a scaffold of tissue matrix when applied to seal the perforation and this subsequently revascularises in readiness for migration of fibroblasts and epithelium. Autologous graft materials include vein, fat, fascia lata, temporalis fascia, perichondrium and cartilage. The materials varied regarding their ease of harvesting, preparation time, placement ease, viability, graft uptake and hearing improvement. Such abundance of materials implicitly implied that there is no clear cut favorite and choice of graft depends on individual surgeon's preference. However due to its anatomic proximity, translucency, and suppleness, temporalis fascia and tragal perichondrium are the two most preferred grafting materials of the contemporary otologist. In this paper, we present our experience in underlay tympanoplasty while comparing temporalis fascia and tragal perichondrium as the ideal graft material with regards to graft uptake and hearing improvement (post operative A-B gap < 10 dB) (Table 2).

Material and Methods

The study group consisted of 50 patients, 33 males (66%) and 17 females (34%) (Table 1) between the ages of 13 to 56 years with unilateral safe perforations and pure conductive hearing loss. Patients with obvious ossicular dysfunction, bilateral disease or external ear pathology were excluded from the study. Patients with ear discharge were initially treated conservatively and were included in the study when their ear became dry for at least 6 weeks. Any patient requiring ossiculoplasty was subsequently excluded from the study.

Jyothi P. Dabholkar (✉)

Professor

10, SUDHA, 3rd Floor

20, Nepean Sea Road, Mumbai - 400 036

Phone: +91-22-23637517

e-mail: tucson@vsnl.com

Fax: +91-22-23640641

Krishna Vora

Ex-Registrar

Abhik Sikdar

Senior Registrar

Dept. of E.N.T.

T N Medical College and B Y L Nair Ch. Hospital

Mumbai - 400 008

Sex	No. of Patients	Percentage
Male	33	66%
Female	17	34%
Total	50	100

Comparative Results of Take Up Rate Using Fascia/Perichondrium Grafts

Graft Material	Graft Takenup	Residual Perforation	Total	% of Success
Fascia	21	4	25	84%
Perichondrium	20	5	25	80%

Pre-Operative Assessment

A thorough clinical examination of ear, nose and throat was done with special reference to the ear. An otoscopic examination was done to record the site and size of perforation. All findings were confirmed with examination of the ear under a microscope. Hearing status was assessed with tuning fork tests and pure tone audiometry. Antibiotics and decongestants were started 24 hours prior to surgery. After premedicating with atropine and promethazine, patients were operated under local anesthesia using 2% lignocaine and 1:80,000 adrenaline. Younger patients were operated under general anesthesia.

Surgical Procedure

All patients were operated using a postaural incision. The temporalis fascia graft was harvested through the same incision (Fig. 1). For the tragal perichondrial graft, an incision was made 2mm medial from the tragal crest line. The tragal cartilage was removed by cutting through the areolar tissue (Fig. 2). The perichondrium was dissected in continuity from both surfaces of the excised cartilage (Fig. 3). The cartilage was replaced in its skin pocket and the incision closed. The graft was spread out and the redundant tissue shaved (Fig. 4). It was subsequently dried over a bowl of hot water.

Fascia / Perichondrium Grafts in Type I Tympanoplasty

Sex	No. of Patients	Percentage
Male	25	50%
Female	25	50%
Total	50	100%

Comparative Results of Hearing Improvement Using Fascia/Perichondrium Grafts

Graft Material	Post-Operative Gap <10dB	Post-Operative Gap >10dB	Rejected Cases to residual perfection	% of Success
Fascia	16	6	4	76.2
Perichondrium	15	6	5	76

The edges and undersurface of the perforation were freshened. The handle of malleus was de-epithelialised. The tympanomeatal flap was elevated from 6 o'clock to 12 o'clock position to enter the middle ear. Ossicular intactness and mobility was confirmed. After putting antibiotic steroid soaked gel foam in the middle ear near the Eustachian orifice, the graft was placed medial to the handle of malleus and carefully tucked below the perforation. Tympanomeatal flap was repositioned. The final graft position was checked and readjusted if required. External auditory meatus was filled with antibiotic steroid soaked gel foam to stabilize the graft. Incision was closed and pressure dressing given.

Post-Operative Care

Antibiotics, analgesics and decongestants were given for 3 weeks. Patients were advised not to cough, strain or sneeze. Dressing was changed after 24 hours and suture removal was done on the 7th postoperative day. All patients were called for regular follow up. The gel foam in the external auditory canal was not disturbed for 3 weeks. Antibiotic ear drops were started after that to facilitate dissolution of gel foam and to promote healing. On the 8th week, status of the healed neotympanum was recorded and pure tone audiometry was done to assess the auditory status. The same was done after 3 months to see if there were any changes.

Fig. 1 Harvesting of fascial graft through postaural incision

Fig. 2 Harvesting of tragal cartilage

Fig. 3 Separating perichondrium from tragal cartilage

Fig. 4 Shaving of redundant tissue from graft

Result

In this series surgical success was evaluated in terms of:

1. Intactness of ear drum
2. Closure of post operative A-B gap < 10 dB

For evaluation of results we have included cases of identical conditions, operated by the same surgical team with identical post operative treatment.

The results of graft take with temporalis fascia and tragal perichondrium were 84% and 80% respectively (Table 3). Temporalis fascia achieved a satisfactory hearing improvement in 76% of the patients while tragal perichondrium achieved 75% hearing gain (Table 4).

Discussion

Otitis media¹ is a general term used to describe any inflammatory disease of the mucous membrane lining the middle ear cleft. It is an important disease of children and adults and is caused by multiple interrelated factors including infections, Eustachian tube dysfunction, allergy and barotrauma. Chronic otitis media is the most advanced disease state in the spectrum of otitis media and is associated with some form of irreversible pathologic condition in the middle ear such as granulation tissue, ossicular changes, tympanosclerosis, tympanic membrane perforation and cholesteatoma. Traditionally chronic otitis media is classified into tubotympanic disease characterized by the presence of a central perforation and atticotympanic disease characterized by the presence of a cholesteatoma.

Tympanoplasty is the main surgical treatment for tubotympanic disease. It is defined² as an operation performed to eradicate disease in the middle ear and to reconstruct the hearing mechanism without mastoid surgery, with or without tympanic membrane grafting. The ideal tympanoplasty restores sound protection for the round window by constructing a closed, air containing middle ear against the round window membrane and restores sound pressure transformation for the oval window by connecting a large tympanic membrane or substitute membrane with the 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 the protected window. Then sound pressure transformation for the oval window must be provided by mobile ossicular continuity between the large tympanic membrane and the small oval window.

Raine and Singh³ in a retrospective analysis of 114 tympanoplasties in children in the age group of 7 to 16 demonstrated a significant higher rate of failure between 8 and 12 years. The probable explanation of high incidence of failure in younger children is due to increased incidence of upper respiratory tract infection and immature Eustachian tube function. They advocate deferring surgery till 12 years for achieving better results. In our study the youngest patient was 13 years of age.

Ronald Strahan⁴ documented that the incidence of graft failure and failure to restore hearing were higher in older age group.

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 in 1958 to temporalis fascia in 1964 by Ned Chalet and cartilage in 1963. Since then skin as a grafting material has been discarded due to its desquamation properties with chances of cholesteatoma formation. Vein grafts also have not been so popular due to its chances of getting reperforated. To date temporalis fascia and perichondrium have been the two most commonly used grafting materials.

In this study we have compared the results of tragal perichondrium and temporalis fascia grafts used for the repair of perforated tympanic membrane using underlay technique. Both tragal perichondrium and temporalis fascia are accessible near the operative site, available in adequate amount, have excellent contour, can be thinned down and possess excellent survival capacity. Thus they fulfill all the criteria of ideal graft tissue. Both being mesodermal in origin, they are free from the possibility of post operative cholesteatoma.

In the study conducted by Gibb⁵ using temporalis fascia as graft material by underlay technique the percentage take rate was 87.5%. Strahan^[4] achieved graft uptake success rate of 87% by underlay method. The hearing restoration rate for temporalis fascia was 82% in the study conducted by R. W. Strahan, Paul H. Ward, Mario Acquarelli, Bruce Jafek. The present study achieves a take rate of 84% and hearing restoration of 76%.

Goodhill⁶ achieved near 100% success rate with tragal perichondrium in underlay tympanoplasty. Strahan⁴ recorded 86% tragal perichondrium graft uptake. Eviator⁷ noted that graft take rate with tragal perichondrium by underlay method was 90.47%. A study was conducted by John L. Dornhoffer⁸, from the department of Otolaryngology - Head and Neck Surgery, University of Arkansas to study the hearing results using perichondrial grafts. Out of 22 patients who underwent

the surgery, the graft was taken up in all the patients and the average A-B gap was 6.8dB in the postoperative period. Present study achieves 80% take rate and a hearing restoration rate of 75%. The overall graft take rate and hearing restoration with tragal perichondrium and temporalis fascia is nearly identical.

Conclusion

From the present study we may conclude that:

1. Both tragal perichondrium and temporalis fascia provide viable autograft material.
2. Both materials are mesodermal in origin which excludes the risk of iatrogenic cholesteatoma.
3. Both achieve comparable and excellent graft takes.
4. Both achieve comparable and good hearing restoration.

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