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Original Research Article

Evaluation of graft uptake using temporalis fascia and cartilage perichondrium supplemented with autologous platelet rich plasma in tympanoplasty

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ABSTRACT

Background: Tympanoplasty involves grafting the perforation of the tympanic membrane with materials such as temporalis fascia, cartilage perichondrium, periosteum, vein, fat etc. Both temporalis fascia and cartilage perichondrium are easy to harvest with minimum donor site complications and both have been used extensively in tympanoplasty. Platelet rich plasma aids as an adhesive and supplements healing by providing growth factors. Till date there is scarcity of literature comparing the healing outcome of both cartilage perichondrium and temporalis fascia supplemented with platelet rich plasma. Hence, in this study we are comparing cartilage perichondrium supplemented with platelet rich plasma and temporalis fascia supplemented with platelet rich plasma.
Methods: An observational study involving 60 patients was done. Patients with chronic otitis media were evaluated by otoendoscopy to assess the ear and were categorised into 2 groups which received temporalis fascia and cartilage perichondrium respectively. All cases were supplemented with platelet rich plasma. Post-operative assessment was done by otoendoscopy.
Results: Total 21 patients received temporalis fascia and 39 patients received cartilage perichondrium. At the end of 6 weeks the graft site appeared unhealthy in 6.66% cases who received temporalis fascia and 1.66% in those who received cartilage perichondrium.
Conclusions: We found that cartilage perichondrium supplemented with platelet rich plasma had a better uptake after 6 weeks due to its superior mechanical stability. The results are more rewarding than the use of temporalis fascia with platelet rich plasma.

Keywords: Temporalis fascia, Tympanoplasty, Cartilage perichondrium, Platelet rich plasma

INTRODUCTION

Temporalis fascia remains the most frequently used graft material with closure of the tympanic membrane in 70% to 90% of primary tympanoplasties in different hands. However, in some situations such as advanced middle ear pathology, retraction pockets, and atelectatic ears, temporalis fascia tends to undergo atrophy in the subsequent postoperative period regardless of placement techniques.[1] Our dissatisfaction with the temporalis fascia with a higher incidence of recurrent perforations compelled us to use a tougher material that would not only prevent reperforation but also prevent retractions. Cartilage has shown to be a promising graft material to close perforations in the tympanic membrane. Although it is similar to temporalis fascia, its more rigid quality tends to resist resorption, retraction, and reperforation, even in the milieu of continuous eustachian tube dysfunction.[2]

Heerman was first to consider temporalis fascia as a grafting material. Storrs successfully employed it thereafter. The concept of grafting tragal cartilage and perichondrium was introduced by Goodhill. The ideal grafting material used for tympanic membrane closure should meet certain criteria namely, low rejection rate, sufficient quantity, good tensile strength, conductive properties similar to that of tympanic membrane and easy availability. Membranous grafts like temporalis fascia and perichondrium meet these criteria and result in closure of tympanic membrane perforation in 95% of ears with normal ventilation. However, in situations such as recurrent perforation, total perforation, and chronic mucosal dysfunction or severe atelectatic tympanic membrane, fascia and perichondrium may undergo atrophy and result in graft reperforation. Cartilage perichondrium would theoretically work well in these conditions, being tougher and easily neovascularised. The incorporated cartilage would give it the necessary stiffness and mechanical stability to avoid retraction. Also, it has a low metabolic rate and good acceptance in the middle ear. Concerns have been raised about stiff nature of cartilage, as it could reduce the vibratory properties of neotympanum. However, adequate thinning of the cartilage seems to overcome this problem. The objective of our is to evaluate the graft uptake using temporalis fascia and cartilage perichondrium supplemented with autologous platelet rich plasma in tympanoplasty.

METHODS

Source of data

All the patients above 10 years of age with CSOM and TM perforation attending the out-patient department of ENT at a tertiary care referral centre between January 2019 to December 2019.

Inclusion criteria

All the patients above the age group of 10 years, having good general physical condition were included in the study. Central perforation of the pars tensa of the tympanic membrane with dry ear for a minimum period of 3 weeks.

Exclusion criteria

Patients having sensorineural or mixed hearing loss, atticoantral disease and tympanosclerosis were excluded from the study.

Patients underwent tympanoplasty after obtaining fitness for surgery. Blood was drawn prior to the surgical procedure and platelet rich plasma was extracted by centrifugation for use while placing the graft.

Statistical tool

IBM™ SPSS (statistical package for social sciences) version 23.

RESULTS

In our study of 60 cases of chronic suppurative otitis media, the male and female ratio was 1.5:1. Most of the patients were in the age group of 31-40years which was 35% of the total patients as seen in Table 1.

Table 1: Age wise distribution of patients.

Age groups (years)	No of patients	% of patients
≤30	16	26.66
31-40	21	35
41-50	14	23.33
51-59	9	15
Total	60	100.00
Mean age	42.8	

Table 2: Type of graft used among patients.

Type of graft	No of patients	% of patients
Temporalis fascia	21	35
Tragal cartilage perichondrium	39	65
Total	60	100.00

Table 3: Follow up examination of patients on oto-endoscopy.

Follow up outcome	No of patients (% of patients) at 3 weeks	No of patients (% of patients) at 6 weeks
Graft area/ EAC appearing unhealthy	13 (21.66)	5 (8.33)
Temporalis fascia	11 (18.33)	4 (6.66)
Tragal cartilage perichondrium	2 (3.33)	1 (1.66)
Graft appearing healthy	47 (78.34)	55 (91.66)
Temporalis fascia	10 (16.66)	17 (28.33)
Tragal cartilage perichondrium	37 (61.66)	38 (63.33)
	Chi square: 17.95 P value: 0.000023	Chi square :4.85 P value: 0.027564
Total	60 (100.00)	60 (100.00)

Mean age of the patients was 42.8. Out of the total patients, 21 patients received temporalis fascia and 39 patients received cartilage perichondrium graft as seen in Table 2. The outcome of the surgery was evaluated after 3 weeks and 6 weeks as seen in Table 3. It was found that the graft site was healthy in 91.66% cases at the end of 6 weeks.

Healthy graft site was judged by the presence of an intact graft with good epithelisation with no displacement and absence of discharge and unhealthy graft site was assessed based on the presence of congestion of external auditory canal, granulation tissue, ear discharge, residual perforation.

Only 5.66% of the patients who received temporalis fascia and 1.66% of the cases who received tragal perichondrium had unhealthy graft site on otoendoscopy at the end of 6 weeks. This suggests that tragal perichondrium is superior to temporalis fascia and the results were statistically significant.

DISCUSSION

The perforations of the tympanic membrane (TM) may be of traumatic origin or due to chronic suppurative otitis media.

The leading causes of conductive hearing loss is chronic suppurative otitis media (CSOM) where perforation of TM is present. In such cases the integrity of the tympanic membrane must be re-established quickly to preserve the hearing and to protect the structures of the ear from external insults.[3]

Normally wound healing includes- epithelial migration, increased fibroblastic reaction, vascular proliferation and tissue remodelling. In contrast to this, healing of TM begins with bridging of the squamous epithelial layer, followed by regeneration of the fibrous layer.[4]

Acceleration of perforation of TM and healing follows two main strategies i.e. stromal support to the regenerating tissue and cellular regeneration. If the perforations fail to heal spontaneously or by conservative therapy, they require surgical closure.

Freshening of the edges of TM perforations or cauterization with chemicals such as silver nitrate and trichloroacetic acid have very limited success. Results of various studies done on growth factors concluded that the growth factors function as promoters of cellular regeneration and mobilization. A recent technique of using PRP has been used to accelerate TM perforation healing.[5]

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 all the results of which are variable.

Platelet-rich plasma (PRP) accelerates the healing of tympanic membrane perforation following tympanoplasty. It prevents graft displacement or shrinkage, especially in wet grafts, with its sealant property. Platelet-rich plasma improves the overall success rate of tympanoplasty.[6] Furthermore, it has no noticeable side effects. There are numerous clinical objectives motivating the use of PRP, including promotion of tissue regeneration in both bony and soft tissues, prevention or treatment of infection and restoration of function.[7,8]

Type 1 tympanoplasty is one of the most commonly performed procedures in otology. With advanced microsurgical techniques and equipment, the graft uptake success rates of 96.6% according to Faramarzi et al.[8]

In a study conducted by Indorewala et al. temporalis fascia achieved graft success of 95% for large and 83% for subtotal perforations, while fascia lata achieved graft success of 98% for large and 95% for subtotal perforations.[9]

Erkilet et al suggested that autologous PRP is effective in accelerating TM perforation healing in rats. This encourages us to try it in myringoplasty in large TM perforation in human, particularly as it is an autologous material.[10] A study conducted by El-Anwar et al concluded that the rate of graft uptake with PRP was 100%. In all the cases rate of uptake of the graft was significantly higher than those without PRP. No reported significant complications such as infections were reported.[11]

PRP, being newer biotechnology has demonstrated effects in accelerating and stimulating tissue healing. Efficacy of the treatment with PRP is due to its local delivery of a wide range of growth factors and proteins which support physiologic wound healing.[12] With this study it is suggested that the autologous PRP augments wound healing in chronic perforations of TM and also avoids infection.

Heerman was first to consider temporalis fascia as a grafting material. Storrs successfully employed it thereafter. The concept of grafting tragal cartilage and perichondrium was introduced by Goodhill.[13]

The concept of cartilage and perichondrium was introduced by Goodhill on the basis of its advantages of

low rejection rate, sufficient and easy availability, best tensile strength, possessing conductive qualities similar to TM.[14]

In a pilot study done by El-Anwar et al.[15] a positive effect of PRP on the healing of large TM perforations with perfect results in the first trial of human PRP applications in myringoplasty was established.

A study of topical use of autologous platelet rich plasma in myringoplasty done by El-Anwar et al showed better graft uptake in cases (100%) compared to control (81.25%) and it was statistically significant.[15] A study done by Sankaranarayanan et al on efficacy of autologous platelet rich plasma in myringoplasty also showed better graft uptake in cases (96%) compared to the control group (80%).[16]

Cartilage offers the advantage of higher mechanical stability compared with membranous transplants thus preventing retraction of tympanic membrane in the long run. However, others argue that it may alter the acoustic transfer characteristics of the graft due to the increasing mass and stiffness of the reconstructed tympanic membrane.[17]

In a study by M.M Khan et al graft uptake was in 219 patients, recurrent perforations in 2 years follow-up was in 2 patients, and residual perforation in 2 patients, of a total number of 223 ears operated. The success rate was 98.20% in terms of perforation closure with cartilage tympanoplasty.[18]

In a study by Mansour et al concluded that cartilage perichondrium has the advantages of being stable, malleable but tense, centrally transparent, non-slippery due to the absent central cartilage and enabling rapid healing without delay in hearing improvement.[19]

The use of temporalis fascia and cartilage perichondrium in tympanoplasty is well known. Both have good uptake and have properties useful to provide a scaffold for the epithelialization of the neo-tympanum. Autologous platelet rich plasma is useful and augments better uptake of the graft by providing growth factors and its adhesive property. Hence, we recommend the use of autologous PRP in all cases of tympanoplasty regardless of the type of material used for grafting of the perforation as in the long term the benefits are superior against not using it. In our study we found that cartilage perichondrium fared better than temporalis fascia at the end of 6 weeks. But we recommend multicentric studies with larger sample size to conclusively prove our results.

CONCLUSION

As according to our results of the graft site being healthy in 91.66% cases at the end of 6 weeks. The healthy graft site was judged by the presence of an intact graft with good epithelisation with no displacement and absence of discharge.

We found that cartilage perichondrium supplemented with platelet rich plasma had a better uptake after 6 weeks due to its superior mechanical stability. The results are more rewarding than the use of temporalis fascia with platelet rich plasma.

Hence, we recommend the use of autologous PRP in all cases of tympanoplasty regardless of the type of material used for grafting of the perforation as in the long term the benefits are superior against not using it.

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REFERENCES

1. Ben Gamra O, Mbarek C, Khammassi K, Methlouthi N, Ouni H, Hariga I, et al. Cartilage graft in type I tympanoplasty: Audiological and otological outcome. Eur Arch Oto-Rhino-Laryngology. 2008;265(7):739–42.
2. Dornhoffer JL. Cartilage Tympanoplasty. Otolaryngol Clin North Am. 2006;39(6):1161–76.
3. Verhoeff M, Van Der Veen EL, Rovers MM, Sanders EAM, Schilder AGM. Chronic suppurative otitis media: A review. Int J Pediatr Otorhinolaryngol. 2006;70(1):1–12.
4. Rye MS, Blackwell JM, Jamieson SE. Genetic susceptibility to otitis media in childhood. Laryngoscope. 2012;122(3):665–75.
5. Aljohani Z, Alghonaim A, Alhaddad R, ALShaif W, AlThomali R, Asiry A, et al. Otitis media causes and management. Int J Community Med Public Heal. 2018;5(9):3703.
6. Carter MJ, Fylling CP, Parnell LKS. Use of platelet rich plasma gel on wound healing: a systematic review and meta-analysis. J Plast Surg. 2011;11:382-410.
7. Peerbooms JC, Sluimer J, Bruijn DJ, Gosens T. Positive effect of an autologous platelet concentrate in lateral epicondylitis in a double-blind randomized controlled trial: Platelet-rich plasma versus corticosteroid injection with a 1-year follow-up. Am J Sports Med. 2010;38(2):255–62.
8. Aarhus L, Tambs K, Kvestad E, Engdahl B. Childhood Otitis Media. Ear Hear. 2015;36(3):302–8.
9. Yorgancilar E, Yildirim M, Gun R, Bakir S, Tekin R, Gocmez C, et al. Complications of chronic suppurative otitis media: A retrospective review. Eur Arch Oto-Rhino-Laryngology. 2013;270(1):69–76.
10. Erkilet E, Koyuncu M, Atmaca S, Yarim M. Platelet-rich plasma improves healing of tympanic

membrane perforations: Experimental study. J Laryngol Otol. 2009;123(5):482–7.
11. Boedts D. Tympanic membrane perforations. Acta Otorhinolaryngol Belg. 1995;49(2):149–58.
12. Anniko M, Bernal-Sprekelsen M, Bonkowsky V, Bradley P, Iurato S, editors. Otorhinolaryngology, head and neck surgery. Spring Sci Busin Media. 2010.
13. Chhapola S, Matta I. Cartilage-Perichondrium: An Ideal Graft Material? Indian J Otolaryngol Head Neck Surg. 2012;64(3):208–13.
14. Dabholkar JP, Vora K, Sikdar A. Comparative study of underlay tympanoplasty with temporalis fascia and tragal perichondrium. Indian J Otolaryngol Head Neck Surg. 2007;59(2):116–9.
15. El-Anwar MW, El-Ahl MAS, Zidan AA, Yacoup MARAS. Topical use of autologous platelet rich plasma in myringoplasty. Auris Nasus Larynx. 2015;42(5):365–8.
16. Sankaranarayanan G. a Study on Efficacy of Autologous Platelet. Otolaryngol Online J. 2013;3(3).
17. Poe DS, Gadre AK. Cartilage tympanoplasty for management of retraction pockets and cholesteatomas. Laryngoscope. 1993;103:614–8.
18. Khan MM, Parab SR. Primary cartilage tympanoplasty: Our technique and results. Am J Otolaryngol Head Neck Med Surg. 2011;32(5):381–7.
19. Mansour MH, Askar MH, Albirmawy OA. Repair of tympanic membrane perforation using a modified cartilage-perichondrium composite ring graft. J Laryngol Otol. 2006;120(11):952–4.

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