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Underlay Type 1 Tympanoplasty Using Vascularised Pedicle Temporalis Fascia Graft

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ABSTRACT

Tympanoplasty is procedure to eradicate disease and reconstruct hearing mechanism with or without tympanic membrane grafting. Type 1 tympanoplasty involves repair of tympanic membrane in normal middle ear. It's synonymous with myringoplasty. Since inception of tympanoplasty by Wullstein in 1952, variety of graft material and different surgical techniques were tried with various results. The aim of this study is the assessment of graft up take success rate and hearing improvement in type 1 tympanoplasty using vascularized pedicle temporalis fascia graft. This is a quasi-experimental study that was done in 50 outpatients who attended ENT OPD at government tertiary care center from January 2019 till January 2020 with the diagnosis of Tubotympanic chronic suppurative otitis media who underwent type1 tympanoplasty with vascularized pedicle temporalis fascia graft. Pre-operative and Post-operative Air bone gap is done by pure tone audiometry. Out of the 50 patients two patient developed residual perforation in anterior quadrant 1 months after surgery and these patients were among initial part of study and residual perforation is due to inadequate size of graft. In rest of 48 patients graft take-up was complete and the tympanic membrane was well epithelialized. So graft take-up rate is 96%. ABG closure less than 20 dB is obtained in over 90% of cases. After the surgical intervention, hearing improved to normal in 35 patients out of the total of 50. The modification of type 1 tympanoplasty using a vascularized pedicle temporalis fascia graft gives excellent graft take-up rate overcoming the problems of free graft like shrinkage, vascular necrosis, atrophy of graft.

INTRODUCTION

Surgery for chronic otitis media is one of the commonest otologic procedures performed in developing countries. Tympanoplasty is the procedure to eradicate disease in middle ear and to reconstruct hearing mechanism with or without tympanic membrane grafting Type 1 tympanoplasty involves repair of tympanic membrane when middle ear is normal^[1]. Since the inception of tympanoplasty by Wullstein in 1952, a large variety of graft materials and different surgical techniques have been tried with varying results. Various graft material used to close perforation of tympanic membrane, pedicle graft from ear canal skin, temporalis fascia graft, Vein graft, sclera, corneal graft, perichondrium, pigs bladder, theirsch skin graft, split skin graft etc^[2]. Each graft has its advantages and disadvantages. Temporalis fascia was first used in myringoplasty by Ortegren (1958-59), Heerman (1961) and Storrs (1961). In contrast to all graft materials, temporalis fascia has several advantages including physiological compatibility with tympanic membrane, easy to harvest from same incision site, requires less nutrition, high survival rate, no size limitation for primary operation in middle ear surgery, It can be used as on lay/intermediate/underlay graft, can be used as more than one piece overlap we are often looking for graft take-up rate and hearing improvement as outcome measures of success. Graft take-up means the anatomical position and total epithelialization of the healed tympanic membrane after surgical intervention. There are different methods of placement of the graft namely underlay, inlay and overlay technique^[3]. The most accepted and frequently used technique is underlay of temporalis fascia^[4]. The underlay technique could be performed through post-auricular, end aural or Trans canal approach. Even though general anesthesia is preferred, all these procedures can be done under local anesthesia as well. Temporalis fascia is the most commonly used graft material with closure of the perforation of 70-90% in different hands. However^[5]. Different surgical techniques have been tried to improve the graft take-up rate, as well as to improve the hearing results^[6]. The relentless effort by the pioneers in the field, the graft take-up rate has been improved remarkably. Presently, with reasonable surgical skill and prudent case selection, most of us are able to achieve a take-up rate above 90%. As any other scientifically oriented person our duty is to try to find out methods to improve the graft take-up rate further without jeopardizing the hearing results. In accordance with that we propose a new surgical technique to improve the graft take-up rate without compromising the hearing results.

MATERIALS AND METHODS

This is a quasi-experimental study that was done in 50 outpatients attending ENT department at our tertiary care center from January 2019 till January 2020 with the diagnosis of Tubotympanic chronic suppurative otitis media who underwent type 1 tympanoplasty with vascularized pedicle temporalis fascia graft. The inclusion criteria were, Cases of tubotympanic chronic suppurative otitis media, Patient with moderate conductive hearing loss, Patient between age group 15 to 50 years, Patient of either sex, Patient who was willing to give written informed consent, Ear in quiescent or dry stage. Patient below 15 years and above 50 years, patients who were previously operated (revision surgery)., Cases with ossicular chain erosion, retraction pockets, cholesteatoma were excluded from the study. Those who failed to come for follow up for at least three months were also excluded. A detailed clinical history and examination was done in all patients. Hearing was assessed by tuning fork tests and pure tone audiogram. In all patients, otomicroscopy, pre-operative and post-operative audiograms were performed.



Fig 1. Showing Surgical Anatomy of Temporalis Fascia

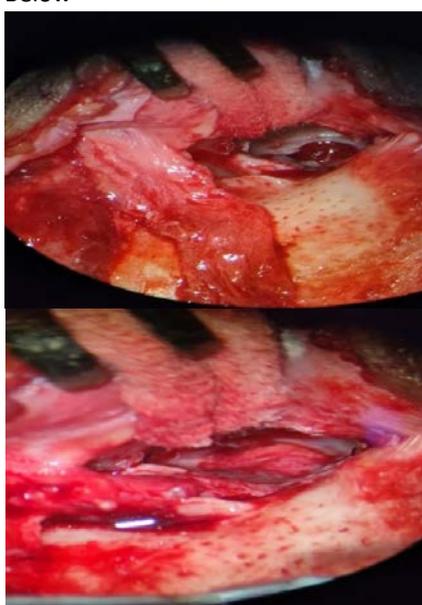
The deep temporal fascia (temporalis fascia, investing layer of temporalis) is separated from superficial fascia by vascular plane of loose areolar tissue .It completely invests the superficial aspect of temporalis muscle down to (but not beyond) the zygomatic arch. Deep temporal fascia supplied by a twig from middle temporal artery, a constant branch of superficial temporal artery. It arises 1-3cm below upper border of zygomatic arch runs superficial to arch and enters deep temporalis fascia immediately above that layers attachment to the zygomatic arch. If middle temporal vessels are protected, the 2 layers of temporalis fascia can be raised as a fully vascularized tissue island. This island can be fashioned as a bilobed/double layered flap depending on manner of dissection.

Operative Technique: All patients were operated under iv sedation and through post-aural approach.

After local infiltration, subcutaneous soft tissue was elevated from the temporalis fascia through the post-aural incision. The pedicle of the graft was identified. It is usually just anterior to 12 o clock of bony external auditory canal embedded in fat .From pedicle two incisions were taken posteriorly one was along temporal line and second was 1.5-2cm above and parallel to first incision and pedicled temporalis fascia graft along with its vascularity was lifted and separated from temporalis muscle below. Graft was everted and then placed as an underlay graft as shown in picture.



Fig. 2. Showing Harvesting and Placement of Temporalis Fascia Pedicled Graft
a) Incision Over Temporalis Fascia
b) Lifting the Graft from Temporalis Muscle Below



c) Graft Reflected and Everted on
d) Closure of Perforation with Underlay Graft External Auditory Canal

Follow Up: Patients were discharged after 48 hours observation with antibiotics, analgesics and antihistamines. Patients were called back after one week, 2week. All patients were followed up monthly for the next two months and a pure tone audiogram was done at the end of three months. A microscopy was also done during this visit to assess the graft take-up. Examination under microscope was repeated at an interval of three months for the next one year.

RESULTS AND DISCUSSIONS

Graft Take-up rate is defined as well epithelialized tympanic membrane in the normal anatomic position without any retractions, having normal conductive characteristics and normal mobility. Air-bone gap [ABG] is defined as the mean of ABGs at frequencies 500, 1000 and 2000 Hz and ABG <10 dB is taken as normal. Out of the 50 patients two patient developed a residual perforation in anterior quadrant 1 months after the surgery following an acute middle ear infection. In rest of the 48 patients graft take-up was complete and the tympanic membrane was well epithelialized and graft take-up rate of 96% shown. ABG closure less than 20 dB was obtained in over 90% of cases. After the surgical intervention, hearing improved to the normal level in 35 patients out of the total number of 50. Details of the pre-operative hearing loss and post-operative ABG closure are given in (Table 1).

Table 1. Showing Pre-Operative and Post-Operative Audiometry Findings

	Air Bone Gap (in dB)	
	Pre OP (N=50)	Number of Patients [%] Post OP (N=50)
0-10	0	33 [66%]
10-20	11 [22 %]	9 [18%]
20-30	34 [68 %]	7 [14%]
30 OR Above	6 [12 %]	1 [2 %]

Present study includes 50 patients in whom we are presenting a modification of over-under tympanoplasty using a pedicle temporalis fascia graft to improve the graft take-up rate without jeopardizing the hearing results. One of the reasons for graft failure in tympanoplasty using temporalis fascia graft is graft necrosis^[7]. From these observations one can, with reasonable certainty, presume that graft take-up rate is better when the graft material stays longer in the middle ear. Pedicle graft resists necrosis more than a free graft. That is the rationale behind this study. The results of our study support our hypothesis., graft take-up rate in our study is 97.7%. And we hope that with more experience and refinement of this technique, we can further improve the results. The overall take-up rate of tympanoplasty using temporalis fascia graft in various studies ranges from 78% to 97.4%^[8,9] and hearing improvement varies from 70% to

85.7%^[10,11]. Nardone M *et al* reported 78% success rate in a critical analysis of long-term results in a 1,000-adult patient series^[8]. And Stage J *et al* claimed 97.4% success rate in underlay tympanoplasty with graft placed over the handle of malleus^[12]. The success rate in mediolateral tympanoplasty was 97% and hearing improvement in 70% of the operated ears as reported by Jung TTK and Park^[13] Palisade cartilage tympanoplasty obtained 71.43% success and average postop ABG was 10.73±7.90 as reported by Marko Velepik^[14]. Hai Gavreil *et al* reported 92.3% graft take-up rate and average hearing improvement of 15 dB by their novel inferior flap technique^[11]. The graft take-up rate of window shade grafting technique was 94% and hearing improvement was 85.7%, reported by Ninad^[15]. The preliminary results of this novel modification of tympanoplasty using a pedicle temporalis fascia graft have been comparable with the best results achieved with tympanoplasty by any other technique as far as the graft take-up rate is concerned. ABG closure achieved in this study is less than 20 dB in 83.7% which is also comparable with most of the studies. Graft resorption is one of the reasons for failure of temporalis fascia graft^[16]. Since we have been using a pedicle temporalis fascia graft the possibility of resorption is remote as it derives its nutrition through the pedicle, probably, that may be the reason for a higher take-up rate achieved by this technique. Residual perforation, re-perforation and necrosis of the total graft material were particularly in anterior perforations which are due to graft dehydration and shrinkage^[17]. The external auditory canal becomes narrower after the surgery due to extra space occupied by the pedicle under the tympanomeatal flap which is one drawback of this technique. This could be minimized by doing a canalplasty in our later cases.

CONCLUSION

Our modification of type 1 tympanoplasty using a pedicle temporalis fascia graft gives excellent graft take-up rate. The functional results achieved by this technique are also comparable with the published data. Highlight of this technique is the use of a pedicle graft instead of a free temporalis fascia graft, in some situations such as advanced middle ear pathology, retraction pockets and atelectasis ears, temporalis fascia tends to undergo atrophy in the subsequent postoperative period regardless of placement techniques. In spite of the very good results, we are compelled to face occasional failures. Extended study in tuberculous otitis media and in patients with residual perforation with this technique is advisable to authenticate vascularized pedicle temporalis fascia graft.

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