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Various techniques of grafting in anterior perforation of tympanic membrane: our experience

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ABSTRACT

Background: The lack of anterior support for the graft frequently leads to graft failure if an underlay method is used whereas anterior blunting is a complication of overlay techniques in the anteriorly located tympanic membrane perforations. The objective of the study was to evaluate the correct surgical technique for the reconstruction of anterior tympanic membrane perforation.
Methods: Our prospective study was conducted from January 2011 to December 2013. This study included 39 patients of either sex, 17-56 years of age groups, at Kamineni Institute of Medical Sciences Narketpally, Nalgonda district, Telangana state. Our surgical experience with a) Simplified underlay technique-in small perforations having healthy remnant in10 patients. b) Button hole and slitting the graft- in thin atrophic ring anteriorly in 25 patients. c) Gerlach' quilting procedure- in inadequate anterior rim in 3 patients and d) Kerr flap-in only anterior rim annulus in 1 patient.
Results: All these methods gave 91.96% closure rate, a mean auditory threshold gain of 8.5 dB was achieved at the frequencies tested.
Conclusions: Here we describe and promote the various techniques of placing grafts in anterior perforations of tympanic membrane, thereby attaining the aforementioned benefits and reducing the incidence of complications.

Keywords: Myringoplasty, Underlay technique, Grafts, Perforation

INTRODUCTION

Attempts to close perforations of the tympanic membrane date back to the 17th century. Since the beginning of the era of tympanoplasty, connective tissue (temporalis fascia, retroauricular periosteum, and tragal perichondrium) has gained the widest use in grafting new tympanic membranes.[1]

The most common area of graft failure when repairing perforations by underlay technique is the anteriosuperior area for following resions: a) lack of graft support and b) less vascularity with a greater risk of re-perforation.[2] The anterior tympanomeatal angle was the main problem area in anterior marginal perforations for both conventional on-lay and underlay techniques.[3]

The following various surgical techniques have been described to overcome these problems when treating the anterior perforations:

***a) Simplified underlay technique*:** Graft was introduced through the perforation after packing middle ear with gel foam and manoeuvred until in contact with drum remnant medially, resting on gel foam bed.[2]

***b) Gerlach's quilting procedure*:** in inadequate anterior rim. In this technique: the graft is prepared, a small tag is

fashioned anteriorly and later pulled through a small tunnel under the anterior-superior annulus.[4]

***c) Kerr flap*:** an underlay graft fashioned to include a tab of fascia that is placed laterally under the annulus and the anterior meatal skin.[5]

***d) Button hole or slitting*:** Graft was placed by underlay technique and a button hole was made in the graft for handle of the malleus to pass through. Underlay with slitting the graft Graft is placed medial to T.M flap and a slit in graft to accommodate handle of malleus.[6]

So the objective of this study was to select a correct technique for repair of anterior perforation of tympanic membrane.

METHODS

The present study included 39 patients (22 males and 17 females) of age between 17-56 years (Figure 1 and 2), who underwent simplified underlay techniques between August 2011 and March 2013 in the Department of Otorhinolaryngology–Head and Neck Surgery at the Kamineni Institute of Medical Sciences Narketpally, Nalgonda district Telangana. Only tubotympanic type of disease with ear that have been dry for at least 3 months and the pure tone average of <40 dB conductive hearing loss were included in this study.

Examination of ear under microscope to know the distance between anterior TM rim and the anterior canal wall inspect the anterior remnant of TM.

The patients were divided into two groups on the following criteria,

a. Size of perforation (subtotal and total perforations were excluded from the present study).
b. Anterior remnant of tympanic membrane.
c. Rim of tympanic membrane around the perforation.

Group I

A) Small central perforation.
B) Moderate to large perforation.

Group II

A) Perforation with adequate anterior rim of tympanic, membrane (>5 mm).
B) Perforation with inadequate rim (<5 mm).
C) Only anterior rim annulus.

The following surgical techniques for placement of graft were selected depending upon the above criteria (Table 1 and Figure 2).

1) *Simplified underlay (group 1A):* Graft was introduced through the perforation after packing middle ear with gel foam and manoeuvred until in contact with drum remnant medially, resting on gel foam bed.

2) *Underlay with button hole the graft (group I B and group II A):* Graft was placed by underlay technique and a button hole was made in the graft for handle of the malleus to pass through. Underlay with slitting the graft (group I B and group II A) Graft is placed medial to T.M flap and a slit in graft to accommodate handle of malleus.

3) *Gerlach quilting procedure (group II B)*: In inadequate anterior rim. In this technique: the graft is prepared, a small tag is fashioned anteriorly and later pulled through a small tunnel under the anterior-superior annulus.

4) *Kerr flap (Group II C):* an underlay graft fashioned to include a tab of fascia that is placed laterally under the annulus and the anterior meatal skin.

Statistical analysis

Data were entered in Microsoft Excel (U.S.A). Results are expressed in percentages and shown with the help of bar diagram and pie chart.

RESULTS

In our study, 39 patients were included based on the criteria mentioned above, among them 22 were males and 17 were females aged between 17-56 years. 33 out of 39 operated patients (20 males and 13 females) had significant improvement in air- bone gap, within 10-15 dB during 6month of follow-up. 6 patients (2 males and 4 female) did not have improvement in air- bone gap because of graft failure secondary to neglected upper respiratory tract infection by patient in second post-op month. In simplified underlay technique 70% of patients improved with healed perforation, one patient had reperforation and 20% of patients had medicalization. In button whole technique, three patients developed re-perforation. In remaining two surgical techniques all patients were improved (Figure 4).

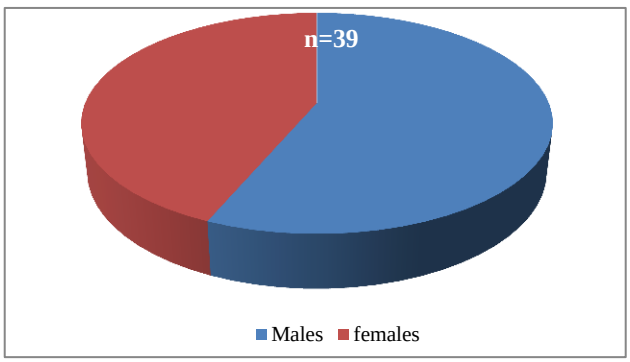

Figure 1: Male:female ratio of patients with tympanic membrane perforation.

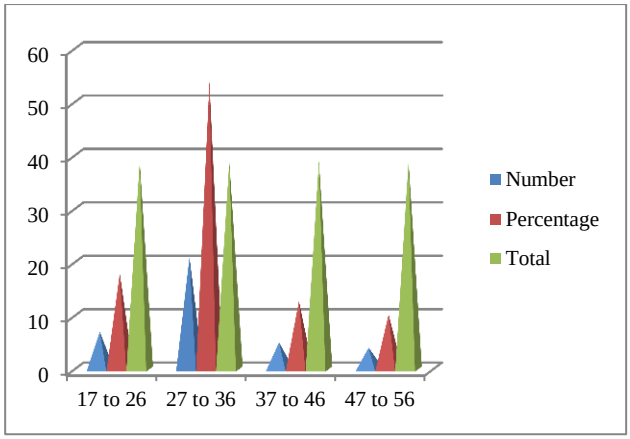

Figure 2: Age distribution of patients with tympanic membrane perforation.

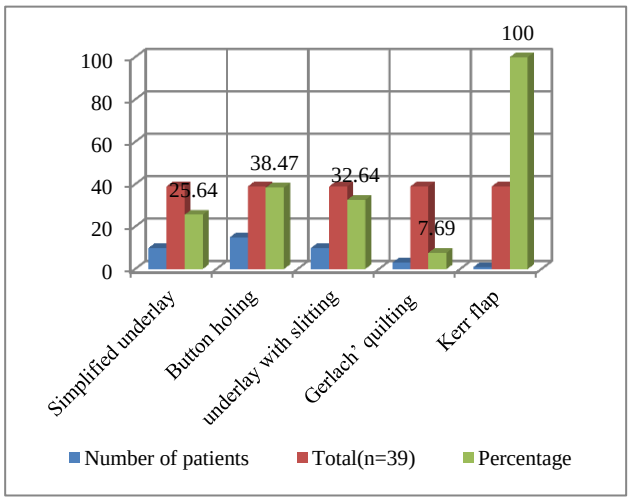

Figure 3: Surgical techniques for patients with tympanic membrane perforation.

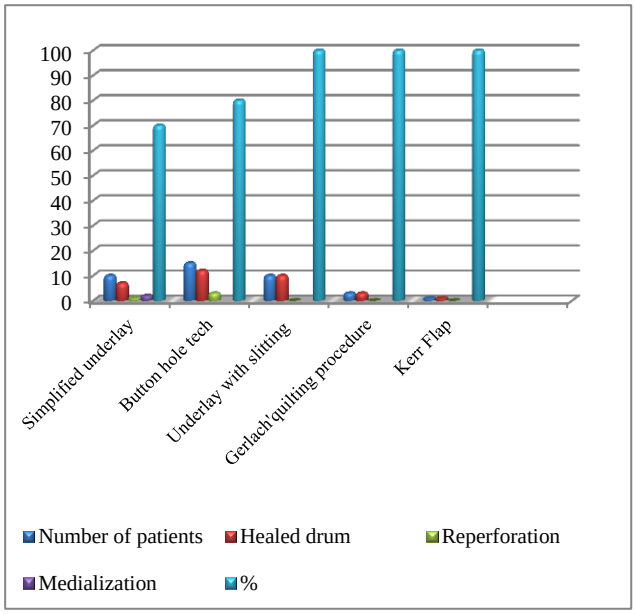

Figure 4: Success rate of different surgical techniques.

Table 1: Surgical techniques for patients with tympanic membrane perforation.

Surgical techniques	No. of patients	%
1)Simplified underlay	10	25.64
2)Button hole &	15	38.46
Slitting	10	25.64
3)Gerlach' quilting procedure	03	07.69
4) Kerr flap	01	02.56
Total(n)	39	100

DISCUSSION

The anterior tympanomeatal angle was the main problem area in anterior marginal perforations for both conventional on-lay and underlay techniques.[3] Here we describe a variation of Gerlach's quilting technique to overcome the problem in three (7.69%) patients with in adequate anterior rim and this modification has proven to be both simple and effective. When the graft is prepared, a small tag is fashioned anteriorly and later pulled through a small tunnel under the anterior-superior annulus. This prevents the graft falling away anteriorly without producing the blunting associated with more extensive undermining of the anterior annulus.[4,5]

The Kerr flap, an underlay graft fashioned to include a tab of fascia that is placed laterally under the annulus and the anterior meatal skin.[4] This technique was performed in one patient only, gave a 97.5 percent closure rate with no cases of anterior marginal blunting and a mean auditory threshold gain of 8.5 dB (95 percent confidence limits 5 to 11.9 dB, $p<0.01$) was achieved at the frequencies tested in Sharp, Terzis, Robinson series.[6] The use of the Kerr flap is recommended when repairing the anteriorly placed tympanic membrane perforation.[7]

To prevent lateralization and anterior blunting in over-lay methods of myringoplasty is by useing a technique of anchoring the temporalis fascia graft to the handle of malleus.[6] The advantage of anchoring the temporalis fascia graft to the handle of the malleus through the buttonhole is that, all around (360^0) movement of the graft is possible. Because the graft is firmly held in position, chances of medial retraction and adherence to promontory are prevented.[8] This technique was used in 15 (38.47%) of our patients, 3 (7.69%) patients developed re-perforation in (button hole technique).

The mediolateral graft method is superior to the traditional medial or lateral graft technique for the reconstruction of large anterior or subtotal TM perforation. It is especially important to position the graft tightly in the anterior sulcus, to prevent failure of graft that occurs most commonly as a result of technical error. It is here that the branches of the anterior tympanic and deep auricular arteries provide a critical blood supply to

the graft. However, this failure rate can be greatly reduced by anchoring the anterior margin of the graft beneath the annulus. These new methods should help otologic surgeons to improve outcome of myringoplasty for anterior or total TM perforation.[9-11] These procedure said in creation of neo-tympanum. It prevents inadvertent movements and displacement of the graft while manoeuvring intra-operatively, and follow up post-operatively.

In simplified underlay procedures in our series 30% was failure rate, 10% re-perforation and 20% mediatisation. Sheehy has suggested such grafts will have a lower "take" rate, being more prone to retract away from the anterior margin and leaving gap.[12]

CONCLUSION

Temporalis fascia grafting for tympanic membrane reconstruction has been in use since centuries now. Here we describe and promote the various techniques of placing grafts in anterior perforations of tympanic membrane, thereby attaining the aforementioned benefits and reducing the incidence of complications. Once the right technique is chosen for graft placement, the future of tympanoplasty will rest on the troublesome ancillary problems like Eustachian tube function, postoperative infections and fibrosis during healing process.

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

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