3-FLAP TYMPANOPLASTY – A SIMPLE AND SURE SUCCESS TECHNIQUE

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ABSTRACT : *Objective Three-flap tympanoplasty, a simple method for tympanic membrane repair, is recorded as an alternative method, which probably has advantages over other procedures and its efficacy evaluated*

Patients Four hundred and fifty patients with subtotal or large central perforations with either an anterior bony overhang or very small anterior rim of the perforation who underwent 3-flap tympanoplasty were included in this study Follow up period was 24 months

Technique After removing the margin of the tympanic membrane remnant, three flaps (Superior, anterior and posterior) were elevated from the external auditory canal wall The temporalis fascia graft was then placed over the handle of malleus and all the three flaps were repositioned over the graft

Main outcome measures The graft take over rate and hearing improvement postoperatively were the main outcome measures

Results Four hundred and twenty-five patients (94 44%) had successful grafts Both subjective and objective hearing improvement with a compliant tympanic membrane was seen in all of these patients postoperatively Medialisation or lateralisation of the intact tympanic membrane did not occur Twenty-five patients had graft rejection, which was noted about 4 weeks after surgery and was due to infections

Conclusion 3-flap tympanoplasty is a simple technique with a very good success rate It is a useful method for busy practioners and junior otolaryngologists

Key Words *3-flap Tympanoplasty, 3s technique, Tympanomeatal flap, Vascular strip*

INTRODUCTION

Tympanoplasty has been well established for decades as the surgery of choice for Chronic Suppurative Otitis Media (CSOM) The promotion of "Tympanoplasty" by Zollner in 1951 and Wullstein in 1952 started a new era in the history of otology From its initial days, tympanoplasty has been modified by many authors in terms of approach, technique and materials used for grafting the tympanic membrane Each had their respective merits, demerits and success rates But whatever be the technique or route of surgery, very large and subtotal perforations have always posed a problem to the otologists Very large or subtotal perforations with a very small remnant of tympanic membrane and an anterior bony overhang are many times more prone to failure after tympanoplasty Al Shaikh et al (1998) performed underlay tympanoplasty by both anterior and posterior flap technique and compared the result of tympanoplasty only by posterior flap technique with a follow up period of 20 months The success rate in their study with combined posterior and anterior flap is better than the posterior flap alone

Graft placement lateral to the malleus is easier than placing the fascia medial to the handle of malleus Placing the fascia medial to malleus reduces the middle ear space Placing the graft lateral to the malleus minimizes medialisation Importantly by placing the graft lateral to the malleus, ossicular reconstruction could be performed directly to the underside of malleus (Kartush et al 2002) The present study evaluates a new technique "3 flap tympanoplasty" with three vascular strips while treating a large and/or subtotal perforation and records a simple and sure success or otherwise a "3-S Technique"

MATERIALS AND METHODS

Four hundred and fifty cases of CSOM with 3-flap tympanoplasty were included in this study performed from June 1992 to June 2004 All the cases had undergone a thorough clinical, audiological and radiological examination and documentation Only the cases with very large and subtotal perforations were included in the study and examined under the operative microscope Patients with active CSOM received conservative medical treatment

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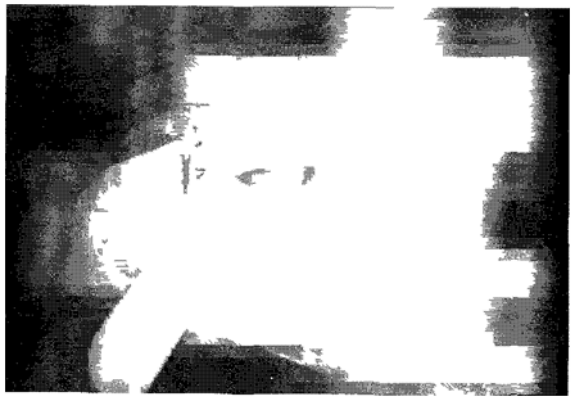

Fig I Modified Endaural Incision

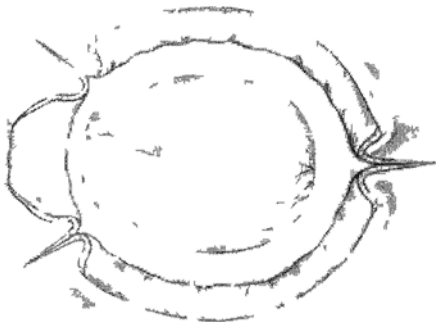

Fig III Three elevated meatal skin flaps (anterior, posterior and superior)

Fig II Three radial incisions at 1 O'clock, 11 O'clock and 6 O'clock positions

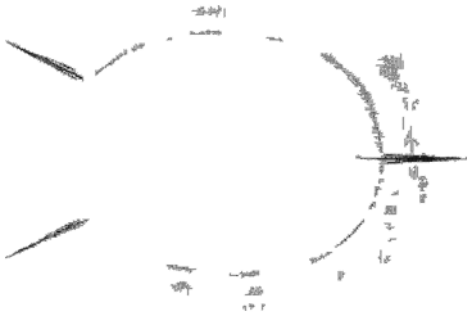

Fig IV Graft placed beneath the three repositioned flaps

preoperatively in the form of oral antibiotics and/or antihistaminics with systemic decongestants and topical antibiotic with steroid eardrops. The septic foci were evaluated and treated as and when necessary. A dry and inactive ear preoperatively after evaluation of septic foci was the prerequisite in all the patients before surgery.

All the cases were operated under local anaesthesia. The infiltration was given with freshly prepared mixture of 2% Xylocaine with 1:47000 Adrenaline by adding half ampoule of 1:1000 adrenaline in 30 ml of 2% Xylocaine with 1:200000 adrenaline. Temporalis fascia, harvested through a separate incision, was the grafting material. A modified endaural incision was used in all the patients. This incision consists of only the vertical limb of Lempert's Endaural Incision utilizing the incisura terminalis in between the crus of the helix and the tragus (Fig. I).
The Plester's retractor with double prong is then applied. After exposure the margin of the tympanic membrane remnant is stripped out so that the ingrowths of the cuticular epithelium in the medial surface of the remnant of the tympanic membrane is removed. After removal of the margin, three radial incisions are taken from within outwards at the 1 O'clock, 11 O'clock and 6 O'clock positions of the tympanic membrane remnant (Fig.II).

The incision in the 6 O'clock position cuts through the annulus tympanicus. The three skin flaps are elevated from within outwards in the bony external auditory canal wall e.g. anterior flap, superior flap and posterior flap. The cuticular layer from over the handle of malleus and from the malleolar folds is elevated along with the superior meatal skin flap (Fig. III).

The middle ear mucosa and the ossicular chain were inspected. Excluding any pathology from the attic, mesotympanum and hypotympanum the harvested temporalis fascia graft is placed within the canal at the level of the sulcus tympanicus. The dried up graft was

dipped into the sterile normal saline just before application. The graft was placed lateral to the handle of malleus. After placing the graft the superior flap or vascular strip is repositioned securely over the graft. Then the anterior flap and the posterior flap along with the annulus tympanicus were placed over the graft (Fig.IV).

No gelfoam pieces were put into the middle ear. The repositioned flaps are pushed medially with dry small gelfoam pieces until the anterior and posterior flaps come to their original position at the level of the sulcus tympanicus and the incision lines meet with each other. The bony external auditory canal is then packed with pieces of dry gelfoam. Antibiotic eardrop was then instilled over the gelfoam pieces. The modified endaural incision is closed by interrupted subcutaneous sutures with 3-0 atraumatic rapid Vycril and a small medicated ribbon gauge pack was placed in the cartilaginous external auditory canal. A standard mastoid bandage is made and the patient discharged on the next day. The dressings are removed on the 7th postoperative day. An antibiotic eardrop without steroid, preferably chloramphenicol, was advised to put thrice a day for two weeks along with other usual medications. The gelfoam in the external auditory canal was cleared after the third postoperative week. Postoperative Pure Tone Audiometry and Tympanometry were performed after 3months, 6 months and 1 year and the results were analysed. The average follow up period in this study was 2 years.

OBSERVATIONS AND RESULTS

Four hundred and fifty cases (ears) were included in the present study. The male and female ratio was 11:7. The average age of incidence was 22.5 years (range 17 to 53 years). The preoperative mean hearing loss was 40-45 dB air-bone gap. All the cases had normal cochlear reserve. Preoperative Tympanometry showed B type curve with low base and absent reflexes in all the affected ears. The modified endaural incision used in this study had no adverse effect in terms of bleeding during surgery, canal stenosis or poor healing. Though gelfoam was not applied in the middle ear in any of the cases, graft placed over the handle of malleus showed no tendency to fall back in the mesotympanum. The graft was kept away from the medial wall of the middle ear by the air entry through the eustachian tube and snugly attached with the overlying vascular flaps. During the follow up period the graft was successfully taken up in 94.44% (425) cases; rest of the

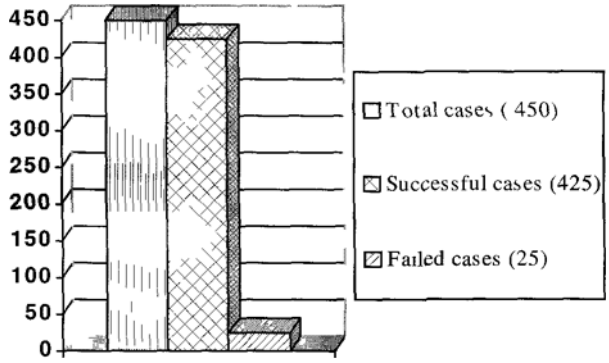

Fig V Postoperative Graft take up rate

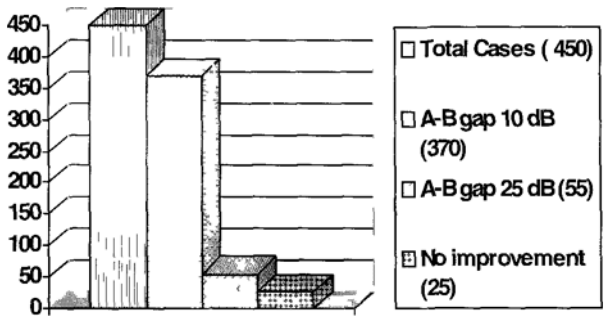

Fig VI Postoperative hearing results

5.56% (25) cases showed partial or total graft rejection (Fig.V).

Both subjective and objective hearing improvement was assessed and recorded in all the cases with successful graft take over. The air-bone gap was closed within 10dB in 87.06% (370) cases and within 25db in the rest 12.94% (55) cases (Fig. VI).

Postoperative Tympanometry showed "A" type curve in 68.24% (290) cases, "As" curve in 17.17% (73) cases and "Ad" curve in the rest 14.59% (62) cases (Fig.VII). Stapedial reflex was recorded in all the successful cases postoperatively.

DISCUSSION

Otologists are doing tympanoplasties for very large or subtotal perforations or prominent anterior overhangs in different ways following different techniques. Difficulties in operative techniques and exposure problems have been the major obstacles for getting satisfactory results. A gap or perforation in the anterior part of the tympanic membrane often develops after surgery in these cases.

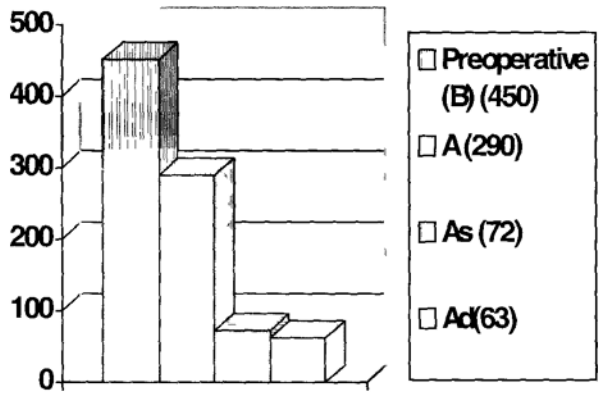

Fig VII Postoperative Tympanogram

The surgical approach may be either through an endaural approach or through a postauricular approach (Sambaugh 1967, Kartush et al 2002). The endaural incision gives good access to posterior perforations while the postauricular incision gives good anterior exposure (Glasscock & Sambaugh 1990, Mills et al 1997, Ludman & Wright 1998). The modified endaural incision used in the present study proved to be adequate enough for very large or subtotal perforations and also in ears with anterior bony overhang. This incision is taken only for exposure. Most of the otologists, while performing tympanoplasty, either elevate a Tympanomeatal Flap (TMF) or fashion a Vascular Strip (VS) superiorly. Glasscock & Sambaugh (1990) proposed elevation of a superiorly based vascular strip and a free skin graft from the rest of the canal wall, before placing the temporalis fascia graft in overlay technique. Underlay tympanoplasty using anterior and posterior flaps has been advocated by al-Shaikh et al (1998) for subtotal perforations. Ludman & Wright (1998) opined that while performing tympanoplasties for subtotal perforations, after elevating the tympanomeatal flap, the dissection of the annulus should proceed far more anteriorly in respect to standard cases, before placing the graft. They also suggested to make a limited tunnel 1-2 mm wide between the annulus and the anterior bony canal wall to pull a small tag of graft material through the tunnel and locate the unstable segment in cases where there is no anterior rim. Kartush et al (2002) elevated a tympanomeatal flap posteriorly and dissected off the entire drum remnant from the long process of the malleus anteriorly before placing the graft. They opined that the elevation of the drum remnant off the malleus provides the following advantages:

1) Increased overlap of the graft and drum remnant,
2) Better preparation of the graft bed,
3) Precise graft placement unobsceured by the malleus and
4) Excellent medial support by the malleus handle.

The three flaps used in the present study (superior, anterior and posterior) produced an adequate exposure in all the cases either in very large or subtotal perforations, in cases with very thin anterior rim or in cases with anterior bony overhang. The anterior flap can be elevated even in cases with bony overhangs and is not difficult to perform. The annulus cut at the 6 o'clock position does not create any problem subsequently. In cases where only two meatal flaps are fashioned (Sambaugh 1967), the lower flap may become bulky and create problem particularly in ears with narrow canals. This is not a problem in our 3-flap technique.

Glasscock & Sambaugh (1990) recommended routine placement of medicated gelfoam in the middle ear before placing the graft to prevent its medialisation. Ludman & Wright (1998) however opined that placement of gelfoam in the middle ear is not necessary if the graft is adequately tagged anteriorly or if a tunnel is fashioned beneath the anterior annulus for pulling up the graft and the patient is encouraged to auto inflate a day or two after surgery. We do not use gelfoam in the middle ear in any of our cases. During the surgery, air in the middle ear enters through a patent eustachian tube and keeps the graft inflated thereby preventing medialisation. This helps in two ways as follows:

1) Patency of the Eustachian tube is established during the operation,
2) Inflation of the graft after replacement of the flaps indicates a perfect air seal.

Glasscock & Sambaugh (1990) and Ludman & Wright (1998) recommended placing the graft medial to the handle of malleus and tucking the graft margin underneath the annulus remnant. Kartush et al (2002) suggested the placement of the graft over the malleus but under the annulus and named it "Over-under tympanoplasty." In the present study the graft is placed lateral to the handle of malleus. The superior flap and the anterior and posterior flaps with the annulus tympanicus are replaced over the graft. This is at par with the technique reported by Kartush et al (2002). The procedure followed in the present study did not result in any medialisation or lateralisation of the graft. The graft stayed securely in its position as it was supported medially by the handle of malleus, which acts

as a cantilever, and laterally by all the three vascular strips. For the same reasons there is no reduction of middle ear space. No blunting of the anterior angle between the tympanic membrane and canal wall was noted in any of the cases. Kartush et al (2002) have also reported similar advantages.

In the present study the gelfoam placed over the graft and the flaps were dry and not medicated. The dry gelfoams are easy to manipulate and helps to push the flaps together with the graft medially with ease. It is difficult with medicated soft gelfoam pieces. At the end of the placement of the gelfoams upto the bony cartilaginous junction, the dry gelfoam pieces are moistened with antibiotic eardrops.

The graft take over rate in the present study is 94.44%, which is comparable with the results of Glasscock & Sambaugh (1990) i.e. 96-97%. The superior vascular strip is the principal supply to the majority of the graft. So placement of the superior VS is mandatory to prevent graft rejection. Cvjetkovic et al (2003) studied the density of capillaries, arterioles, venulolymphatic spaces and a total volume density of all vascular elements of the auditory canal skin in three groups of patients. The first two groups underwent tympanoplasties for CSOM through two different canal skin incisions: TMF and VS respectively. The third group consisted of nonoperated patients. They had found no significant difference in the vascularisation of the canal wall skin between any of the three groups. Al-Shaikh et al (1998) documented better results with the two-flap technique in comparison to posterior TMF only for treating subtotal perforations.

In the present study, considering the successful cases (425 cases), the postoperative air bone gap closure was recorded to be within 10dB in 87.06% cases and within 25dB in 12.94% cases whereas Kartush et al (2002) reported the average improvement in air bone gap of 5.3 dB.
A compliant tympanic membrane in 94.44% (425) cases postoperatively highlights the advantage of this 3-flap tympanoplasty.

The reasons for the failure in this study may be explained by postoperative infection.

The advantages of the 3-flap tympanoplasty include the following :
1) It is ideal for large or subtotal perforations, in cases with anterior bony overhang or with very thin anterior rim of tympanic membrane remnant,
2) Exposure of the anterior middle ear is excellent,
3) There is no blunting,
4) Success rate is very high,
5) It is a simple technique,
6) There is no reduction of middle ear space and no adhesion of the graft with the promontory.

So to conclude the 3-flap tympanoplasty is a simple and sure success technique for treating large or subtotal perforations with minimal anterior rim and bony anterior overhangs. The postoperative graft take up rate and hearing improvement are also excellent with practically no blunting, medialisation or lateralisation of the graft.

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