Prospective study of 100 cases of underlay tympanoplasty with superiorly based circumferential flap for subtotal perforations

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Abstract

Objective Underlay Tympanoplasty with superiorly based circumferential flap for dry subtotal perforations.

Study Design A prospective study of cases with dry subtotal perforations, which underwent surgery between August 2001–Feb. 2004.

Setting Study was conducted on patients attending ENT OPD in S.M.S. Medical College and Hospital from August 2001–Feb. 2004 with dry subtotal perforations.

Results It was noted that 89% of the cases were in the age group of 11 to 40 years, while one case was of 7 years of age and 9% of cases were between the age of 41–50. 50% of the cases had dry ear for less than 3 months while 75% of cases had dry ear for less than 1 year. Graft take rate was 97% with completely healed tympanic membrane. Rejection of the graft was observed in 2% of the cases. Hearing gain of 10–30dB was achieved in 95% of the cases. 7% of the cases suffered minor complications like otitis media with effusion (2%) retraction (2%) and lateralization (1%).

Conclusion Duration for which ear has been dry did not affect the results. 49% of cases had dry ear for less than 3 months, with good graft take up rate and hearing gain.

Pneumatization of mastoids, had a direct relationship with, post operative hearing gain, which ranged from 10–30 dB, in 95% of the cases. We observed, 97% graft take rate. Rejection of the graft was found in only 2% of the cases. 97% of the graft take rate and good hearing gain in our study can be correlated with expertise technique to deal with subtotal perforations.

Keywords Tympanoplasty · Subtotal perforation · Underlay tympanoplasty

Introduction

Tympanoplasty includes all procedures when the drum is lifted from its position in the ear canal. Tympanoplasty alone or type 1 tympanoplasty denotes that the surgery is confined to the drum alone, and no manipulation of the ossicles occurs.

State-of-the-art knowledge, techniques, and equipment in tympanoplasty are the immediate result of over 145 years of inspiration, innovation, and industry by numerous otologic surgeons.

Banzer (1651) first described tympanic membrane repair in 1640 using pig bladder stretched across an ivory tube and placed into the ear. In 1878, Berthold (1982) used a full thickness skin graft to successfully repair a perforation and coined the term “myringoplastik” to describe the procedure. Similar reports by Ely (1881) and Tangamann (1844) have been described. The introduction of microsurgery and antibiotics in the 1950s stimulated Zollner and Wullstein (1955) to develop new myringoplasty techniques.

Over the years, various techniques have been attempted to improve tympanoplasty results. These include overlay tympanoplasty (House, 1960); underlay tympanoplasty (Shea, 1960); “Gelfilm sandwich tympanoplasty” (Karlan, 1979); “Crown cork tympanoplasty” (Hartwein, 1992); “swinging door tympanoplasty” (Schwaber, 1986). Office tympanoplasty techniques have also been described, includ-

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ing paper patching, lobule fat graft and more recently, self-stabilizing tympanic membrane patchers (Kartush, 2000).

This study designed to determine the result of an ideal technique or an ideal application of a technique for tympanoplasty in the cases of dry subtotal perforations

Material and Methods

The study was conducted on patients attending to E.N.T. O.P.D. in S.M.S. Medical College from Aug. 2001 to Feb. 2004, with dry subtotal perforations. Cases were diagnosed clinically and with pure tone audiometry assessment. Primary infective foci to the nose, paranasal sinuses, and throat, was taken care of before planning for the surgery. Proposed surgical plan for the cases was as follows:

- Post auricular incision.
- Harvesting the temporalis fascia graft.
- Canal incision is given from 12 'O clock to 1'O clock, just medial to the SPINE OF HENLE.
- Elevation of circumferential tympanomeatal flap, which is superiorly based ensures the separation of endothelial layer from epithelial layer.
- This exposure allows wide view of the anatomy of the middle ear, and to assess the status and mobility of the ossicles.
- Temporalis fascia graft is anchored under the handle of malleus and repositioned all around the bony annulus and bony meatus. If the malleus handle is medialised to much, judicious cutting of medialised part of the handle of malleus is done
- Tympanomeatal flap is repositioned.

Results

89% of the cases were in the age group of 11 to 40 years, while one case was of 7 years of age and 9% of cases were between the age of 41-50. Males outnumbered the females, ratio being 1.8: 1. Involvement of the right ear was observed in 73% of cases while 27% of cases showed left ear involvement.

Most of the patients presented with ear discharge of more than 3 years (38%) & hearing loss (28%). 50% of the cases had dry ear for less than 3 months. 75% of cases had dry ear for less than 1 year. 10% of the cases had sclerotic mastoids while 90% had cellular mastoids (Table 1).

Preoperatively 86% of the cases presented with air bone gap, in the range of 10-40dB. (Table 2) Degree of hearing loss was mild in 45%, moderate in 37% of cases. (Table 3) Graft take rate was 97% with completely healed tympanic membrane. (Table 4) Rejection of the graft was observed in 2% of the cases. Hearing gain of 10-30dB was achieved in 95% of the cases. (Table 5). 7% of the cases suffered minor complications like otitis media with effusion (2%) retraction (2%) myringitis (2%) and lateralization (1%) (Table 6).

Table 1 Mastoid Cellularity

Mastoid Cellularity	No. of Patients	% of Patients
Well pneumatized (cellular)	71	71
Diploic	19	19
Sclerotic	10	10
Total	100	100

Table 2 Pre Operative (A-B gap) in dB

(A-B gap) in dB	No. of Patients	% of Patients
10-25 dB	16	16
26-40 dB	70	70
41-55 dB	14	14
Total	100	100

Table 3 Degree of Hearing Loss

Degree	Loss in dB	No. of Patients	% of Patients
Mild	26-40 dB	45	45
Moderate	41-55 dB	37	37
Moderately Severe	56-70 dB	12	12
Severe	71-91 dB	6	6
Total		100	100

Table 4 Condition of post operative TM

Condition of T.M.	No. of Patients	% of Patients
Healed	97	97
Residual perforation	1	1
Rejected	2	2
Total	100	100

Table 5 Post operative hearing gain (A - B gain in dB)

Hearing gain in (AB) (dB)	No. of Patients	% of Patients
< 10 dB	5	5
10-20 dB	56	56
21-30 dB	39	39
Total	100	100

Table 6 Complications in 7 cases (Total Number of patients 100)

Complications	No. of Patients	% of Patients
OME	2	2
Retraction	2	2
Myringitis	2	2
Lateralization	1	1
Total	7	7

Discussion

It is often reported that repair of STP is less successful than that of smaller perforations because it is technically more difficult. The author's surgical technique seem to be valuable method for the closure of sub total perforations of tympanic membrane.

We achieved drum healing (97%) and maximum number of patients had post operative hearing gain ranging from 10–30 dB. This was possible, as we adopted better surgical technique of raising circumferential flap, so as to get proper placement of the graft on bony annulus and under the handle of malleus to achieve proper conization of the grafted tympanic membrane.

Technique of underlay tympanoplasty was preferred by us, as it has many advantages, that there is no risk of blunting, lateralization of graft and epithelial cyst formation, as elaborated by Doyle (1992) [1]. Our results and observations about underlay tympanoplasty matches with that of Doyle (1992) [1] and Glasscock (1973) [2], where underlay tympanoplasty is justified as a technique with better results. These findings are in contrast to the results of Rizer (1997) [3], who achieved drum healing in 95.6% in overlay, as compared to 88.8% in underlay tympanoplasty.

Many tympanomeatal skin flaps have been used in tympanoplasty by various surgeons to achieve good drum healing and hearing gain, post-operatively. Palva (1963) [4] introduced his *Swing Door Technique* to enhance anterior visualisation of the tympanum. Ralli et al (2000) [5] used underlay anchored myringoplasty which utilizes anterior and posterior tunnels to achieve proper tension of the tympanic membrane as well as lateral traction of the malleus handle. It resulted in drum healing (91.7%) and pure tone average (PTA) post operatively was 27dB as compared with 55 dB preoperatively. Primrose and Kerr (1986) [6] were able to improve graft tension by using an anterior tunnel created under the annulus. Gristwood and Venables (1993) [7] described an underlay myringoplasty creating two anterior tunnels for graft stabilization. Sauvage et al (1993) [8] presented a surgical technique that included the creation of a large anterior flap for stabilizing the fascia.

In addition, thin Silastic has often been used to avoid the formation of new adhesions (Sheehy, 1989) [9]. Farrior (1968) [10] described elevation of tympanomeatal flap from 12'O clock to 3'O clock position. We modified this technique and extended the incision to 1'O clock position, to base our flap superiorly, which allows the graft to be anchored under the handle of malleus and to be repositioned into the bony annulus, which allows good graft take up rate and post operative hearing gain.

Sheehy (1980) [11] in his review of cases of myringoplasty has advised against the operation in patients under the age of seven for the fear of subsequent middle ear effusion.

The duration for which, ear has been dry did not seem to affect our results, as ears, which were dry for < 3 months

(49%) had comparable results with those which were dry for ≥ 1 year (24%). This finding rejects the commonly held belief among the otolaryngologists that an ear which has been dry for a longer time has a better chance of healing than an ear, which has been dry for a lesser period of time or is wet. This corroborates the findings of Rizer (1997) [3] and suggests that meticulous removal of disease and careful graft placement offsets any adverse influences of these factors.

Plain skiagrams of mastoids revealed cellular or well pneumatized mastoids in majority of cases (71%), while sclerotic mastoids were limited to 10% of cases which reflects severe and long standing disease. Pneumatization had a direct bearing on post operative hearing gain, in majority of cases, who had cellular mastoids, it ranged from 10–30 dB (95%), but in cases of sclerotic mastoids it came down to < 10dB. This trend reflects that reservoir of disease in the mastoid does have a bearing on hearing gain, if not on graft take -up rate. Experience that we gained from our study, showed that size of the perforation and location of perforation does not influence healing, as also observed by Yung (1983) [12] and Rizer (1997) [3]. The results greatly depend upon surgical expertise.

Dry and clean cases that we chose for our study, reflected on the hearing loss with which, patients came to us for consultation. 75% of patients had mild (45%) or moderate (37%) hearing loss, because there was no ossicular fixation and other associated mucosal disease or cholesteatoma, which could affect hearing status, adversely.

The most significant finding in our study was that graft take rate was 97%. We took special care to maintain an air filled space in the middle ear and to preserve the mucosa of the promontory as well.

Sheehy and Anderson (1980) [11] reported a 97% take rate in 472 overlay tympanoplasty surgeries. Gibb and Chang (1982) [13] and Packer et al (1982) [14] have reported the success rate of revision tympanoplasty as being high and of the order of primary surgery.

Two of our cases suffered complete rejection of the grafted tympanic membrane, probably due to infection but coincidentally both had sclerotic mastoids and long standing history of discharge (> 1 year).

We did not evaluate eustachian tube functions, preoperatively. Two patients came in follow up with otitis media with effusion, which were dealt with grommet insertion. 2% of cases showed retraction of grafted tympanic membrane, while 2% of cases had myringitis, which was subsequently treated with steroid drops. Lateralised tympanic membrane was found to be present in a single case. Residual perforation was noted in a single case which was corrected with fat plasty.

Preoperative (A-B) gap was in the range of 26–40 dB in 70% and 10–25 dB in 16% of cases. 82% of the cases had mild to moderate degree of hearing loss while 18% were in the moderately severe to severe grade.

In our study the hearing gain ranged from 10–30 dB in almost 95% of the cases, while only 5% of cases were with hearing gain less than 10 dB.

Sheehy (1980) [11] in a study of 472 cases of overlay myringoplasty reported post operative conductive deficit within 10dB for 80% of cases.

Good hearing gain in our study can be correlated with expertise technique to deal with subtotal perforations with special reference to the circumferential flap, maintaining the conization of the grafted tympanic membrane by placing the graft under the handle of malleus.

Various surgeons have used different kinds of grafts to repair tympanic membrane perforations. Most popular are autogenous grafts. Zollner (1954) [15] and Frenckner (1955) [16] used pedicled ear canal skin graft to close perforations. Shea (1960a) [17] introduced vein graft to close tympanic membrane perforations. It goes to the credit of Heermann (1960) [18] for introducing *Temporalis fascia* as a grafting material in tympanoplasty.

We used *Temporalis Fascia* graft to close subtotal perforations and could achieve good results both in terms of drum healing (97%) and closure of (A-B) gap – (95% of patients showed closure of A-B gap to 10–30dB).

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