

Medial versus Medio-lateral Tympanoplasty in Large Central and Subtotal Perforation – A Prospective Study

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ABSTRACT

Introduction

Large central and subtotal tympanic membrane (TM) perforations are difficult to repair because of less vascularity of anterior TM than posterior TM and the anterior bony overhang that blocks visualization. Some studies reported very encouraging results with the medio-lateral tympanoplasty in such cases. We have undertaken this study to find out efficacy of this technique in large central and subtotal perforations and to compare the results of medio-lateral with medial tympanoplasty.

Materials and Methods

The present prospective study was conducted in the Department of Otorhinolaryngology of a medical college and hospital, West Bengal from January 2013 to December 2014. Patients were alternatively divided into two groups. Medial technique was used in Group I and medio-lateral technique was used in Group II.

Results

Each group comprised of 40 patients each. Maximum number of patients in each group was in the age group of 15-25 years. The overall graft uptake rate in this study was 95% in medio-lateral technique compared to 80% of underlay technique.

Conclusion

The medio-lateral tympanoplasty is suitable for reconstruction of large central or subtotal TM perforation. It takes advantage of both medial and lateral grafting methods while avoiding their pitfalls.

Keywords:

Tympanic Membrane Perforation; Tympanoplasty

One of the common sequelae of chronic otitis media is tympanic membrane (TM) perforation. Large central and subtotal tympanic membrane (TM) perforations continue to be one of the greatest problems in tympanoplasty surgery. Repair of these perforations is less likely to be successful as compared to repair of small and posterior perforations.^{1,2} Large central and subtotal TM perforations are difficult to

repair because of less vascularity of anterior TM than posterior TM and the anterior bony overhang that blocks visualization.³

There is a greater risk of re-perforation and obliteration of the anterior part of middle ear cavity.⁴ Although the lateral (overlay) technique has a higher success rate for reconstructions of large central and subtotal TM perforations, serious complications may occur. These problems have been managed by a variety of surgical techniques, such as the use of William's microclip,⁵ sandwich graft tympanoplasty,⁴ over-underlay tympanoplasty.⁶ Yet, a still better method is needed to repair anterior and subtotal TM perforations. Jung and Park in 2005 reported very encouraging results with the medio-lateral tympanoplasty, where graft is placed medially to the posterior half of TM perforation and

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laterally to the anterior half of perforation. This method is a hybrid of the medial and lateral tympanoplasty techniques thus takes advantages of both methods.⁷ In light of very encouraging results of medio-lateral tympanoplasty, we have undertaken a prospective study to find out efficacy of this technique in large central and subtotal perforations and to compare the results of medio-lateral with medial tympanoplasty.

Materials and Methods

The present study was conducted in the Department of Otorhinolaryngology of a medical college and hospital, West Bengal. Eighty six patients of either sex in the age group of 15-50 years suffering from chronic otitis media with large central or subtotal perforation were selected for the study from the outpatient department during the period from January 2013 to December 2014. We selected patients with ear free from active discharge for at least 4 weeks; Air bone gap more than 25 dB on pure tone audiogram; good cochlear reserve; without any complication; and no focus of infection in nose and throat. Patients with actively discharging ear; hearing loss >60 dB; marked deviated nasal septum or active sinus disease; history of ear surgery in the past were excluded from the study. Written informed consent was taken from all patients and their guardian. This study was approved by Institutional Ethical Committee. Six patients did not turn in follow up. So they were excluded from the study. These patients were alternatively divided into two groups. Each group comprised of 40 patients. Medial technique was used in Group I and medio-lateral technique was used in Group II.

History of all the patients was documented in detail. All of them were subjected to thorough clinical examination and the otoscopic findings were confirmed by examination of the ear under microscope (EUM). Pure tone audiogram of both ears for air and bone conduction were done. Patients were posted for tympanoplasty operation under local anaesthesia and sedation after doing all routine investigations. Autologous temporalis fascia graft was used in all cases. Also trans-canal technique was used in all the cases.

In medial tympanoplasty technique graft was advanced under the posterior tympanomeatal flap and

under the malleus handle to the anterior most extent of the perforation and the edges of the graft was tucked under the margin of drum remnant. Small pieces of the gelfoam were used to overlap the junction of rim and graft circumferentially.

In medio-lateral tympanoplasty technique vertical canal incisions were made at the 12 and 6 O'clock position. The 6 o'clock incision was extended right up to the annulus. The 12 o'clock incision was made down to a few millimetres above the annulus to preserve blood supply because the anterior canal skin was used as the superiorly based flap. Connecting incision was given 3 mm away from the annulus on posterior canal skin. Posterior tympanomeatal flap was elevated. With a curved round knife, horizontal incision was made in the anterior canal skin. The distance of the anterior horizontal canal incision from the anterior annulus should be about the same as the diameter of the perforation. After the incision the anterior canal skin was elevated medially. The antero-medial canal skin flap was elevated up to the annulus or margin of the tympanic membrane perforation. At the annulus, only the squamous epithelial layer of the tympanic membrane was carefully elevated to the anterior half of the perforation edge, leaving the anterior annulus intact. The temporalis fascia was grafted medially for the posterior half of the perforation and the handle of the malleus and was grafted laterally over the annulus in the anterior half of the perforation. Antero-medial skin was rotated to cover perforation and fascia in a superiorly based flap. Antero-lateral canal skin was replaced. Gelfoam soaked in antibiotic solution was placed lateral to the tympanic membrane. An umbilical tape coated with framycetin ointment was placed in external auditory canal.

Patients were discharged next day with antibiotic, analgesic and antihistaminic. Each case was reviewed at 1 week, 3 week, 2 months, 6 months and 1 year. Post-operative pure tone audiometry was done at 6 months and 1 year.

Results

Total 80 patients were divided into two equal groups randomly. Medial tympanoplasty was done in Group I and medio-lateral tympanoplasty was done in Group II.

Table I: Distribution of patients according to size of perforation

SIZE OF PERFORATION	TOTAL NUMBER OF PATIENTS	HEALTHY VOLUNTEERS
	GROUP I	GROUP II
Subtotal Perforation	34 (85%)	36 (90%)
Large Central Perforation	06 (15%)	04 (10%)

Table II: Relationship between graft take-up and size of perforation

SIZE OF PERFORATION	TOTAL NUMBER OF PATIENTS	HEALTHY VOLUNTEERS
	GROUP I	GROUP II
Large	4/6 (66%)	4/4 (100%)
Subtotal	28/34 (82%)	34/36 (94%)
Overall	32/40 (80%)	38/40 (95%)

Maximum number of patients in each group was in the age group of 15-25 years. There were total 44 males and 36 females. All patients in this study had a history of ear discharge in the past, though the ear was apparently dry for at least four weeks before they were taken up

for tympanoplasty. In both groups 15% patients had bilateral ear involvement. Size of the perforation was defined as follows³: Pin-point; Small (smaller than one quarter of the tympanic membrane size); Medium (up to half the size of tympanic membrane); Large (up to

Table III: Follow up examination in Group I

OTOSCOPIC FINDINGS	10TH DAY	3RD WEEK	2ND MONTH	6TH MONTH
Intact graft	-	32 (80%)	32 (80%)	32 (80%)
Anterior sulcus blunting	-	-	-	-
Graft lateralization	-	-	-	-
Discharge	-	8 (20%)	-	-
Residual perforation	-	8 (20%)	4 (10%)	2 (5%)
Graft rejection	-	-	6 (15%)	6 (15%)

Table IV: Follow up examination in Group II

OTOSCOPIC FINDINGS	10TH DAY	3RD WEEK	2ND MONTH	6TH MONTH
Intact graft	-	36 (90%)	36 (90%)	38 (95%)
Anterior sulcus blunting	-	-	-	-
Graft lateralization	-	-	-	-
Discharge	-	04 (10%)	-	-
Residual perforation	-	-	02 (5%)	-
Graft rejection	-	-	02 (5%)	02 (5%)

three quarters the size of tympanic membrane); Subtotal (when only annulus remains). In Group I, 34 (85%) cases had subtotal perforation whereas six (15%) cases had large central perforation. In Group II, 36 (90%) cases had subtotal perforation, whereas four (10%) cases had large central perforation (Table I). In Group I, four (10%) cases had medially retracted handle of malleus.

In rest 36 (90%) cases handle of malleus was normal. In Group II, two (05%) cases had medially retracted handle of malleus; while it was partially necrosed in two (05%) cases and normal in 36 (90%) cases. In Group I, four (10%) cases had moist the middle ear mucosa. While the middle ear mucosa was normal in 36 (90%)

cases. In Group II, two cases had moist middle ear mucosa, rest were normal. Tuning fork test was done in all patients with 512 Hz frequency tuning fork and results were compared with the audiogram. Based on the pure tone audiogram, hearing loss was classified as mild (24-40 dB), moderate (41-55 dB), moderately severe (56-70 dB), severe (71-90 dB) or profound (>90 dB).¹⁹ In both the groups 95% of the patients had conductive hearing loss in the range of 25-40 dB and four patients had a loss of 45 dB. The overall graft take-up rate in group I was 80% and in group II it was 95% (Table II). In Group I, discharge was noted in eight patients which was resolved by changes of antibiotic and six patients

Table V: Average post-operative hearing gain in Group I

HEARING GAIN	NUMBER OF PATIENTS
0-5 dB	08 (20%)
5-10 dB	00 (0%)
10-15 dB	20 (50%)
15-20 dB	10 (25%)
>20 dB	02 (05%)

Table VI: Average post-operative hearing gain in Group II

HEARING GAIN	NUMBER OF PATIENTS
0-5 dB	02 (05%)
5-10 dB	00 (0%)
10-15 dB	14 (35%)
15-20 dB	22 (55%)
>20 dB	02 (5%)

had graft rejection and two had residual perforation (Table III). In Group II, discharge was noted in four patients which was resolved by changes of antibiotic and two patients had graft rejection and two had perforation which was healed with application of chemical cautery (Table IV).

In Group I, the average preoperative A-B gap was 35.5 dB while the average postoperative A-B gap was 21.5 dB, giving an average postoperative gain of 14 dB. Majority of patients 30 (75%) had a gain in the range of 10-20 dB. Two patients had a gain of more than 20 dB (05%), eight (20%) had 0-5 dB gain. This included two patients with perforation and six with graft rejection (Table V). In Group II, the average preoperative A-B gap was 36.5 dB with average postoperative gap of 18.5 dB thereby average gain of 17.5 dB. 36 (90%) patients had a hearing gain of 10-20 dB, while two (5%) had gain of more than 20 dB. Rest two (5%) patients had no gain of hearing. This group comprised of two cases with graft rejection (Table VI).

Discussion

It has been shown that one of the most important factors in the success of tympanoplasty is the size and site of the perforation.^{1,2} The success rate of repairing small and posterior perforations can be higher than 90% but the success rate dropped to 67% in the repair of anterior and subtotal perforations.⁸

Using fluorescein dye, Applebaum and Deutsch demonstrated that the anterior tympanic membrane is less vascular than the posterior part. Because of this reduced vascularity, there is greater risk that epithelialisation and healing may not occur in the anterior part prior to necrosis and re-absorption of the graft. In this area of the ear drum, there is also a problem with fixation of the fascia graft.³

One of the main problems in subtotal perforation is the lack of anchorage and support for the graft, especially with the underlay technique. It has been stated that the graft acts as a scaffold for the migration of squamous epithelium and mucosa. Hence persistence of the graft in correct position is more critical to the successful closure of the large perforation than small one.

Schuknecht (1976) believes that surgical technique is most important factor in the success of tympanoplasty especially for anterior and subtotal perforations.⁹ Two classic methods for reconstruction of TM perforation have been medial and lateral technique. Each technique has its advantages and disadvantages.^{10,11}

In medial technique, the graft is placed medial to the drum remnant after excision of the edges of the perforation. It is simple and easy to perform particularly when perforation is small. There is no anterior sulcus blunting or lateralization of graft. But there is a chance of reduction in the middle ear space. Moreover medial technique is not suitable for subtotal or total perforations.¹²⁻¹⁶

In lateral technique the epithelium of the drum remnant is elevated from the fibrous layer, this usually being done in continuity with the flaps made from skin after giving the circumferential incision. Advantages of this technique are visualization of anterior meatal skin is usually complete, which is important in cases where the perforation reaches the anterior annulus; the middle ear space is not compromised as the graft is applied outside the existing layer of middle ear mucosa. Although the lateral technique has a higher success rate for the reconstruction of anterior or subtotal TM perforations, serious complications may occur. Disadvantages are squamous cyst formation from remnants of epithelium left behind the skin flaps; blunting of the anterior sulcus due to accumulation and organization of blood deep to skin graft or due to lateral deposition of the fascia graft over the anterior canal wall; lateralization of the graft which is considered to be a continuation of a process of blunting. In the later postoperative period the graft may become lateralized due to contractile tightening of the graft tissue.¹²⁻¹⁶ In lateralization, the TM loses contact with the conductive mechanism of the middle ear resulting in hearing loss.

Various techniques have been described to overcome the problems. Stage J and Back-Pederson (1992), presented a study in which the graft was placed lateral to the handle of malleus in underlay tympanoplasty.¹⁷ Kartush et.al. (2002) introduce the term over-underlay tympanoplasty. It was a contribution of two classical techniques; in which the graft is placed lateral to the handle of malleus, and under the drum remnants and

annulus.¹⁸ Farrior (1989) in the management of anterior and subtotal tympanic membrane perforations described the sandwich graft tympanoplasty which uses both an internal and external layer of areolar fascia, plus immediate epithelial coverage and reported a 98% success rate.⁴ Weider (1981) reported a 99% success rate with the use of the William's microclip to secure the fascia graft.⁵ Cody DT and Taylor WF (1973) reported the use of double fascia grafts, one medial and one lateral to the drum remnant, which yielded a higher rate of successful perforation closure than using single layer grafting techniques.¹⁹ Hung et.al. (2004), used antero-superior anchoring technique and reported success rate between 85.7% to 100%.²⁰ Gerlinger et.al. (2006) described anterior anchoring technique combining the anterior "pull-back" method and reported 100% graft take up rate.²¹

Jung and Park (2005) described medio-lateral tympanoplasty for anterior or subtotal tympanic membrane perforation and reported 97% success rate.⁷ In 2009 Jung et. al. presented a comparative study between medial and medio-lateral graft tympanoplasty and reported a success rate of 97% using the medio-lateral technique.²² In this technique, the fascia graft is placed medial to the handle of malleus and posterior half of the tympanic membrane perforation but lateral to the anterior half of the perforation. This method is a hybrid of the medial and lateral graft techniques that takes advantages of both methods. The advantages include prevention of anterior fall away of the fascia; stability of the graft; prevention of lateralisation of graft; better blood supply because anterior canal skin is rotated as a rotational flap rather than free graft. Jung & Park⁷ (2005) and Jung et.al.²² (2009) reported no case of lateralization.

In the present study age group ranged from 15-50 years; patients younger than 15 years were excluded from the study. This age group was selected due to its likelihood of their proper and regular follow up as well as to rule out failure of graft acceptance due to repeated upper respiratory tract infections as seen in children, and reduced healing tendency of the elderly. More-over presbycusis tends blur the auditory functions in higher age group.

In the present study maximum number of patients

was male (55%) and females comprises of 45% of cases with a male to female ratio of 1.2:1. This is because males in villages are usually in the habit of taking bath in the ponds and are more liable to suffer from COM as compared to females. Also males seek medical advice much more readily than females, as they have more outdoor life and have more interaction with society.

All the ears were free from active discharge at the time of surgery though there was history of ear discharge in the past. However, some authors have reported good results of tympanoplasty in wet ears.²³

No correlation was observed between the bilateral involvement and the successful outcome of tympanoplasty in the present study. This is in accordance with the study done by Smyth et.al.²⁴

The overall graft uptake rate in this study was 95% in medio-lateral technique compared to 80% of medial technique. These results are in accordance to earlier studies by Jung and Park and Jung et.al.^{7,22} There was no case of lateralization in the present study like previous studies.

Conclusion

The medio-lateral graft method has been developed and used for reconstruction of large central or subtotal TM perforation. It takes advantage of both the medial and lateral grafting methods while avoiding their pitfalls. A high success rate of 95% similar to other studies provides support in this favour.

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