

Study of full cuff tympanoplasty technique with temporalis fascia graft

Abstract

This report compares two techniques of underlay technique for tympanic membrane repair with full cuff and without full cuff technique. The Non Randomized Clinical Prospective Study included a total of 81 patients out of which 37 had undergone full cuff tympanoplasty technique surgery. In both the techniques, the results were reliable. Full cuff technique has less chance of post operative tympanosclerosis and granulations and residual perforation as compared to without full technique. Full cuff technique has more chances of gain in hearing postoperatively. Careful technique and precise work are the keys to successful tympanoplasty. Thus otologic surgeons should cultivate effective techniques, attempting to continuously improve their results to achieve perfection.

Keywords: full cuff technique, tympanoplasty, large perforation

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Introduction

Tympanic membrane (TM) perforation is usually a consequence of chronic ear disease, trauma, or iatrogenic effects following surgical treatment.¹

- A. Chronic suppurative otitis media (CSOM) is a long standing infection of a part or whole of middle ear cleft characterised by intermittent or persistent, chronic purulent drainage through a perforated tympanic membrane.
- B. It is of two types :
 - i. Tubotympanic disease (safe type)
 - ii. Atticoantral disease (unsafe type)
 - iii. For surgical repair of TM perforation, myringoplasty is usually proposed. The myringoplasty procedure is now one of the most common performed methods on the ear. In TM reconstruction, two aims should be fulfilled. The first aim is the closure of the perforation, and the second aim is to obtain a new TM with acoustic qualities similar to those of a normal TM.²

Tympanoplasty is defined as a surgical procedure to eradicate disease in the middle ear cleft and to reconstruct the hearing mechanism, with or without mastoid surgery:

- a. Term Was Coined By Wullstein
- b. It includes reconstruction of tympanic membrane and ossicular chain, tympanic membrane reconstruction.
- c. It is usually done with temporalis fascia graft.^{3,4}

Two classic methods for the reconstruction of a TM perforation have been used: the underlay or overlay graft techniques:

- a. Underlay technique – graft material is placed medial to the fibrous layer of the tympanic membrane.
- b. Overlay technique – graft material is placed lateral to the fibrous layer of the tympanic membrane.

Each of these approaches and techniques has its advantages and disadvantages.^{5,6} The underlay technique is perhaps more commonly used worldwide; this technique is easier to perform and less time consuming and more suitable for posterior perforations. This

technique has disadvantages, including a decreased mesotympanic space, medial displacement of the graft and lower success rate in subtotal and anterior perforations. Additionally, the technique has a lower risk for lateralization, and a more acceptable success rate, even in the hands of less-experienced surgeons.⁸

The overlay technique avoids this pitfall, but there is a risk of graft lateralization, anterior blunting, delayed healing, stenosis of the external canal, epithelial pearls, and iatrogenic cholesteatoma. Despite its higher success in repairing anterior and subtotal perforations, there is a consensus concerning the overlay technique being more technically challenging.⁹

Various other techniques of TM repair have been described. The term 'sandwich technique' was coined by Farrior in 1983 to describe a method in which sheets of temporalis fascia were placed medial and lateral to the drum, with the fibrous layer as the 'meat' in the 'sandwich'.¹⁰ Raghavan et al.,¹¹ used the same term to describe a technique in which a pedicled skin flap is used to partially cover an overlay TM graft.

Tabb and Shea first innovated medial positioning of grafting tissue to the malleus and residue of TM.¹⁰⁻¹³ Kartush et al. used the over-underlay technique for the tympanoplasty procedure.¹⁴ The perforation size is also a factor affecting the success of TM reconstruction besides the chosen surgical technique. Subtotal or total TM perforations present a surgical challenge. It has been reported that the perforation size is a prognostic factor, and poorer results are obtained with large versus small perforations.¹⁵ These perforations are at a high risk of reperforation, retraction pockets and obligatory revision surgeries. These TM perforations are more difficult to treat because of less extensive TM margins to support graft survival and less tension to resist tympanic retraction postoperatively. Reasons for graft failure include graft displacement, improper placement, autolysis, infection, and Eustachian tube dysfunction.¹⁶

There are three different underlay techniques:

1. Subannular placement of temporalis graft
2. Anterior tucking of temporalis fascia graft
3. Full cuff placement¹⁷
4. Vascular strip incision is taken 3 to 5 mm lateral to the annulus

in the posterior canal wall and extended 1 to 3mm lateral to the annulus in the anterior canal wall.

5. Thus the incision is extended from 11 o' clock to 1 o' clock position
6. Incision is taken along the 5 o' clock and along the 2 o' clock position along the external auditory canal and tympanomeatal flap is raised.¹⁸
7. In the present study, the tympanoplasty results of patients with chronic otitis media who have undergone full cuff tympanoplasty in our tertiary care centre were compared in terms of re-perforation, lateralization, and hearing improvement. The results were also compared with those reported previously.

Aims and objectives

- a. To assess the success rate of Full Cuff Technique in Tympanoplasty
- b. To compare the Results of Temporalis Fascia Placement with and Without Full Cuff Technique in Tympanoplasty Surgery in Terms of Hearing and Graft Uptake.
- c. To assess THE Patient's Satisfaction Score in Full Cuff Technique.

Materials and methods

1. Type of study – non randomized clinical prospective study
2. Place of study –tertiary care centre
3. Study period – august 2015 to july 2016.
4. Follow up – 6 months.

Inclusion criteria

1. Chronic suppurative otitis media of tubotympanic type with perforation (small, moderate , large and subtotal perforations)
2. Age group 15 to 55 years and both sexes
3. Dry ear for three weeks (inactive or quiescent stage of disease).
4. Patient giving consent for the surgery.
5. Co-operative patient giving regular follow up.

Exclusion criteria

1. Cases of Chronic Suppurative Otitis Media of Atticoantral Type
2. Cases of Chronic Suppurative Otitis Media With Extensive Disease Requiring Procedure Like Modified Radical Mastoidectomy
3. Patients with Tuberculous Otitis Media
4. Patient not Cooperative
5. Patient with Poor follow Up
6. Mentally Retarded Patients and Pregnant Female Patients.
7. Patient not Fit for Surgery in Anesthetic Point of View
8. Patients not Giving Consent for the Surgery

Preoperative evaluation

- a. History And Ent Examination
- b. Tuning Fork Tests
- c. Pure Tone Audiometry

- d. Examination Under Microscope
- e. All Anaesthetic Examinations
- f. Written and Informed Consent For Surgery

Preoperative preparation

- a. Vital parameters were recorded.
- b. Written informed consent of the patient taken
- c. Pre-operative audiometry done and evaluated under microscope
- d. Preparation of the patients, shaving of hair of the post auricular region 3cm inside the hair line done.
- e. Lignocaine sensitivity test done
- f. Inj. Tetanus toxoid 0.5 mg given.
- g. Preoperative dose of antibiotic given.

Operative procedure

1. Supine position of patient given with painting and draping
2. Infiltration of LA with adrenaline postaurally
3. Infiltration of LA with adrenaline endaurally only in the cartilagenous part in all quadrants.
4. Post auricular incision
5. Incision taken through skin and subcutaneous tissue
6. Temporalis fascia graft exposed and areolar tissue removed
7. Temporalis fascia graft harvested
8. 'c' shaped incision taken in subcutaneous tissue
9. Posterior meatotomy done
10. Under microscope , margins of perforation freshened
11. Full cuff placement of graft is done
12. Suturing is done in layers
13. Mastoid dressing is done
14. Postoperative examination is done for facial palsy and nystagmus

Post operative care

- a. Check dressing done on the day after surgery.
- b. Patient discharged on oral antibiotics, analgesics and anti-histaminic.
- c. Patient advised to avoid nose blowing.
- d. Patient called in OPD after seven days for suture removal.
- e. Dressing taken off, sutures removed and patient advised to apply (Table 1–4).

Neosporin ointment over the scar and instill drops into the ear three times a day, keep ear dry, avoid contact with water for 6 weeks and keep ear canal covered with a cotton ball round the clock:

1. Patients come after 2 to 3weeks
2. Patient further called for follow up at 1, 3 and 6 months post-operatively and analyzed for hearing status, presence of discharging ear, waterproof ear, and residual perforation.

Table 1 Post operative examination findings in full cuff technique

Complications	1 month	3 month	6 month
Blunting of anterior angle	0	2	3
Narrowing of external auditory canal	0	0	3
Otitis media	5	0	0
Gain in hearing	5db	7db	21 db
Residual perforation/medialization of graft	7	7	8
Tympanosclerosis	0	1	3
Granulations	0	3	4

Table 2 Post operative complications in without full cuff technique

Complications	1 month	3 month	6 month
Blunting of anterior angle	0	1	2
Narrowing of external auditory canal	0	0	2
Otitis media	4	0	0
Gain in hearing	5db	6db	19 db
Residual perforation /medialization of graft	7	8	10
Tympanosclerosis	0	1	5
Granulations	0	3	7

Table 3 Preoperative symptoms

Preoperative symptoms	Total 81 patients
Ear discharge (intermittent)	75 % - 60 patients
Reduced Hearing	65 % - 52 patients
Otalgia	25 % - 20 patients
Tinnitus	5 % - 4 patients
Vertigo	0%

Table 4 Postoperative subjective assessment

0–No change	One month	Three months	Six months
1–mild			
2–moderate			
3–severe			
Hearing improvement	0–20	0–2	0–1
	1–17	1–18	1–16
	2–0	2–17	2–10
	3–0	3–0	3–10
Pain in ear	0–0	0–10	0–27
	1–25	1–23	1–10
	2–10	2–4	2–0
	3–2	3–0	3–0
Discharge in ear	0–25	0–6	0–29
	1–10	1–19	1–8
	2–2	0–16	2–0
	3–0	0–16	3–0
	0–17	0–27	0–32
Tinnitus	1–20	1–10	1–5
	2–0	2–0	2–0
	3–0	3–0	3–0

Postoperative assessment

Follow up study done at the period of 1 month, 3 month and 6 months in terms of:

1. Graft uptake
2. Residual perforation
3. Gain in hearing
4. Canal wall sagging
5. Granulations

The results were as follows:

1. Granulations in 4 patients (10%)
2. Narrowing of EAC in 3 (8%)
3. Residual perforation in 8 (20%)
4. Average hearing gain was 21 db.

Full cuff technique has fewer chances of post operative tympanosclerosis and granulations and residual perforation as compared to without full technique:

- a. Full cuff technique has more chances of gain in hearing postoperatively.
- b. But disadvantages include more risks of blunting of anterior angle and narrowing of external auditory canal (Figure 1).
- c. Thus, the satisfaction score for (Table 5)
- d. Hearing gain was 1.21 ie less than expected 1.314
- e. Ear discharge was 0.40 - satisfactory since less than 0.51
- f. Pain was 0.82–satisfactory since less than 0.96
- g. Tinnitus 0.31– satisfactory since less than 0.4031

Table 5 Satisfaction score

	HE		
	Mean	Std. deviation	Satisfactory
	1 Month	0.4595	0.50523
	3 Months	1.4054	0.59905
	6 Months	1.7838	0.88616
	Total	2.2162	0.87807
Pain	1 Month	1.3784	0.59401
	3 Months	0.8378	0.60155
	6 Months	0.2703	0.45023
	Total	0.8288	0.7119
Discharge	1 Month	0.3784	0.59401
	3 Months	0.6216	0.59401
	6 Months	0.2162	0.41734
	Total	0.4054	0.56211
Tin	1 Month	0.5405	0.50523
	3 Months	0.2703	0.45023
	6 Months	0.1351	34658
	Total	0.3153	0.466675

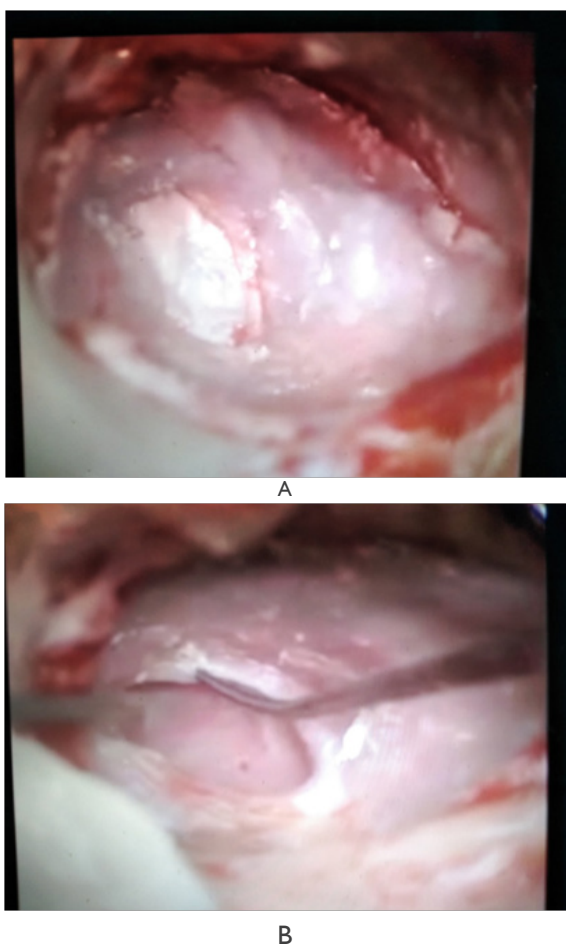


Figure 1 The area of greyish pale discoloration at 3 weeks postoperatively.

Comparison with similar studies

- Karansingh yadav did retrospective study of modified full cuff technique found graft uptake was 95.4% and hearing has improved in all patients and concluded that this technique is easier and less time consuming. This technique can be taught to beginners.
- P Hosmani, L Ananth, SB Medikeri “comparative study of efficacy of graft placement with and without anterior tagging in type one tympanoplasty for mucosal- type chronic otitis media” journal of laryngology and otology, 2012Feb; issue02;vol 126; pp125-130.
- Farhad Mokhtarinejad et al., did 38 cases (group-A) circumferential sub annular grafting and 25 cases (group-B) of underlay tympanoplasty with extension of anterior edge of the graft forward against the lateral wall of the Eustachian tube, they found success rate in 97% in group-A and 100% in group B patients, improvement of the air conduction thresholds in all frequencies and closure of the mean air bone gap were significant and similar among two groups.
- Comparison of canal wall incisions for tympanoplasty for large central perforations.
- Sohail Vaidya, Saumya K Shah, Mamta Choudhary.

Discussion

Large perforations of the tympanic membrane (TM) have always been more difficult to repair and require modification in technique in many aspects. There are several ways in which canal wall incisions are placed during tympanoplasty. For large perforations, it is very important to provide support to the graft material by additional canal incisions in order to avoid any residual perforations. Problems of granulations and canal skin edema or sagging are frequently encountered. Most tympanoplasty techniques require skin incision of the external auditory canal (EAC). This step is not without the morbidity and postoperative complications such as delayed healing, granulation tissue, lateralization, blunting, and iatrogenic cholesteatoma. Anterior tucking is done in all the cases of full cuff technique. For large perforations of the TM, the vascular strip incision with anterior tucking (VSAT) technique has the best success rates and minimal canal skin related complication rates with comparatively quick healing. The tympanometal flap with anterior tucking (TMFAT) gives good success rates and is comparatively easy to perform. The full cuff technique appears more appealing during surgery, but the problems of granulations and canal wall sagging are more as compared to other techniques. The success rate is acceptable for full cuff, but the healing time is higher than the other techniques. Mokhtarinejad et al. have described a technique of circumferential subannular grafting with good results. They have concluded that underlay tympanoplasty with elevation of the annulus away from the sulcus tympanicus in the anterior sharp tympanometal angle and placement of the graft between it and anterior bony canal is not associated with increased risk of blunting and lateralization of the graft, if that sharp angle is adequately restored.

Roychoudhuri has described a three flap technique with three incisions in the canal at 1 o'clock, 11 o'clock and 6 o'clock positions. The incision at 6 o'clock position cuts through the annulus tympanicus.

Lee et al.,⁷ have described a superiorly based flap for anterior or subtotal perforations with good results. Cvjetkovic *et al.* have made a quantitative analysis of vascularization after two basic incisions of tympanoplasty namely the TMF incision and the vascular strip incision and found out that there were no significant differences in vascularization of auditory canal skin between TMF and VS patients from one side and the control group on the other side. Rogha et al have compared two methods of TM grafting when graft materials medial or lateral to the malleus and found that the hearing results and success rates are very much similar in both these techniques. In their study, the graft material is pierced in a near central part of the graft, and they lodged so that the malleus handles projects through the graft perforation in a medial to malleus group patients. In Comparison of canal wall incisions for tympanoplasty for large central perforations by Sohail vaidya, Saumya K Shah, Mamta Choudhary, the annulus tympanicus was never cut in any of the cases and underlay technique with lateral to handle of malleus grafting has been done in all cases. They had combined anterior tucking step with this technique to give extra support anteriorly for large perforations. Karansingh yadav did retrospective study of modified full cuff technique found graft uptake was 95.4% and hearing has improved in all patients and concluded that this technique is easier and less time consuming. This technique can be taught to beginners. In our study, blunting of angle, external auditory canal narrowing was more in full cuff technique. But residual perforation, tympanosclerosis, and granulations were less in full cuff technique as compared to without full cuff technique. Also, gain in hearing was more in full cuff technique.

Results

A Total of 37 Patients were Examined who were Falling in the Criteria and had undergone Full Cuff Tympanoplasty. They were Examined For Evidence of Granulations, Narrowing of EAC, Residual Perforation and Hearing Gain.

Conclusion

Full cuff technique requires expertise. It assures placement of graft correctly below the annulus from all sides ruling out the medialization of graft. It also has advantages in terms of gain in hearing, granulations and residual perforation. The full cuff technique appears more appealing during surgery, but the problems of granulations and canal wall sagging are more as compared to other techniques. The success rate is acceptable for full cuff, but the healing time is higher than the other techniques. Blunting of angle, external auditory canal narrowing was more in full cuff technique. But residual perforation, tympanosclerosis, and granulations were less in full cuff technique as compared to without full cuff technique. Also, gain in hearing was more in full cuff technique. Full cuff technique is a skilled technique which requires expertise. The technique can be done for small, moderate, large and subtotal perforations. Gradually, this technique is gaining importance. Post operative care, pre operative evaluation, skill of the surgeon and compliance of the patient—all these factors are important for the success of this technique.

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None.

Conflicts of interest

The author declares there is no conflict of interest.

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