



Comparative Study of Outcome of Tympanoplasty between Endoscopic and Microscopic Approach

Mushfiqur Rahman^{1*}, Kazi Atikuzzaman², A.H.M Ferdous Nur³

¹Assistant Professor, Department of ENT & Head Neck Surgery, Enam Medical College Hospital, Dhaka, Bangladesh. Email: shishircomch12@yahoo.com, Orcid ID: 0000-0002-6556-1859

²Professor, Department of ENT Head & neck Surgery, Enam Medical College Hospital, Dhaka, Bangladesh Email: dratikmmc@yahoo.com, Orcid ID: 0000-0002-4406-3308

³Medical Officer, Chandpur 250 Bed General Hospital, Chandpur, Bangladesh. Email: ferdowsnur43@gmail.com, Orcid ID: 0000-0002-3069-8441

*Corresponding author

Received: 14 April 2022

Revised: 21 July 2022

Accepted: 30 July 2022

Published: 22 August 2022

Abstract

Background: Tympanoplasty is a common operation performed by ENT specialist. It is a challenging event to treat with a microscope when the external canal is narrow or overhang. The endoscopic permeal approach gives the advantage of wide angle view and can avoid post-auricular approach and canaloplasty. The aim of the study was to compare the outcome of tympanoplasty in post-auricular microscopic and permeal endoscopic approach. **Material & Methods:** A total of 100 patients between the age group 15 to 44 years who were attending the ENT OPD, suffering from Chronic Suppurative Otitis Media (CSOM) were selected on the basis of perforation type and their workup was done to assess the candidature for tympanoplasty. Comparative analysis between the two groups were done based on analysis using SPSS 24 software version. The level of significance was set to 5% ($P < 0.05$). **Results:** A total of 100 patients were included in the study the overall graft take was 92.3% in cases of Endoscopic permeal technique as compared to 88.88% in the case of Microscopic postaural underlay technique, with a majority of the failures in the large central perforation group rendering a $p = 0.021$ for patients operated for Large perforations, $p = 0.036$ or moderate perforations and $p = 0.0476$ for small perforations. There was a difference in hearing improvement with majority of the cases improving to the range of 10-21 dB in permeal endoscopic technique compared to 07-18 dB in postaural Microscopic technique. **Conclusion:** In terms of graft take rate, hearing improvement and complications, the permeal endoscopic method outperforms the postauricular microscopic approach.

Keywords: -Endoscopic, tympanoplasty, microscopic approach, Type I tympanoplasty.

INTRODUCTION

Tympanoplasty is one in every of the foremost common surgery performed within the Department of otolaryngology. Throughout the last hundred years varied modifications in the surgical techniques are introduced and unremitting efforts created by otologists everywhere the globe to attain the simplest

surgical outcome. With the arrival of microscope, the standard techniques have been changed to stripped invasive surgery achieving higher results and fewer complication rate.^[1] Tympanoplasty became first utilized in 1953 through to explain surgical strategies for reconstruction of the hearing mechanism. Wullstein categorized Tympanoplasty into 5

exceptional types, initially defined in 1956.^[2] Type 1 entail repair of the tympanic membrane unaided and the middle ear is normal. Type one tympanoplasty is otherwise known as myringoplasty. Type 2 include repair of the tympanic membrane and middle ear and defects in the malleus only. In Type 3 the tympanic membrane is repaired and directly connected to the head of the stapes. Type 4 tympanoplasty is a repair when the stapes foot plate is mobile, but the crura are absent. The middle ear only consist of the eustachian tube and hypotympanum. Type 5 is a repair involving a fixed stapes footplate. The surgical procedure tympanoplasty has achieved a state of art over the years. A range of technique have been attempted in order to attain better results with improved hearing. These incorporate the overlay technique,^[3] the underlay tympanoplasty,^[4] over underlay technique,^[5] Gelfilm sandwich technique,^[6] Crown cork tympanoplasty,^[7] Swinging door technique,^[8] laser assisted spot welding tympanoplasty,^[9] microclip techniques and others like the fascial pegging,^[10,11] annular wedge tympanoplasty,^[12] loop tympanoplasty,^[13] paper patching, lobule fat graft and the self-stabilizing tympanic membrane patchers.^[14] Post auricular approach: In 1853, Sir William Wilde of Dublin introduced his famous postaural incision for suppuration of the ear with postaural abscess since then it has been widely used for the post auricular approach for tympanoplasty.^[15] The incision is followed by harvesting the Temporalis Fascia Graft and elevating the Tympanomeatal Flap and look for the Tympanic membrane and examine the middle ear and placement of the underlay graft. Permeatal Approach: In this technique

temporalis fascia graft is taken by a small incision (5mm to 1cm) in the supra auricular region, tympanic membrane was examined through the external canal with 2.7mm endoscope, perforation margin was freshened with direct visualization, middle ear was examined and the ossicle movement was assessed. Graft was placed under the freshened margins and secured with gelfoam. Karhuketo et al., has emphasized that the endoscopic method fulfills the rations of minimally invasive surgery, and gives better visualization and evaluation of ossicles and middle ear anatomy.^[16]

Objectives

The study aimed to compare the graft acceptance and complications associated with the Permeatal endoscopic Tympanoplasty and Postaural Underlay technique with the help of microscope.

MATERIAL AND METHODS

A total of 100 patients between the ages of 15 and 44 who attended the OPD ENT with chronic suppurative otitis media (CSO) were selected according to the type of perforation and their work-up was carried out to assess the candidacy for tympanoplasty. The study was conducted over a period of one year during which patients attending the ENT OPD with chronic suppurative otitis media were selected according to the type of perforation. Patients are examined by otoscope and microscopic examination also performed to confirm the findings of otoscopy and assis the middle ear structures. A written informed consent was taken with explaining the benefits, risks, and procedure to be performed. The procedure of

tympanoplasty was performed by the Permeatal endoscopic Tympanoplasty and traditional Postaural Underlay technique with microscope. Results were assessed in terms of graft take up, associated complication and improvement in hearing and compared with each procedure. j=0mparative analysis between the two groups were done based on using SPSS 24 software version. The level of significance was set to 5% ($p < 0.05$).

Inclusion Criteria

1. Patients with chronic suppurative otitis media (CSOM) with inactive disease (6 weeks of dry ear).
2. Patients of chronic suppurative otitis media with conductive hearing loss.

Exclusion Criteria

1. Patients with severe systemic diseases and other comorbid conditions.
2. CSOM patients with ossicular chain abnormalities.
3. Patients with sensorineural hearing loss assessed with the help of Pure tone Audiometry.
4. Patients with secondary cholesteatoma and granulation tissue in middle ear.

RESULTS

A total of 100 patients were included in the study and the overall graft take was 92.72% in cases of Permeatal endoscopic technique as compared to 88.88% in the case of microscopic postaural technique. There was a difference in hearing improvement with majority of the cases improving to the range of 10-21 dB in Permeatal endoscopic technique compared to 7-18 dB in Postaural microscopic technique.

Table 1: Demonstrate and distribution of the study according to Age.

Age Distribution	Endoscopic technic (Permental approach)		Microscopic technic (Post-mental approach)	
	n=55	%	n=45	%
15-24	4	7.27	11	24.44
25-34	34	59.64	20	44.45
35-44	17	30.90	14	31.11
Mean±SD	32.46±6.01		30.31±7.91	
Min-Max	19-44		17-44	

Table 2: Demonstrate and distribution of the study according to Sex

Sex Distribution	Endoscopic technic (Permental approach)		Microscopic technic (Post-mental approach)	
	n=55	%	n=45	%
Male	35	63.63	29	64.44
Female	20	36.36	16	35.55

Table 3: Demonstrate and distribution of the study according to Surgical Outcome.

Outcome	Endoscopic technic (Permental approach)		Microscopic technic (Post-mental approach)	
	n=55	%	n=45	%
Successful Tympanic membrane healing	51	92.72	40	88.88

Table 4: Demonstrate and distribution of the study according to hearing improvement.

Outcome	Endoscopic technic (Permental approach)		Microscopic technic (Post-mental approach)	
	range		range	
Hearing improvement	10-21 dB		07-18 dB+3	

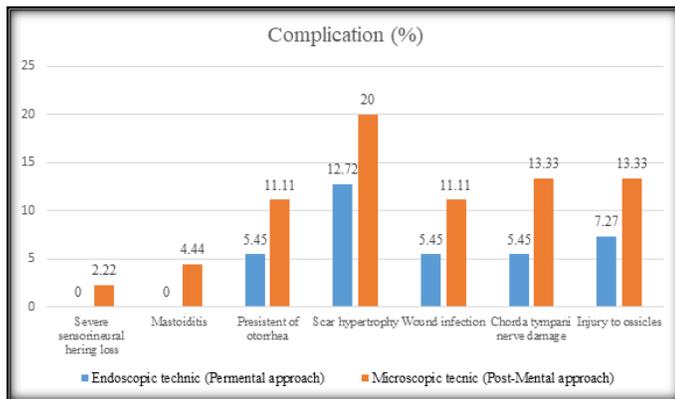


Figure 1: Demonstrate and distribution of the study according to Complication

DISCUSSION

Tympanoplasty is a surgical procedure defined as reconstruction of the hearing mechanism with reconstruction of tympanic membrane. Various approaches have been described but with the advent of microscope the surgery has become quite simplified. The things to be considered which might have resulted in the difference in results between the two techniques is, first and foremost its tissue trauma which is much more in postaural approach compared to permealal microscopic approach. Secondly handling of the

tympanomeatal flap by elevating it from the bony external auditory canal also leads to oedema and delayed post-operative healing which is prevented in permealal technique. Lastly, the preservation of vascular strip comes into consideration which is not affected during the permealal technique but there are chances of it getting damaged while raising the tympanomeatal flap, these all factors lead to more complications and affect wound healing. During the initial post-operative period the graft is held in place by gelfoam and later on, there is epithelization and also vascularization of the graft material. In the permealal technique there is preservation of the blood supply of the tympanic membrane in the whole circumference which is affected in post aural technique hence, affecting the graft take up. Many studies have considered the comparison of postaural underlay grafting with permealal technique. The advantages of the postauricular microscopic approach is bimanual surgical handling and binocular visualization, but the disadvantage of microscopy is that the field of view has to be frequently changed for better visualization of different areas which needs the patient's head

to be manipulated or the microscope has to be repeatedly mobilized. Surgery, has the limitation that it is based on a two dimensional visualization of images on the monitor and because of this depth perception becomes difficult,^[17] But, a full HD camera system provides much better visualization of views and has greatly minimized this drawback. Another drawback with endoscopic approach is the need for "one-handed" surgery which can also be rectified with the help of trained assistant holders. Yadav et al., have emphasized that in the repair of the tympanic membrane perforation done with the help of permeal technique there is no possibility of an iatrogenic cholesteatoma formation as compared to the conventional myringoplasty done with postaural technique.^[18] Usami et al., reported on 22 myringoplasty patients treated with assistance with a follow-up time of 24.5 months. The rate of perforation closure was 81.8% and improvement in ABG after surgery was 14.8 dB.^[19] Karhketto et al., reviewed the records of 29 myringoplasty patients treated with the aid of rigid microscope with a follow-up time of one year. The rate of perforation closure was 80% and improvement in ABG after surgery was 7 dB.^[20] In our study, we got an overall graft take up of was 92.72% in cases of permeal technique as compared to 88.88% in the case of postaural underlay technique by microscope with majority of the patients improving to the range of 10 - 21 dB in Permeal technique and to the to the range of 07 - 18 dB by postaural technique. Raj A. emphasizes that with angled microscope, it is possible to visualize other structures like round window niche, eustachian tube orifice, incudo-stapedial joint etc. that are difficult to observe through the operating microscope.^[21]

A comparative study conducted by Thirumaran NS, concluded that there is 93% graft take up rate permeal approach compared to 91 % graft take up rate by post aural approach.^[22] Mohindra S. et al., did 49 cases of myringoplasty and 6 cases of ossiculoplasties through the transcanal route using rigid microscope. The success rate regarding perforation closure was 91.5% and average air bone gap improvement was 22.24 dB in the myringoplasty groups.^[17] Ahmed ELGuindy (Tanta, Egypt) has evaluated the role of the rigid in the management of 36 cases of dry central perforation of the tympanic membrane. The graft uptake rate was 91.7 percent and air bone gap was closed to less than 10dB in 83.3 percent.^[22]

Limitations of the Study

The present study was conducted during a short amount because of time and funding limitations. The tiny sample size was conjointly a limitation of the current study.

CONCLUSIONS

The permeal endoscopic tympanoplasty had compatible graft uptake rate as well as hearing improvement compared to postauricular microscopic procedure. The endoscope provide the advantage of wide panoramic view and magnification with proper resolution. It also avoid post auricular incision and canaloplasty. Thus minimal invasive surgery can be done by endoscope with less complications, time and morbidity.

Recommendation

This study can serve as a pilot to a much larger research involving multiple centers that can

provide a nationwide picture, validate regression models proposed in this study for future use and emphasize points to ensure better management and adherence.

Acknowledgements

The wide range of disciplines involved in Comparative Study of Outcome of

Tympanoplasty between Endoscopic and Microscopic Approach research means that an Editor needs much assistance from referees in the evaluation of papers submitted for publication. I am very grateful to many colleagues for their thorough, helpful and usually prompt response to requests for their opinion and advice.

REFERENCES

1. Latuska RF, Carlson ML, Neff BA, Driscoll CL, Wanna GB, Haynes DS. Auricular burns associated with operating microscope use during otologic surgery. *OtolNeurotol.* 2014;35(2):227-33. doi: 10.1097/MAO.0b013e3182a5d340.
2. Parodi M, Thierry B, Blanchard M, Couloigner V, Garabédian EN. Using a new otologic operating microscope: unexpected complications. *Int J PediatrOtorhinolaryngol.* 2015;79(5):755-7. doi: 10.1016/j.ijporl.2015.02.028.
3. Singh NK, Nagpure PS, Yadav M, Chavan S. Comparative Study of Permeatal Sandwich Tympanoplasty and Postaural Underlay Technique. *J ClinDiagnRes.* 2016;10(4):MC01-4. doi: 10.7860/JCDR/2016/19001.7555.
4. Lee SY, Lee DY, Seo Y, Kim YH. Can Endoscopic Tympanoplasty Be a Good Alternative to Microscopic Tympanoplasty? A Systematic Review and Meta-Analysis. *Clin Exp Otorhinolaryngol.* 2019;12(2):145-155. doi: 10.21053/ceo.2018.01277.
5. Aziz AA. Underlay cartilage tympanoplasty: different ways of application of the graft. *EJO.* 2018;34(3):194-7.
6. Ogura T, Merkely G, Bryant T, Winalski CS, Minas T. Autologous chondrocyte implantation "segmental-sandwich" technique for deep osteochondral defects in the knee: clinical outcomes and correlation with magnetic resonance imaging findings. *Orthop J Sports Med.* 2019;7(5):2325967119847173.
7. Solmaz F, Akduman D, Haksever M. Tri-layer Tympanoplasty as a New Technique in High-risk Tympanic Membrane Perforations. *Iran J Otorhinolaryngol.* 2019;31(106):259-265.
8. Hanna E, Eliachar I, Cothren R, Ivanc T, Hughes G. Laser welding of fascial grafts and its potential application in tympanoplasty: an animal model. *OtolaryngolHeadNeckSurg.* 1993;108(4):356-66. doi: 10.1177/019459989310800408.
9. Milton CK, Bien AG, Krempel GA, Sanclement JA, Mhaweji R, Glenn CA. Primary Dural Repair Using Titanium Microclips Following Lateral Skull Base Surgery. *J NeurolSurg B Skull Base.* 2021;83(Suppl 2):e306-e311. doi: 10.1055/s-0041-1729903.
10. Malhotra M, Malhotra R, Varshney S, Priya M, Bhardwaj A, Tyagi A, et al. A Historical Review of Indian Perspectives on Techniques of Tympanoplasty. *Int J Otolaryngol.* 2020;2020:1408270. doi: 10.1155/2020/1408270.
11. Malhotra M, Varshney S, Malhotra R, Joshi P. Indian Perspectives on Graft Materials Used for Repair of Tympanic Membrane. *J ClinDiagnRes.* 2017;11(7):ME01-ME06. doi: 10.7860/JCDR/2017/26289.10199.
12. Malhotra M, Malhotra R, Varshney S, Priya M, Bhardwaj A, Tyagi A, et al. A Historical Review of Indian Perspectives on Techniques of Tympanoplasty. *Int J Otolaryngol.* 2020;2020:1408270. doi: 10.1155/2020/1408270.
13. Singh NK, Nagpure PS, Yadav M, Chavan S. Comparative Study of Permeatal Sandwich Tympanoplasty and Postaural Underlay Technique. *J ClinDiagnRes.* 2016;10(4):MC01-4. doi: 10.7860/JCDR/2016/19001.7555.
14. Yang X, Wang L, Shen Y, Guo B, Zhi-wei Z, Sun J. Feasibility of using the postauricular-groove approach without endoscopic assistant for excision of parotid tumors. Results from a series of 58 cases. *J CraniomaxillofacSurg.* 2022;50(5):449-455.



15. Iannella G, Marcotullio D, Re M, Manno A, Pasquariello B, Angeletti D, et al. Endoscopic vs Microscopic Approach in Stapes Surgery: Advantages in the Middle Ear Structures Visualization and Trainee's Point of View. *J IntAdvOtol.* 2017;13(1):14-20. doi: 10.5152/iao.2017.3322.
 16. Bernhardt S, Nicolau SA, Soler L, Doignon C. The status of augmented reality in laparoscopic surgery as of 2016. *MedImage Anal.* 2017;37:66-90. doi: 10.1016/j.media.2017.01.007.
 17. Gülşen S, Erden B. Comparison of endoscopic butterfly-inlay versus endoscopic push-through myringoplasty in repairing anterior perforations of the tympanic membrane. *J LaryngolOtol.* 2020;1-7. doi: 10.1017/S0022215120000006.
 18. Özdemir D, Özgür A, Akgül G, Çelebi M, Mehel DM, Yemiş T. Outcomes of endoscopic transcanal type 1 cartilage tympanoplasty. *Eur Arch Otorhinolaryngol.* 2019;276(12):3295-3299. doi: 10.1007/s00405-019-05636-w.
 19. Li B, Asche S, Yang R, Yueh B, Fina M. Outcomes of Adopting Endoscopic Tympanoplasty in an Academic Teaching Hospital. *AnnOtolRhinolLaryngol.* 2019;128(6):548-555. doi: 10.1177/0003489419830424.
 20. Dornhoffer J. Cartilage tympanoplasty: indications, techniques, and outcomes in a 1,000-patient series. *Laryngoscope.* 2003;113(11):1844-56. doi: 10.1097/00005537-200311000-00002.
 21. Singh NK, Nagpure PS, Yadav M, Chavan S. Comparative Study of Permeatal Sandwich Tympanoplasty and Postaural Underlay Technique. *J ClinDiagnRes.* 2016;10(4):MC01-4. doi: 10.7860/JCDR/2016/19001.7555.
 22. Lou Z. The evaluation of endoscopic cartilage myringoplasty to repair perforations with otomycosis. *Am J Otolaryngol.* 2020;41(4):102493. doi: 10.1016/j.amjoto.2020.102493.
- Source of Support: Nil, Conflict of Interest: None declared