

Original Article

Comparison of Surgical Outcome between Endoscopic and Microscopic Type 1 Tympanoplasty

Md. Khalid Mahmud¹, Md. Monjurul Alam², Md. Mainul islam³, Mohammad Habibur Rahman⁴, Riashat Azim Majumder⁵, Nasima Akhtar⁶, Pran Gopal Datta⁷, Abirvab Naha⁸

Abstract:

Background: Chronic otitis media (COM) is the long-standing infection of a part or whole of middle ear cleft characterized by ear discharge & perforation. The most common presenting symptoms are ear discharge, mild to severe hearing loss, sometimes tinnitus even vertigo. Treatment of COM is mainly operative. The treatment of inactive mucosal variety of COM is Type 1 tympanoplasty. It can be done by microscopic or endoscopic technique. Both methods have some merits and demerits.

Objectives: Aim of the study was to compare the surgical outcomes between endoscopic and microscopic type 1 tympanoplasty.

Methods: This study was carried out in the Department of Otolaryngology–Head & Neck surgery of Bangabandhu Sheikh Mujib Medical University, Dhaka from March 2017 to June 2019 and 60 (30 in each group) patient were included in the study. All patients underwent type 1 tympanoplasty. In Group A endoscopic tympanoplasty cases and in Group B microscopic tympanoplasty cases were placed. Operation duration, post-operative pain, post-operative hearing status, graft uptake was compared in two groups.

1. Resident Surgeon, Department of ENT Oncology, National Institute of Cancer research & Hospital, Mohakhali, Dhaka, Bangladesh.
2. Professor, Department of Otolaryngology-Head & Neck Surgery, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh.
3. Assistant Registrar, Department of Otolaryngology-Head & Neck Surgery, Khulna Medical College, Khulna, Bangladesh.
4. Consultant, Department of Otolaryngology-Head & Neck Surgery, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh.
5. Medical Officer, Department of Otolaryngology-Head & Neck Surgery, Mugda Medical College, Dhaka, Bangladesh.
6. Professor, Department of Otolaryngology-Head & Neck Surgery, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh.
7. Professor, Department of Otolaryngology-Head & Neck Surgery (Ex), Ex-Vice Chancellor, BSMMU, Dhaka
8. Specialist, ENT-Head & Neck Surgery, Sheikh Fazilatunnessa Mujib Memorial KPJ Specialized Hospital & Nursing College, Gazipur, Bangladesh.

Correspondence Author: Dr. Md. Khalid Mahmud, 17, Poribag, Sonargaon road, Dhaka. Email: khalidmahmud33@gmail.com. Cellphone: 01717703773

Results: *There were no significant difference of graft uptake and hearing gain (>0.05). But endoscopic operative time and post-operative pain were less than microscopic group (<0.05).*

Conclusion: *Through endoscopic tympanoplasty is a newer approach and it has some limitations. As endoscopic tympanoplasty requires less time, less pain with similar graft uptake and audiological success. It can be adopted as an alternative method of tympanoplasty.*

Keywords: Tympanoplasty, Chronic otitis media, Microscope, Endoscope.

Introduction:

Chronic Otitis Media (COM) is a chronic inflammatory disease of the middle ear and mastoid that often results in partial or total loss of the tympanic membrane (TM) and ossicles, leading to conductive hearing losses¹. Disabling hearing impairment in Bangladesh is 9.6 % and CSOM is the leading cause of hearing impairment². The treatment of inactive mucosal variety of COM is mainly surgical. Tympanoplasty is one of the commonest operations performed in COM³. After the invention of microscope tympanoplasty was done by it. Over the last hundred years, continued efforts have been made by otologists all over the world to attain the perfect surgical outcome⁴.

Conventionally, surgeons perform microsurgery of the middle ear with the assistance of a microscope. Microscope offers a straight-line view, which limits the visual field in the deep recesses of the middle ear⁵. Middle ear endoscopy was first introduced by Mer and colleagues in 1967 but till the last decade endoscopes have been mainly used for diagnostic and photographic purposes⁶. Over the past few years, the endoscope has been used increasingly for otological inspection and surgery⁷.

Endoscope offers a wide field of view with magnification. The view during microscopic surgery is limited by the narrowest segment of the ear canal, whereas transcanal endoscopy bypasses the narrowest ear canal and provides a wider view even in zero-degree endoscope is used⁸. Endoscope provides multiple axis view with extremely sharp image with high resolutions⁹.

Endoscope is better in cosmesis, it can be performed without canaloplasty¹⁰. The outcomes of grafts performed using the endoscopic approach are similar to that achieved by the microscopic approach¹¹.

Microscopy is adequate for most dissection, but various sub regions of the middle ear are better visualized with endoscopy¹². Surgeons can rotate an angled endoscope to obtain all-round vision, thereby enabling visualization of the anterior margin of the perforation⁵. The advantages of endoscope are improved depth of field, wider viewing angle, indirect line-of-sight with angled endoscopes, better resolution with magnification¹³.

Endoscopic surgery is suitable for chronic otitis media, malformations of the auditory ossicles, traumatic damage to the ossicles, cholesteatomatous otitis media, otosclerosis, and other diseases¹⁴. Hidden areas of ear are better visualized by endoscope like sinus tympani, ant epitympanic recess, facial recess¹⁵. Advantages of endoscopic ear surgery compared to the microscopic surgery include avoiding endaural and postauricular incisions, minimal soft tissue dissection and angled view avoiding bone dissection¹⁶.

However, the endoscope has some limitations. One hand technique, continuous cleaning of the scope tip, thermal injury and damage to the tissues are the drawback. Surgeons need special learning curve to improve their personal skills¹⁷. Despite some limitation, the use of endoscope in middle ear surgery is increasing day by day all over the world¹⁸.

Endoscopic ear surgery started in Bangladesh in 2005 but it works regularly from 2010¹⁹. Nowadays endoscopic ear surgeries are being performed very often in Bangabandhu Sheikh Mujib Medical University. This study has tried to mitigate the debate whether endoscopic surgery is effective enough in comparison with conventional microscopic surgery.

Methods:

Type 1 tympanoplasty was done in all cases under GA using temporalis fascia as graft. All microscopic approach performed by post aural or trans canal approach whereas endoscopic tympanoplasty was be done by trans canal approach & graft was taken by a hairline incision in endoscopic tympanoplasty. Common surgical technique was followed. Graft was placed by underlay technique. All microscopic surgeons followed the same surgical technique. All the patients were given prophylactic antibiotics. Endoscopic surgery was counted as group A and Microscopic surgery was counted as group B. Operative time was noted and postoperative pain was evaluated from 1st postoperative day by using numeric pain scale (Figure-2) grading (1-10). All the patients were given acetaminophen (paracetamol) 500mg orally three times a day postoperatively for a week. All the patients were kept under regular follow upto 3 months. Final assessment of graft success was done at the end of 3 month by otoscopic and endoscopic examination and hearing assessment were done by postoperative PTA at the end of 3 month, where postoperative A-B gap were calculated at 500, 1000, 2000 Hz. Graft success were considered when patient had intact new tympanic membrane without any perforation and audiological success were considered when postoperative air bone gap closure is e"10dB than preoperatively²⁰. Those patients who failed the criteria were considered as failure.

Results:

Among 60 patients, Maximum respondents of endoscopic group A between 15 -25 age. In Group B was the Microscopic Group where. maximum respondents were between 26-35years of age (Fig-1).

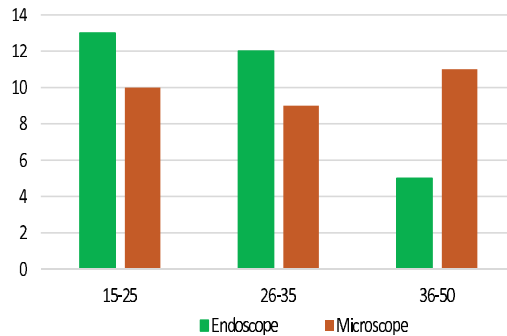


Fig.-1: Distribution of the patients in different age groups.



Fig. 2: Numeric pain rating scale (0-10)

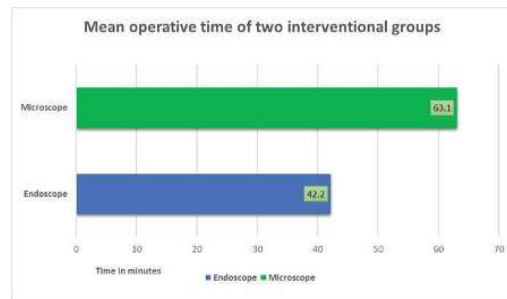


Figure 3 : Comparison of mean operative time in two Groups. Operative time in Group A was significantly shorter than in Group B based on student's t test (p value <0.0001).

Table-I
Operated ear involvement:

Operated ear	Group A (endoscopic)	Group B (Microscopic)	p value
	(n=30) (%)	(n=30) (%)	
Right	16 (53.33)	10 (33.33%)	0.11801 ^{ns}
Left	14(46.66)	20 (66.66%)	
Total	30 (100%)	30 (100%)	

Chi-square test is used, ns= not significant

Table -II
Comparison of Graft success between two intervention groups

Intervention	Graft success		Column total	χ^2	P- value
	Success	Failed			
Group A(Endoscopic)	28	2	30	0.359	> 0.05
Group B(Microscopic)	29	1	30		
Row total	57	03	60		

Table -III
Comparison of audiological results between two intervention groups.

Intervention	Audiological results		Column total	χ^2	P- value
	Success	Failed			
Group A(Endoscopic)	22	8	30	0.0821	>0.05
Group B(Microscopic)	21	9	30		
Row total	43	17	60		

Audiological success rate was 73.33% in Group A and 71.66% in Group B, which was not statistically significant.

Table-IV
Audiological outcome in two interventional groups

	Group A (Endoscope) (n=30)	Group B (Microscopic) (n=30)	Total	P value
Audiological success	22 (73.33%)	21(70.0%)	43(71.66%)	0.77449 ^{ns}
Audiological failed	08 (26.66%)	09 (30%)	17(28.33%)	
Total	30	30	60 (100%)	

Chi-square test is used, ns= not significant

Discussion:

One of the variables of the study was to assess the operating time between two study Groups. Based on the findings, for Group A patients, the operative time was 38 min to 52 mins. Mean time of operation was 42.2 mins \pm 3.06. For Group B patients, the operative time was 39 min to 75 min. Mean time was 64.9 \pm 8.50 min whereas the highest time was 75 min and lowest time was 39 min. The operation time in Group A was significantly shorter than in Group B based on student's t test ($p < 0.0001$). Three cases were performed trans canal route rather than retro auricular route. The operative time of trans canal route was near to endoscopic Group but retro auricular route was lengthy. Excluding the trans canal route mean operative time was 65.2. This result suggests that Group A takes less time to perform Type 1 tympanoplasty. Whereas trans canal endoscopic and microscopic type 1 tympanoplasty takes almost similar time. Similar studies conducted in India and Taiwan²², they found transcanal endoscopic and microscopic type 1 tympanoplasty takes almost similar time. Another study shows transcanal endoscopic surgery takes less time than retroauricular microscopic surgery⁵.

In this study, the numeric pain rating scale (Figure-2) was used to see the postoperative pain level in two comparative Groups. The mean pain score was 4 \pm 0.870 in Group A and 6.03 \pm 0.808 was in Group B. 6 was the highest pain level and 3 was the lowest pain level in Group A. Whereas 7 was the highest and 4 was the lowest pain level in Group B. The pain score in Group A is significantly shorter than in Group B based on student's t test ($p < 0.0001$). This result was similar with the result of another study²². In microscopic surgery there was large postauricular incision whereas endoscopic surgery had small

hairline incision. A larger incision might cause more pain than smaller incision.

Assessment of hearing status was another parameter of this study. 10 dB A-B closure postoperatively had taken as success at the end of 3 months. Preoperatively, the air conduction levels of the ears in Group A and Group B were 34.83 \pm 3.82 dB and 35.4 \pm 3.73 dB. There were no significant differences between two Groups ($p = 0.563905$). The bone conduction of ears in Group A and Group B were 11.63 \pm 1.37 dB and 11.73 \pm 1.73 dB. There was no significant difference between the two Groups ($p = 0.760075$). The ABGs were 23.25 \pm 4.07 dB and 23.72 \pm 3.77 dB. There was no significant difference between the two Groups ($p = 0.64486$).

Post operatively, the improvements in the air conduction level of ears in Group A and Group B were 10.98 dB and 10.74 dB. There was no significant difference between the two Groups ($p = 0.357798$). The improvements in the bone conduction level of ears in Group A and Group B were 0.59 dB and 0.11 dB. There was no significant difference between the two Groups ($p = 0.050288$). The AB closure were 11.56 dB and 10.69 dB respectively. There were no significant differences between two Groups ($p = 0.616105$).

In Group A only 8 cases were failed, and 22 cases were success audiologically. Mean hearing gain was 11.56 dB. Whereas only 9 cases were failed in Group B and 21 cases were success audiologically, mean hearing gain was 10.69 dB. After analysis of preoperative and postoperative data there was no significant differences between two Groups by Chi square test^{4,21,22}.

In this study post-operative Graft success were evaluated and compared in two Groups. In Group A 2 cases were failed as perforation was seen and graft success rate was 93.33%. In Group B only 1 case was

failed and success rate was 96.66%. There was no significant difference between two interventional Groups (Table -II). This finding was similar with the result of other studies^{5,21}.

Post-operative Hearing status was evaluated in two Groups. Where Group A audiological success cases were 22 and Group B were 21. There was no statistical difference between two Group (p value >0.05) which was similar to the result of another study.

However, this study indicates that operative time and post-operative pain were less in Group A (Endoscopic) but hearing gain and Graft success had no significant difference between two Groups.

Both endoscopic and microscopic surgical procedure were same, as freshening of the margin of perforation, graft placement, packing. So, graft success and hearing outcome had similar outcome.

Endoscope is a newer tool for ear surgery. In my study, endoscopic tympanoplasty had similar hearing outcome and graft success rate with less operative time and less postoperative pain. Endoscope may be an alternative of microscope in the treatment of inactive mucosal variety of chronic otitis media.

Conclusion:

Endoscopic ear surgery takes less time, causes less postoperative pain with similar hearing outcome and graft success. Endoscopic ear surgery may be the alternative to limited access surgery in the otologic field.

References:

1. Merchant S.N., McKenna M.J., Rosowski J.J. Current status and future challenges of tympanoplasty. *European archives of oto-rhino-laryngology*. 1998 May 1;255(5):221-8.
2. Tarafder K. H., Akhtar N., Zaman M. M., Rasel M. A., Bhuiyan M. R. & Datta P.G., 2015. Disabling hearing impairment in the Bangladeshi population. *The Journal of Laryngology & Otology*, vol.129(2), pp.126-35.
3. Artuso A., Nardo, W.D., Corsu, E.D., Marchese, M.R. & Quaranta, N., 2004. Canal wall down tympanoplasty surgery with or without ossiculoplasty in cholesteatoma, *Hearing results, Acta otolaryngologica*, vol. 24, pp. 2-7.
3. Harugop A.S., Mudhol R.S. & Godhi R.A., 2008. A comparative study of endoscope assisted myringoplasty and microscope assisted myringoplasty. *Indian Journal of Otolaryngology and Head Neck Surgery*, vol. 60, pp.298–302.
4. Patel J., Aiyer R.G., Gajjar Y., Gupta R., Raval J. & Suthar P.P., 2015. Endoscopic tympanoplasty vs microscopic tympanoplasty in tubotympanic disease: a comparative study of 44 cases. *International Journal of Research in Medical Sciences*, vol.3(8), pp. 1953-7.
5. Huang T.Z., Ho K.Y., Wang L.F., Chien C.Y. & Wang H.M., 2016. A Comparative Study of Endoscopic and Microscopic Approach Type 1 Tympanoplasty for Simple Chronic Otitis Media. *Journal of International Advance Otolaryngology*, vol.12(1), pp.28-31.
6. El-Guindy A., 1992. Endoscopic transcanal myringoplasty. *The Journal of Laryngology and Otology*, vol.106, pp. 493-5.
7. Mohindra S., Panda N. K., 2010. Ear surgery without microscope; is it possible. *Indian Journal of Otolaryngology - Head & Neck Surgery*, vol 62, pp.138-41.
8. Tseng C.C., Lai M.T., Wu C.C., Yuan S.P. & Ding Y.F., 2017. Comparison of

- the efficacy of Endoscopic Tympanoplasty and Microscopic Tympanoplasty: A systemic review and Meta-Analysis. The American Laryngological Rhinological and Otological society, Inc. Laryngoscope, vol. 127, pp.1890-6.
9. Raj A., Meher R., 2001. Endoscopic transcanalmyringoplasty-A study. Indian Journal of Otolaryngology & Head Neck Surgery, vol.53, pp.47-9.
 10. Lade H., Choudhary S.R. & Vashishth, A., 2014. Endoscopic vs microscopic myringoplasty: a different perspective. European Archives of Otorhinolaryngology, vol. 271, pp. 1897-902.
 11. Akyigit A., Sakallıoglu O. & Karlidag, T., 2017. Endoscopic tympanoplasty. The Journal of Otology, vol. 12, pp. 62-7.
 12. Bennett M.L., Zhang D., Labadie R.F. & Noble J.H., 2016. Comparison of Middle Ear Visualization with Endoscopy and Microscopy. Journal of Otology & Neurotology, vol.37, pp.362-66.
 13. Cohen M. S., Landegger L.D., Kozin E.D. & Lee D.J., 2015. Pediatric Endoscopic Ear Surgery in Clinical Practice: Lessons Learned and Early Outcomes. The Laryngoscope, vol.126, pp.732-38.
 14. Lannella G., Marcotullio D., Massimo R., Manno A., Pasquariello B., Angeletti D., Falasca V. & Magliulo G., 2017. Endoscopic vs Microscopic Approach in Stapes Surgery: Advantages in the Middle Ear Structures. Visualization and Trainee's Point of View. The Journal International Advance Otology, vol. 13(1), pp.14-20.
 15. Postsangbam D.S., 2017. Endoscopic Tympanoplasty Type 1: Improving Techniques. International Journal of Research in Medical Science. vol-5(4), pp.6-13.
 16. Migirov L., Shapira Y., Horowitz Z. & Wolf M. 2011. Exclusive endoscopic ear surgery for acquired cholesteatoma: preliminary results. Journal of Otology Neurotology, Vol-32(3), pp.433-6.
 17. Marchioni D., Villari D., Mattioli F., Alicandri-Ciufelli M., Piccinini A. & Presutti L., 2013. Endoscopic Management of Attic Cholesteatoma. A Single-Institution Experience. Otolaryngology Clinic of North America, vol.46, pp.201-9
 18. Yadav S.P.S., Aggarwal N., Julaha M. & Goel A., 2009. Endoscope-assisted myringoplasty. Singapore Medical Journal. Vol. 50(5), pp.510-12.
 19. Alam M.M., 2017. Experience of endoscopic ear surgery in Bangladesh. Conferenceseries.com, vol. 7 (5), pp. 45.
 20. Pradhan P., Anant A. & Venkatachalam V., 2017. Comparison of Temporalis Fascia and Full-Thickness Cartilage Palisades in Type-1 Underlay Tympanoplasty for Large/Subtotal Perforations. Iranian Journal of Otorhinolaryngology, Vol. 29(2), pp.63-8.
 21. Choi N., Noh Y., Park W., Lee J.J., Yook S., Choi J.E., Churung W., Cho Y., Hong S.H. & Moon I.J., 2017. Comparison of Endoscopic Tympanoplasty To Microscopic Tympanoplasty. Clinical and Experimental Otorhinolaryngology, vol. 10(1), pp.44-49.
 22. Ahmed A., Alam S., Hashmi S.F. & Hasan S.A., 2016. A Prospective Study Comparing the Results of Endoscope Assisted Versus Microscope Assisted Myringoplasty. Global Journal of Otolaryngology, vol. 1(4), pp.1-6.