



Jenina Rachel D.J. Escalderon, MD
William L. Lim, MD

Department of Otorhinolaryngology
Head and Neck Surgery
University of Santo Tomas, Manila, Philippines

Correspondence: Dr. William L. Lim
Department of Otorhinolaryngology
Head and Neck Surgery
University of Santo Tomas Hospital
España Blvd., Sampaloc Manila 1015
Philippines
Phone: (632) 731 3001 local 2411
Email: ust_enthns@yahoo.com

The authors declare that this represents original material, that the manuscript has been read and approved by all the authors, that the requirements for authorship have been met by each author, and that each author believes that the manuscript represents honest work.

Disclosures: The authors signed disclosures that there are no financial or other (including personal) relationships, intellectual passion, political or religious beliefs, and institutional affiliations that might lead to a conflict of interest.

Presented at the Philippine Society of Otolaryngology – Head and Neck Surgery 61st Annual Convention and 10th International Symposium on Recent Advances in Rhinosinusitis and Nasal Polyposis. Free Paper Presentation. November 30, 2017. Manila Hotel, Manila, Philippines.

Presented at 2018 Research Fortnight: Poster Exhibition. February 20, 2018. CME Auditorium, University of Sano Tomas, España, Manila.

Presented at the 10th International Academic Conference in Otolaryngology, Rhinology and Laryngology. March 1-3, 2018. Fairmont Hotel, Makati City

Presented at the 2nd International Conference on Ear, Nose and Throat Disorders. May 14-15, 2018. Osaka, Japan.



Creative Commons (CC BY-NC-ND 4.0)
Attribution - NonCommercial - NoDerivatives 4.0 International

Operative Time and Tympanic Membrane Graft Uptake in Endoscopic Transcanal versus Microscopic Post-Auricular Tympanoplasty for Chronic Otitis Media

ABSTRACT

Objective: To compare surgical outcomes (operative time and tympanic membrane graft uptake) obtained by endoscopic transcanal tympanoplasty (ET) and microscopic post-auricular tympanoplasty (MT) in patient with inactive chronic otitis media.

Methods:

Design: Retrospective Cohort

Setting: Multicenter study in 3 Private Tertiary Hospitals

Participants: 18 patients who underwent microscopic or endoscopic tympanoplasty for chronic otitis media.

Results: Each group had 9 patients with median age of 43 (31-65 years) for the MT and 47 (29-59 years) for the ET group. There was no significant difference in median age of the two groups (Mann-Whitney $U=17$, $P=.22$). Male: female ratio was (5:4) and (6:3) for the ET and MT group, respectively, with no significant difference in gender distribution ($\chi^2=0.90$, $P=.34$). Mean operative time for the ET and MT group was 86.7 minutes and 140.6 minutes, respectively, with significantly lower mean operative time for the ET group ($t=3.57$, $P=.0025$). There was complete tympanic membrane graft uptake in both groups.

Conclusion: Regardless of technique, tympanoplasty is an effective surgical treatment among patients with inactive chronic otitis media. Endoscopic tympanoplasty may be an alternative to conventional microscopic tympanoplasty that may use less operative time, producing similarly complete graft uptake.

Keywords: *chronic otitis media, tympanoplasty, endoscopic tympanoplasty, microscopic tympanoplasty, perforation, tympanic membrane*

Tympanoplasty is a surgical procedure that conventionally utilizes an operating microscope to visualize the tympanic membrane and middle ear and is commonly performed in the Philippines. Although the use of endoscopes has traditionally been limited to paranasal sinus surgeries,¹ several reports have been made on endoscopic tympanoplasty worldwide.¹⁻⁵ In our country, however, there is a scarcity of studies on endoscopic techniques for micro-otologic

surgery and the practice of endoscopic tympanoplasty is limited. While endoscopy opens more surgical access options for otologic surgery, it requires the surgeon to trade the binocular hands-free microscope for the monocular, technically more challenging endoscope;⁶ a technique with which most otologic surgeons may not be as familiar.

Our search of the English literature using the keywords “endoscopic” “tympanoplasty” “Philippines” on MEDLINE (PubMed), Cochrane, HERDIN and Google Scholar yielded no published reports on endoscopic tympanoplasty in the country. Through this retrospective cohort, we attempt to evaluate the application of this approach among Filipino patients by comparing with the conventional approach.

Specifically, this study aims to determine the operative time and tympanic membrane graft uptake of endoscopic endaural tympanoplasty compared to microscopic post-auricular tympanoplasty in patients with inactive chronic otitis media.

METHODS

With Institutional Board Review (IRB) approval (University of Santo Tomas Hospital Protocol IRB-2017-06-120-TR) this retrospective cohort retrieved the medical records of all patients with inactive chronic otitis media who underwent endoscopic or microscopic tympanoplasty by a single surgeon (WL) in any of three tertiary hospitals -- St. Luke's Medical Center- Bonifacio Global City (SLMC-BGC), University of Santo Tomas Hospital (USTH) and Hospital of the Infant Jesus (HIJ) from January 2015 - August 2017. Records with operative techniques and pre- and post-operative notes and video otoscopy findings were considered for inclusion.

Excluded were medical records with incomplete data, those of patients in whom cortical mastoidectomy or mastoid antrotomy with tympanoplasty was performed, or records of patients who had previous surgery for chronic otitis media and those with ossicular discontinuity.

Medical records were selected, assigned a reference number and data was de-identified by the principal investigator (JE). Demographics such as age and gender including surgical approach, duration of surgery and postoperative complications were tabulated by the same investigator. Based on video otoscopic findings in hospital charts, pre-operative tympanic membrane perforation was classified into 3 groups by JE following the method of Ambani *et al.*⁷ 25-50% perforation was classified as medium; 51 to 75% as large; and 76% or more as subtotal/total. Standard surgical techniques had been employed for microscopic post-auricular tympanoplasty (MT) and endoscopic transcanal tympanoplasty (ET) by a single surgeon.

Surgical Techniques

Microscopic Tympanoplasty (MT)

Microscopic techniques utilized a post-auricular approach using an OPMIØ Vario/S88 (Carl Zeiss, Oberkochen, Germany) or Leica M720 OH5 (Surgitech, USA) operating microscope. Lidocaine 2% (Xylocaine, Aspen, France) with 1:100,000 epinephrine (Adrenaline, Par Pharmaceutical Inc, USA) was infiltrated subcutaneously over the post-auricular area and anterior external auditory canal (between tragus and triangular fossa). A post auricular skin incision using blade 15 (Feather, Germany) was carried down to the subcutaneous layer exposing fascia. A Weitlaner sharp self-retaining retractor (BV206R, Aesculap, USA) was placed and an approximately 2 x 2 cm superficial temporalis fascia graft was harvested and dried over a metal medicine glass.

A T-incision was carried down through periosteum and periosteal flaps were developed using a Langenbeck periosteal elevator (Aesculap, USA). External auditory canal skin along with the first layer of tympanic membrane was elevated using a drum elevator. Micro-cotton balls soaked in pure epinephrine were used to control mucosal bleeders. A Rosen pick needle (Bausch+Lomb Storz, N16901, Tuttlingen, Germany) was used in freshening the edges of the tympanic membrane perforation. The graft was then placed by underlay technique, the tympanomeatal flap was replaced and secured with Gelfoam (Ferrosan, Soborg, Denmark) packing. The post-auricular incision was closed in layers using absorbable sutures.

Endoscopic Tympanoplasty

Transcanal approaches used endoscopes measuring 3.0 mm with both 0 and 30 degree angles (Karl Storz GmbH & Co. KG - Tuttlingen, Germany) connected to a camera connector, light source and high definition monitor (Richard Wolf, ENDOCAM Performance HD and ENDOLIGHT LED 1.1, Knittlinge, Germany).

Lidocaine 2% (Xylocaine, Aspen, France) and 1:100,000 epinephrine (Adrenaline, Par Pharmaceutical Inc, USA) was infiltrated in the facial side of the tragal cartilage followed by a 1.5 cm skin incision over the dome of the tragal cartilage with a no. 15 scalpel blade (Feather, Germany). The incision was extended through the skin and cartilage with the perichondrium. The subcutaneous tissue was dissected laterally from the perichondrium and the cartilage was retracted superiorly with forceps and incised using Metzenbaum blunt scissors (BC277R, Aesculap, USA). A vertical incision was made with a scalpel into the inferior part of the tragus to completely mobilize the tragal graft. The harvested graft was placed in a sterile water-filled medicine cup.

Using standard microotologic ear surgical instruments (N1705

ENT Surgery Set, Karl Storz, Tuttlingen, Germany) the tympanomeatal flap was raised via underlay technique from 6 o' clock to 12 o' clock position. (Figure 1A) The middle ear was inspected. (Figure 1B) The harvested tragal cartilage graft was inserted into the middle ear and kept inferiorly at the handle of malleus, resting on the posterior canal wall. (Figure 1C) The graft was then placed by underlay technique, the tympanomeatal flap was replaced and secured with Gelfoam (Ferrosan, Soborg, Denmark) packing. (Figure 1D)

Post-operative procedures

The microscopic group had sterile cotton placed in the cavum concha and a 2 mm elastic bandage was applied over the mastoid area while the endoscopic group had sterile gauze applied over the tragus secured with medical tape.

All patients were given post-operative medications (analgesics,

antibiotics and decongestants) and advised to avoid Valsalva, forceful blowing of nose and straining. Regular weekly follow up was done. Sutures were removed one week post operatively, antibiotic otic drops were started at the third and fourth week post-operatively and tympanic membrane graft uptake was evaluated by the same surgeon (WL) at two months, and a video otoscopy recording was included in the medical record.

Data Collection and Analysis

Patients were divided according to operative technique into the microscopic tympanoplasty (MT) and endoscopic tympanoplasty (ET) group by the principal investigator (JE). Outcome measures were operative time and tympanic membrane graft uptake. The mean operative time was defined as the time-marked incision to the time-marked end of surgery based on operating room records accomplished

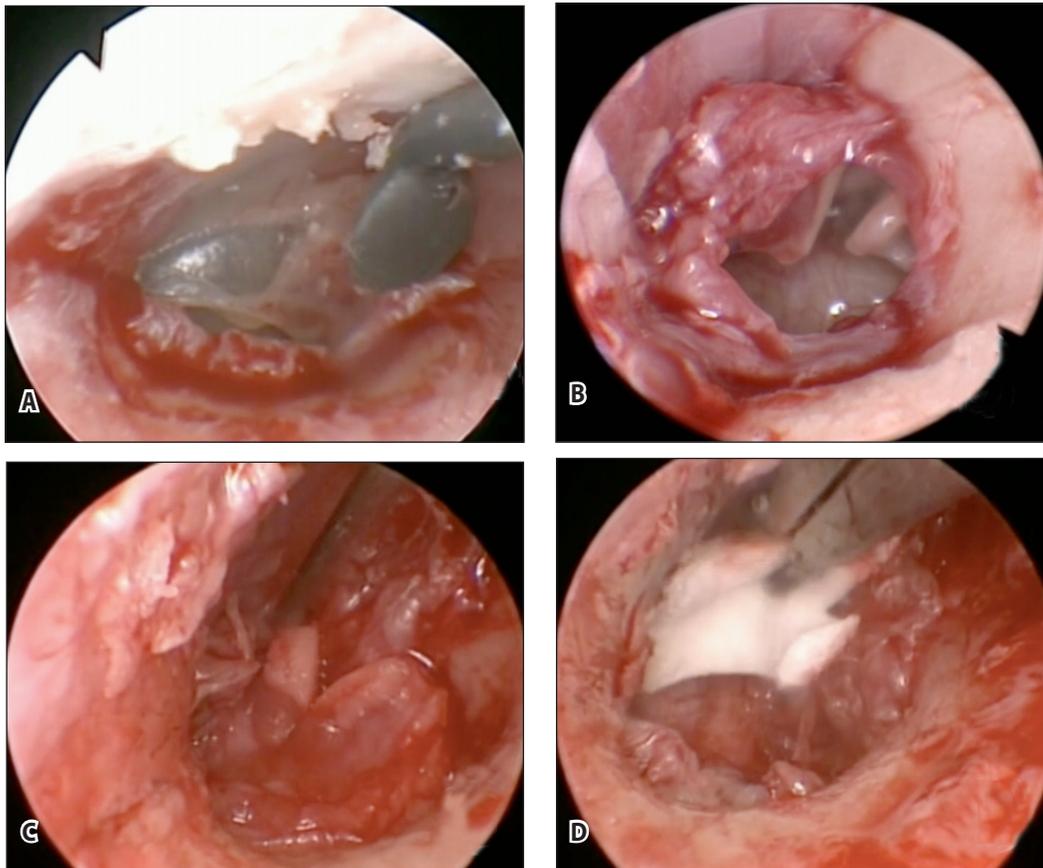


Figure 1. Representative images of transcanal endoscopic tympanoplasty in one patient. **A.** Elevation of tympanomeatal flap; **B.** Middle ear is inspected; **C.** Graft placed in the posterior canal wall; and **D.** Tympanomeatal flap secured with Gelfoam.

by operating room staff for all patients. Successful graft take was defined as complete closure of the perforation documented at 2 months post operation with video otoscopy recorded by the surgeon utilizing a 3.0 mm 0° endoscope (Karl Storz GmbH & Co. KG – Tuttlingen, Germany), based on review of video recordings by the investigator, JE.

Statistical computations utilized IBM SPSS statistics for Windows, Version 19.0. (IBM Corp., Armonk, NY). The Mann-Whitney test was utilized to check the difference in median age between the two groups while the T-test was used to check the significant difference in the mean operative time between the two techniques. The chi-square test was then utilized to check the difference in sex and perforation between the MT and ET groups. An alpha(a) of 0.05 or 95% level of confidence was assumed for this study.

RESULTS

A total of 18 patients fulfilled inclusion and exclusion criteria and were included, 9 in the transcanal endoscopic technique (ET) group

and 9 in the post-aural microscopic technique (MT) group. There were 10 males and 8 females overall, with 4 males (44%) and 5 females (56%) in the ET group and 6 males (67%) and 3 females (33%) in the MT group. There was no significant difference in gender distribution of both groups ($\chi^2=0.90, P=.34$). The median age was 43 (31-65 years) for the MT and 47 (29-59 years) for the ET group. There was no significant difference in median age between the two groups (Mann-Whitney $U=17, P=.22$).

Of the 18 ears, 3 had medium perforation (2, 22% underwent ET; 1, 11% underwent MT), 8 had large perforations (5, 56% underwent ET; 3 33% underwent MT), and 7 had subtotal/total perforation (2, 22% underwent ET; 5, 56% underwent MT). There was no significant difference in perforation between the two groups ($\chi^2=2.12, P=.35$). (Figure 2)

The mean operative time for the ET group was 86.7 (range 60-105) minutes compared to 140.6 (range 90-240) minutes for the MT

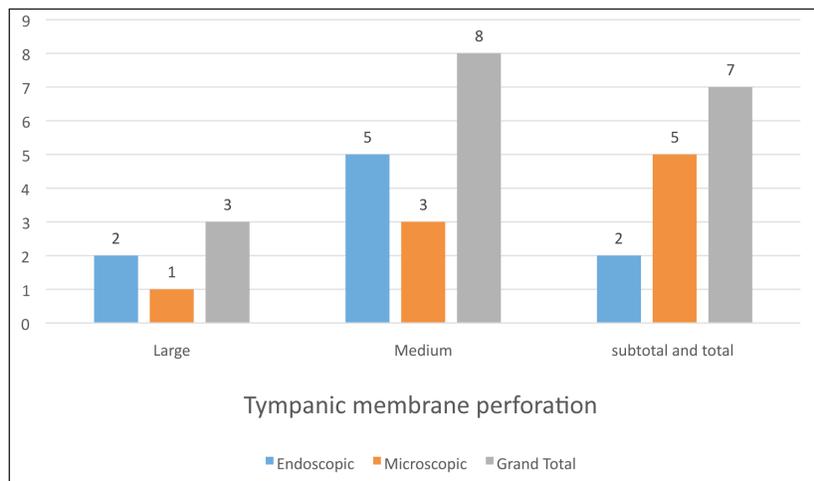


Figure 2. Bar graph showing distribution of pre-operative tympanic membrane perforation size for both groups.

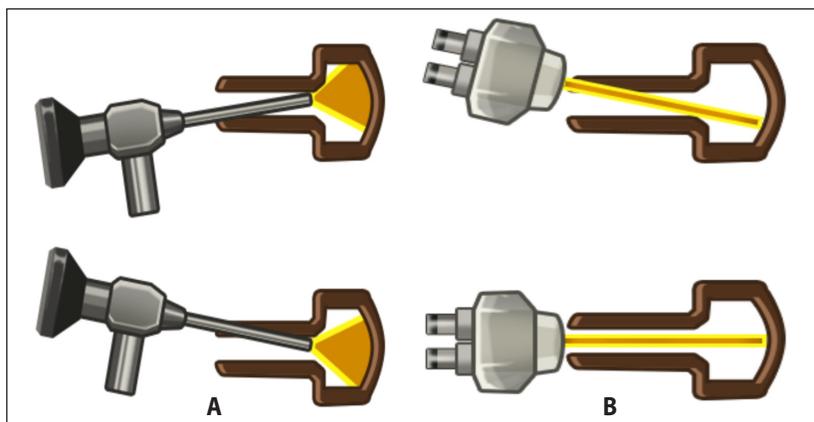


Figure 3. A. The endoscopic view allows the surgeon to access the deep recesses with an angulated endoscope; B. The microscopic technique provides a magnified view with a linear focus. Manipulation of the whole microscope is needed to visualize other parts of the middle ear.



group. Using unpaired t-test, the ET group had significantly lower mean operative time than the MT group with a mean difference of 53.9 minutes ($t= 3.57, P=.0025$).

There was complete tympanic membrane graft uptake in all patients for both groups and no dehiscence or surgical site infection was noted in any patients.

DISCUSSION

Our study demonstrated 100% post-operative tympanic membrane graft uptake among both groups of patients with inactive chronic otitis media that underwent endoscopic transcanal tympanoplasty or microscopic post-auricular tympanoplasty with significantly lower operative time for the former group.

Our findings are consistent with those of previous studies. Dundar *et al.* noted tympanic membrane perforations in 4 (12.5%) of their endoscopic group and 2 (5.71%) in their microscopic group with no significant difference in tympanic membrane graft uptake and shorter operative time for endoscopic tympanoplasty ($p=.000$).⁶ Choi *et al.* reported better results with tympanic membrane graft uptake of 100% in the endoscopic group and 95.8% in the microscopic group with no significant difference between the groups.⁵ Endoscopic tympanoplasty also had a significantly shorter operative time with a mean of 88.9 ± 28.5 minutes compared to the microscopic technique with a mean operative time of 68.2 ± 22.1 minutes ($P=.002$).

The reduction in operative time may be attributed in part to ample visualization of deeply located structures that cannot easily be visualized using the magnified view afforded by the linear focus of a microscope.²

(Figure 3 A, B) The researchers hypothesized that technicality was not a factor due to adequate experience of the surgeon in utilizing endoscopes for sinus surgery. All endoscopic tympanoplasties were accomplished without conversion to microscopic tympanoplasty.

Limitations of this study include the retrospective design and limited sample size meeting inclusion and exclusion criteria within the short study period. To minimize confounding variables, we only included patients with inactive chronic otitis media who underwent tympanoplasty by a single surgeon with similarly-induced anesthesia, uniform surgical technique and instrumentation. Other limitations are selection bias (from prior knowledge of disease and exposure among participants) and information bias (from assumed accuracy of archived data), but we tried to minimize these by not involving the surgeon in applying inclusion and exclusion criteria or in interpretation and analysis of recorded data. A future randomized prospective trial with more study participants and better follow-up may yield more robust conclusions and address the other sources of bias. Pre- and post-operative audiometric findings (not included in this study because they were only available for the ET group) should also be assessed.

Meanwhile, our findings suggest that regardless of technique, tympanoplasty is an effective surgical treatment for patients with inactive chronic otitis media. Endoscopic transcanal tympanoplasty may be an alternative to conventional microscopic post-auricular tympanoplasty in our setting and may involve less operative time producing similarly complete graft uptake.

REFERENCES

1. Zollner F. The principles of plastic surgery of the sound-conducting apparatus. *J Laryngol Otol.* 1955 Oct; 69(10):637-52. PMID: 13263770.
2. Akyigit A, Sakallioğlu O, Karlıdag T. Endoscopic tympanoplasty. *J Otol.* 2017 Apr; 12: 62-67. DOI: 10.1016/j.joto.2017.04.004.
3. Ayache S. Cartilaginous myringoplasty: the endoscopic transcanal procedure. *Eur Arch Otorhinolaryngol.* 2013 Mar; 270(3):853-60. DOI: 10.1007/s00405-012-2056-x; PMID: 22639200.
4. Tseng CC, Lai MT, Wu CC, Yuan SP, Ding YF. Learning curve for endoscopic tympanoplasty: initial experience of 221 procedures. *J Chin Med Assoc.* 2017 Aug; 80(8): 508-514. DOI: 10.1016/j.jcma.2017.01.005; PMID: 28465109.
5. Choi N, Noh Y, Park W, Lee JJ, Yook S, Choi JE, et al. Comparison of Endoscopic Tympanoplasty to Microscopic Tympanoplasty. *Clin Exp Otorhinolaryngol.* 2017 Mar; 10(1):44-49. DOI: 10.21053/ceo.2016.00080; PMID: 27334511 PMID: PMC5327595.
6. Dundar R, Kulduk E, Soy FK, Aslan M, Hanci D, Muluk NB, et al. Endoscopic versus microscopic approach to type 1 tympanoplasty in children. *Int J Pediatr Otorhinolaryngol.* 2014 Jul; 78(7): 1084–1089 DOI: 10.1016/j.ijporl.2014.04.013; PMID: 24816224.
7. Ambani KP, Bhavya BM, Vakharia SD, Khanna A, Katarkar AU. Merits and demerits of endoscopic tympanoplasty. *Int J Otorhinolaryngol Head Neck Surg.* 2017 Apr; 3(2): 395-399. DOI: 10.18203/issn.2454-5929.ijohns20171200.