

Evaluation of Young Surgeon's Experience and Outcomes in Endoscopic Tympanoplasty Surgery

ABSTRACT

Background: Rigid telescopes, which provide wider surgical field imaging, improved resolution, and high magnification capabilities, have recently found widespread use in ear surgery. This study aimed to review the outcomes and duration of operations in endoscopic transcanal tympanoplasty and to guide surgeons who have just started endoscopic ear surgery (EES).

Methods: This study included 47 outpatient or inpatient volunteers who underwent endoscopic transcanal tympanoplasty surgery at the Otolaryngology clinic between March 2021 and March 2023. The age and sex of the patients, the surgery duration, and the side of the operated ear were reviewed. The first 23 operated patients were compared with the last 24 operated patients in terms of the duration of the operation. Postoperative graft success (anatomical success) in the patients at 6 months was reviewed. Hearing gain in patients was examined postoperatively at 6 months using an audiometry test with hearing thresholds at 0.5, 1, 2, and 4 kHz.

Results: Upon examination of the patients at 6 months, the graft success was 89.4%. There was a statistically significant recovery in all 4 frequencies based on the preoperative and postoperative hearing tests ($P = .00$). There was a significant decrease in the duration of the operation in patients who were operated in the later stages of the study ($P = .00$).

Conclusion: Although there is a learning curve associated with EES, this type of operation is based on team effort, and the surgery duration decreases over time, with the experience acquired by each healthcare provider included in the team.

Keywords: Endoscopic surgical procedure, hearing, pure-tone audiometry, tympanic membrane, tympanoplasty



INTRODUCTION

Tympanoplasty is performed in patients with non-suppurative chronic otitis media to repair the eardrum perforation and improve hearing. Transcanal endoscopy or microscopy is used for tympanoplasty. Endoscopic ear surgery (EES) has been recently considered an adjunct or alternative method to microscopic ear surgery.^{1,2} The benefits of EES include visualization of difficult sites, including the supratubal recess, retrotympanum, and facial recess, the ability to enlarge the image, and obtaining a clearer image using rigid telescopes.³⁻⁵ Nevertheless, EES is also associated with certain challenges, including the potential for thermal injury, lack of depth perception in the surgical field, and having to work with one hand.^{6,7} Accordingly, a surgical learning curve is associated with the above complexities. A literature review suggested that the surgery duration decreased as the surgeon's proficiency in EES improved.^{8,9} The present study aimed to review the outcomes and duration of the operation in EES and provide guidance to surgeons who have just started EES during the surgical stages.

MATERIAL AND METHODS

The study was approved by İstanbul Medipol University (Decision no. 917, Date: 09.11.2023). Written informed consent was obtained from all the participants included in the study. This study included 47 outpatient or inpatient volunteers who underwent endoscopic transcanal tympanoplasty surgery at the Ear, Nose, and Throat clinic between March 2021 and

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March 2023. All patients were operated on by the same physician, who had microscopic ear surgery experience and was newly introduced to EES.

The patients who underwent operations that required ossicle repair, endoscopic fat, and butterfly myringoplasty were excluded from the study. All patients underwent surgery under hypotensive anesthesia using remifentanyl. The duration of all operations was recorded, and the time was kept from the beginning of local anesthesia to the end of the surgical operation.

Surgical Technique

First, the perforation edges on the tympanic membrane were renewed with the help of a pick. Then, the tympanomeatal flap was elevated starting 4-6 mm lateral to the annulus. Adrenaline-impregnated cotton pellets were used to reduce bleeding during elevation. The middle ear was entered from under the annulus, preserving the chorda tympani. Ossicular chain mobility was checked. The tympanic membrane over the malleus was completely stripped. Thereafter, the perichondrium on one side of the tragal cartilage was removed for grafting while preserving the tragus apex. A pocket was prepared on the graft to ensure proper adaptation to the manubrium mallei. The graft was placed using the over-underlay technique. Upon placement of the tympanomeatal flap, the graft was checked to see if it completely covered the perforation. The graft was filled in with gelfoam from the bottom and top. The patients were discharged upon dressing on the first postoperative day (Figure 1).

Surgical operations in all the patients were performed using an endovision system with a screen resolution of 1920 × 1080 pixels (Karl Storz 9627 Nb/ks-27 27-inch full HD). A Karl Storz Power Led 175 model device was used as the cold light source. Operations were performed with 0, 30-degree, 2.7 mm-11 cm telescopes (Karl Storz, Tuttlingen, Germany).

MAIN POINTS

- In our study, graft success and improvement in the airway hearing thresholds for all frequencies upon pure-tone audiometry tests are similar to microscopic ear surgery results reported in the literature.
- While the average duration of the operation in this study was 79.8 minutes, this time was shortened in the last cases.
- Previous studies, which closely investigated the learning curve in EES, analyzed the decrease in surgery duration as proficiency increased, but without considering other surgical and patient outcomes.
- Endoscopic ear surgery has a difficult and long learning curve, and the operation time decreases over time with the experience gained by the surgeon and the surgical team.

The age, sex, and the side of the operated ear of all the participants were reviewed. Postoperative graft success (anatomical success) in the patients at 6 months was reviewed. The first 23 operated patients were compared with the last 24 operated patients based on the duration of the operation.

Audiological Evaluation

Pure-tone hearing threshold tests were used for the audiological evaluation of all the patients. A calibrated Grason-STADLER GSI G1 (VIASYS Healthcare, Wisconsin) clinical audiometer was used for the tests in suitably quiet rooms. The airway hearing thresholds were measured with a TDH-39 loudspeaker, whereas the bone conduction hearing thresholds were measured with a RadioEar B 71 vibrator. Hearing gain in patients was examined postoperatively at 6 months using an audiometry test with hearing thresholds at 0.5, 1, 2, and 4 kHz.

Statistical Analysis

The Statistical Package for the Social Sciences version 24 (IBM SPSS Corp.; Armonk, NY, USA) software was used for statistical analysis. Descriptive statistical methods (SD, median, mean, frequency, minimum, maximum, percentage) were used to evaluate the data. The conformity of continuous variables to a normal distribution was evaluated by visual inspection of histograms, Q-Q curves, and the Shapiro-Wilk test. The Student's *t*-test was used to compare surgery duration groups' quantitative variables that met the normal distribution hypothesis. Since the preoperative and 6th-month audiometry findings of the patients showed a normal distribution, they were compared using the "paired *t*-test." A *P*-value of <.05 was considered statistically significant.

RESULTS

Forty-seven volunteer patients who underwent endoscopic transcanal tympanoplasty surgery were included in this study. Of the 47 patients included in the study, 20 were male and 27 were female. The mean age of the patients included in the study was 31.87 (18-51) years. Twenty (42.6%) patients were operated on the left ear, whereas 27 (57.4%) were operated on the right ear. The mean perforation size of the patients was 5.47 mm in the longitudinal axis (Table 1).

The mean surgery duration was 79.83 ± 9.94 minutes. The mean surgery duration in the first 23 patients was 85.65 ± 9.49 minutes. The mean surgery duration in the last 24 patients was 74.25 ± 6.73 minutes. There was a significant decrease in the surgery duration between the patient groups (*P* = .00) (Table 2).

The graft success rate was 89.4% (success in 42 patients, failure in 5 patients) upon postoperative endoscopic examination at 6 months. There was a significant improvement in the airway hearing thresholds for all frequencies upon pure-tone audiometry tests in the patients based on preoperative and postoperative (6-month) results (*P* = .00) (Figure 2).

DISCUSSION

All patients underwent surgery under hypotensive anesthesia to reduce the risk of surgical site bleeding. The patient is prepared with the ipsilateral shoulder down to provide easy

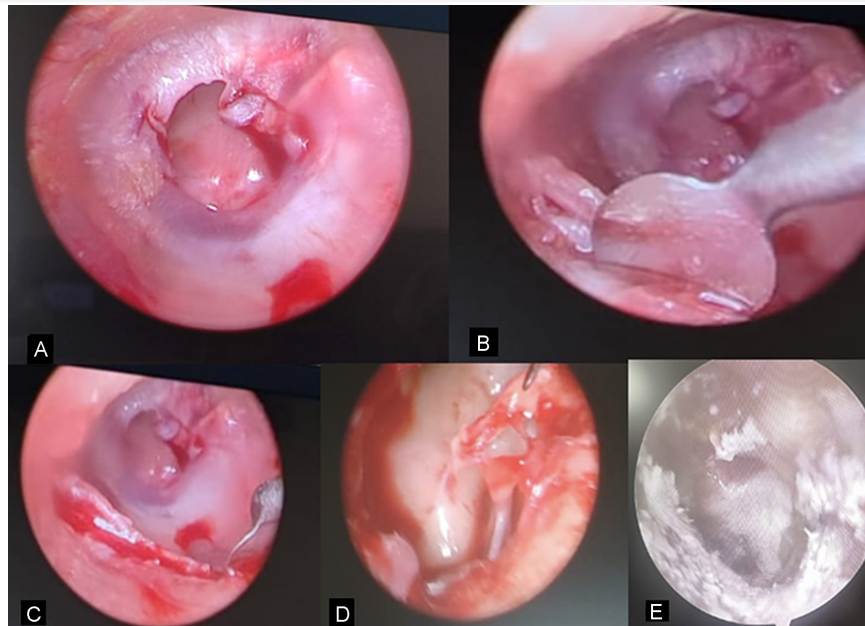


Figure 1. A. Intraoperative view of tympanic membrane perforation. B and C. Tympanomeatal flap elevation. D. Intraoperative ossicular chain control and cleaning of membrane residues on the manubrium mallei. E. Postoperative outpatient clinic examination view (local drop treatment residues).

access to the ear to be operated on.⁸ Appropriate injection of a subcutaneous vasoconstrictive agent into the ear canal significantly reduces bleeding, and local adrenaline cotton pellets used for tympanomeatal flap elevation contribute to bleeding control during the procedure.¹⁰ There are concerns associated with the fact that heat at the tip of the endoscope may cause tissue damage.¹¹ Nevertheless, it was shown that the temperature at the tip of the endoscope was not as high as initially anticipated because the endoscope must have been removed from the ear at regular intervals for cleaning purposes and the use of hot water prevents the endoscope from fogging.¹⁰

Endoscopic and microscopic methods have similar rates of graft success.^{12,13} Along with the graft success, improvements in

pure-tone audiometry and the air-bone gap are similar in both endoscopic and microscopic ear surgery. Consistent with previous studies in the relevant literature, the graft success rate was 89.4% in the present study.^{13,14} Similarly, there was a significant improvement in the airway hearing thresholds for all frequencies upon pure-tone audiometry tests in the patients based on preoperative and postoperative (6-month) results. A limitation of our study is that graft failure and a subsequent increase in the air-bone gap may occur in the long-term follow-up of the patients.

Challenges associated with endoscopic surgery include using only one hand and lack of depth perception.⁴ Therefore, there is a learning curve in the case of EES. The difficult and prolonged learning curve of EES drives otolaryngologists away from EES.⁶ Previous studies, which closely investigated the learning curve in EES, analyzed the decrease in surgery duration as proficiency increased, but without considering other surgical and patient outcomes.^{7,14,15} Previous studies in the literature reported the average surgery duration for endoscopic type 1 tympanoplasty as 60-83 minutes.^{16,17} Consistent with these studies, the mean surgery duration was 79.8 minutes in the present study, which decreased to 74.4 minutes in the latest cases. The decrease in the surgery duration is associated with the surgeon

Table 1. Descriptive Characteristics of the Participants Included in the Study

	Minimum	Maximum	Mean	SD
Age	18.00	51.00	31.8723	10.20362
Sex	N		Percent	
Male	20		42.6	
Female	27		57.4	
Operated side				
Right ear	27		57.4	
Left ear	20		42.6	
Perforation size	Mean		SD	
Male	5.52		0.56557	
Female	5.43		0.79304	
Total	5.47		0.70003	

Table 2 The Mean Surgery Duration of the Patients

	N	Mean Surgery Duration	SD
First operated group	23	85.65	9.49
Last operated group	24	74.25	6.73
Total	47	79.83	9.94

*P = .00. *Statistical significant

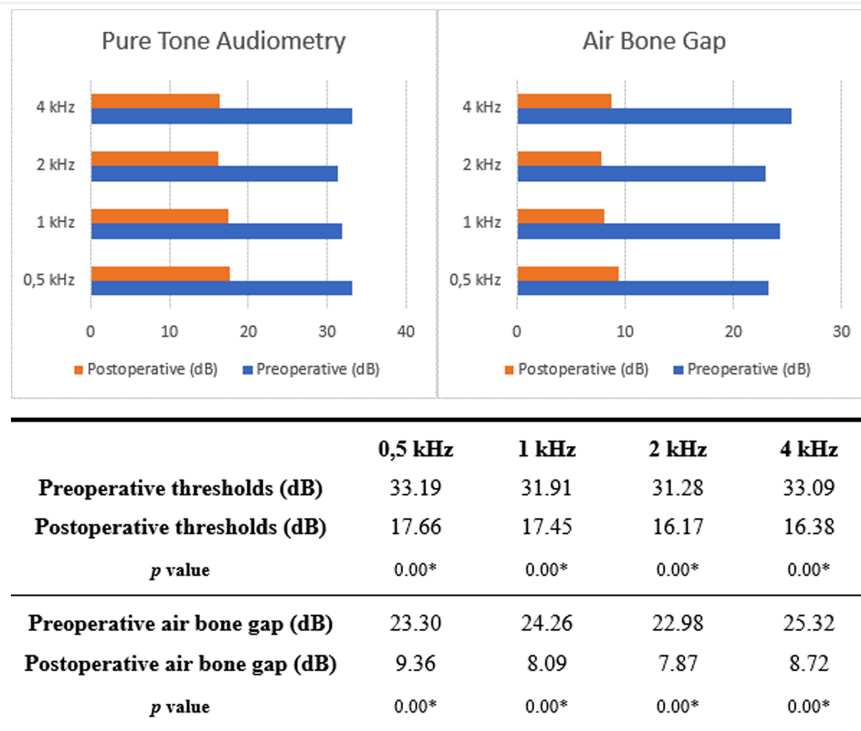


Figure 2. The improvement in the airway hearing thresholds for all frequencies upon pure-tone audiometry tests in the patients, based on preoperative and postoperative (6-month) results. *Statistically significant

getting accustomed to operating with one hand over time and an increased propensity to use the endoscope. Additionally, the surgery duration decreased with increased surgical nurse experience in pre- and intra-operative procedures. It was observed that increased surgical nurse experience in operating table preparation, local anesthesia, gel foam, adrenaline-impregnated cotton pellet preparation, knowledge about patient position and operation table positioning, and knowledge of the surgical tools decreased the surgery duration of EES.

Endoscopic ear surgery has a difficult and long learning curve, and the operation time decreases over time with the experience gained by the surgeon and the surgical team.

Ethics Committee Approval: This study was approved by the Ethics Committee of İstanbul Medipol University (Approval no.: 917, Date: 09.11.2023).

Informed Consent: Written informed consent was obtained from the participants who agreed to take part in the study.

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REFERENCES

- Kennedy EJ, Cleere EF, Crotty TJ, Keogh IJ. Training in endoscopic ear surgery: A scoping review. *Laryngoscope*. 2023;133(12):3269-3278. [\[CrossRef\]](#)
- Marchioni D, Molteni G, Presutti L. Endoscopic anatomy of the middle ear. *Indian J Otolaryngol Head Neck Surg*. 2011;63(2):101-113. [\[CrossRef\]](#)
- Emre IE, Cingi C, Bayar Muluk N, Nogueira JF. Endoscopic ear surgery. *J Otol*. 2020;15(1):27-32. [\[CrossRef\]](#)
- Kiringoda R, Kozin ED, Lee DJ. Outcomes in endoscopic ear surgery. *Otolaryngol Clin North Am*. 2016;49(5):1271-1290. [\[CrossRef\]](#)
- Garcia B, Moussalem GF, Andrade JS, et al. Transcanal endoscopic myringoplasty: a case series in a university center. *Braz J Otorhinolaryngol*. 2016;82(3):321-325. [\[CrossRef\]](#)
- Kozin ED, Lehmann A, Carter M, et al. Thermal effects of endoscopy in a human temporal bone model: implications for endoscopic ear surgery. *Laryngoscope*. 2014;124(8):E332-E339. [\[CrossRef\]](#)
- Tarabichi M. Endoscopic middle ear surgery. *Ann Otol Rhinol Laryngol*. 1999;108(1):39-46. [\[CrossRef\]](#)
- Lucidi D, Fernandez IJ, Botti C, et al. Does microscopic experience influence learning curve in endoscopic ear surgery? A multicentric study. *Auris Nasus Larynx*. 2021;48(1):50-56. [\[CrossRef\]](#)
- Iannella G, Magliulo G. Endoscopic versus microscopic approach in stapes surgery: are operative times and learning curve important for making the choice? *Otol Neurotol*. 2016;37(9):1350-1357. [\[CrossRef\]](#)
- Pothier DD. Introducing endoscopic ear surgery into practice. *Otolaryngol Clin North Am*. 2013;46(2):245-255. [\[CrossRef\]](#)
- Kozin ED, Gulati S, Kaplan AB, et al. Systematic review of outcomes following observational and operative endoscopic middle ear surgery. *Laryngoscope*. 2015;125(5):1205-1214. [\[CrossRef\]](#)
- Tseng CC, Lai MT, Wu CC, Yuan SP, Ding YF. Comparison of the efficacy of endoscopic tympanoplasty and microscopic tympanoplasty:

- A systematic review and meta-analysis. *Laryngoscope*. 2017; 127(8):1890-1896. [\[CrossRef\]](#)
13. Kim HC, Yang HC, Lee SS, Cho HH. Surgical results of tympanoplasty after conversion to the endoscopic approach performed by a surgeon experienced in microscopic surgery. *Eur Arch Otorhinolaryngol*. 2022;279(7):3407-3414. [\[CrossRef\]](#)
 14. Gokgoz MC, Tasli H, Helvacioğlu B. Results of endoscopic transcanal tympanoplasty performed by a young surgeon in a secondary hospital. *Braz J Otorhinolaryngol*. 2020;86(3):364-369. [\[CrossRef\]](#)
 15. Fradeani D, Milner TD, Iyer A. Learning curve in endoscopic tympanoplasties: a prospective study based on outcomes of 141 cases. *Clin Otolaryngol*. 2021;46(4):888-892. [\[CrossRef\]](#)
 16. Liu CY, Yu EC, Shiao AS, Wang MC. Learning curve of tympanoplasty type I. *Auris Nasus Larynx*. 2009;36(1):26-29. [\[CrossRef\]](#)
 17. Jyothi AC, Shrikrishna BH, Kulkarni NH, Kumar A. Endoscopic myringoplasty versus microscopic myringoplasty in tubotympanic CSOM: a comparative study of 120 cases. *Indian J Otolaryngol Head Neck Surg*. 2017;69(3):357-362. [\[CrossRef\]](#)