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Original Article

The Evaluation of Prognostic Factors in Endoscopic Cartilage Tympanoplasty

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ABSTRACT

Objective: To evaluate prognostic factors affecting the success of endoscopic cartilage tympanoplasty, and to evaluate the results of endoscopic tympanoplasty in a tertiary care hospital.
Study Design: Cross-sectional study.
Place and Duration of Study: Department of ENT, Combined Military Hospital, Abbottabad Pakistan, from Aug 2022 to Aug 2023.
Methodology: The study included 122 patients who underwent endoscopic transcanalicular tympanoplasty Type-I. We compared the effects of different variables on success rates and hearing improvement, including gender, affected side, location and size of the perforation, lack of tympanosclerosis, status of the external ear canal, state of the contralateral ear, and surgical background.
Results: Variables that had a statistically significant impact on the surgical outcome (p <0.001) included myringosclerosis, contralateral ear status, affected side, gender, and perforation location. A significant correlation (p <0.001) was found between external ear canal wall protrusion, the size of perforation and interventional success.
Conclusion: Endoscopic Type-I tympanoplasty has a good success rate in terms of both morphology and functionality. Myringosclerosis, contralateral ear status, affected side, gender, and perforation location significantly impact procedural success.

Keywords: Endoscopic Tympanoplasty, Myringosclerosis, Tympanoplasty.

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INTRODUCTION

Endoscopic cartilage tympanoplasty is a surgical procedure used to repair tympanic membrane perforations using endoscopic techniques and cartilage grafts.[1] Evaluating prognostic factors in endoscopic cartilage tympanoplasty is essential for optimizing patient selection and improving surgical outcomes, which involves identifying variables that might predict the outcomes or success rates of the surgery.[1] Several factors can influence the success of endoscopic cartilage tympanoplasty. Larger perforations may pose greater challenges for successful closure. The surgical outcome may also be impacted by the location of the tympanic membrane hole.[2] Any underlying middle ear conditions, such as infection or inflammation, can affect healing and graft success.[3] The quality and size of the cartilage used for the graft can significantly impact the success of the procedure.[4]

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Many studies have examined factors that could impact the functional and anatomical result of tympanoplasty, such as smoking, age, middle ear mucosa condition.[4] In the past, endoscopes were only used in conjunction with a microscope or for basic otological procedures like placing ventilation tubes.[5] However, in recent times, various otological and neurotological surgical procedures have found usage for endoscopes. Otolaryngologists are choosing and favoring endoscopy more and more due to its benefits, which include minimal morbidity and a large field of view under high-quality images, Despite two-dimensional imaging and one-handed surgery's restrictions.[6] The degree of middle ear illness before to surgery is a major determinant of tympanoplasty outcome.[7] Numerous grading schemes have been devised for this purpose, including the Belosi grading scheme, the five-part system of Willstein and Austin, Speight's Black system and Kartsch's intrinsic and extrinsic components.[8]

The purpose of this research was to identify prognostic factors that could affect the endoscopic

cartilage tympanoplasty outcome in terms of gain in hearing and graft success in an adult population.

METHDOLOGY

This cross-sectional study was conducted at the ENT Department of Combined Military Hospital, Abbottabad Pakistan, from August 2022 to August 2023, after receiving permission from the Institutional Ethical Review Committee [IRB-CMHATD-ETH-115-ENT-23].

Inclusion Criteria: Adult patients of either gender who underwent endoscopic Type-I cartilage tympanoplasty for tubotympanic chronic otitis media were included.

Exclusion Criteria: Patients who underwent mastoidectomy, other types of tympanoplasty (Non-Type-I), or revision surgery, and patients with ossicular chain discontinuity or cholesteatomas were excluded.

Sample size was calculated using OpenEpi sample calculator, taking previos prevalence of tubotympanic chronic otitis media as 6.5.9 Written informed consent was taken prior to data collection and nonprobability consecutive sampling was employed for recruiting patients.

Demographic information of patients, results of thorough ear examination and pre-and-postoperative notes were noted, including the timing of the procedure, results of audiometric tests, location and severity of tympanic membrane perforations, the existence of myringosclerosis, the condition of the external ear wall, and condition of the contralateral ear.

Transcanal endoscopic assessment was used to measure the size of the perforation. Based on the position of the malleus handle, the tympanic membrane was divided into four quadrants, each of which made up 25% of the membrane's total surface area. Involvement of fewer than two quadrants meant the hole size was under 50%. If more than two quadrants were involved, the pore size was classified as greater than half. The tympanic membrane has three perforations: anterior, in the anterior quadrants; the posterior, in the quadrant of the posterior; and central, in the central quadrant.

Operational notes were used to diagnose myringosclerosis. An external ear canal that hindered full visualisation of the posterior margin of the perforation during endoscopic examination was considered protusion of posterior canal wall. The interval between administering local anesthesia and applying an external bandage was referred to as the "operation time." Every patient had an orotracheal intubation while under general anesthesia for their procedure.

The following equipment was used: an HD monitor, an HD camera, two rigid endoscopes: 4.0 mm, 0°, 18-cm lens and 3.0 mm, 0°, 14-cm lens., and an LED light source. Using tragal cartilage graft, all patients had endoscopic Type-I cartilage tympanoplasty. As an island, the cartilage graft was made and only the perichondrium remained when the cartilage surrounding the malleus was removed. Graft implantation while using the over-underlay approach, the malleus handle, medial to the annulus, and tympanic membrane were treated. At the final follow-up examination, a healthy, intact, and lateralized tympanic membrane was considered successful outcome. Pure-tone audiometry was carried out both before surgery and during the postoperative phase. The results were displayed at four different frequencies: 500, 1000, 2000, and 4000 hertz. Pre-operative and postoperative air conduction thresholds, as well as the mean air-bone gap, were determined. The following factors were evaluated: contralateral ear status, gender, affected side, External ear canal anterior wall protusion, absence of myringosclerosis, hole size and location (anterior, central, or posterior), and surgical expertise.

The data was analysed using Statistical Package for Social Sciences version 26. The study parameters were compared, p-value <0.05 was considered statistically significant.

RESULTS

One hundred and twenty-two adults of either gender were included in our study. With a mean age of 33.5±12.8 years, the patients ranged in age from 17 to 61. The mean surgery time was 47.40±16.35. Forty-four (36.1%) men and 78(63.9%) women. There were 22 patients with bilateral ear involvement and 100 with single ear involvement that were part of this study. The vast majority (95.3%) of grafts were successful in closing tympanic membrane perforations. According to sex, affected side, tympanic membrane perforation site, myringosclerosis presence, or contralateral ear state, we identified a significant variation in graft success (p-value <0.001). In individuals with anterior ear canal wall protrusion and tympanic membrane perforations, we determined a considerably greater graft success rate (p-value <0.000) when we compared preoperative assessment with postoperative air-to-bone Thus, a significant

improvement was noted (*p*-value <0.001). Table-I displays the impact of particular parameters on the success rate of 122 patients.

Table-I: Comparative Relationship between Prognostic Factors and Surgical Success Rate (n=122)

Parameters	Number of Cases n(%)	Success Rate n(%)
Gender		
Male	44(36.1%)	39(88.6%)
Female	78(63.9%)	71(91.0%)
Perforation Location		
Posterior	35(28.7%)	33(94.28%)
Anterior	29(23.8%)	25(86.2%)
Central	58(47.5%)	53(91.37%)
Perforation Size		
<50	73(59.8%)	70(95.8%)
>50	49(40.2%)	41(83.6%)
Perforation Side		
Right	52(42.6%)	45(86.5%.)
Left	48(39.3%)	43(89.5%)
Bilateral	22(18.0%)	21(95.4%)
Myringosclerosis		
Absent	88(72.1%)	80(90.9%)
Present	34(27.9%)	28(82.35%)
Condition of Contralateral Ear		
Normal	97(79.5%)	88(90.72%)
Perforation or atelectasis	25(20.5%)	21(84.2%)

Table-II shows the comparison of pre-operative and postoperative hearing findings. It is found that there is a significant relationship between preoperative and postoperative hearing findings (*p* <0.001).

Table-II: Comparison of Pre-Operative and Postoperative Hearing Findings (n=122)

Parameters	Air–Bone Gap (Db) Mean±SD (Range)	Mean±SD Pure Tone Average Air Conduction (Db)	*p*-value
Before Surgery	22.9±7.4(7–44)	32.8±9.3(17–77)	<0.001
After Surgery	10.5±3.9(3–44)	21.8±7.2(17–73)	<0.001

DISCUSSION

The size of the perforation, which has shown inconsistent findings in the literature, is one of the factors influencing the tympanoplasty success rate. According to certain publications, graft success rates were significantly greater for individuals who had tympanic membrane perforations treated with endoscopic tympanoplasty.[9] Another study similar to ours evaluated that neither the success rate of the graft nor the improvement in hearing was impacted by the extent of the hole in the tympanic membrane.[10] Our investigation revealed a similar situation. It was discovered that patients' chances of receiving graft were lower in those who had more than 50% tympanic membrane perforation. Determining the factors that affect tympanoplasty success is fundamental.

In our study, we took no any action if the myringosclerosis did not come into contact with the hole's edges, because the hole will get bigger when the myringosclerosis is removed. We observed that the success of endoscopic tympanoplasty was adversely affected by posterior wall perforation of the external ear canal. This is in line with another study.[11]

Patho logical contralateral ears have been regarded by some studies as a poor prognostic factor because they may be indicative of Eustachian tube dysfunction.[12] According to a similar study, individuals with perforations in their contralateral ears had worse transplant success rates.[13] On the other hand, Zhu *et al.*, discovered no connection between surgical success and the state of the contralateral ear conditions.[14] We evaluated prognostic factors in this study for endoscopic tympanoplasty. Perception of perforation margins, whether entire or partial, was found to be unrelated to graft success rate in a study.[15] All quadrants of tympanic membrane perforations had similar high graft success rates, according to an analysis of endoscopic tympanoplasty trials that have been published in the literature.[16] Our research demonstrated that surgical success rate was associated with the location of the perforation during endoscopic tympanoplasty. Additionally, different techniques to improve revelation in anterior ear canal bone curette and anterior tympanomeatal flap elevation are examples of anterior perforations. Various literature reviews and meta-analyses indicate that endoscopic and microscopic tympanoplasty transplant success rates vary from 50 to 99%.[16] However, multiple international studies did not find any such association on patients undergoing endoscopic cartilage tympanoplasty.[17,18] The location of the tympanic membrane perforation was another aspect that was examined. Although there are conflicting articles on this topic, in theory, anterior perforations are supposed to be more challenging to access and produce stable grafts.[19] Tan *et al.*, conducted a meta-analysis regarding the factors influencing the effectiveness of microscopic Type-I tympanoplasty revealed that the perforation's location and the outcome of the graft were not linked to efficacy.[20] We evaluated that surgical experience had a major

influence on long-term results. Our study shows a tympanic closure percentage at six months following surgery as 92.5%. In contrast, one study's success rate was 90.2% in the second three years and 84.9% in the first, with an overall graft success rate was 95.3% for tympanic membrane perforation closure.[21] We think that the longer follow-up period (mean follow-up, 36 months) may be the cause of this shift. The final characteristics examined in this research were gender and position within the ear. The placement of graft in the ear or gender showed statistically significant relationships with the graft success rate, which contradicted the findings of prior research.[22]

We may be better able to assess the benefits and drawbacks of endoscopic surgery if we compare various patient groups receiving microscopic procedures.

LIMITATION OF STUDY

A relatively short follow-up period was the main limitation of our study. A longer period, spanning years instead of month, may yield more important findings.

CONCLUSION

Endoscopic Type-I tympanoplasty has a good success rate in terms of both morphology and functionally. Myringosclerosis, contralateral ear status, affected side, gender, and perforation location significantly impact procedural success.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

MR & NB: Conception, study design, drafting the manuscript, approval of the final version to be published.

MT & SB: Data acquisition, data analysis, data interpretation, critical review, approval of the final version to be published.

MZK & SH: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

REFERENCES

1. Cavaliere M, Mottola G, Rondinelli M. Tragal cartilagetymoanoplasty: anatomic and fuctional result in 306 cases. Acta Otolaryngol Ital 2019; 29(1): 27–33. https://doi.org/10.1016/j.bjorl.2018.12.006
2. Dursun E, Terzi S, Demir E, Özgür A, Çelebi Ö, Özergin Z, et al. The evaluation of prognostic factors in endoscopic cartilage tympanoplasty. Eur Arch Otorhinolaryngol 2020; 277(10): 2687-2691. https://doi.org/10.1007/s00405-020-05992-y
3. Pinar E, Sadullahoglu K, Calli C. Evaluation of prognostic factors and middle ear risk index in tympanoplasty. Otolar-yngol Head Neck Surg 2018; 139(3): 386–390. https://doi.org/10.1016/j.otohns.2008.05.623
4. Elnaem A, Modather M, Jaleel AA, Mohamed AN. Evaluation of prognostic factors and middle ear risk index in type 1 tympanoplasty. Egypt J Hosp Med 2021; 83(1): 1569-1574. https://doi.org/10.1007/s00405-010-1473-y
5. Emir H, Ceylan K, Kizilkaya Z. Success is a matter of experience: type 1 tympanoplasty: influencing factors on type 1tympanoplasty. Eur Arch Otorhinolaryngol 2017; 264: 595–599. https://doi.org/10.1007/s00405-006-0240-6
6. Pandey BR, Singh MM. Endoscopic Transcanal Type I Cartilage Tympanoplasty for Anterior Perforation of Tympanic Membrane: A Cross-sectional Study. J Lumbini Med Coll 2022;10(2):9. https://doi.org/10.1007/s12070-022-03320
7. Aggarwal SK, Dev R. Comparative study of tympanoplasty and its outcome in various age groups using the middle ear risk index scale. Indian J Otol 2020; 26(1): 4-8. https://doi.org/10.13201/j.issn.2096-7993.2023.02.003
8. Sevil E, Doblan A. Significance of the middle ear risk index in predicting tympanoplasty success in the elderly. Eur Arch Otorhinolaryngol 2021; 278: 3689-3695. https://doi.org/10.1007/s00405-020-06430-9
9. Gundu P, Kiranmayee B, Kumar D, Ivaturi PB. Evaluating the role of middle ear risk indices in assessing postoperative outcome following tympanoplasty procedure. Bengal J Otolaryngol Head Neck Surg 2021; 29(3): 295-300. https://doi.org/10.1007/s00405-019-05636
10. Mangia LR, Amadeu NT, da Silva M, Patzer LS, de Souza E, Hamerschmidt R. Success rates and predictors of outcomes of type I tympanoplasty performed by residents in a teaching tertiary hospital. J Otol 2023; 18(4): 214-219. https://doi.org/10.1016/j.joto.2023.09.003
11. Dash M, Deshmukh P, Gaurkar SS, Sandbhor A. A Review of the Middle Ear Risk Index as a Prognostic Tool for Outcome in Middle Ear Surgery. Cureus 2022; 14(11): e31038. https://doi.org/10.7759/cureus.31038
12. Özgür A, Dursun E, Erdivanli ÖÇ. Endoscopic cartilage tympanoplasty in chronic otitis media. J Laryngol Otol 2016; 129(11): 1073–1077. https://doi.org/10.1017/S002221511500239X
13. Albera R, Ferrero V, Lacilla M. Tympanic reperforation in myringoplasty: evaluation of prognostic factors. Ann Otol Rhinol Laryngol 2016; 115(1): 875–879. https://doi.org/10.1177/000348940611501202
14. Zhu XH, Zhang YL, Xue RY, Xie MY, Tang Q, Yang H. Predictors of anatomical and functional outcomes following tympanoplasty: a retrospective study of 413 procedures. Laryngoscope Investig Otolaryngol 2021; 6(6): 1421-1428. https://doi.org/10.1002/lio2.689
15. Dursun E, Özgür A, Terzi S. Endoscopic transcanalstapes surgery: our technique and outcomes. Kulak Burun Bogaz Ihtis Derg 2016; 26(1): 201–206. https://doi.org/10.1007/s00405-020-05835-w
16. Özdemir D, Özgür A, AkgülG et al. Outcomes of endoscopic transcanal type 1 cartilage tympanoplasty. Eur Arch Otorhinolaryngol 2019; 276(1): 3295–3299. https://doi.org/10.1007/s00405-019-05636
17. Haci C, Bayram O, Gurbuz G, Barcan Y, Acikalin RM, Yasar H. Investigation of factors affecting pediatric type 1 endoscopic tympanoplasty results and success rates of surgery. Auris Nasus Larynx 2023; 50(6): 848-853. https://doi.org/10.1016/j.anl.2023.03.001

18. Dursun E, Demir E, Terzi S. Endoscopic type 1 cartilage tympanoplasty in children. Int J Pediatr Otorhinolaryngol 2020; 131(1): 109854. https://doi.org/10.1016/j.ijporl.2019.109854
19. Mathri A, Neelamkavi NJ. A Prospective Study to Evaluate Role of Middle Ear Risk Index in Tympanoplasty with Mastoidectomy as a Prognostic Parameter. Ann Otol Neurotol 2022; 5(1): 31-35. https://doi.org/10.3389/fphar.2023.1207141
20. Tan HE, Maria PL, Eikelboom RH. Type I tympanoplasty meta-analysis: a single variable analysis. Otol Neurotol 2016; 37: 838–846. https://doi.org/10.1097/MAO.0000000000001099
21. Jung DJ, Lee HJ, Hong JS, Kim DG, Mun JY, Bae JW, et al. Prediction of hearing outcomes in chronic otitis media patients underwent tympanoplasty using ossiculoplasty outcome parameter staging or middle ear risk indices. Plos one 2021; 16(7): e0252812. https//doi.org/10.1371/journal.pone.0252812
22. Dash M, Chavan A. Predictive Value of Middle Ear Risk Index (Meri) in Surgical Outcome of Tympanoplasty. Ann Rom Soc Cell Biol 2021: 3346-3354. https://doi.org/10.1002/lio2.879