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Research Article

Comparison of the Efficacy of Endoscopic Tympanoplasty and Microscopic Tympanoplasty

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Abstract

Objective of this study is to compare the endoscopic tympanoplasty (ET) and microscopic tympanoplasty (MT) regarding graft uptake, hearing improvement and cost effectiveness. The total number of patients included in the study was 68 full filling inclusion and external criteria. The total number of patients included in the study was 68, among these 50 were males and 18 were females. Mean age was 44 years. Disease was seen in right ear in 43 patients and in the left ear in 35 patients. The main procedure performed was Tympanoplasty Type 1with underlay technique. Patients were divided into two groups, MT (A) and ET (B), each of this was further divided into Tympanoplasty with Cortical Mastoidectomy (A1, B1) and Tympanoplasty without Cortical Mastoidectomy (A2, B2). Among each type, the graft was either taken from Temporalis Fascia (TF); (A1f, A2f, B1f, B2f) or from the tragal cartilage (TC); (A1c, A2c, B1c, B2c). The success rate was determined by average hearing improvement and graft uptake. According to the results, MT with Cortical Mastoidectomy had success rate of 100% and MT without Cortical Mastoidectomy had success rate of 80% (with TF, the success rate is 75% and with TC, it is 100%). ET with Cortical Mastoidectomy had success rate of 100% and ET without Cortical Mastoidectomy had success rate of 85% (with TC). Total number of patients in which tympanoplasty was done with cortical mastoidectomy (all wet ears) was 46. The results were extraordinary and graft uptake was 100%. Total number of patients who underwent tympanoplasty without cortical mastoidectomy, (all dry ears) was 22. Results were only 81.8%. It was found that patients with ET and TF, were more satisfied with the scar as it became invisible in 2 months. The scar was cosmetically unacceptable in patients having undergone cortical mastoidectomy along with either ET or MT with use of TF graft.

Keywords

Tympanoplasty, Cartilage, Microscope, Endoscope

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1. Introduction

Microscopic tympanoplasty (MT) can be performed through postauricular, endaural, and transcanal approaches, has been the usual procedure for repairing perforated tympanic membranes since the 1950s. [1-4]. A postauricular incision increases the field of view of the surgical site and the transcanal approach is used for patients who have a wider ear canal and small tympanic perforations [5, 6]. Thus, most surgeons operate MT through the postauricular approach. MT has a commendable graft take rate (>90%) but this technique requires a detailed preparation, hair shaving, general anesthesia and deep postauricular incision [7, 8].

Since the late 1990s, surgeons have started performing endoscopic tympanoplasty (ET) [7-20]. The field of view is the key difference between MT and ET. The view during microscopic surgery is restricted and depends on the narrowest segment of the ear canal. On the other hand, transcanal endoscopy offers a broader view as it bypasses the narrowest part of the ear canal and even when a 08 endoscope is used [1, 2, 9]. Hence, ET is less invasive than MT as it does not need canalplasty, postauricular incision or general anesthesia [2, 3, 10].

Majority of the relevant studies performed are cohort studies without a comparative study design [1, 3, 11, 12]. For nearly two decades, the comparative efficacy of ET and MT has not been clear. Thus there are grounds for an updated systematic review and meta-analysis of this topic.

In this study, comparison is made the two procedures in the following aspects:

1: The efficacies of endoscopic and microscopic tympanoplasty.

2: Benefits of cortical mastoidectomy with tympanoplasty in wet perforations.

3: Graft uptake; comparing tragal cartilage (TC) with temporalis fascia (TF).

4: Hearing improvement; comparing TF and TC, and MT and ET.

5: Cost effectiveness and cosmetic results.

2. Materials and Methods

This cross sectional study was conducted at PAF hospital Islamabad, during period of 5 years from Dec 2018 to Dec 2023. All patients who fulfil the inclusion criteria were selected and divided into 8 groups. The main procedure was Tympanoplasty Type 1 which was divided into two groups, Microscopic Tympanoplasty (A) and Endoscopic Tympanoplasty (B), each of this group was further divided into Tympanoplasty with Cortical Mastoidectomy (A1, B1) and Tympanoplasty without Cortical Mastoidectomy (A2, B2). Among each type the graft for Tympanoplasty was either taken from Temporalis Fascia (A1f, A2f, B1f, B2f) or from the Tragal Cartilage (A1c, A2c, B1c, B2c).

Inclusion criteria comprised of patients of all ages who had diagnosed tympanic membrane perforations medium-subtotal, dry central perforation or patients having perforations with mild mucoid discharge with no growth on culture sensitivity. Patients having marginal or attic perforations, cholesteatoma formation, uncontrolled diabetes mellitus, ossicular chain disease, revision surgery and uncontrolled infections and where minimum follow-up of less than 6 months was not available; were excluded from the study. Underlay grafting technique was used in in all groups.

Types of outcome measures were tympanic membrane (TM) closure, hearing improvement, rate of canalplasty and cosmetic results. TM closure rate was the primary outcome measure at a minimum follow-up period of 6 months. Graft failures earlier than 6 months were categorized as surgical failures. Audiometric and cosmetic results were the secondary results.

The data was collected and results were analyzed using SPSS Version 22.0. P value less than.05 was considered significant.

3. Results

The total number of patients included in the study was 68, among these 50 were males and 18 were females. Mean age was 44 years. Disease was seen in right ear in 43 patients and in the left ear in 35 patients.

The main procedure performed was Tympanoplasty Type 1 which was divided into two groups, Microscopic Tympanoplasty (A) and Endoscopic Tympanoplasty (B), each of this was further divided into Tympanoplasty with Cortical Mastoidectomy (A1, B1) and Tympanoplasty without Cortical Mastoidectomy (A2, B2). Among each type, the graft for Tympanoplasty was either taken from Temporalis Fascia (A1f, A2f, B1f, B2f) or from the tragal cartilage (A1c, A2c, B1c, B2c). The success rate was determined by average hearing improvement and graft uptake. According to the results, Microscopic Tympanoplasty with Cortical Mastoidectomy had success rate of 100% and Microscopic Tympanoplasty without Cortical Mastoidectomy had success rate of 80% (with Temporalis Fascia, the success rate is 75% and without tragal cartilage, it is 100%). Endoscopic Tympanoplasty with Cortical Mastoidectomy had success rate of 100% and Endoscopic Tympanoplasty without Cortical Mastoidectomy had success rate of 85% (with Tragal Cartilage). Total number of patients in which tympanoplasty was done with cortical mastoidectomy (all wet ears) was 46. The results were extraordinary and graft uptake was 100%. Total number of patients who underwent tympanoplasty without cortical mastoidectomy, (all dry ears) was 22. Results were only 81.8%.

It was found that patients with ET and TF, were more satisfied with the scar as it became invisible in 2 months.

The scar was cosmetically unacceptable in patients having

undergone cortical mastoidectomy along with either ET or MT with use of TF graft. The results were analyzed using SPSS Version 22.0. P value was less than 0.05, considered significant.

Table 1. Showing Pre- operative findings.

Type of procedure	Side-procedure	Type of graft	Age		Gender		Pre-op findings			
			Min	Max	Males	Females	Ear	Side left	Right	Average Hearing loss (dB)
Microscopic Tympanoplasty (36) (A)	With Cortical Mastoidectomy (26) (A1)	Temporalis Fascia (24) (A1f)	15	58	19	05	Wet	13	11	20
		Tragal Cartilage (02) (A1c)	29	29	01	01	Wet	02	00	20
	Without Cortical Mastoidectomy (10) (A2)	Temporalis Fascia (08) (A2f)	19	35	06	02	Dry	05	03	30
		Tragal Cartilage (02) (A2c)	21	21	01	01	Dry	01	01	20
Endoscopic Tympanoplasty (32) (B)	With Cortical Mastoidectomy (20) (B1)	Temporalis Fascia (14) (B1f)	15	64	12	02	Wet	09	05	30
		Tragal Cartilage (06) (B1c)	12	31	05	01	Wet	04	02	40
	Without Cortical Mastoidectomy (12) (B2)	Temporalis Fascia (00) (B2f)								
		Tragal Cartilage (12) (B2c)	30	57	06	06	Dry	10	02	40

Table 2. Showing results of the study.

Type of procedure	Side-procedure	Type of graft	Pre-op findings			Post-op findings			
			Ear	Side left	Right	Hearing loss (dB)	Hearing improvement	Graftuptake	Percentage of success
Microscopic Tympanoplasty (36) (A)	With Cortical Mastoidectomy (26) (A1)	Temporalis Fascia (24) (A1f)	Wet	13	11	20	15	Well	100%
		Tragal Cartilage (02) (A1c)	Wet	02	00	20	20	Well	100%
	Without Cortical Mastoidectomy (10) (A2)	Temporalis Fascia (08) (A2f)	Dry	05	03	30	15	Well (except 02)	75%
		Tragal Cartilage (02) (A2c)	Dry	01	01	20	20	Well	100%
Endoscopic Tympanoplasty (32) (B)	With Cortical Mastoidectomy (20) (B1)	Temporalis Fascia (14) (B1f)	Wet	09	05	30	20	Well	100%
		Tragal Cartilage (06) (B1c)	Wet	04	02	40	30	Well	100%
	Without Cortical	Temporalis Fascia							

Type of procedure	Side-procedure	Type of graft	Pre-op findings			Post-op findings			
			Ear	Side		Hearing loss (dB)	Hearing improvement	Graftuptake	Percentage of success
				left	Right				
	Mastoidectomy (12) (B2)	(00) (B2f)							
		Tragal Cartilage (12) (B2c)	Dry	10	02	40	25	Well (except 02)	85%

4. Discussion

The purpose of tympanoplasty is repair of the tympanic membrane perforation and improvement of hearing loss but other aspects like cost effectiveness, cosmetic results, canalplasty, better surgical view and duration of surgery should also be taken into account. We compared our study with preceding studies in all these matters [1, 2 13, 14].

There was no remarkable difference in the pre- and postoperative air conduction, bone conduction thresholds, and air-bone gap values between the two groups, but a considerable audiological improvement was observed in both groups ($p < 0.05$). With respect to recurrence of tympanic membrane perforation, postoperative otorrhea, and discomfort symptoms, there was no significant difference between the two groups ($p > 0.05$). The duration of surgery and hospitalization period were shorter in the ET group than in the MT group ($p < 0.05$). There were no considerable differences in the cost of surgery between the two groups ($p > 0.05$), but the overall cost was much lower in the ET group than the MT group ($p < 0.05$).

The TM closure rates and hearing results of ET and MT were comparable this finding is consistent with those of previous reports [2, 3, 18, 19]. However, the patients undergoing ET had a decreased canalplasty rate and more preferable cosmetic outcome than those having undergone MT [1, 2, 15-17]. The difference in the TM closure rates between ET and MT was not much. Additionally, this study is unlikely to alter the estimated effect.

The improvements in air-bone gaps for ET and MT were comparable and could be attributed to the similar TM closure rates of both techniques [1, 2, 18, 19]. Nevertheless, the improvement in hearing outcomes is consistent with findings from prior studies [1-3].

The rates of tympanic membrane closure and the outcomes in hearing were similar between endoscopic and microscopic tympanoplasty (85.1% vs. 86.4%, respectively; RR: 0.98; 95% CI: 0.85 to 1.11; I 2 5 0) (mean difference of improvements of air-bone gaps: 22.73; 95% CI: 26.73 to 1.28; I 2 5 80%).

Another study found that microscopic tympanoplasty (MT) was more effective than endoscopic tympanoplasty (ET) in terms of both tympanic membrane (TM) closure and hearing improvement, especially during a minimum follow-up period of 6 months. Tympanic membrane (TM) closure rates of ET ranged from 80% to 100% [7-20], while those of MT ranged from 83% to 100% [1, 3, 20, 21].

The rate of canalplasty in endoscopic tympanoplasty (ET) was notably lower compared to that in microscopic tympanoplasty (MT). Otologic microscopy's surgical view is constrained when encountering a tortuous, stenotic ear canal, or bony overhang [2, 3, 22, 23]. Microscopic otologic surgeons need to elevate the canal skin and remove the bony overhang to visualize the entire annulus ring. In comparison, the endoscopic tympanoplasty (ET) provides a wider view compared to microscopic tympanoplasty (MT), eliminating the need for canalplasty [2, 3, 24]. Similar to the findings of previous studies, in our study canalplasty was not conducted in any case of endoscopic tympanoplasty (ET), whereas in all cases of microscopic tympanoplasty (MT), canalplasty and bone curettage were necessary. Additionally, patients who underwent ET had better cosmetic outcomes compared to those who underwent MT, as ET doesn't necessitate a postauricular incision [25, 26]. Consistent with findings from prior research it was observed in our study that postauricular incisions not only led to postoperative pain but also resulted in auricular deformities and numbness of the ear [2, 3, 6]. Furthermore, the operative time for endoscopic tympanoplasty (ET) was shorter compared to that of microscopic tympanoplasty (MT), with an average difference of 30minutes.

Additionally, patients undergoing ET had an earlier discharge after surgery than those undergoing MT [2, 3]. Our study findings align with those of previous research. Nassif et al. reported that in the endoscopic tympanoplasty (ET) group, 77% of patients were discharged on postoperative day one, whereas in the microscopic tympanoplasty (MT) group, only 13% of patients were discharged on postoperative day one. Additionally, cosmetic outcomes in our study were similar to those reported in prior studies [2, 3]. (In Harugop et al.), at the end of 6 months, 27 of the patients in the MT group, 20% (10/50) rated their cosmetic outcome as poor. In (Lade et al), In the microscopic tympanoplasty (MT) group, 16.7% (5 out of 30) of patients reported their cosmetic outcomes as only

satisfactory due to the presence of incision scars at the 6-month postoperative mark. Conversely, all patients in the endoscopic tympanoplasty (ET) group reported excellent cosmetic results in both studies. A combined analysis indicated that patients undergoing ET achieved more favorable cosmetic outcomes compared to those undergoing MT. (RR, 0.07; 95% CI, 0.01 to 0.48; P <.01, I 2 5 0).

Our study findings regarding hospital stay and cost are consistent with those of previous research, showing that endoscopic tympanoplasty (ET) is associated with shorter hospital stays and lower costs compared to microscopic tympanoplasty (MT) [1, 2].

There were no significant differences observed in the pre- and postoperative air conduction, bone conduction thresholds, or air-bone gap values between the two groups. However, both groups showed significant improvement in audiological outcomes postoperatively ($p < 0.05$). There were no significant differences observed between the groups in terms of recurrence of tympanic membrane perforation, postoperative otorrhea, or discomfort symptoms. ($p > 0.05$). The duration of surgery and hospital stay were shorter in the endoscopic tympanoplasty (ET) group compared to the microscopic tympanoplasty (MT) group. ($p < 0.05$). Hence, there were no significant differences observed in operation costs between the two groups ($p > 0.05$). However, the total cost was significantly lower in the endoscopic tympanoplasty (ET) group compared to the microscopic tympanoplasty (MT) group. ($p < 0.05$). Without cortical mastoidectomy the graft uptake was poor in both microscopic tympanoplasty (MT) and endoscopic tympanoplasty (ET), which aligns with findings from prior studies. In one study, the inclusion of cortical mastoidectomy in type I tympanoplasty did not enhance graft take-up rates or hearing improvement in cases of chronic suppurative otitis media tubotympanic disease. Therefore, cortical mastoidectomy is deemed unnecessary in cases of uncomplicated tympanoplasties [27].

Our findings were consistent with those of a previous study where cortical mastoidectomy combined with tympanoplasty in a wet ear yielded favorable results. In that study, tympanoplasty without mastoidectomy resulted in a graft uptake of 80%, whereas tympanoplasty combined with cortical mastoidectomy resulted in a graft uptake of 95% [28].

5. Conclusion

In our comparative study, tympanic membrane closure rates and hearing improvement was almost similar in the patients having undergone either endoscopic or microscopic tympanoplasty. However, ET has a shorter duration of surgery and a brief hospital stay for the patient. Additionally, the overall cost of the procedure is also less as compared to MT. Furthermore, the patients undergoing endoscopic tympanoplasty have a decreased canalplasty rate and more preferable cosmetic outcome than those having undergone microscopic tympanoplasty. Cortical mastoidectomy is needed in cases of complicated tympanoplasties and wet ears.

Hence, ET is a safe, effective, and economical surgical procedure.

Author Contributions

Tallat Najeeb: Conceptualization, Data curation, Formal Analysis, Investigation, Project administration, Supervision

Nisa Siddiqui: Project administration, Validation, Visualization, Writing – original draft, Writing – review & editing

Arshia Bilal: Data curation, Formal Analysis, Methodology, Software

Saleem: Data curation, Funding acquisition, Resources, Validation

Muhammad Aazam Khan: Data curation, Formal Analysis, Investigation, Methodology, Resources

Abdul Hameed Bhatti: Data curation, Formal Analysis, Funding acquisition, Investigation, Supervision

Conflicts of Interest

The authors declare no conflicts of interest.

References

[1] Chih-Chieh Tseng MD, MPH, Ming-Tang Lai MD, PhD, Chia-Che Wu MD, PhD, Sheng-Po Yuan MD, Yi-Fang Ding MD. Comparison of the efficacy of endoscopic tympanoplasty and microscopic tympanoplasty: A systematic review and meta-analysis: The Laryngoscope, November 2016 https://doi.org/10.1002/lary.26379Citations:88

[2] István Pap, István Tóth, Noémi Gede, Péter Hegyi, Zsolt Szakács, Laryngoscope, 127: 1890–1896, 2017.

[3] S. Gulsen et al. Comparison of endoscopic transcanal and microscopic approach in Type 1 tympanoplasty Braz J Otorhinolaryngol (2019).

[4] C. P. Yiannakis et al. Preliminary outcomes of endoscopic middle-ear surgery in 103 cases: a UK experience. J Laryngol Otol (2018).

[5] Dipesh Shakya, Arun KC, Ajit Nepal. A Comparative Study of Endoscopic versus Microscopic Cartilage Type I Tympanoplasty. Indian Journal of Otolaryngology and Head and Neck Surgery. 2023.

[6] Dipesh Shakya, Arun KC, Thieme Revinter Publicações Ltda Rio de Janeiro, Brazil. A Comparative Study of Endoscopic versus Microscopic Cartilage Type I Tympanoplasty. 2023.

[7] Dong Jo Kim a, Hyun Min Lee a, Sung-Won Choi b, Se-Joon. Comparative study of endoscopic and microscopic tympanoplasty performed by a single experienced surgeon. American Journal of Otolaryngology. Volume 42, Issue 1, January–February 2021, 102788.

[8] Chih-Chieh Tseng MD, MPH, Ming-Tang Lai MD, PhD, Chia-Che Wu MD, PhD, Sheng-Po Yuan MD, Yi-Fang Ding MD. Comparison of the efficacy of endoscopic tympanoplasty and microscopic tympanoplasty: A systematic review and meta-analysis. Volume127, Issue8, August 2017. Pages 1890-1896.

[9] Hardman J, Muzaffar J, Nankivell P, Coulson C. Tympanoplasty for chronic tympanic membrane perforation in children: systematic review and meta-analysis. Otol Neurotol 2015; 36: 796–804.

[10] Raj A, Meher R. Endoscopic transcanal myringoplasty-A study. Indian J Otolaryngol Head Neck Surg 2001; 53: 47–49.

[11] Usami S, Iijima N, Fujita S, Takumi Y. Endoscopic-assisted myringoplasty. ORL J Otorhinolaryngol Relat Spec 2001; 63: 287–290.

[12] Tarabichi M, Ayache S, Nogueira JF, Al Qahtani M, Pothier DD. Endoscopic management of chronic otitis media and tympanoplasty. Otolaryngol Clin North Am 2013; 46: 155–163.

[13] Ayache S. Cartilaginous myringoplasty: the endoscopic transcanal procedure. Eur Arch Otorhinolaryngol 2013; 270: 853–860.

[14] Furukawa T, Watanabe T, Ito T, Kubota T, Kakehata S. Feasibility and advantages of transcanal endoscopic myringoplasty. Otol Neurotol 2014; 35: e140–e145.

[15] Migirov L, Wolf M. Transcanal microscope-assisted endoscopic myringoplasty in children. BMC pediatr 2015; 15: 32.

[16] Awad OG, Hamid KA. Endoscopic type 1 tympanoplasty in pediatric patients using tragal cartilage. JAMA Otolaryngol Head Neck Surg 2015; 141: 532–538.

[17] Kozin ED, Gulati S, Kaplan AB, et al. Systematic review of outcomes following observational and operative endoscopic middle ear surgery. Laryngoscope 2015; 125: 1205–1214.

[18] Nayeon Choi, Yangseop Noh, Woori Park, Jung Joo Lee, Sunhyun Yook, Ji Eun Choi, et al. Comparison of Endoscopic Tympanoplasty to Microscopic Tympanoplasty. Clin Exp Otorhinolaryngol. v. 10(1); 2017 Mar PMC5327595.

[19] Nambiar RV et al. Int J Otorhinolaryngol Head Neck Surg. 2019 Mar; 5(2): 314-318 International Journal of Otorhinolaryngology and Head and Neck Surgery | March-April 2019 | Vol 5.

[20] A. Sen, K. Özdamar. Which graft should be used for the pediatric transcanal endoscopic type 1 tympanoplasty? A comparative clinical study. Int J Pediatr Otorhinolaryngol, 121 (2019), pp. 76-80.

[21] S. Doğan, C. Bayraktar. Endoscopic tympanoplasty: learning curve for a surgeon already trained in microscopic tympanoplasty. Eur Arch Otorhinolaryngol, 274 (2017), pp. 1853-1858.

[22] T. Y. Huang, K. Y. Ho, L. F. Wang, C. Y. Chien, H. M. Wang. A comparative study of endoscopic and microscopic approach type 1 tympanoplasty for simple chronic otitis media. J Int Adv Otol, 12 (2016), pp. 28-31.

[23] M. M. Khan, S. R. Parab. Endoscopic cartilage tympanoplasty: a two-handed technique using anendoscope holder. Laryngoscope, 126 (2016), pp. 1893-1898.

[24] S. Mohanty, V. Manimaran, P. Umamaheswaran, S. Jeyabalakrishnan, S. Chelladurai. Endoscopic cartilage versus temporalis fascia grafting for anterior quadrant tympanic perforations — a prospective study in a tertiary care hospital. Auris Nasus Larynx, 45 (2018), pp. 936-942.

[25] Kadir Özdamara, Alper Senb. a Private Lotus Hospital, Department of Otorhinolaryngology, Head and Neck Surgery, Şanlıurfa, Turkey. https://doi.org/10.1016/j.bjorl.2019.06.014

[26] Nippon Jibiinkoka Gakkai Kaiho. Comparison of tragal perichondrium and COOK artificial material in endoscopic type 1 tympanoplasty, Laparoscopic, Endoscopic, and Robotic Surgery. 2023.

[27] Sagesh, Madayambath. Evaluation of outcomes of tympanoplasties with and without cortical mastoidectomy. Indian Journal of Otology; Oct-Dec 2023 - Volume 29 - Issue 4.

[28] Anjana Agrawal and Puneet Bhargava. Comparative Evaluation of Tympanoplasty with or Without Mastoidectomy in Treatment of Chronic Suppurative Otitis Media Tubotympanic Type. Indian J Otolaryngol Head Neck Surg. 2017 Jun; 69(2): 172–175. Published online 2017 Jan 11. https://doi.org/ 10.1007/s12070-016-1038-5