TYMPANOPLASTY TYPE-1: DIFFERENT APPROACHES AND THEIR SURGICAL OUTCOMES

Fazal-I-Wahid, Abdul Manan*, Muhammad Saleem**, Bakhht Zada, Habib-Ur-Rehman, Naseem Ul Haq, Muhammad Javaid

Teaching Institute, Lady Reading Hospital, Peshawar Pakistan, *Bolan Medical College, Quetta Pakistan,
**KMU Institute of Medical and Dental Sciences, Kohat Pakistan

ABSTRACT

Objective: To calculate the surgical outcomes of different approaches of tympanoplasty type 1 in terms of air bone gap closure, wound healing, and postoperative pain.

Study Design: Prospective cross-sectional study.

Place and Duration of Study: Department of ENT, Head and Neck Surgery, Medical Teaching Institute (MTI), Lady Reading Hospital (LRH), Peshawar, Pakistan from Jun 2018 to May 2020.

Methodology: Size of sample was 75 patients divided into three groups. Consent was obtained from all the patients included in study. After proper evaluation and relevant investigation pre- and post-operative PTA was performed. Tympanoplasty type-1 was performed by the same surgeon by the three approaches following established otological surgical protocol. Collected data was entered in SPSS-25 for analysis.

Results: All 75 patients were divided into three equal groups. Male were 55 (73.3%), females were 20 (26.7%). Male: female ratio was 2.7:1. Majority of patients presented in 2nd and 3rd decades of life 31 (41.33%) and 28 (37.33%) respectively. Pre-operative mean ± SD, ABG in groups A, B and C were 37.60 ± 11.28 dB, 37 ± 9.68 dB and 31.80 ± 12.40 dB, respectively. No significant difference was found amongst the three groups regarding pre-operative and post-operative ABG (p=0.85 and p=0.4), respectively. Mean ± SD, wound healing time in Groups A, B and C were 1.00 ± 0.00, 1.80 ± 0.40 and 1.76 ± 0.43 respectively with p=0.0001 and similarly postoperative pain with p=0.001. The wound healing time and post-operative was statistically better (p<0.05) in group A (Transmeatal approach) than other groups.

Conclusion: Although wound healing time and post-operative pain were significantly minimum in transmeatal approach for tympanoplasty, but overall success rate of tympanoplasty was not statistically significant among these three approaches.

Keywords: Tympanic membrane, Perforation, Surgical outcome, Tympanoplasty.

How to Cite This Article: Wahid F, Manan A, Saleem M, Zada B, Rehman HU, Haq NU, Javaid M. Tympanoplasty Type-1: Different Approaches and Their Surgical Outcomes. Pak Armed Forces Med J 2021; 71(Suppl-3): S495-S499. Doi: https://doi.org/10.51253/pafmj.v71i1l.7938

INTRODUCTION

Chronic Suppurative Otitis Media (CSOM) is a common otological problem encountered by otolaryngologist worldwide. Its prevalence in developing countries is 2-17%. The risk factor for CSOM includes poor hygiene, overcrowded families, persistent middle ear infection and underlying sino-nasal pathologies.1 Clinical presentations of CSOM include aural discharge, decreased hearing and pain in ears. CSOM can be treated medically with appropriate medications and ensuring proper hygiene. In case acuteotitis media is not addressed properly it may convert into CSOM, where it can be treated surgically.2 Ear drum perforation can be closed surgically called myringoplasty if themiddle ear is also explored with, it is called tympanoplasty. Different materials are used for closure of the tympanic membrane defect. Historically, myringoplasty was started by Berthod in 1878 using thick skin graft. Wullstein and Zollner also studied split skin graft. The commonly used grafting materials include the temporalis fascia, tragal and Conchal cartilage and vein grafts.3 Various approaches are used for repair of TM. The commonest approaches are transmeatal, endaural, post-aural and endoscopic. The feasibility of these approaches depends on site, size of TM perforation, width and anatomical orientation of the external auditory canal and surgeon preference. Trans-meatal approach is somewhat minimally invasive technique that can be used where meatus is wider and TM perforation is small.4 In case of posteriorly located TM perforation end-aural approach can be used with limited incision of canal wall. However, post-aural incision is commonly used for anteriorly located or large TM perforation. Each of these approaches encompases advantages and disadvantages. Any surgical procedure performed for repair of TM perforation can be accompanied by complications. These complications may affect both short and long terms results of myringoplasty and tympanoplasty. Some of the complications include infection, tinnitus, dizziness, failure to take graft, and sensorineural hearing loss.1,3,5

Correspondence: Dr Fazal-I-Wahid, Department of ENT, Medical Teaching Institute, Lady Reading Hospital, Peshawar Pakistan
This study aims to determine surgical outcome of tympanoplasty type 1 in terms of acoustic improvement, wound healing, postoperative pain and graft success. This study is never conducted in this institute before, so it may help devise a protocol for repair of TM perforation in the future, focusing on a shorter duration of surgery and maximum success of the procedure.

**METHODOLOGY**

This prospective cross-sectional study was carried out at the Department of ENT, Head and Neck Surgery, Medical Teaching Institute (MTI), Lady Reading Hospital (LRH), Peshawar, Pakistan from June 2018-May 2020. A sample of 75 was computed by G-Power calculator taking α 0.05 and β 0.05. These patients were divided into three groups according to approach to the middle ear with unequal number of 25 patients in each group. In group A Transmeatal approach was performed, in group B end-aural while in group C post-aural approach was adopted. Non-probability (Convenient) sampling method was used. Informed consent was obtained from all the participants of the study.

**Inclusion Criteria:** Male and female patients aged from 15-50 years, with dry tubotympanic type otitis media, having conductive type hearing impairment with Air-Bone Gap not more than 20 dB were included.

**Exclusion Criteria:** Patients with active or attico-antral type and not willing for study were excluded.

After admission each patient was properly assessed by taking history and examination. Relevant investigations were performed. Autoscopic examination was performed and TM perforation was established. Pre-operative and post-operative pure tone audiometry (PTA) was performed by the senior most audiologist. The PTA machine used was Amplaid 455 made in Italy. Frequencies checked in PTA were 500, 1000, 2000 and 4000 kHz. Air bone gap on PTA was computed before and after surgery. Success of the surgery was denoted by reduction in post-operative air bone gap and closure of the TM defect. Post-operative pain and wound healing was calculated for all the three groups. Graf materials used were temporalis fascia and tragal cartilage. Every patient was called for follow up to look for post-operative pain, wound healing, graft success and ABG closure.

Data were collected on well-designed proforma. These data were entered into SPSS-25 and analyzed. For qualitative data frequency and parentage was calculated while for quantitative data Mean ± SD were calculated. Confidence interval was 95% and p<0.05 was taken significant.

**Procedure**

Tympanoplasty type 1 was performed by author himself, keeping in view universally accepted protocol for ear surgery. After intubation with general anesthesia of the patient in supine position, local anesthesia with local anesthetic of 2% xylocaine mixed in 1: 8000 epinephrines was injected into the meatus in all four quadrants and in tragus. The area of interested was properly scrubbed with pyodine solution and then draped.

![Figure-1: Endaural approach for right ear tympanoplasty type 1.](image1)

![Figure-2: Postaural approach for right ear tympanoplasty type 1.](image2)
recovered from anesthesia and shifted to ward for post-operative care. Patients were put on antibiotics, analgesics antihistaminic and vasoconstrictor nasal spray to keep eustachian tube patent. Patients were instructed to avoid straining, forceful nasal blowing and coughing. Every patient was called for follow up visit. On follow up visit, autoscopy, endoscopy and PTA were performed and findings were noted.

![Figure-3: Tragal cartilage graft harvested.](image)

![Figure-4: Left TM large central perforation.](image)

![Figure-5: left TM graft taken.](image)

**RESULTS**

All patients included counted 75, who were divided into three equal groups. Male were 55 (73.3%), females were 20 (26.7%). Male: female ratio was 2.7:1. Majority of patients presented in 2nd and 3rd decades of life 31 (41.33%) and 28 (37.33%), respectively. There were 22 (29.33%) males and 9 (12%) females in age group 16-25 years, while in age group 26-35 years males were 20 (6.67) and females were 8 (10.67%) (Table-I). Pre-operative mean ± SD, ABG in groups A, B and C were 37.60 ± 11.28 dB, 37 ± 9.68 dB and 31.80 ± 12.40 dB, respectively. No significant difference was found amongst the three groups regarding pre-operative and post-operative ABG (p=0.85 and p=0.4), respectively. Mean ± SD, wound healing time in groups A, B and C were 1.00 ± 0.00, 1.80 ± 0.40 and 1.76 ± 0.43 respectively with p=0.0001 and similarly postoperative pain with p=0.001. The wound healing time and post-operative was statistically better (p<0.05) in group A (Transmeatal approach) than other groups (Table-II).

### Table-I: Demographics of patients (n=75).

| Gender   | n (%)     |
|----------|-----------|
| Male     | 55 (73.3) |
| Female   | 20 (26.7) |

| Age (years) | Mean ± SD | n (%) |
|-------------|-----------|-------|
| 15          |           | 6     |
| 16-25       |           | 22    |
| 26-35       |           | 20    |
| 36-45       |           | 3     |
| >46         |           | 4     |
| Total       |           | 55    |

### Table-II: Comparison between pre-operative and post-operative air bone gap, wound healing time and post-operative pain among groups A, B & C (transmeatal, endaural & postaural).

|                | Mean | SD  | Std. Error | p-value |
|----------------|------|-----|------------|---------|
| Pre-operative ABG |      |     |            |         |
| Group A         | 37.60| 11.28| 2.25       | 0.85    |
| Group B         | 37.00| 9.68 | 1.93       |         |
| Group C         | 31.80| 12.40| 2.48       |         |
| Post-operative ABG |      |     |            |         |
| Group A         | 8.88 | 6.09 | 1.21       | 0.41    |
| Group B         | 7.40 | 5.51 | 1.10       |         |
| Group C         | 8.48 | 7.28 | 1.45       |         |
| Wound healing time |      |     |            |         |
| Group A         | 1.00 | 0.00 | 0.00       | 0.0001  |
| Group B         | 1.80 | 0.40 | 0.08       |         |
| Group C         | 1.76 | 0.43 | 0.08       |         |
| Post-operative pain |     |     |            |         |
| Group A         | 1.32 | 0.47 | 0.09       | 0.001   |
| Group B         | 1.76 | 0.43 | 0.08       |         |
| Group C         | 1.76 | 0.43 | 0.08       |         |

*ABG: Air Baig Gap*

The maximum success rate of tympanoplasty type 1 was 97.33% in patients where post aural approach was adopted (Table-III).
Table-III: Success rate of tympanoplasty type I in groups A, B and C (transcanal, endaural and postaural).

| Graft Taken | Graft Not taken | Success Rate | \( p \)-value |
|-------------|-----------------|--------------|---------------|
| Group A     | 72 (96%)        | 96%          | 0.653         |
| Group A     | 70 (93.33%)     | 93.33%       |               |
| Group A     | 73 (97.33%)     | 97.33%       |               |

**DISCUSSION**

Total patients studied in this study were 75, who were divided into equal groups to look for surgical outcomes of all three approaches to middle ear. This study is of unique nature, as in this study, all three approaches have been studied, which is contrary to other studies where only two approaches have been studied. Although in this study male were dominant with 73%, that is contrary to study of Sharma where females were common (61%). However majority of studies showed male predominance, probably due to easy reach of men to seek healthcare. We observed that the most of cases presented in second and third decades 31(41.33%) and 28 (37.33%) respectively, which is in consistence with the study of Sharma where maximum cases found in 2nd and 3rd decades 44 (48.89%) and 26 (28.89%), respectively. Similarly, Alam’s study where patients presented in 2nd and 3rd decades of life were 61.33% and 22.67% respectively.6 The reason for this may be that 2nd and 3rd decades is the most active stage of life, and any person in this age is more cautious regarding his health issue and gets early access to treating physician. Myringoplasty is performed for the reconstruction of TM perforation. In this study, anterio-inferior quadrant perforation was the commonest finding 44 (60%), while posterio-superior quadrant perforation was the least 5 (6%), that is contradictory to the study of Singh, where posterio-inferior compartment was commonly involved 11 (36.7%).8 Pars tensa irrespective of superior or inferior component is the area of TM membrane, which is commonly involved in TM perforation because it is directly affected by pressure changes both internally through eustachian tube and externally through external auditory canal. Mean pre-operative ABG in patients underwent transeanal, endaural and postaural approaches for tympanoplasty was 37.60 ± 11.28 dB, 37 ± 9.68 dB and 31.80 ± 12.40 dB, respectively, having no significant difference among these groups \( p>0.05 \). Khafagy et al conducted a comparative study on endoscopic and microscopic use and found that preoperative mean ± SD ABG was 19.23 ± 5.67 dB and 20.26 ± 5.31 dB. There was no significant difference between these two groups \( p>0.05 \).9 Similarly, Salam also reported that preoperative mean ± SD average PTA in patients operated with microscope (group A) and those operated with an endoscope (group B) for tympanoplasty were 31.15 ± 4.9 dB and 30.89 ± 5.03 dB, respectively, while pre-operative mean ± SD ABG in groups A and B were 18.14 ± 4.77 dB and 19.81 ± 4.23 dB, respectively. Thus no significant difference was found between the groups in term of PTA and ABG \( p=0.869 \) and \( p=0.249 \).10 Jain also studied the outcome of microscopic versus endoscopic use and found that the mean ± SD preoperative air conduction was 36.42 ± 3.87 and 34.33 ± 6.37 respectively in both groups with no statistical difference between the two groups \( p=0.18 \).11 We noted that mean post-operative ABG in patients underwent transeanal, endaural and postaural approaches for tympanoplasty was 8.88 ± 6.09 dB, 7.40 ± 5.51 dB and 8.48 ± 7.28 dB, respectively, having no statistically significant difference among these groups \( p>0.05 \). However, mean wound healing time and postoperative pain was minimum in transmeatal group \( p<0.05 \) in current study. Likely in the Khafagy study using endoscopic and microscopic approaches the mean ± SD post-operative ABG was 11.67 ± 5.31 dB and 13.39 ± 7.23 dB, respectively. Thus, there was nonsignificant difference between the two groups \( p>0.05 \).2 Similarly, Jain also pointed out that for both microscopic and endoscopic use mean ± SD post-operative ABG was 29.42 ± 8.20 dB and 26.11 ± 5.14 dB, with no significant difference between the microscopic and endoscopic approaches \( p=0.13 \).11 Salam’s study finding also supports our findings as he computed that at 3 months postoperatively mean ± SD PTA were 17.14 ± 5.34 dB and 16.47 ± 4.49 dB for groups A and B. However post-operative mean ± SD ABG were 8.47 ± 5.04 dB and 8.65 ± 3.42 dB, and no significant difference was observed \( p>0.05 \), and post-operatively mean ± SD ABG was 8.47 ± 5.04 dB and 8.65 ± 3.42 dB, respectively, for both groups with no significant difference \( p=0.89 \) between the two groups.10 The success rate for transcanal, endaural and postaural approach in this study was 96%, 93.33% and 97.33%, respectively. There was nonsignificant difference between the three approaches \( p>0.05 \). Khafagy found that overall success rate of the microscopic and endoscopic approaches was 73.3% and 80%, respectively, and there was insignificant difference between the two approaches \( p>0.05 \).9 Chidlow conducted a study on practice patterns in myringoplasty surgery among Australian surgeons and found that overall success rate varied from 70-90%.12 The success rate in the Sharma study for permeatal, endaural and postaural approaches was 73.33%, 83.33%, and 86.66%, respe-
ctively. However, statistical analysis showed no significant difference in the success rate between the three approaches (p>0.10).6

It is revealed from literature that the success rate of surgical intervention for TM reconstruction is not merely associated with the approaches, rather diameter and location of ear drum rupture, external auditory canal width and surgeon preference also play important role.13-18

ACKNOWLEDGMENT

We acknowledge the work of Syed Hamid Statesian in helping statistical analysis of my data.

LIMITATION OF STUDY

Limitation of this study is a small sample size with shorter follow-up, so other studies with large sample size and long follow up may be recommended to look for long-term results.

CONCLUSION

Tympanoplasty type 1 is the ideal surgical procedure performed for closure of the tympanic membrane perforation and dealing with middle ear pathology. The choice of any of the three approaches depends on the diameter and site of the ear drum perforation, external auditory canal width and surgeon preference. Although wound healing and post-operative pain were significantly minimum in transmeatal approach for tympanoplasty, but overall success rate of tympanoplasty was not statistically significant among these three approaches.

Conflict of Interest: None.

Authors’ Contribution

FW: Conception of work, writing of introduction, AM: Literature Review, MS: Critical revision, BZ: Data Collection, HUR: Data Analysis, NUH: Writing of discussion, MJ: Writing of results

REFERENCES

1. Umamaheswaran P, Mohanty S, Manimaran V, Jayagandhi S, Jayabalakrishnan SP. A comparative study of sequential vs. simultaneous type I tympanoplasty in patients with bilateral chronic otitis media-Mucosal type. J Otol 2020; 15(1): 59-61.
2. Huang TY, Ho KY, Wang LF, Chien CY. A Comparative study of endoscopic and microscopic approach type I tympanoplasty for simple chronic otitis media. J Int Adv Otol 2016; 12(1): 28-31.
3. Patel J, Aiyer RG, Gajjar Y, Gupta R, Raval J, Suthar PP. Endoscopic tympanoplasty vs microscopic tympanoplasty in tubotympanic csmx: a comparative study of 44 cases. Int J Res Med Sci 2015; 3(8): 1953-1957.
4. Shakya D, Arun KC, Nepal A. A comparative study of endoscopic versus microscopic cartilage type I tympanoplasty. Int Arch Otorhinolaryngol 2020; 24(1): 80-85.
5. Ramalingam V, Kamindan K, Murugan RK, Rajeswari V. A comparative study on outcome of Type I Tympanoplasty using sliced 1-mm Conchal cartilage and full-thickness Conchal cartilage for grafting. Egypt J Otolaryngol 2020; 36(2): 5-8.
6. Sharma DK, Singh S, Sohal BS, Singh B. Prospective study of myringoplasty using different approaches. Ind J Otolaryngol Head Neck Surg 2009; 61(2): 297–300.
7. Alam KM, Alam MM, Hossain MD, Karim MA, Hossain MA, Sarker MZ. Comparative study of different approaches of myringoplasty in chronic otitis media. Bang J Otorhinolaryngol 2016; 22(1): 21-25.
8. Singh MN, Hamam PD, Lyngdoh NC, Priyokumar OS. Evaluation of hearing status in pre and postoperative endoscopic type I tympanoplasty and its influencing factors. J Med Soc 2014; 28(2): 166-170.
9. Khafagy MSE, El-Habashy HSE, El-Hamshary MTME. Comparative study between endoscopic and microscopic tympanoplasty through transcanal approach. Al-Azhar Med J 2020; 49(1): 83-90.
10. Salam RTA, Nambiar SS, Anusha V. Comparative study of the outcomes of tympanoplasty by the conventional microscopic and endoscopic techniques. Int J Sci Stud 2018; 6(9): 81-86.
11. Jain S, Kumar D, Singh SP, Upadhyay VP, Dubey AK, Singh HN. Comparative study of advantages and disadvantages of endoscopic versus conventional myringoplasty - a prospective study. Int J Otorhinolaryngol Clin 2018; 10(3): 81-86.
12. Chidlow C, Prunty S, Hinton-Bayre A, Shubhraj S, Renton J, Kuthubutheen J. Practice patterns in myringoplasty surgery among Australian surgeons. Aust J Otolaryngol 2020; 3(2): 28-32.
13. Lee SY, Lee DY, Seo Y, Kim YH. Can endoscopic tympanoplasty be a good alternative to microscopic tympanoplasty? a systematic review and meta-analysis. Clin Exper Otorhinolaryngol 2019; 12(2): 145-155.
14. Aggarwal P, Sohal BS, Goyal JP. Comparative study of endoscopic tympanoplasty and conventional tympanoplasty. Int J Otorhinolaryngol Head Neck Surg 2020; 6(2): 1804-1810.
15. Aggarwal SK, Dev R. Comparative study of tympanoplasty and its outcome in various age groups using the middle ear risk index scale. Ind J Otol 2020; 26(1): 4-8.
16. Ojha T, Kansara A, Yogi V. Comparative study of cartilage shield tympanoplasty vs temporalis fascia graft tympanoplasty: a retrospective study. J Mahatma Gandhi Univ Med Sci Tech 2019; 4(5): 71-73.
17. Awan Z, Bashir H, Hussain A. Myringoplasty: A comparative study of different graft materials and various surgical techniques. Ann Pak Inst Med Sci 2008; 4(4): 209-211.
18. Sridhara Narayanan D, Vijay Kumar B, Hari PM. Comparative study of graft materials used in myringoplasty. J Pharm Sci Res 2016; 8(12): 1339-1342.