

Hearing Improvement after Type-1 Tympanoplasty in Chronic Otitis Media

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ABSTRACT

Background: Chronic otitis media means chronic inflammation of mucosa of middle ear cleft which is defined by continuous or intermittent ear discharge through a tympanic membrane perforation. COM is now appearing as a significant problem causing hearing loss in our country. The occurrence of COM is overwhelmingly high in the developing countries like Bangladesh due to poor living condition, high rate of population, less knowledge of personal hygiene, malnourishment, tobacco intake, inadequate health education etc. COM can be treated with Tympanoplasty.

Objective: To assess the hearing improvement after type-1 tympanoplasty.

Method: The study was conducted over 35 patients by prospective observational method who were attending the ENT OPD from March 2022 to February 2024 irrespective of age and sex who went through tympanoplasty (Type-1). Preoperative and postoperative audiometry was done in all patients to assess the hearing improvement. Post-operative hearing assessment was done at 3 and 6 month after surgery.

Results: In this study, majority were in between 21 to 30 years. The female and male ratio in this study is 1.3:1. Among all patients 8 (22.86%) presented with anterior perforations, 16 (45.71%) presented with central perforations and 11 (31.43%) presented with posterior perforations. While majority of cases 16 (45.71%) were presented with small perforations, 9 (25.71%) presented with medium perforations and 10 (28.57%) presented with large perforations. After type-1 tympanoplasty 25 (71.43%) patients gained their normal hearing ability, 9 (25.71%) improved up to mild degree range and only 1 (2.86%) patient showed no significant improvement. In case of small perforations, the mean AB gap was 33.32 dB, in medium perforation AB gap was 38.04 dB and in large perforation AB gap was 49.44 dB before surgery. The AB gap after surgery in case of tiny perforations was 9.89 dB, in case of moderate perforations AB gap was 18.34 dB Indicate significant hearing improvement and in case of large perforations the mean AB gap was 48.89 dB that indicates less hearing improvement.

Conclusion: There was significant hearing improvement after type-1 tympanoplasty in case of small perforation (P value <.001) but in case of large perforation there was no satisfactory improvement (P value = 0.701) in hearing status. Thus, size of perforation have significant impact in hearing improvement after type-1 tympanoplasty according to this study.

Keywords: COM, Tympanoplasty, Hearing improvement, AB gap.

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INTRODUCTION

COM means chronic inflammation of mucosa middle ear cleft which is defined by continuous ear discharge of tympanic membrane perforation. As it's a chronic infection it leads to gradual and severe destruction of middle ear structures which clinically manifested by ear discharge and deafness. In COM it gradually causes irreversible mucosal damages, formation of granulation tissue, retraction pockets that gradually forms cholesteatoma, destruction of the ear ossicles, tympanosclerosis. CSOM can be classified into two primary categories. A. Tubotympanic which is safe/mucosal variety B. Atticoantral which is unsafe/squamosal variety. Further classification includes accordingly into inactive mucosal, active mucosal and active squamosal, Retracted tympanic membrane and Healed tympanic membrane. Now a days deafness is overwhelmed worldwide. COM is now appearing as a significant problem causing hearing loss in our country too. Hearing loss is considered as a concealed mass because it is overlooked and underestimated easily as it is not as dreadful as other hearing condition. Because of it's insidious onset, majority of patients presents at a very advanced stage. The South East Asia is suffering from this kind of problem mostly.¹ Various studies reveals that the prevalence of COM are higher in rural areas and most patients comes with advanced stages because of their limited knowledge, poor awareness and inadequate health care services. Approximately 80% people with hearing impairment from the lower economic countries and in there proper medical services are below average. The incidences of COM is particularly pronounced in the developing countries. The poor living standard and living conditions, malnutrition, limitation of individual hygiene, overcrowding, tobacco intake, absence of health consciousness, bottle feeding with supine posture, recurrent viral infection of

upper respiratory tract and absence of healthcare assessment; all are the important causes for CSOM in Bangladesh.^{2,3} Hearing loss is one of the most common symptoms of COM which is usually conductive type of hearing loss but sensory neural loss may also occur in some cases. Tympanic membrane perforation hampers the sound wave transmission to the middle ear as perforation shorten the surface area of the tympanic membrane where effective sound transmission can occur. The pressure difference of the tympanic membrane also decreased as the mechanical coupling between the available intact portions of the TM and the malleus depending on their position and thus hearing loss occurs.⁴ So, the patient experiences more hearing loss with large size perforation. The position of perforation, ossicular status, granulation tissue availability, mucous adhesion, adhesion of mucous and eustachian tube function are important for assessment of the hearing status.

The volume of air space which lies on the middle ear plays a critical role that describes the status of hearing loss in perforation. The smaller middle ear volumes the lower the sound pressure differences, that results in exacerbating the condition. COM can be treated by both in conservative and surgical method. Small perforations usually heal on their own with time but surgery is required when a perforation becomes larger. COM with large non healing perforations are treated surgically. The surgical procedure is called tympanoplasty. The goal of tympanoplasty is to restore normal hearing and to overcome deafness as far as possible.

The concept of tympanoplasty was first introduced by Berthold in 1878, after that the methods of tympanoplasty was further developed by Wullstein. Tympanoplasty is the preferred surgical procedure for restoring hearing and addressing chronic infections.

Wullstein categorized Tympanoplasty into 5 exceptional types, initially defined in 1956.⁵

Type 1 Tympanoplasty is done in patients where there are the presence of all three bony parts of inner ear which are functioning. Thus, OCR is not needed. There are also type 2, type 3 and type 4 tympanoplasty which are applied in more severe consequences of tympanoplasty.

Usually different types of graft materials are used but Temporalis fascia is commonly used for reconstruction of TM in tympanoplas

Evaluate the hearing progression in patients after tympanoplasty(type 1) by comparing the mean AB gap preoperatively and then postoperatively was the main objective of this study.

MATERIALS AND METHODS

This was conducted by the prospective observational study in the ENT department of CMH Rangpur from Mar 2022 to Feb 2024 over 35 patients irrespective of age and sex. Accidental sampling was done. Patients attending the ENT OPD with COM over a period of 2 years were selected for this study and underwent Type 1 tympanoplasty. All the patients were assessed based on history, thorough clinical examinations (otoscopy, Rhinoscopy) and audiological examinations. To assess the degree of hearing loss and to calculate the AB gap all the patients underwent preoperative and postoperative Pure Tone Audiometry as per WHO classification. Before surgery every patients went through routine investigations along with microscopic examination. The purpose was to evaluate the site and size of perforation, tympanosclerosis had occurred or not, presence or absence of any inflammatory mucosa in the middle ear, and to assess the middle ear structures. X-ray mastoid in Schuler's view was also done for every

patients. CT scan was also done in patients with suspected retraction pockets. All patients undergone the same operation method. The surgery was performed under local or general anaesthesia. The operation was done using a microscope via post-auricular approach through underlay technique using "temporalis fascia" as a graft material. Follow up of all patients was performed accordingly after 1 week, 6 weeks, 3 months and 6 months. 1 week after the surgery the packing given was removed and the wound was evaluated. The next 6 weeks, three months and 6 months regular follow up of the patients were done routinely. For the selection of patients regarding this study we used some inclusion and exclusion criteria's as followings:

Inclusion criterias:

- Patients having inactive COM.
- Dry perforations.
- Patients having conductive type of hearing loss.

Exclusion criterias:

- Patients having sensory neural type of hearing loss which was assessed by PTA.
- CSOM patients with cholesteatoma and granulation tissue in the middle ear.
- Patients with erosion of ossicles.
- Patients with immunodeficiency and sever systemic disease such as DM.

Statistical analysis

The data that was considered and placed in a Microsoft Excel sheet and then transferred to the data editor of SPSS (version 30.0). Variables which was continuous were tabled as Mean±SD and by percentages ,categorical variables were tabled. One sample T test was applied for comparing .Moreover, Students' Independent

t-test, Chi-square test and ANOVA were employed for comparing various parameters. P value of less than .05 was considered statistically significant.

RESULTS

In our study 35 cases were included. The study was done based on age, sex, location and size of perforation, presenting complaints of patients, degree of hearing loss according to WHO before and after Type-1 tympanoplasty, preoperative and postoperative mean AB gap according to size of perforation.

TABLE-I: Distribution of the study according to age and sex.

Age	No. of patient	Percent (%)	Sex	No. of patient	Percent (%)
10-20	6	17.14%	Male	02	5.17 (%)
			Female	04	11.42 (%)
21-30	18	51.43%	Male	06	17.14 (%)
			Female	12	34.28 (%)
31-40	08	22.86%	Male	05	14.28 (%)
			Female	03	8.57 (%)
41-50	03	08.57%	Male	02	5.17 (%)
			Female	01	2.85 (%)

TABLE-II: Distribution of study according to location and size of perforation

Location	No. of patient	Percent (%)	Size	No. of patient	Percent (%)
Anterior	08	22.86%	Small	16	45.71%
Posterior	11	31.43%	Medium	09	25.71%
Central	16	45.71%	Large	10	28.57%

TABLE-III: Distribution of study according to presenting complaints

Presenting complaints	No. of patient	Percent (%)
Hearing impairment	35	100%
Intermittent otorrhoea	35	100%
Earache	20	57.14%
Vertigo	0	0%
Tinnitus	0	0%
Headache	3	8.57%

TABLE-IV: Pre-operative and post-operative hearing loss according to WHO after Type-1 tympanoplasty

Degree of hearing loss (In dB)	No. of patient (Pre operative)	Percent (%)	No. of patient (Post operative)	Percent (%)
Normal (0-25)	0	0%	25	71.43%
Mild (26-30)	25	71.43%	09	25.71%
Moderate (41-55)	10	28.57%	01	2.86%
Moderately severe (56-70)	0	0%	0	0%
Severe (71-91)	0	0%	0	0%
Profound (Above 91)	0	0%	0	0%

TABLE-V: PTA after Type-1 tympanoplasty in study ears according to size of perforation

Size of perforation	Sample	Preop Mean AB GAP	SD (±)	Range	Postop mean AB GAP(After 6 months)	SD (±)	Range	Comparison	P value
Small	16	33.32	1.32	31-35.43	9.89	1.31	7.61-12.04	Preop Vs postop	<.001
Medium	09	38.04	1.04	36.21-39.33	18.34	1.04	16.51-19.63		<.001
large	10	49.44	4.39	43.21-55.33	48.89	4.36	43.00-55.00		.701

DISCUSSION

COM is one of the main threat for hearing loss in our country. Most of the patients presents with aural discharge, earache and hearing impairment. Tympanoplasty is the treatment of choice in case of COM. Tympanoplasty (Type-1) was done in all the 35 patients selected for this study. Tympanoplasty (Type-1) is a surgery in which reconstruction of TM was done by repairing it with graft where the ossicular chain remains intact and mobile. In this study we described different types of parameters to assess the status of hearing improvements after successful tympanoplasty (Type 1). Preoperative audiological assessments were done beforehand and during the 3 months and 6 months follow up period after the surgery. According to our study, age ranged in between 10 to 50 years which is shown in table 1 Majority of cases were between 21 to 30 years which is 18 (51.43%) of the total study group. In the study

done by M. Mahamud Et-Al⁶ 21-30 years age group are affected mostly which is almost same to our study. Some other studies also shows almost same age range i.e. in the study of Varshney S et al⁷, 16-25 years age group was affected more. Similarly, in the study conducted by Latoos et al⁸, 20-29 years age group was more in this list.

The female and male ratio in our study is 1.3:1. Males are less 15 (42.86%) compared to female 20 (57.14%). Similar result found in the study of Islam et al⁹ and Sarker et al¹⁰, 1.5:1 and 3:2 is the ratio of male and female respectively (15,19.). From the study by Latoos et al⁸, 1.2:1 was the ratio in between male and female. In all those studies female patients are predominant. While male predominance found in the record done by Gaurav Batni et al¹¹, 41 (41%) and 59 (59%) were male and female patients respectively and the ratio was 1:1.4. Similar result also found in the study done by Jain K et al¹² where 19 (55.3%) were male and 16 (44.7%) were female patient.

Among all patients 8 (22.86%) presented with anterior perforations. Majority of patients 16 (45.71%) presented with central perforations and 11 (31.43%) presented with posterior perforations. In the study of Biswas et-al¹³ 26% anterior central, 27 % in posterior central and 38% subtotal perforation is observed. On the other hand In Joshi et-al¹⁴ 36% anterior central, 29% posterior central and 25% subtotal perforation are observed.

Small size perforations were founded in most of the cases. 16 (45.71%) were presented with small perforations, 9 (25.71%) presented with medium perforations and 10 (28.57%) presented with large perforation. Study conducted by Sarker et al¹⁵ shows that medium sized perforations 25(45%) patients, large size perforation in 17 (28.67%) patients whereas small size perforation in 12(19.33%) patients.

All the 35 (100%) patients came with the complaints of hearing impairment and intermittent otorrhoea. Study done by Shetty et al¹⁶ and Somashekara et al¹⁷ also shows same result. Similar result also found in the studies of M. Mahamud et-al⁶ and Lokhna et-al.¹⁸ In our study 20 (57.14%) patients presented with earache and only 3 (8.57%) presented with headache whereas in Shetty et-al¹⁶ 18% patients were suffer with earache. In our study patients gave no history of having vertigo and tinnitus whereas in Shetty et-al¹⁶ 15% patients were suffering from tinnitus and in Lokhna et al¹⁸ 5.4% of cases.

Hearing status before and after type-1 tympanoplasty was done according to WHO criteria of degree of hearing loss where 25 (71.43%) patients had mild degree hearing impairment, 10 (28.57%) patients had moderate degree hearing impairment before operation. There was no case who had moderately severe, severe, profound hearing loss. After operation 25 (71.43%) patients gained their normal hearing ability, 9 (25.71%) improved upto mild degree deafness and only 1 (2.86%) patient was not improved and remained in the range of moderate deafness.

Patients with large size perforations showed less improvement after surgery than small and moderate size perforations. We did a study by comparing the mean AB gap among the patients following the size of perforations preoperatively and postoperatively. The hearing condition of the patients were assessed in their 6 months follow up period to determine the hearing improvement after surgery. In case of small perforations the mean AB gap was 33.32 dB (SD 1.32), in medium perforation the mean AB gap was 38.04 dB (SD 1.04) and in large perforation AB gap was 49.44 dB (SD 4.39) before surgery. After surgery following 6 months during the follow up the AB gap in case

of tiny perforations was 9.89 dB (SD 1.31) which indicates hearing improvement within normal range, in case of moderate perforations the mean AB gap was 18.34 dB (SD 1.04) which is also within normal limit and in case of large perforations the mean AB gap was 48.89 dB (SD 4.36) with a p value of $<.001$ in case of small and medium perforation and in case of large perforation its .701 that indicates less improvements of hearing loss even after surgery. Study conducted by V.P. Narve et al¹⁹ shows that 15.67dB was gained in case of large perforation, 12.75dB in medium perforation and 7.39dB was gained in case of small perforation. In the study of Joshi et al¹⁴ hearing gain occurred in 29 (67.44%) cases and no improvement seen in 14 (32.56%) cases. Zhang colleagues²⁰ state that AB gap is least in case of tiny perforation (less than 40%) and AB gap was most in larger perforation (more than 40%) (23). Some studies imply that the size of perforation may play a role on outcome^{15,21} which is similar to our study. While some studies have also determined that the size of perforation does not have any role on surgical outcome^{22,23}.

CONCLUSION

This statistical study shows that, the postoperative AB gap (mean) was improved in patients associated with small to moderate perforations (p value $<.001$). Meanwhile, there was no significant improvement in the postoperative mean AB gap in patients having large perforations (p value =0.701). Thus Type-1 tympanoplasty is beneficial to patients with small to moderate degree of perforations with no change in the ossicular chain. It also concludes that significant hearing improvement can be gained if treatment is done in the right time before the perforation becomes large. Here in this study, we do not find any commencing variation in the outcome in patients who

undergone tympanoplasty because of large perforations.

REFERENCES

1. World health organization regional office for south-east Asia, 1985: State of hearing & ear care in the South East Asia region. chapter-1, page-7.
2. Ludman H, 1998, 'Reconstruction's of the middle ear', Mawson's Diseases of the ear, 6th ed. Edward Arnold, London, 1998; 429-38.
3. Swanepoel D. Infant hearing loss in developing countries: A silent health priority', *Audiology Today* 2008; 20:108-132
4. Pickles JO, 2008 Physiology of hearing. Scott-Brown's Otorhinolaryngology, Head & Neck Surgery. chapter-229, 7th ed. Edward Arnold: Great Britain, vol.5, pp. 3184.
5. Parodi M, Thierry B, Blanchard M, Couloigner V, Garabédian EN. Using a new otologic operating microscope: unexpected complications. *Int J Pediatr Otorhinolaryngol.* 2015;79(5): 755-7. doi: 10.1016/j.ijporl.2015. 02.028.
6. Mahamud, M., Aich, M. L., Mamun, A. A., & Alam, R. (2020). Evaluation Of Hearing Status After Type I Tympanoplasty. *Bangladesh Journal Of Otorhinolaryngology*, 24(1), 50-55.
7. Varshney S, Nangia A, Bist SS, Singh RK, Gupta N, Bhagat S. Ossicular Chain Status in Chronic Suppurative Otitis Media in Adults. *Indian J Otolaryngol Head Neck Surg.* 2010;62(4):421-6.
8. Latoo MA, Bhat R, Jallu AS. Hearing gain after tympanoplasty: a prospective study. *Int J Otorhinolaryngol Head Neck Surg.* 2020;6(6):1096
9. Islam T, Rashid HA, Ali MI and Haque M. The outcomes of myringoplasty. *Bangladesh J Otorhinolaryngol*, 2013; 19: 202-9.

10. Sarker MZ, Ahmed M, Patwary K, Islam R, Joarder AH. Factors Affecting Surgical Outcome of Myringoplasty. *Bangladesh Medical Journal* 2012; vol. 41(3): 45-48.
11. Batni G, Goyal R. Hearing Outcome After Type I Tympanoplasty: A Retrospective Study. *Indian J Otolaryngol Head Neck Surg.* 2014;67(1):39-42.
12. Jain K, Pandey A, Gupta S. A Clinical Study of Hearing Outcome after Type I Tympanoplasty. 2016;3(10):48-54.
13. Biswas SS, Hossain A, Alam M, Atiq T And Al-Amin Z. 'Hearing Evaluation After myringoplasty', *Bangladesh J Otorhinolaryngol* 2011; 16:23-28
14. Joshi RR, Jha AK, Rijal AS, Dhungana A And Shrestha KK, Hearing Evaluation After Myringoplasty At Nepal Medical College And Teaching Hospital *Journal* 2013; 2:36-42.
15. Sarker MZ, Ahmed M, Patwary K, Islam R, Joarder AH. Factors affecting surgical outcome of Myringoplasty. *Bangladesh J Otorhinolaryngol.* 2011;17(2):82-7.
16. Shetty S. Pre-operative and Post-operative Assessment of Hearing following Tympanoplasty. *India. J Otolaryngol Head Neck Surg.* 2012;64(4):377-81.
17. Somashekara KG, Swathi RK, Nirwan S. A study of hearing improvement after tympanoplasty by means of pure tone audiometry. *IJSR.* 2014;3(12):2277-8179.
18. Lokhna, Harsh & Kumar, Sanjay & Bansal, Anshul. (2020). To Assess The Hearing Improvement In Patients Of Chronic Otitis Media Tubotympanic Type Post Tympanoplasty. *The Journal Of Medical Research.* 6. 305-308. 10.31254/Jmr.2020.6611
19. Narve VP. A Study of Evaluation of Hearing Loss in Tympanic Membrane Perforation and Hearing Outcome after Tympanoplasty. 2019;07(04):887-92
20. Zhang ZG, Huang QH, Zheng YQ, Sun W, Chen YB, Si Y. Three autologous substitutes for myringoplasty: a comparative study. *Otology & Neurotology* 2011; 32(8):1234-8.
21. Onal K, Uguz MZ, Kazikdas KC, Gurses ST, Gokce H. A multivariate analysis of otological, surgical and patient-related factors in determining success in myringoplasty. *Clinical Otolaryngology* 2005; 30(2): 115-20
22. Yung MW. Myringoplasty for subtotal perforation. *Clinical Otolaryngology and Allied Sciences* 1995; 20(3): 241-5.
23. Perkins R, Bui HT. Tympanic membrane reconstruction using formaldehyde-formed autogenous temporalis fascia: twenty years' experience. *Otolaryngology-Head and Neck Surgery* 1996; 114(3):366-79.