

Original Article

Outcome of Type 1 Tympanoplasty in Paediatric Patients

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Abstract:

Background: *Type 1 Tympanoplasty is a widely performed procedure for inactive mucosal COM. Considerable controversy remains in choice of type-1 tympanoplasty in the paediatric patients.*

Objectives: *To assess the outcomes of type-1 tympanoplasty in paediatric patients.*

Methods: *This study was conducted in the Department of Otolaryngology-Head & Neck Surgery, BSMMU, Dhaka, from July 2018 to December 2019, with 44 paediatric patients having an inactive mucosal variety of chronic otitis media. Patients were divided into 10-14 and 15-18 years age group. All patients underwent type-1 tympanoplasty under operating microscope and temporalis fascia used as a graft material. Minimum hearing improvement of 10 dB was regarded as an audiological success and an intact graft at the end of the third month was regarded as graft success. The statistical significance was set to $p < 0.05$.*

Results: *The graft success rate was 90.9% and audiological improvement was 81.8% in paediatric tympanoplasty. Success rate was higher in 15-18 years age group than 10-14 years of age group which was statistically insignificant. Irrespective of the site, size, duration of discharge showed an insignificant association with outcomes of pediatric type-1 tympanoplasty.*

Conclusion: *Type-1 tympanoplasty showed promising result in paediatric patients. The age of the patients did not significantly affect the postoperative outcome.*

Keywords: *Type-1 tympanoplasty, COM, paediatric patients, PTA, graft success, audiological success.*

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Introduction:

Chronic Otitis Media (COM) is a chronic inflammatory disease of the middle ear cleft that usually leads to a partial or entire loss of the eardrum and ossicles, resulting in conductive hearing losses¹. COM may be subdivided into Inactive mucosal, Inactive squamous, Active mucosal, Active squamous, Healed². The main symptom of inactive mucosal COM is intermittent otorrhea, which usually associated with episodes of upper airway infections or a history of extrinsic contamination accompanied by hearing loss. The otoscopic examination usually finds a perforation in pars tensa of the tympanic membrane of varying size, and the middle ear mucosa looks almost normal except for some degree of hyperemia³.

Disabling hearing impairment in Bangladesh is 9.6 %, according to the national survey on the prevalence of hearing impairment in Bangladesh. COM is the leading cause of hearing impairment⁴. COM is a common condition affecting 0.5-30% of any community worldwide and most common in developing countries. The frequency is higher in the paediatric age group⁴.

Chronic otitis media usually begins in childhood. The disease commonly occurs during the period of the first six years of a child's life, with a peak age of around two years. Patients with eardrum perforation which continue to discharge for a period of 3 months are recognized as CSOM cases⁵.

The treatment of COM is mainly surgical. There were five types of Tympanoplasty for treatment of various types of COM. Type 1 Tympanoplasty is a widely accepted and performed worldwide for inactive mucosal COM. The goal of the surgery is to repair the eardrum, restoring the sound to the round window protection by obtaining an air-filled cavity and restore the mechanisms that drive the sound, improve hearing, and cessation of otorrhea⁶.

Tympanoplasty was popularized by Zollner and Wullstein within the middle of the 1950s. The success rate of tympanoplasty still remains matter of substantial interest. There has been particular attention to the outcomes of paediatric tympanoplasty since 1960s. In the literature, a success rate of paediatric tympanoplasties ranges from 35 to 94%⁷.

Temporalis fascia still considered the most commonly used graft material with a 93-97% success rate in tympanoplasty. However, the success rate tended to decrease in some situations like recurrent perforation, total perforation, chronic mucosal dysfunction, or severe atelectatic eardrum. The stiffness and mechanical stability of the cartilage graft have obvious benefits in reducing retraction of the eardrum, but it had been unclear whether the increase in stiffness and mass would compromise the sound conduction properties of the eardrum. Concerns that the stiffness and mass of cartilage graft may adversely affect hearing haven't been substantiated in clinical outcome reports⁸.

Pediatric patients show poorer results compared with adults undergoing tympanoplasty surgery. Many have argued that poorer results is due to continued auditory tube dysfunction with recurrent attacks of otitis media, frequent attack of upper respiratory tract infection, difficulty in post operative care resulting in re-perforation⁹. Vartiainen and Vartiainen conducted a study to assess various factors affecting success in pediatric tympanoplasty and found that the only statistically significant prognostic factor was the patients gender¹⁰. Koch et al recommended that tympanoplasty be performed on children older than eight years¹¹. Gupta and Mishra noted that cochlear reserve is good in paediatric patient and potential for restoring and preserving hearing is excellent in paediatric tympanoplasty¹².

Several studies have been done about type 1 tympanoplasty in children. In India, found better results in children older than 11 years of age is reported by Srivastava and Mohan¹³. While, El-Magd and Sobhy In Egypt found better results in children between 7 to 10 years of age than 11 to 14 years¹⁴. Sirena et al reported that factors such as age, presence of unilateral or bilateral pathology and size of perforation were not determinants of surgical success¹⁵. As no literature is available regarding outcome of type-1 tympanoplasty among pediatric patients in our country, this study may give some light on the outcome of type-1 tympanoplasty in pediatric patients and to analyze the factors that influence the outcome.

Methods:

This prospective observational study was carried out at the Department of Otolaryngology-Head & Neck Surgery at BSMMU, Shahbag, Dhaka, from July 2018 to December 2019, with 44 patients with an inactive mucosal variety of COM. The subjects were selected based on the inclusion and exclusion criteria. Informed written consent was taken from the participant's guardian. Ethical clearance was obtained from the Institutional Review Board (IRB) of BSMMU. Pre-operatively all patients were evaluated by detailed history and clinical examination. Patients with a history of nasal allergy, nasal polyposis, upper respiratory tract infections were appropriately treated before ear surgery. The ear to be operated had to be dry at least 6 weeks before surgery. The size and site of the perforations were recorded. The hearing assessment was initially performed clinically by tuning fork tests and then by Pure tones audiometry. All cases were operated under operating microscope using temporalis fascia by underlay technique under general anesthesia, and the minimum qualification of a surgeon is an associate professor. Patients were kept under regular follow up but the final assessment for graft and audiological status were done 12 weeks postoperatively and

assess the ear by otoscope and microscope. Condition of the graft along with any sign of complications were noted. Patients were assessed with pure tone audiometry and tympanometry at 12 weeks. An intact graft at the end of the 12 weeks postoperatively considered as graft success, and a minimum hearing improvement of 10 dB average in speech frequencies was regarded as an audiological success. There were two patients missed the follow-up, and the Hot-deck imputation technique was applied for missed follow up. All the information was recorded in a prefixed questionnaire (Appendix III). The data were calculated in an excel spreadsheet, which was then exported to SPSS (26.0) for analysis. The statistical significance was set to $p < 0.05$. Demographic characteristics and study variables were analyzed using descriptive statistics. The results of the study were expressed as mean, standard deviation (\pm SD), frequency, and percentages. Results were tabulated and statistically analyzed using Chi-square and Pair student t-test.

Results:

This prospective observational study was comprised of total 44 patients among which 19(43.2%) were male and 25(56.8%) were female patients. Age of the patients ranges from 10 to 18 years with mean age was 14.55 ± 2.50 years. patients were divided into 10-14 and 15-18 years age group.

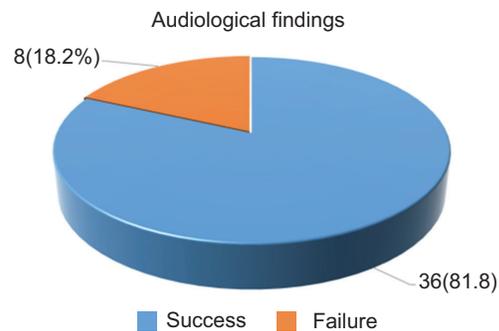


Figure-1: Pie diagram showing the audiological status of the study patients.

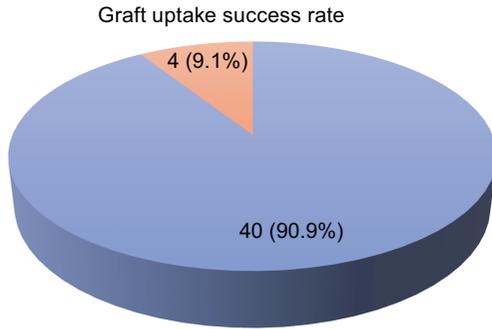


Figure-2: Pie diagram showing the graft uptake status of the study patients

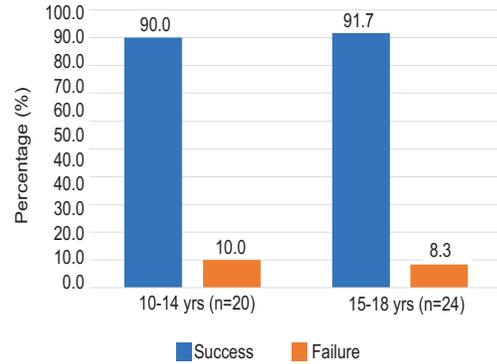


Figure-3: Association of graft success with age group

Table I:
Comparison of audiological findings before and after operation

Parameters	Audiological findings		p-value
	Preoperative (n=44) Mean±SD	Postoperative (n=44) Mean±SD	
Bone conduction	11.73±4.05	9.03±4.65	<0.001*
Air conduction	35.79±3.36	20.64±5.69	<0.001*
AB gap	24.05±3.67	11.64±3.74	<0.001*

Table II:
Distribution of audiological successful patients by hearing improvement level (n=36).

Audiological improvement in dB	Frequency	Percentage (%)
10-15 dB	22	61.11
16- 20 dB	14	38.89
Total	36	100.0

Table III:
Association of audiological success with age group (n=44).

Age group	No of patients	Audiological findings		p-value
		Success (No. (%))	Failure (No. (%))	
10-14	20	16(80.0%)	4(20.0%)	0.775 ^{ns}
15-18	24	20(83.3%)	4(16.7%)	
Total	44	36(81.8%)	8(18.2%)	

Discussion:

The aim of the study to assess outcomes of type-1 tympanoplasty in paediatric patients and analyze the factors that affects the outcome.

In the present study, the overall graft success rate of pediatric tympanoplasty was 90.9%. Among 10-14 years of age group, 90.0% of patients had graft success and 15-18 years age group, 91.7% of patients had success. No significant difference in the success rate between the two age groups. A related study conducted by Srivastava and Mohan found that overall success was 86% within the patient's age 9-14 years, age less than 11 years 75%, and more than 11 years was 90.3%¹³. Backlaci et al. narrated the success rate of paediatric tympanoplasty was 86.3%, which is consistent with the present study⁷. El-Magd and Sobhy narrated no statistical difference in the success rate between two age groups (83.3%) in the younger age group and (78.8%) in the older group¹⁴. Rozendorn et al described that age under nine years is associated with significantly higher rates of persistent and recurrent perforations¹⁶. Ribeiro et al reported that an eardrum perforation could be closed at any age¹⁷. On the other hand, Gupta and Mishra¹², Yung et al¹⁸ reported that age is a key prognostic factor that influences the outcomes of paediatric tympanoplasty. This may be due to the lower incidence of upper airway infections and better Eustachian tube function at a later age than younger children

In the present study, maximum patients 36(81.8%) had audiological success. Out of 20 patients having age 10-14 years, 16(80.0%) patients had audiological success, and out of 24 patients age 15-18 years, 20(83.3%) patients had success. No significant difference in success rate between 10-14 years and 15-18 years of age group ($p>0.05$). Srivastava and Mohan (2014)

reported audiological success was seen in 40 (80%) cases, which was consistent with the present study¹³. In agreement with the current study Singh et al. reported audiological success 61% was seen in age <14 years and 65% in >14 years, which was not a significant difference in success rate between two age groups¹⁹.

In the present study, mean bone conduction at preoperative 11.73 ± 4.05 dB and postoperative 9.03 ± 4.65 dB. Mean air conduction in preoperative 35.79 ± 3.36 dB and postoperative 20.64 ± 5.69 dB. Mean AB gap in preoperative 24.05 ± 3.67 dB and postoperative 11.64 ± 3.74 dB. Mean bone conduction, air conduction, and AB gap was significantly decreased at postoperative from preoperative. In accordance with this study Baklaci et al. reported similar statistically significant result⁷.

In the present graft success rates were 80% (4 ears) in anterior perforations, 100% (8 ears) in posterior perforations, 75.0% (3 ears) in inferior perforations, and 92.6% (25 ears) in subtotal perforations which was not statistically significant. Pignataro et al. conducted a study which is consistent with the present study. They reported that the outcome of pediatric tympanoplasty was not affected by the site of perforation²⁰.

In present study, audiological success rates were 60% (3 ears) in anterior perforations, 100% (8 ears) in posterior perforations, 75.0% (3 ears) in inferior perforations and 81.5% (22 ears) subtotal which was not statistically significant. Ribeiro et al. reported audiological success was 100% in posterior perforation, 88.9% in anterior perforation, 33.3% in inferior perforation¹⁷. Pignataro et al found that the site of the perforation had no effect on the outcomes²⁰.

In the present study graft success rates were 83.3%, 90.9%, and 92.6% in small, medium,

and large size perforation, respectively. There was no statistically significant difference in the graft success rates among the different sizes of perforations ($p > 0.05$). Singh et al stated that the success rate of 75, 88, and 75% respectively for small, medium, and large perforations¹⁹. This finding correlates with the present study.

In the present study, audiological success rates were 83.3%, 81.8%, and 81.5% in small, medium, and large size perforation, respectively. There was no statistically significant difference in the audiological success rates among the different sizes of perforations ($p > 0.05$). Ribeiro et al. reported 80.3% and 68.0% audiological success in $< 50\%$ and $> 50\%$ size of perforations respectively¹⁷. Reports conflict on whether perforation size is a significant prognostic factor Sarkar et al⁵.

In the current study, the rate of graft success and audiological success was higher (94.1%) with the duration of ear discharge ≤ 4 years than > 4 years. But the success rate were not statistically significant. This result was similar with study done by El-Magd et al¹⁴ and Srivastava and Mohon¹³. This may be due to a long duration of middle ear pathology and mucosal changes that affect the outcome of an operation.

In the present study, a higher rate of audiological and graft failure in bilateral perforation than unilateral perforation. The failure rate was not statistically significant with the side of perforation. In agreement with the present study, El Magd and Sobhy reported a higher failure rate in bilateral perforation¹⁴.

The factors (age, site of and size of perforation, duration of discharge) acknowledged to influence the graft, and audiological success in Type-1 paediatric tympanoplasty was statistically not

significant. A long term follow up study with inclusion of unaddressed factors should be done.

Conclusion:

Type-1 tympanoplasty has a good chance of success in children over ten years old. The age of the patients, size, and site of perforation, duration of discharge did not significantly influence the postoperative outcome. It gives the child a safe, dry, and functional ear.

References:

1. Merchant SN, McKenna MJ & Rosowski JJ. Current status and future challenges of tympanoplasty. *European Archives of Otorhinolaryngology* 1998; 255: 211-8.
2. Shrestha L, Shrestha I and Amatya RC. Comparison of clinical presentation between Chronic Otitis Media Mucosal with Squamous. *Kathmandu University Medical Journal*, 2010; 8(4):387-91.
3. Fukuchi I, Cerchiari DP, Garcia E, Rezende CEB and Rapoport PB. Tympanoplasty: Surgical results and a comparison of the factors that may interfere in their success. *Brazilian Journal of Otorhinolaryngology*, 2006; 72(2):267-71.
4. Tarafder KH, Akhtar N, Zaman MM, Rasel MA, Bhuiyan MR. and Datta PG. Disabling hearing impairment in the Bangladeshi population. *The Journal of Laryngology & Otology*, 2015; 129(2): 126-35.
5. Sarkar S, Roychoudhury A and Roychoudhuri BK. Tympanoplasty in children. *European Archives of Otorhinolaryngology*, 2009; 266(5):627-33.
6. Dawood MR.. Hearing evaluation after successful myringoplasty. *Journal of otology*, 2017; 12(4):192-7.

7. Baklaci D, Guler I, Kuzucu , Kum RO and Ozcan M. Type 1 tympanoplasty in pediatric patients: a review of 102 cases. *BMC Pediatrics*, 2018; 18(1):345-9.
8. Merenda D, Koike K, Shafiei M and Ramadan H. Tympanometric volume: a predictor of success of tympanoplasty in children. *Otolaryngology—Head and Neck Surgery*, 2007; 136(2):189-92.
9. Tadke K, Ghorpade R, Lahane V and Mundada PS. Impact of type of graft material on outcome of tympanoplasty: a comparison between temporalis fascia and cartilage with perichondrium. *International Journal of Otorhinolaryngology and Head and Neck Surgery*, 2018; 4(5):1301-3.
10. Vartiainen E and Vartiainen J. Tympanoplasty in young patients: the role of adenoidectomy. *Otolaryngology—Head and Neck Surgery*, 1997; 117(6):583-5.
11. Koch WM, Friedman E, McGill TJ and Healy GB.. Tympanoplasty in children: the Boston Children's Hospital experience. *Archives of Otolaryngology—Head & Neck Surgery*, 1990; 116(1):35-40.
12. Gupta N and Mishra RK. Tympanoplasty in children. *Indian Journal of Otolaryngology and Head and Neck Surgery*, 2002; 54(4):271-3.
13. Srivastava A, Mohan C. Surgical Outcome in Paediatric Tympanoplasty: Our Experience. *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, 2014; 13(2): 48-51.
14. El-Magd EAA, Sobhy KM. Evaluation of Type I Tympanoplasty in Children in Upper Egypt. *Otolaryngol (Sunnyvale)*, 2017; 7(6): 1-5.
15. Sirena E, Carvalho B, Buschle M. and Mocellin M. Timanoplastia myringoplasty type 1 and in residency surgical results and audiometric. *Arquivos Internacionais de Otorrinolaringologia*, 2010; 14(04):.417-21.
16. Rozendorn N, Wolf M, Yakirevich A, Shapira Y and Carmel E. Myringoplasty in children. *International journal of pediatric otorhinolaryngology*, 2010; 90:245-50.
17. Ribeiro JC, Rui C, Natercia S, Jose R. and Antonio P. Tympanoplasty in children: a review of 91 cases. *Auris Nasus Larynx*, 2011; 38(1):21-5.
18. Yung M, Neumann C and Vowler SL. A longitudinal study on pediatric myringoplasty. *Otology & Neurotology*, 2007;28(3):353-5.
19. Singh GB, Sidhu TS, Sharma A. and Singh N. Tympanoplasty type I in children an evaluative study. *International Journal of Pediatric Otorhinolaryngology*, 2005; 69(8): 1071-6.
20. Pignataro L, Della Berta LG, Capaccio and Zaghis, A. Myringoplasty in children: anatomical and functional results. *The Journal of Laryngology & Otology*, 2001. 115(5):369-73.