Original Article

Outcome of Type 1 Tympanoplasty in Paediatric Patients

Md. Lutfar Rahaman¹, Nasima Akhtar², Ashim Kumar Biswas³, Md. Sha Sakender⁴, Murshedur Rahman⁵, SM. Rasel Parvez⁶

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.

1. Registrar, Dept. of ENT & Head-Neck Surgery, Shaheed Suhrawardy Medical College Hospital.
2. Professor, Dept. of Otolaryngology-Head & Neck Surgery, Bangabandhu Sheikh Mujib Medical University.
3. Associate Professor, Dept. of Otolaryngology-Head & Neck Surgery, Bangabandhu Sheikh Mujib Medical University.
4. Registrar, Dept. of ENT & Head-Neck Surgery, Shaheed Suhrawardy Medical College Hospital.
5. Registrar, Dept. of ENT & Head-Neck Surgery, Shaheed Suhrawardy Medical College Hospital.
6. Assistant Registrar, Dept. of ENT & Head-Neck Surgery, Sir Salimullah Medical College & Mitford Hospital.

Address of Correspondence: Dr. Md. Lutfor Rahaman, Registrar, Dept. of ENT & Head-Neck Surgery, Shaheed Suhrawardy Medical College Hospital, Cell: 01885038977, e-mail: dr.lutfor14@gmail.com
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 losses. COM may be subdivided into Inactive mucosal, Inactive squamous, Active mucosal, Active squamous, Healed. 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 hyperemia.

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 impairment. 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 pediatric age group.

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 cases.

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 otorrhoea.

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%.

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 reports.

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 reperforation. 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 gender. Koch et al recommended that tympanoplasty be performed on children older than eight years. Gupta and Mishra noted that cochlear reserve is good in paediatric patient and potential for restoring and preserving hearing is excellent in paediatric tympanoplasty.
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 Mohan. While, El-Magd and Sobh in Egypt found better results in children between 7 to 10 years of age than 11 to 14 years. Sirena et al reported that factors such as age, presence of unilateral or bilateral pathology and size of perforation were not determinants of surgical success. 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 (± 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.
Table I:
Comparison of audiological findings before and after operation

| Parameters        | Preoperative (n=44) | Postoperative (n=44) | p-value |
|-------------------|---------------------|----------------------|---------|
|                   | Mean±SD             | 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 | Success (No. (%) | Failure (No. %) | p-value |
|-----------|----------------|------------------|-----------------|---------|
| 10-14 yrs | 20             | 16(80.0%)        | 4(20.0%)        | 0.775ns |
| 15-18 yrs | 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%. Backlaci et al. narrated the success rate of paediatric tympanoplasty was 86.3%, which is consistent with the present study. 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 group. Rozendorn et al described that age under nine years is associated with significantly higher rates of persistent and recurrent perforations. Ribeiro et al reported that an eardrum perforation could be closed at any age. On the other hand, Gupta and Mishra, Yung et al 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 audiologically 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 study. 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 groups.

In the present study, mean bone conduction at preoperative 11.73±4.05dB and postoperative 9.03±4.65dB. Mean air conduction in preoperative 35.79±3.36dB and postoperative 20.64±5.69dB. Mean AB gap in preoperative 24.05±3.67dB and postoperative 11.64±3.74dB. 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 result.

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 perforation.

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. Ribeirio et al. reported audiological success was 100% in posterior perforation, 88.9% in anterior perforation, 33.3% in inferior perforation. Pignataro et al found that the site of the perforation had no effect on the outcomes.

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 perforations. 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 respectively. Reports conflict on whether perforation size is a significant prognostic factor Sarkar et al.

In the current study, the rate of graft success and audiological success was higher (94.1%) with the duration of ear discharge > 4 years. But the success rate were not statistically significant. This result was similar with study done by El-Magd et al and Srivastava and Mohon. 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 perforation.

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.

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