

Outcome of Type 1 Tympanoplasty in Al Nahdha Hospital and Influencing Factors: A Retrospective Study

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Abstract

Introduction: The management for Chronic Suppurative Otitis Media (CSOM) is tympanoplasty. The aim of the surgery is prevention of recurrent ear discharge and improvement in hearing, and the success rate shows a wide range. There are several influencing factors that are presumed to affect the outcome of tympanoplasty, however their effect is considered controversial. There is no study in Oman that evaluates the success rate of this surgery. Therefore, in this study we aim to evaluate the anatomical and functional outcome of Type 1 Tympanoplasty in Al Nahdha Hospital, Oman from the year 2010 to 2020. In addition, we aim to assess various factors that might have influenced the outcome and to add to the literature our experience.

Methods: This is a retrospective study, which involves all patients who had undergone Type 1 Tympanoplasty in Al Nahdha Hospital from 2010 to 2020. The demographic data for all patients was collected, in addition to the pre-operative findings, pre and post-operative Air-bone Gap (ABG) in a Pure Tone Audiometry (PTA), the surgical approaches and type of grafts used. The success rate was defined as intact tympanic membrane 6 months after the surgery and hearing improvement success was assessed by closure of air-bone gap closure of 10dB or more.

Results: The total number of patients was 345, 40.6% were male, and 59.4% were female. The graft success rate was found to be 84.3%. The pre-operative air bone gap (ABG) was 26.12 ± 9.55 , and the post-operative ABG was 14.40 ± 9.36 with a gain of 11.71. This was statistically significant with a P-value of <0.001 . Hearing improvement (>10 dB gain in ABG) was seen in 201 (67%) patients. There was no statistically significant difference in hearing improvement and graft success rate when compared with influencing factors including age, gender, size of perforation and surgical approach. However, there was a statistically significant difference between the type of graft used, where cartilage graft showed better hearing improvement as compared with temporalis fascia graft.

Conclusion: the graft success rate of Type 1 Tympanoplasty in Al Nahdha Hospital was found to be 84.3%, and closure of A-B gap was 11.7. The percentage of patients who had improvement in A-B gap closure of >10 dB were 67%. These results are comparable with results of other published studies. Factors that are presumed to influence the outcome of type 1 tympanoplasty were statistically not significant, and this is consistent with other studies. Cartilage graft was found to give a better closure of AB gap, which was statistically significant. We recommend that further studies be conducted with a longer follow-up period and address more factors to achieve a better insight pertaining to the outcome of Type 1 Tympanoplasty.

Keywords: Tympanoplasty; A-B Gap; Conductive Hearing Loss; Graft.

Introduction

Chronic Suppurative Otitis Media (CSOM) is defined as chronic inflammation of the middle ear, which is characterized by the presence of a tympanic membrane (TM) perforation, which might cause recurrent ear discharge and hearing impairment.¹ CSOM is a common public health problem world-wide and is considered quite common in the developing countries.² It has a major impact on the social life of an individual due to persistent otorrhea and hearing disability.

The definitive management for CSOM is tympanoplasty. The aim of this surgery includes the prevention of recurrent ear discharge, improvement in hearing, in addition to the ease in hearing aid usage.³ Type 1 tympanoplasty is the repair of the tympanic membrane without reconstruction of the ossicles. Many types of grafts and different surgical approaches have been implemented in the past. The most widely used grafts nowadays are Temporalis Fascia (TF) graft and cartilage graft.³

Despite the routine nature of this surgery, failures have been reported in the literature, and the success rate shows a wide range.⁴ There are several influencing factors that are presumed to affect the outcome of tympanoplasty, such as age, gender, size of perforation, surgical approach and type of graft material used. However, despite the presence of many published studies, their effect on the outcome of the surgery is still considered controversial.²

In our study, we aim to evaluate the anatomical and functional outcome of Type 1 Tympanoplasty in Al Nahdha Hospital, Oman from the year 2010 to 2020. In addition, we aim to assess the various factors that might have influenced the outcome.

Methods

Ethical approval for this study was obtained from the Committee of Medical Research of Ministry of Health – Oman.

The study was a retrospective study which involved all patients who have undergone Type I tympanoplasty in the ENT Department in Al Nahdha Hospital during the period from January 2010 to December 2020.

The demographic data of all patients were collected including age and gender. The pre-operative examination was collected including the size and the position of the perforation. All patients had a pure tone audiometry (PTA) pre and post-operatively. Operative details including surgical approach and type of graft used were also collected.

Patient with cholesteatoma, those who had undergone mastoidectomy, ossiculoplasty or revision tympanoplasty were excluded from the study, in addition to patients with no follow-up after the surgery.

Patients were followed up at intervals (2 weeks, 1 month, 3-6 months, 1 year). The status of the tympanic membrane was assessed at 6 months post-operatively, in addition to the PTA. The success rate of the surgery in this study was defined as an intact tympanic membrane and 10dB or more airborne gap closure, 6 months post-operatively.

The collected data were tabulated in Epidata Program and statistical analysis was done using IBM SPSS Statistics. A P-Value of <0.05 was considered statistically significant. Pre and post A-B gap results were compared using Paired T-test. Association between two categorical variables were assessed using Chi-square test.

Results

The total number of cases included in the study was 345. Out of these, 140 (40.6%) were male, and 205 (59.4%) were female. The age range was from 14 to 70 years and a mean age of 37.6 ± 12 years. *Figure 1* shows the distribution of cases according to different age groups.

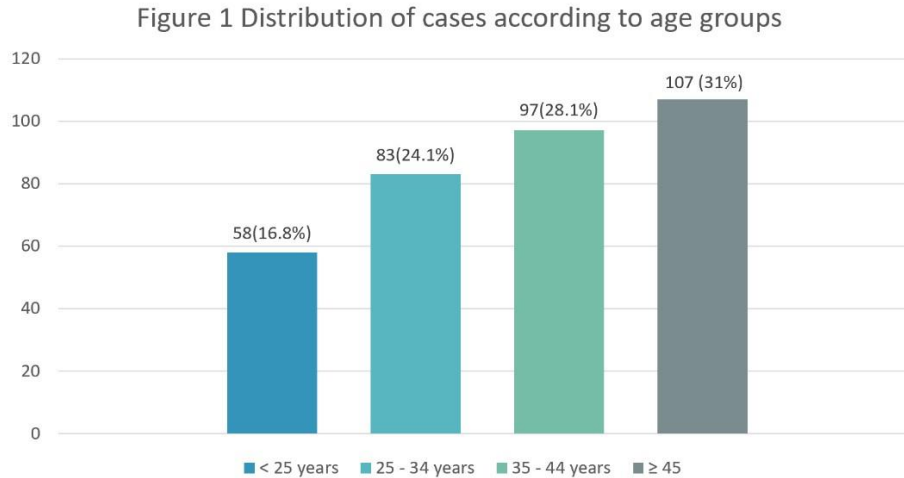


Figure 1: Distribution of cases according to age groups.

Most patients, accounting for 245 (71%) had undergone tympanoplasty through post-aural approach, 59 (17.1%) had permeal approach, and the remaining 41 (11.9%) had endaural approach. With regards to the type of graft used; temporalis fascia was used in 236 (68.4%) of the cases, and cartilage graft was used in 109 (31.6%) of the cases, as shown in *Figures 2 and 3*.

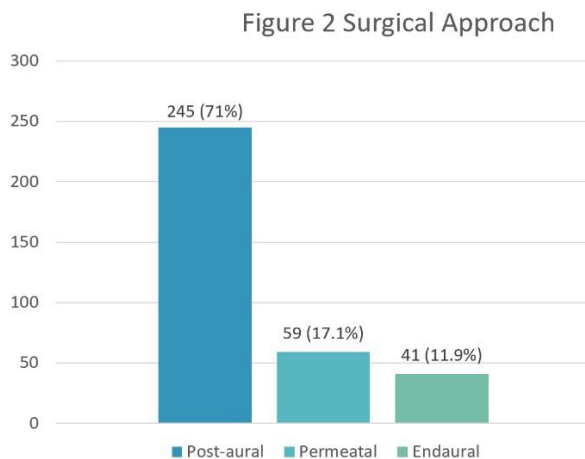


Figure 2: Surgical approach.

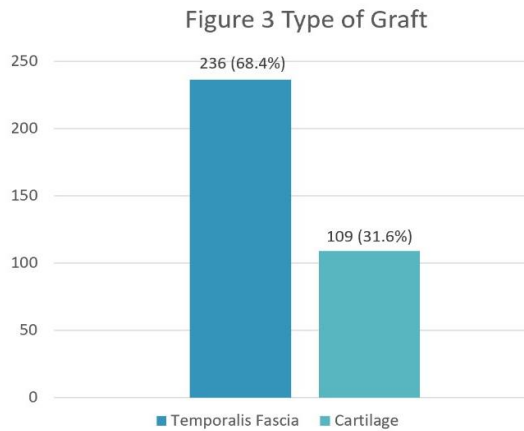


Figure 3: Type of graft.

The follow-up duration was 3-6 months in 212 (61.4%) cases, 6 months – 1 year in 90 (26.1%) cases, and > 1 year in 43 (12.5%) cases.

The graft success rate (intact TM after 3-6 months) was found to be 84.3%, and 54 (15.7%) were found to have a residual perforation, as illustrated in *Figure 4*. Out of the 54 cases with residual perforation; 19 (5.5%) required a revision surgery.

Figure 4 Post Operative TM Status at 6 months

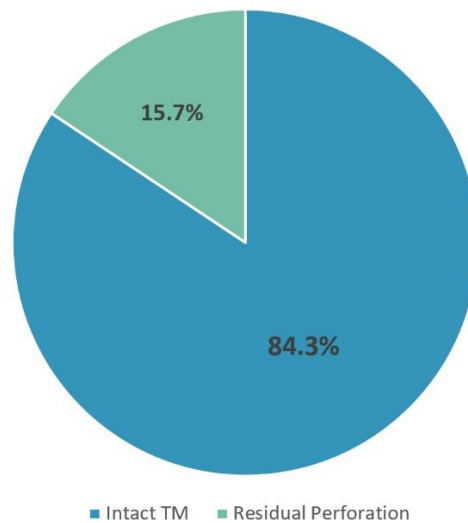


Figure 4: Postoperative TM status at six months.

The average pre-operative air conduction was 38.52 ± 15.37 , the average post-operative air conduction was 25.00 ± 16.15 with a gain of 13.52. The average pre-operative air bone gap (ABG) was 26.12 ± 9.55 , and the average post-operative ABG was 14.40 ± 9.36 with a gain of 11.71. This was statistically significant with a P-value of <0.001 . This is summarized in *Table 1*. Hearing improvement (10dB or more air-bone gap closure) was seen in 201 (67%) patients. Hearing remained the same in 95 patients (31.7%), and worsened in 4 patients (1.3%), *Table 2*.

Table 1: Pre & Post Operative and Gain of Air Conduction and A-B Gap

	Preoperative	Postoperative	Gain	p-value
Air conduction	38.52 ± 15.37	25.00 ± 16.15	13.52	< 0.001
Air bone gap	26.12 ± 9.55	14.40 ± 9.36	11.71	

Table 2 Percentage of Hearing Improvement

Hearing	Number	Percentage
Improved (A-B gap ≥ 10dB)	201	67%
Same	95	31.7%
Worsened	4	1.3%

Table 3 summarizes the gain in A-B gap and the graft success rate according to different factors.

With regards to age as an influencing factor; the age group of <25 years had the highest gain in A-B gap of 17.15, with a P-value of 0.041, whereas the graft success rate was observed the highest the age group 25 – 34 years with a percentage of 88%, which was not statistically significant. With regards to gender, the graft success rate in males was 85.7%, and 84.3% in females, with a P-value of 0.651. The gain in A-B gap between males and females were almost the same. Subtotal perforations had the highest gain in A-B gap of 15.24dB, and medium sized perforations had the highest graft success rate of 88.5%, with a P-value of 0.644 and 0.163, respectively. Permeatal approach had the highest gain in A-B gap of 16.09 dB and the highest graft success rate of 88.1%. Cartilage graft had the highest gain in A-B gap and in graft success rate, with a P-value of 0.009 and 0.633, respectively.

Table 3: Graft success rate and Gain in A-B Gap according to factors.

Factors	Gain in A-B Gap	P-value	Graft Success	P-value
Age				
< 25 years	17.15	0.041	44 (75.9%)	0.273
25 – 34 years	13.06		73 (88.0%)	
35 – 44 years	14.08		82 (84.5%)	
≥ 45 years	14.23		92 (86%)	
Gender				
Male	15.25	0.668	120 (85.7%)	0.651
Female	14.87		171 (84.3%)	
Perforation Size				
Small	15.13	0.644	36 (81.8%)	0.163
Medium	14.64		131 (88.5%)	
Large	13.65		103 (83.1%)	
Subtotal	15.24		21 (72.4%)	
Surgical approach				
Post-aural	13.95	0.224	207 (84.5%)	0.404
Permeatal	16.09		52 (88.1%)	
Endaural	14.63		32 (78.0%)	
Graft Type				
Temporalis Fascia	13.58	0.009	197 (83.5%)	0.633
Cartilage	16.17		4 (86.2%)	

Discussion

CSOM is a common disease world-wide, which can be problematic to the patients, with recurrent ear discharge being the commonest symptom. Tympanoplasty is common otologic surgery, with a good success rate both anatomically and functionally. In this study, we evaluated the graft success rate and functional outcome in terms of A-B gap closure after type tympanoplasty 1 in 345 cases.

Regarding the anatomical outcome in our study, the graft success rate was 84.3%. This is comparable to other studies published in the literature. The quoted success rate of type 1 tympanoplasty ranges from 80% - 95%.^{5,6} In a study published by G. Batni et al., the graft success rate was seen in 88% of the cases.⁵ In another study published by Sajida et al, the graft success rate after 1 year was 80.5%.⁷ A prospective study of 40 cases published by Saha, the graft success rate was 85%, 6 months after the surgery.⁸ Our study had a similar graft success rate when compared to other studies.

The mean A-B gap is the most common outcome measure used in tympanoplasty.⁹ In this study, hearing improvement was measured using gain in ABG pre and post operatively. A 10 dB or more A-B gap closure is considered as a good hearing improvement. The average pre-operative A-B gap was 26.12 ± 9.55 and the average post-operative A-B gap was 14.40 ± 9.36 , with a gain of 11.7 dB. This was found to be statistically significant with a p-value of <0.001 . The number of patients who had improvement in A-B gap >10 dB was 201 (67%), the number of patients who had improvement <10 dB or no change in A-B gap was 95 (31.7%), out of these patients; eight of them had fixed ossicles due to tympanosclerosis. And 4 patients (1.3%) had worsening of hearing post operatively, 3 of them had fixed ossicles due to tympanosclerosis and one patient had the hearing test one month after the surgery, which was not repeated.

In a study conducted by Thakur and Singh in 2015; they found that 82.8% of patients had improvement in hearing of >10 dB A-B gap gain, and 8 patients (5.3%) had worsening of hearing.⁴ Aslam and Iqbal found, in their study, that 74% of the patients had >15 dB A-B gap gain.⁶ The rate of hearing improvement in our study is lower than those published in the literature. Most of the studies that were mentioned had a follow-up period of 1 year. However, in our study, majority of patients were followed up for 3-6 months, out of the patients' group who had no improvement in hearing; 65.2% of them were followed up 3-6 months. This could be one reason for having lower rate of hearing improvement as compared to other studies.

Furthermore, this study evaluated few factors that can influence the outcome. The factors addressed in this study were age, gender, size of perforation, surgical approach and type of graft used. Age had no influence on the graft success rate, however, we observed a statistically significant better A-B gap gain in the <25 years age group. Many authors reported that age does not affect the success of tympanoplasty.^{3,10} Results of a study conducted by Thakur et al showed that age did not influence the outcome of the surgery.⁴ Another study conducted by Mak and Mackendrick showed that younger age groups had similar results of older age groups.¹⁰ However, Saha et al., found that the young age group, <24 years, had a better post-operative hearing and better graft success rate.⁸ In our study, gender had no influence on the graft success rate as well as the gain in A-B gap. This is consistent with many studies in the literature. Thakur reported that graft success rate in females was 94.6% and in males 88%, which was not statistically significant.⁴

The size of the perforation and surgical approaches were also analyzed as influencing factors and were found to have no effect on the outcome of the surgery in our study. Saha et al.⁸ evaluated the surgical approach as an influencing factor and reported that there was no difference in the outcome between post-aural, permeal and endaural approach.

The size of the perforation does not affect the surgical outcome as supported by many studies.^{4,6} Aslam et al reported that the perforation size had no effect on the graft or hearing improvement success rate.⁶ By contrast, Sajid reported that smaller sized perforation had the highest graft success rate, and that the larger the perforation the lower the success rate.⁷

The use of cartilage graft versus temporalis fascia graft has always been a controversial subject. Many studies have been conducted and concluded that hearing outcome in cartilage tympanoplasty are comparable to temporalis fascia.⁵ In a meta-analysis of 37 studies, it was concluded that graft success rate of cartilage graft compared to temporalis fascia graft was 92% and 82%, respectively, and that hearing outcome was similar in both graft types.¹¹ Similarly, in another study by Jain et al., they have reported that graft uptake in temporalis fascia tympanoplasty was 82.9% and 97.1% in cartilage graft, this was statistically significant.¹² In contrast, Effat has reported in his study comparing inlay cartilage with underlay temporalis fascia, that cartilage had worse graft success (43% versus 83%).¹³ In comparison to the temporalis fascia, we have found

that the cartilage graft had, a statistically significant, better A-B gap closure, and a better, yet statistically not significant, graft success rate. These results are consistent with other studies.

Other factors were evaluated in other studies; like status of the contra-lateral ear, dry or discharging middle ear at the time of surgery. Emir et al. reported that the status of the operated ear at the time of the surgery did not influence the success rate.³ On the other hand, Saha et al.,⁸ they have found that the graft success rate in patients with bilateral TM perforation was 66%, and 92.8% in those who had a unilateral TM perforation, this was found to be statistically significant. These factors were not included in our study.

This study had few limitations. One of them being is that the study was a retrospective study. Missing data is one of the down sides of a retrospective study. Also, the cases included in the study were done by multiple surgeons, rather than one single surgeon. In addition, there were other factors that were not evaluated in this study, that could have influenced the outcome of the surgery, according to some studies shown in the literature. Another limitation of this study was the followup duration, most of our patients were followed up for a period of 3-6 months. A longer follow-up might have given a better outcome in terms of hearing improvement. Also, the time interval between the surgery and post operative PTA varied between the cases.

Conclusion

In conclusion, the graft success rate of Type 1 Tympanoplasty in Al Nahdha Hospital in the past 10 years was found to be 84.3%, and the closure in the A-B gap closure was 11.7. The percentage of patients who had improvement in A-B gap closure of 10dB or more were 67%. These results are comparable with results of other published studies. Factors (age, gender, size of perforation, surgical approach) that are presumed to influence the outcome of type 1 tympanoplasty were statistically not significant. This is consistent with other studies. Cartilage graft was found to give a better closure of A-B gap, which was statistically significant. We recommend that further studies be conducted with a longer follow-up period and address more factors to achieve a better insight pertaining to the outcome of Type 1 Tympanoplasty.

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