Cartilage Tympanoplasty type 1: Surgical Outcome in Aden, Yemen

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Abstract

Background: Tympanoplasty type 1 is surgical repair of the tympanic membrane (TM) perforation with assessment of ossicular mobility which is indicated to restore hearing ability as well as to prevent recurrent otorrhea.

Methods: A retrospective review of the records of all patients who underwent tympanoplasty during the period 2013 - 2016.

Results: The total patients were 102. Males were (48%) and females (52%).

Female to male ratio was 1.08:1, and the mean age was 25.9 ± 6.5 years.

Bilateral were (36.7%), and unilateral (36.3%). Sites of tympanic membrane were (42.2%) central, (31.4%) posterior and (26.4%) anterior.

Perforation sizes were (52.9%) large, (25.5%) medium and (21.6%) small.

The preoperative A-B gap was higher 92(90.2%) in the hearing level of > 20 decibels, while the postoperative A-B gap was higher in the gap group 0-10 decibels (51%) followed by gap group 11-20 decibels 45(44.1%); (p = 0.000).

The mean preoperative A-B gap was 32.16 ± 6.84 dB and postoperative A-B gap was 12.11 ± 8.19 dB. The hearing gain was 20.05 dB (p = 0.000). .

The preoperative hearing threshold was 52.16 ± 6.84 dB and postoperative hearing threshold was 32.15 ± 8.19 dB. The hearing gain was also, 20.01 dB. (p < 0.05). Only 7 (6.9%) patients had complications, and the graft success rate was 98.04%.

Conclusion: We concluded that cartilage tympanoplasty is a reliable graft material for reconstruction of tympanic membrane perforations, and gives excellent hearing results, in unilateral and in bilateral tympanic membrane perforations.

Key words: Cartilage Tympanoplasty, hearing outcome, complications

Introduction

Surgical repair (tympanoplasty) of the perforated tympanic membrane (TM) is indicated to restore hearing ability as well as to prevent recurrent otorrhea (1). Tympanoplasty was introduced by Berthold and later developed and modified by Wullstein and Zollner (1,2,3,4). The various surgical approaches to tympanoplasty include endomeatal (per meatal), endaural, and post-auricular routes. These approaches have a different effect on surgical outcome, depending on the size and site of perforation (1). A surgical technique using either underlay or overlay of grafts over the perforated TM has been employed by various surgeons (1,5,6). The underlay is widely used and is relatively simple to perform, as the graft is placed entirely medial to the remaining drum and malleus (1,2,7).

Objective

To evaluate the outcome of cartilage tympanoplasty: hearing results and complications

Materials and method

The study was a retrospective study involving all patients who underwent Type I tympanoplasty done by the same surgeon (the author) at the Ear, Nose and Throat (ENT) department at Al-Gamhoria Teaching Hospital, and two private hospitals, in Aden, Yemen, between January 2013 and December 2016.

All patients were assessed pre-operatively by detailed history and clinical examination. The patients with tubotympanic disease and dry central perforations were selected.

Patients with a history of nasal allergy, other nasal diseases, throat problems or any systemic disease were appropriately treated before having ear surgery. Cases of cholesteatoma, ossicular pathology and wet tympanic membrane perforations were excluded from the study. The side, size and site of the perforations were recorded. The patency of Eustachian tube was assessed. Hearing assessment was initially performed clinically by tuning fork tests and then by Pure tones Audiometry. Ossicular chain integrity was speculated by preoperative A–B gap on audiometry and then it was checked per operatively when the tympanum was opened. CT scan of temporal bone was performed in all patients. All cases were operated through post aural approach using cartilage perchondrium graft from tragus by underlay technique under general anesthesia. Patients were followed at regular intervals for minimum 1 year post-operatively. Status of the graft, along with any evidence of complications was noted, assessment of hearing was done 1year postoperative by pure tones audiometry. A-B gap and air conduction threshold from speech frequencies (500,1000 ,2000HZ) were recorded.

The collected data were tabulated and statistical analysis was done by estimating rates, means and standard deviations, paired sample t-test was used and p-value < 0.05 was considered as statistically significant. The statistical software package SPSS version 17 was used.

Results

A total number of 102 patients, who were admitted in the ENT department in Al-Gamhoria Teaching Hospital and two other private hospitals during the study period, were included in this study. Table 1 and Figure 1 shows that forty nine (48%) were males and 53(52%) were females. The female to male ratio is 1.08:1, and the mean age was 25.9 ± 6.5 years (range 15 - 45 years). The predominant sides involved were bilateral 65 (36.7%), while the unilateral sides were 37(36.3%). The perforation locations of tympanic membrane were 43(42.2%) central, 32(31.4%) posterior and 27(26.4%) anterior. The predominant perforation sizes were 54 (52.9%) large, 26(25.5%) medium and 22(21.6%) small.

Table 1: Distribution of variables

Variables	No	%
Sex:		
Males	49	48.0
Females	53	52.0
Female to male ratio:	1.08:1	
Mean age (years):	25.9 (SD) ± 6.5	
Age range (years):	15-45	
Side involved:		
Unilateral	37	36.3
Bilateral	65	63.7
Site of perforation:		
Anterior	27	26.4
Central	43	42.2
Posterior	32	31.4
Size of perforation:		
Large	54	52.9
Medium	26	25.5
Small	22	21.6

Figure 1: Proportions of study patients related to sex

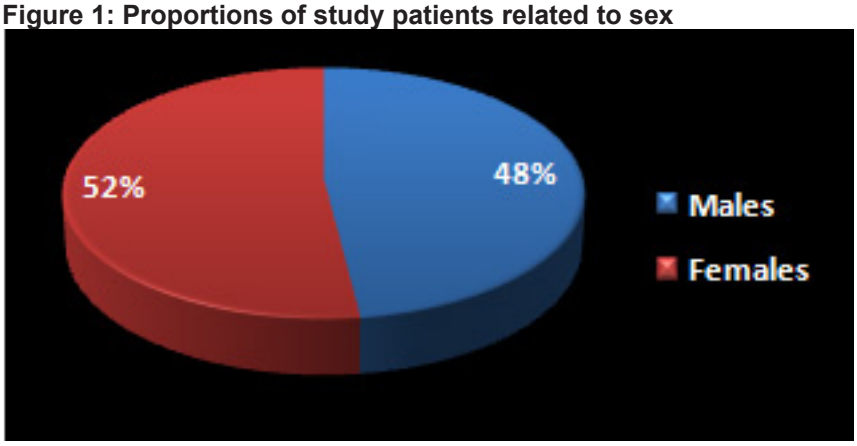

Table 2 and Figure 2 show the pre-operative and postoperative hearing gap related to hearing levels in decibels. Preoperative gap in the air bone gap group 0 – 10 decibels were 0 (0.0%) and in the group 11 – 20 dBs were 10 (9.8%). The preoperative gap was higher 92(90.2%) in the hearing level of > 20 decibels,

while the postoperative gap was higher in the gap group 0-10 decibels 52(51%) followed by gap group 11-20 decibels 45(44.1%) and in the gap group more than 20 decibels were 5(4.9%). The difference between values is statistically significant (p = 0.000).

Table 2: Pre-operative and postoperative gap related to air bone gap group (n = 102)

Air bone gap group (dB)	Preoperative gap		Postoperative gap	
	No	(%)	No	(%)
0 – 10	0	(0.0)	52	(51)
11 – 20	10	(9.8)	45	(44.1)
> 20	92	(90.2)	5	(4.9)

Chi-square = 152; p = 0.000

Figure 2: Pre-operative & postoperative gap related to gap group in decibels

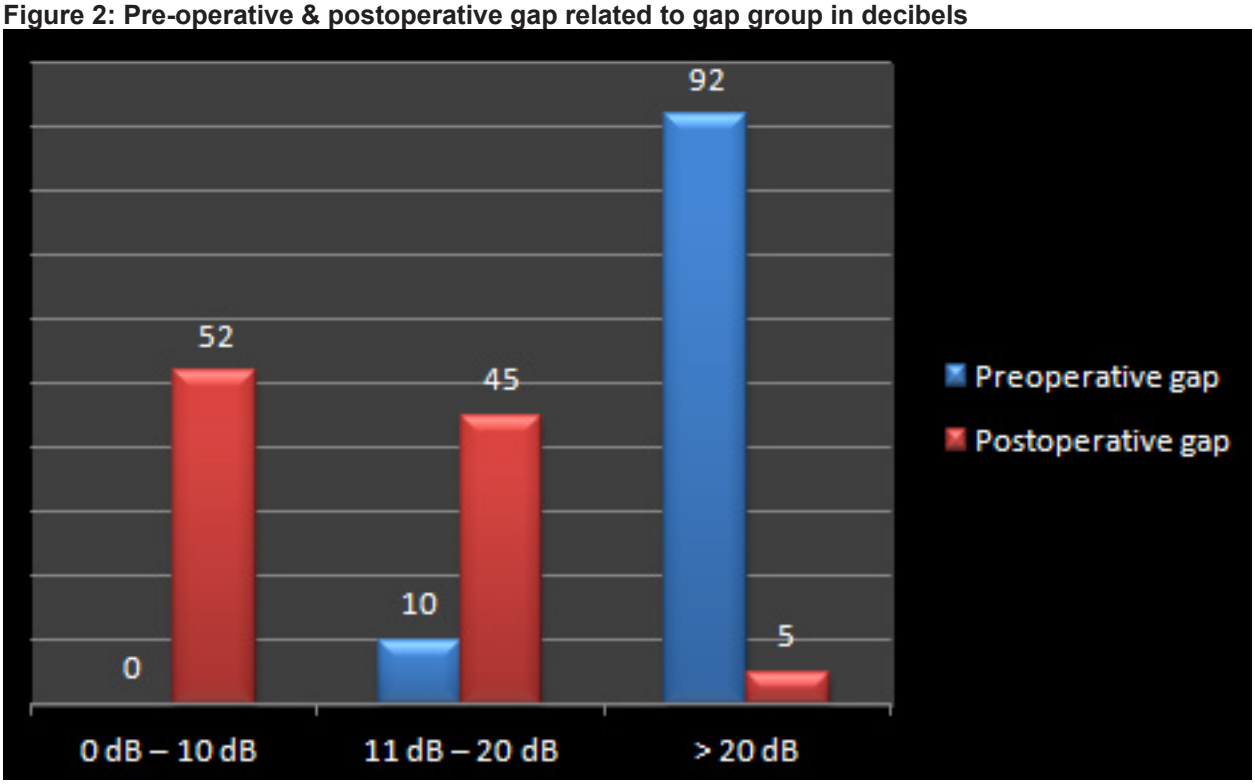

Table 3 reveals that the mean of preoperative A-B gap is 32.16 ± 6.84 dB and postoperative A-B gap is 12.11 ± 8.19 dB. The hearing gain is 20.05 dB. The difference between means is statistically significant, p = 0.000; [95% CL: 19.117 – 20.981].

Table 3: Means of preoperative and postoperative A-B gap and hearing gain

Items	Mean ± SD	P-value & paired test
Preoperative A_B gap	32.16 ± 6.84	p = 0.000; [95%, CL: 19.117-20.981]
Postoperative A_B gap	12.11 ± 8.19	
Hearing gain	*20.05 dB*	

The preoperative air conduction hearing threshold is 52.16 ± 6.84 dB and postoperative air conduction hearing threshold is 32.15 ± 8.19 dB. The hearing gain is also, 20.01 dB. Also, the difference between values is statistically significant, p = 0.000; [95% CL: 19.09 – 20.93] as shown in Table 4.

Table 4: Means of preoperative and postoperative air conduction threshold and hearing gain

Items	Mean ± SD	P-value & paired test
Preoperative threshold	52.16 ± 6.84	p = 0.000; [95%, CL: 19.09-20.93]
Postoperative threshold	32.15 ± 8.19	
Hearing gain	*20.01 dB*	

Complications were Otorrhea 3(2.9%) and a group of complications (adhesive graft, failed graft, serous otitis media, and wound infection) for each one 1(1.0%), as appears in Table 5.

Table 5: Distribution of patients without & with postoperative complications

Items	No	%
No complications	95	93.1
Adhesive graft	1	1.0
Failed graft	1	1.0
Otorrhea	3	2.9
Serous otitis media	1	1.0
Wound infection	1	1.0
Total	102	100

Discussion

Perforations of the tympanic membrane are quite frequent, being caused by infections, trauma or by iatrogenic maneuvers. The size and localization of tympanic defects are variable, their correct evaluation being essential for a successful management of the pathology (8,9).

Cartilage or composite cartilage grafts are more resistant to infections, middle ear pressure, and lack of capillary feed (10,11).

Our study included 102 individuals who had examined, diagnosed and undergone tympanoplasty and were postoperatively evaluated for hearing bone air gap, hearing threshold and complications. The female patients were predominant 53(52%) while male patients were 49(48%). The female to male ratio was 1.08:1.

These findings are in accordance with the findings of Gierek et al (12), Kiakujori et al (13) and Prasad et al (14) who in their studies also had female predominance. In contrast to our study Homquist (15) had male predominance.

The mean age of the patients in our study was 25.9 ± 6.5 years (range 15 - 45 years). This finding was similar to findings by others (13,14,16).

In the present study the predominant sides involved were bilateral 65 (36.7%, while the unilateral sides were 37(36.3%). We classified the tympanic membrane perforation size as large (subtotal), medium and small. The predominant perforation sizes were large (52.9%) followed by medium (25.5%) and small (21.6%). We found also, the perforation locations of tympanic membrane were central (42.2%), posterior (31.4%) and anterior (26.4%).

These findings were to some extent similar to the finding reported by Thakur et al (17) who found that site of perforation affects the degree of hearing loss. Big central and central malleolar perforation causes greater hearing loss than other perforation sites (18). Most authors also reported less success with the anterior perforation probably because the anterior portion of the tympanic membrane is the least vascular area. Longer duration of disease causes more damage to the middle ear mucosa (19).

We used underlay technique of graft placement in all patients of the present study. Similar technique of graft placement was used in the study of Gerber et al (20), Kotecha et al (21) and Dornhoffer (22).

In the present study, 92(90.2%) patients had preoperative hearing loss (air-bone gap) more than 20 decibels. While in the group of 11 – 20 dBs there were only 10 (9.8%) patients, whereas no patient had an air bone gap 0 - 10 dB prior to surgery.

This was similar to the finding reported by Dabhekar et al (23) that 91% (60/65) patients had preoperative hearing loss (air-bone gap) between 20-40 dB.

Other authors such as Dornhoffer (22) found (45%), Gerber et al (20) found (59.9%) and reported much less preoperative hearing loss, between 20-40 decibels.

In a study from Egypt by Fatthy et al (24), they reported that in preoperative hearing loss (air-bone gap) there was no patient in group of A-B gap 0 to 10 dBs. This finding is comparable to our finding.

Our results differ in the number of patients in the group of A-B gap 10 - 20 decibels as well as in the group above 20 decibels.

Our explanation of the higher preoperative hearing loss in the present study is similar to that mentioned before by Dabhekar et al (23) that it is probably due to more reluctance of patients towards their health, resulting in late referral to an otologist.

In the present study, mean preoperative air bone gap was 32.16 ± 6.84 dB. A similar finding was reported by Dabhekar (23) et al (30.14 ± 6 dB) and Aidonis (25) et al (32.4 ± 14.1 dB).

Mean postoperative air-bone gap in this study, was 12.11 ± 8.19 dB while in the study by Dornhoffer (22) it was 14.1 ± 9.5 dB and in the study of Mayaleh et al (26) it was 12.2 ± 7.3 dB.

The hearing gain in this study was 20.05 dB which was in accordance with a previous study by Dornhoffer (27) wherein mean hearing gain was 19 dB and a study finding of Dabhekar (23) where it was 18.6 dB.

Onal et al (28) reported in their study that hearing outcomes for all patients ABG was 29.59±9.88 dB pre-operatively and 16.56±9.30 dB post-operatively and the association between values was statistically significant (p =0.001).

We found in our study the preoperative air conduction hearing threshold was 52.16 ± 6.84 dB and postoperative hearing threshold was 32.15 ± 8.19 dB. The hearing gain was also, 20.01 dB. Also, the difference between values is statistically significant, p = 0.000; [95% CL: 19.09 – 20.93]. Our finding is to some extent similar to the findings reported by Onal et al (28) that preoperative air conduction threshold was 40.69 ± 9.11 decibels and the postoperative threshold was 22.97 ± 8.37 decibels.

Also, in our study the hearing gain in air conduction threshold was 20.01 dB which is comparable to that reported by Ben Gamra et al (29) in which they mentioned in their study that the postoperative mean of air conduction gain was 21 ± 11 dB.

In the current study we found that out of 102 patients only 7(6.9%) patients had complications. The complications were Otorrhea 3(2.9%) [due to mild otitis externa which was treated by antibiotics] and a group of complications (adhesive graft, failed graft, serous otitis media, and wound infection) for each one 1(1.0%). Serous otitis media developed in an allergic rhinitis patient and was improved by anti-allergic treatment.

If we consider that adhesive graft 1(1%) and failed graft 1(1%) the lack of success in the tympanoplasty surgery was in 2 patients and the success of tympanoplasty in 100 patients, so the graft success rate was 98.04%. Our finding was comparable with the study result of Khan et al (30) in which they reported the success rate was 98.20%.

Conclusion

- Cartilage tympanoplasty gives excellent hearing results whatever the site or size of perforation, with rare postoperative complications;
- Cartilage is a reliable graft material for repairing the tympanic membrane perforations;
- Cartilage tympanoplasty gives better hearing results in bilateral tympanic membrane perforations where the dysfunction is of the Eustachian tube.

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