

Cartilage Tympanoplasty for Management of Tympanic Membrane Perforation: Comparison with Temporalis Fascia Graft Technique: A Review of 60 Cases

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ABSTRACT

Objectives: To observe the graft take up rate and the hearing outcome in both temporalis fascia and conchal cartilage graft and to compare outcome of cartilage tympanoplasty to the temporalis fascia graft technique.

Materials and Methods: We report a case series analysis of 60 cases of chronic otitis media managed in our department in the year of 2014-2015. Patients with Central perforation, good cochlear reserve and Patent Eustachian tube only were in the study. Chronic otitis media with complication were excluded, so were patients with per operative ossicular discontinuity, fixed foot plate. Patients were randomly allocated into two groups. Patients in group A underwent cartilage tympanoplasty and patients in group B underwent tympanoplasty using temporalis fascia as graft.

Results: It has been established by this study that tympanoplasty with cartilage graft has a high degree of graft taken (96.67%) in comparison to temporalis fascia graft (90%). Our data indicate that cartilage graft provided satisfying hearing improvement in 90% of the patients in comparison to temporalis fascia graft (80%). Hearing improvement seen after follow up of 3 months among both groups was statistically insignificant ($P = 0.640$ and Chi square value 0.891), proving that overall hearing improvement after Cartilage tympanoplasty

is comparable to tympanoplasty with Temporalis fascia as a graft.

Conclusion: Type I tympanoplasty using conchal cartilage, has given good hearing results in patients with chronic otitis media, in terms of integrity and intactness of the graft, discharge-free ear and improvement of hearing.

Keywords: Tympanoplasty, Temporalis Fascia Graft, Conchal Cartilage Graft, Chronic Otitis Media.

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INTRODUCTION

Chronic otitis media (COM) is an inflammatory process in middle ear space that results in long term or more often, permanent changes in tympanic membrane including atelectasis, dimer formation, perforation, tympanosclerosis, retraction pocket development or cholesteatoma¹. Chronic otitis media is a real health problem in developing countries like India due to low awareness in general health, poor personal hygiene, malnutrition, poor environmental sanitation and overcrowding. The surgical management of uncomplicated tubotympanic CSOM is based on following principles: To eradicate active disease, promote the drainage and healing, To prevent reinfection in ear has remain inactive (dry ear) by restoring an air filled middle ear cavity lined by health mucosa, to restore the functions of middle ear To prevent complications.

The surgical management in an uncomplicated tubotympanic type of C.S.O.M. varies with the size and site of perforation; however the essence of procedure is to close the perforation with

restoration of functioning of middle ear by procedure of myringoplasty.

Since the introduction of tympanoplasty, in the fifties, by Zollner² and Wullstein³ various graft materials and perforation closure techniques have been described since then such as temporal fascia⁴, perichondrium⁵, periosteum⁶, vein⁷, duramater⁸ and cartilage^{9,10}. Cartilage is preferred because of its increased stability and resistance to middle ear pressure even in cases with chronic eustachian tube dysfunction. Utech, in 1959, first introduced cartilage in middle ear surgery¹¹. The mechanical characteristics of cartilage offer the advantage of high resistance to retraction and re-perforation. Cartilage has a constant shape, firmer than fascia and also lacks fibrous tissue, so that the post-operative dimensions remain the same and it is also nourished by diffusion and shows great adaptation with tympanic membrane¹². The present study has been aimed to utilize the conchal cartilage as a graft for tympanoplasty.

MATERIALS AND METHODS

We report a case series analysis of 60 cases of chronic otitis media managed in our department in the year of 2014-2015. Patients with Central perforation, good cochlear reserve and Patent Eustachian tube only were in the study. Chronic otitis media with complication were excluded, so were patients with per operative ossicular discontinuity, fixed foot plate. All patients underwent routine investigation preoperative pure tone audiometry and X-ray mastoids Lateral oblique view. Patients were randomly allocated into two groups. Patients in group A underwent cartilage tympanoplasty and patients in group B underwent tympanoplasty using temporalis fascia as graft.

Table 1: Pre operative puretone audiometry

Hearing loss in A-B gap (in db)	Number of patient	
	Group A	Group B
20-35	15	10
36-50	12	14
>50	3	6

Table 2: Comparison of A-B Closure In Group A

Hearing loss (in db)	Number of patient	
	At First post operative month	At Third post operative month
10-20	17	25
21-35	11	3
>36	2	2

Table 3: Comparison of A-B Closure In Group B

Hearing loss (in db)	Number of patient	
	At First post operative month	At Third post operative month
10-20	18	22
21-35	8	5
>36	4	3

Table 4: Comparison of A-B Closure at First Post-Operative Month

Hearing loss (in db)	Number of patient	
	Group A	Group B
10-20	17	18
21-35	11	8
>36	2	4

Group A: Patient underwent cartilage tympanoplasty;
Group B: Patient underwent tympanoplasty using temporalis fascia as a graft

Table 5: Comparison of A-B Closure at Third Post-Operative Month

Hearing loss (in db)	Number of patient	
	Group A	Group B
10-20	25	22
21-35	3	5
>36	2	3

Group A: Patient underwent cartilage tympanoplasty;
Group B: Patient underwent tympanoplasty using temporalis fascia as a graft

OBSERVATION AND RESULTS

In cartilage tympanoplasty group (Group A), 15 patients presented with pure tone audiogram ranged between 20-35dB, 12 patients with range 36-50dB and 3 patients with >50dB. Average AB gap ranged between 22 to 65dB. In Temporalis fascia group, 10 patients presented with pure tone audiogram ranged between 20-35dB, 14 with range 36-50dB and 6 with >50dB. Pre-operatively average PTA ranged between 20 to 68 dB. (Table 1)

In cartilage group, AB gap when compared at the end of first post-operative month was not significant with P value of 0.0832 and chi-square value of 0.368. While at the end of third post-operative month it was not significant with P value of 0.047 and Chi square value of 6.097. While results at the end of third post-operative month compared with pre-operative value it shows significant improvement in hearing with P value of 0.017 and Chi square 8.100. (Table 2)

In temporalis fascia group, AB gap when compared at the end of first post-operative month was not significant with P value of 0.115 and chi-square value of 4.322. While at the end of third post-operative month it was not significant with P value of 0.539 and Chi square value of 1.235. While when results at the end of third post-operative month compared with pre-operative value it shows significant improvement in hearing with P value of 0.008 and Chi square 9.763. (Table 3)

At the end of first post-operative month, in cartilage group, 17 patients were having AB gap in range of 10-20 dB, 11 patients in range of 21-35dB and 2 patients with >36 dB. Average AB gap ranged between 18 to 63dB while in temporalis fascia group 18 patients were having AB gap in range of 10-20 dB, 8 patients in range of 21-35dB and 4 patients with >36 dB. Average AB gap ranged between 12 to 68 dB. (Table 4)

At the end of third post-operative month, in Cartilage group, 25 patients having AB gap in range of 10-20 dB, 3 patients in range of 21-35 dB and 2 patients with AB gap >36dB. Average AB gap ranged between 10 to 63 Db. In Temporalis fascia group, 22 patients having AB gap in range of 10-20 dB, 5 patients in range of 21-35 dB and 3 patients with AB gap >36dB. Average AB gap ranged between 12 to 68dB. (Table 5)

The successful graft uptake was seen in 56 patients (93.33) at the end of third post-operative month without any post-operative complication, while in 4 patients (6.67%) medialisation of graft was observed. No significant difference noted in both groups with P value 0.605 and Chi square value 0.268. (Table 6)

In cartilage group, out of 30 patients, successful graft uptake with no discharge and dry ear was seen in 29 patients (96.67%) while in 1 patient (3.33%) presented with small residual anterior perforation, which healed with application of 25% Trichloro-acetic acid after 2weeks. (Table 7)

In Temporalis Fascia group, out of 30 patients, 27 patients (90%) presented with successful graft take up with dry ear, while 3 patients (10%) presented with discharging ear and residual perforation at the end of third post-operative month. (Table 8)

DISCUSSION

Chronic suppurative otitis media is one of the major illnesses in our country. A large majority of the CSOM cases belong to the safe or tubo- tympanic variety in which central perforation is present in the tympanic membrane. It leads to loss of hearing and recurrent ear discharge which contributes to the morbidity in the

Table 6: Graft Uptake Result of Tympanoplasty

Result	Number of patient	Percentage
Successful	56	93.33
Unsuccessful	4	6.67

Table 7: Result of Tympanoplasty Using Conchal Cartilage as a Graft

Result	Number of patient	Percentage
Successful	29	96.67
Unsuccessful	1	3.33

Table 8: Result of Tympanoplasty Using Temporalis Fascia as a Graft

Result	Number of patient	Percentage
Successful	27	90
Unsuccessful	3	10

population. The patient also suffers socially due to deafness and face embarrassment due to aural discharge. These patients come to ENT surgeons in order to be relieved of these symptoms. Tympanoplasty is one of the operations employed by ENT surgeons for these patients. It not only gives the patient a dry ear but also improves hearing in most of the patients.

Lot of graft materials have been used by various surgeons for covering the perforation in the ear drum. Now a day the most commonly used graft material is temporalis fascia.

Cartilage is a reliable graft for tympanic membrane reconstruction as it is nourished by diffusion and becomes well incorporated in the tympanic membrane¹². The advantage of the use of cartilage over Temporalis fascia cannot be overlooked as its toughness prevents the retraction of the tympanic membrane, but there has been concerns regarding hearing results after the use of this cartilage. Two main reasons why many otologists prefer fascia rather than cartilage are the easier technique of fascia harvesting and the postoperative hearing improvement. Thickness of the cartilage graft certainly will affect the hearing result. However, large cartilage plates with thickness no more than 0.5 mm have been suggested as acceptable and the graft take of this technique has been reported with excellent outcomes¹³. There is minimal inflammatory tissue reaction with cartilage. Cartilage tympanoplasty is said to prevent retraction pockets in the tympanic membrane because of its firm support. There is some resistance to infection with cartilage during the healing period. Thus, the risk of recurrent perforation is reduced. In cases of severe Eustachian tube dysfunction, cartilage maintains its integrity and resists resorption as well as retraction¹⁴. Cartilage graft has been thought to have a very low metabolic rate, a factor helpful in maintaining intactness of the graft.

The demographic and clinical data was collected which included age, sex, rural/urban population, diagnosis (chronic suppurative otitis media with or without cholesteatoma), prior otologic surgery, details of surgical technique, intra-operative findings (middle ear mucosa status, ossicular chain status, and reconstruction), post-operative findings (graft incorporation), hearing and duration of follow-up. The main outcome measures were both anatomical and

functional in form of graft incorporation and postoperative hearing function.

In our study in the temporalis fascia group, follow up was done after 3 months and found that in 27 (90%) patients the tympanic membrane graft was intact and in 3 (10%) patients residual perforations were present. In the conchal cartilage group, after 3 months follow up, it was found that in 29 (96.67%) patients the tympanic membrane was intact and residual perforation was seen in one (3.33%) patient. In our study, the overall graft acceptance rate with the cartilage graft is 96.67% suggesting that cartilage tympanoplasty is an excellent technique, which is in agreement with the outcome of other studies done by various authors.

Neumann, et al.,¹⁵ reported no recurrent perforations, a 100% graft survival and eardrum closure-rate in palisade cartilage tympanoplasty in 29 patients who had been operated on 9 years ago. It has been proposed that the reason why cartilage is more resistant than the fascia to the changes caused by negative middle ear pressure is because the cartilage receives its nourishment mainly through diffusion¹² and the thickness of the cartilage remains intact and retains its strength to resist negative pressure forces¹⁶.

In 1963, Goodhill et al did 19 cases of tympanoplasty using tragal perichondrial graft and in their preliminary report they has 100% take up rate in all cases and dry ear was obtained in a short period of time¹⁷.

Khan and Parab (2011)¹⁸ achieved a success rate of 98.20% with the use of tragal cartilage perichondrium composite graft in tympanoplasty. Re-perforation rate is comparatively less and graft integration rate is significantly higher with the use of cartilage graft¹⁹.

Sheehy and Glasscock²⁰ in a series of 808 primary cases in which they used temporalis fascia as graft material concluded that there was a 97.5% graft take up rate. This was in comparison with 499 primary cases, in which canal wall skin was used as graft material in which the take up rate was 91.8%. Preoperative and postoperative pure-tone audiometry was done in all patients and pure-tone average of A-B gap was calculated using 500, 1000 and 2000 Hz. At the end of 3rd post-operative month, when A-B gap compared among both the groups it was found to be insignificant with P value of 0.640 and Chi-square value 0.891.

In 1997, Dornhoffer²¹ retrospectively compared the audiometric results of patients who had repair of their eardrum using cartilage (with and without perichondrium) grafting to those who had repair using perichondrium or fascia alone. He found no significant variation in hearing results in the two operative techniques. Hearing improved in the cartilage tympanoplasty group, with a residual PTA air-bone gap of 6.8 dB. This was not a statistically significant difference to the 7.7 dB PTA air-bone gap observed in the perichondrium/fascia group.

In study done by Yung et al.²² graft take up rate in cartilage (80%) versus fascia (84.2%) was seen. Post-operative air-bone gap of \leq 20 dB, cartilage (41.6%) versus fascia (64.4%). No statistically significant difference in graft take up or hearing was observed.

In study by Cabra et al.²³, higher morphological Higher morphological success in cartilage (82.3%) than fascia (64.4%) i.e., absence of retraction, atrophy, lateralization, anterior blunting, and otorrhea ($p = 0.03$) Postoperative air-bone gap of \leq 20 dB, cartilage (62.5%) versus fascia (73.9%). No significant difference in hearing was observed.

CONCLUSION

Type I tympanoplasty using conchal cartilage, has given GOOD hearing results in patients with COM, in terms of integrity and intactness of the graft, discharge-free ear and improvement of hearing.

REFERENCES

1. Glasscock- Shambaugh surgery of the ear 6th edition.page 427-428,465
2. Zollner, F. (1955) The Principles of Plastic Surgery of the Sound Conducting Apparatus. Journal of Laryngology and Otolology, 69, 637-652
3. Wullstein, H.L. (1952) Functional Operation in the Middle Ear with Split Thickness Skin Graft. Archives of Otorhinolaryngology, 161, 422-436
4. Heermann, H. (1960) Tympanic Membrane Plastic Repair with Temporalis Fascia. Hals Nas Ohrenh, 9, 136-139.
5. Salen, B. (1968) Tympanic Membrane Grafts of Full Thickness Skin, Fascia and Cartilage with Its Perichondrium, an Experimental and Clinical Investigation. Acta Oto-Laryngologica, 244, 5-73.
6. Bocca, E., Cis, C. and Zernotti, E. (1959) L'impiego di lembi liberi di periostio nella tympanoplastica. Archivio Italiano di Otologia, Rinologia e Laringologia. Supplemento, 40, 205.
7. Tabb, H.G. (1960) Closure of Perforation of the Tympanic Membrane by Vein Grafts: A Preliminary Report of 20 Cases. Laryngoscope, 70, 271-274
8. Albrite, J.P. and Leigh, B.G. (1966) Dural Homograft (Alloplastic) Myringoplasty. The Laryngoscope, 76, 1687-1693.
9. Jansen, C. (1963) Cartilage-Tympanoplasty. The Laryngoscope, 73, 1288-1302
10. Salen, B. (1963) Myringoplasty Using Septum Cartilage. Acta Otolaryngologica, 57, 82-91.
11. Utech, H. (1959) Ueber diagnostische und therapeutische Moeglichkeiten der Tympanotomie bei Schalleitungsstoerungen. Zeitschrift für Laryngologie, Rhinologie, Otologie und ihre Grenzgebiete, 38, 212-221.
12. Levinson, R.M. (1987) Cartilage-Perichondrial Composite Graft Tympanoplasty in the Treatment of Posterior Marginal and Attic Retraction Pockets. Laryngoscope, 97, 1069-1074.
13. Chen XW, Yang H, Gao RZ, Yu R, Gao ZQ. Perichondrium/cartilage composite graft for repairing large tympanic membrane perforations and hearing improvement. Chin Med J (Engl). 2010 Feb 5;123(3):301-4.

14. Wang X, Song J, Wang H. [The results of tympanoplasty with titanium prostheses]. Zhonghua Er Bi Yan Hou Ke Za Zhi. 1996;31(6):325-7.
15. Neumann A, Kevenhoerster K, Gostian AO. Long-term results of palisade cartilage tympanoplasty. Otol Neurotol. 2010 Aug;31(6):936-9.
16. Yu-Hsuan Wen, Lee-Ping Hsu, Peir-Rong Chen, Chia-Fone Lee:Design Optimization of Cartilage Myringoplasty using Finite Element Analysis :Tzu Chi Med J 2006 18 No. 5
17. Goodhill, V et al. Tympanoplasty with perichondral graft. Archieves of Otolaryngology; 1964; 79; 131-137
18. Khan MM, Parab SR, Primary cartilage tympanoplasty: Our technique and results. Am J Otolaryngol 2011; 32: 381-7.
19. Lacovou E, Vlastarakos PV, Papacharalampous G, Kyrodimos E, Nickolopoulos TP. Is cartilage better than temporalis muscle fascia in type I tympanoplasty? Implications for current surgical practice. Eur Arch Otorhinolaryngol 2013; 270: 2803-13.
20. Sheehy, Glasscock et al. Tympanic membrane grafting with Temporalis fascia. Archieves of otolaryngology; 1967; 86;391402.
21. Dornhoffer JL. Hearing result with cartilage tympanoplasty. Laryngoscope 1997; 107: 1094-99.
22. Yung M, Vivekanandan S, Smith P. Randomized study comparing fascia and cartilage grafts in myringoplasty. Ann Otol Rhinol Laryngol 2011;120:535Y41.
23. Cabra J, Monoux' A. Efficacy of cartilage palisade tympanoplasty: randomised controlled trial. Otol Neurotol 2010;31:589Y95.

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