Review Article

Cartilage perichondrium composite graft myringoplasty: A review

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Abstract

Background: Chronic suppurative otitis media is a major cause of tympanic membrane perforation in the developing world. Surgical intervention in the terms of "Myringoplasty" is the treatment of choice for effective closure of tympanic membrane perforation. Today most commonly used grafts are temporalis fascia and tragal perichondrium. **Aims and Objectives:** To evaluate the result of cartilage perichondrium graft in myringoplasty. **Material and Methods:** This study was conducted in the department of ENT and Head and Neck Surgery S.M.G.S Hospital G.M.C Jammu for a period of one year connecting from October 2015 to October 2016. This study includes a detailed history and complete physical examination with relevant investigations in 30 cases of safe type of chronic suppurative otitis media. Myringoplasty using cartilage perichondrium graft was conducted in all the cases. The hearing results were compared in terms of post-operative average ABG (air-bone gap) and ABG closure. **Summary and Conclusion:** In the present prospective study, 30 patients underwent myringoplasty procedure in which composite cartilage graft was used as graft material. 28 (93.33%) ear grafts were intact and in place. While as there were 2 (6.67%) cases of graft failure. The comparison of pre-operative with post operative air-bone gap showed a significant difference. Mean value of ABG pre operative was 31.06 ± 6.29 dB. Mean value of ABG post operative third month was 14.27 ± 6.43 dB. Hence it is concluded that the use of cartilage perichondrium graft is successful in perforation closure and hearing improvement.
Key words: Myringoplasty, perichondrial graft.

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INTRODUCTION

CSOM (Chronic suppurative otitis media) is an inflammatory process in the middle ear space that results in long term or more often permanent changes in the tympanic membrane including atelectasis, perforation, tympanosclerosis, retraction pocket development or cholesteatoma.[1] CSOM is usually classified into tubotympanic disease and atticoantral disease. Tubotympanic disease is usually characterized by perforation of pars tensa. Atticoantral disease most commonly involves pars flaccida characterized by cholesteatoma formation.[2] Surgical intervention in terms of "myringoplasty" is the treatment of choice for effective closure of tympanic membrane perforation. Surgery of the tympanic membrane dates back as far as the 17th century when first attempt at repair of a tympanic membrane perforation with a pig's bladder was described.[3] In 1853, Toynbee placed a rubber disk attached to a silver wire over a perforation.[4] He reported significant improvement in hearing with this method. Later in 1877 paper patch technique was proposed which is still used today for preoperative evaluation of potential hearing improvement after surgery. [5] Wullstein (1952) and Zollner (1953) are given credit for ushering in the modern era of tympanoplasty. They placed split thickness skin grafts over the de-epithelialized TM remnant.[6] In 1961, Storrs reported a series of patients in which temporalis fascia was used as an outer surface graft.[7] Myringoplasty is unrelated to the size of perforation, the approach, the condition of the mucosa or the tubal function.[8] Today most commonly used grafts are temporalis fascia and tragal perichondrium. Temporalis fascia was used first in myringoplasty by Ortegrent (1964)[9], Heerman (1961)[10] and Storss (1961).[7] The success rate of temporalis fascia has been close to 90%. [11] Although the temporalis fascia has been widely used, it can eventually become thin and atrophic leading to reperforation. Also in cases of subtotal perforation,

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atelectatic ear and retraction pockets results of temporalis fascia graft in the long term is not satisfactory. [12] The perichondrium also undergoes atrophy and subsequent failure in the post-operative period regardless of placement technique. To overcome this, perichondrium cartilage composite grafts are used with good results. The very first cartilage perichondrium composite graft the annular graft was introduced by Goodhill in (1964). [13] Cartilage contributes minimally to an inflammatory tissue reaction and is well incorporated with tympanic membrane layers; it also provides firm support to prevent retraction. The greatest advantage of the cartilage perichondrium graft has been thought to be its very low metabolic rate. It receives its nutrients by diffusion, is easy to work with because it is pliable and it can resist deformation from pressure variations. Perichondrium attached to cartilage share with fascia the quality of being mesenchymal tissue, but they are thicker and stiffer. Subtotal or total perforations are at high risk for graft failure, can be treated efficiently and a durable and resistant reconstruction of the TM with reasonable hearing can be achieved with cartilage perichondrium composite graft. [14] Cartilage perichondrium composite graft have proven to be particularly appropriate for surgical situations that benefit from stiffness of cartilage (Adhesive otitis, retraction pockets, subtotal tympanic membrane defects and revision myringoplasty). [15]

POPULAR TECHNIQUES OF CARTILAGE TYMPANOPLASTY-MIRKO TOS (2009) [16]

Inlay Butterfly Graft- This technique was originally described for small harvested with intact perichondrium myringoplasty. The tragal cartilage graft is harvested with perichondrium on both sides. Using a surgical blade, a 2mm circumferential incision is made on the cartilage to create a groove with an appearance similar to wings of butterfly. After perforation rim is freshened, the cartilage graft can then be anchored on the perforation similar to a tympanostomy tube.

Perichondrium- Cartilage Island Flap- Tragal cartilage graft is harvested because it is flat, thin (1mm) and abundant. Perichondriom from the side away from the external auditory canal is removed. A flap of perichondrium is produced, posteriorly, that will eventually drape over the posterior canal wall. Next a complete strip of cartilage 2mm in width is removed vertically from center of cartilage to accommodate the entire malleus handle. The entire graft is placed is underlay fashion, with malleus fitting groove.

Palisade Techniques- Cartilage graft is cut into several slices or strips, which are then placed together, medial to the malleus to reconstruct the tympanic membrane.

Cartilage Shield Technique- In this technique a round piece of conchal cartilage is harvested and perichondrium on both sides is removed. A small wedge of cartilage is removed to accommodate handle of malleus. The graft is then placed medial to the handle of malleus and tympanic membrane remnant. In our clinical practice we encounter great deal of patients suffering from tympanic membrane perforations, retractions, previous myringoplasty failure requiring myringoplasty. The present study is a controlled prospective study aimed at clinical outcome of composite cartilage perichondrium graft in myringoplasty.

MATERIAL AND METHODS

This was a prospective study to be conducted in the department of ENT and Head and Neck Surgery. S.M.G.S. Hospital G.M.C.Jammu for a period of one year connecting from October 2015 to October 2016. The study was done on the patients with age 12 years and above, of both sexes with safe CSOM. Those to be excluded from the study were children less than 12 years of age, medically unfit patients, those without useful residual cochlear function, malignant neoplasms of external and middle ear, sensorineural hearing loss and unsafe CSOM. A thorough clinical work up of all the patients was done. Detailed history of the patient was taken and complete head and neck examinations were performed on all patients. The otoscopic examination was done and the findings were confirmed by examination under microscope. The PTA test was performed within 7 days prior to the operation. Impedance audiometry was carried out wherever required. Complete blood counts of the patient were done. Patients were investigated for blood urea, creatinine, electrolytes, liver function tests and blood sugar. Computed Tomography of the temporal bones, was done in cases of failed myringoplasty. All patients were operated under either general anaesthesia or local anaesthesia. The decision between choosing transcanal or post-auricular approach was dependent on the canal width either narrow or wide. Examination under microscope was done and type of perforation, retraction pockets, tympanosclerotic plaque, ossicular erosion was noted. The graft material harvested was composite cartilage perichondrium graft from choncha or tragus. The type of myringoplasty was either overlay or underlay. The follow up of the patients was done at an interval of 1 month, 2 month and 3 month post operatively. The hearing results were compared in terms of post-operative average ABG (air-bone gap) and ABG closure. The post-operative ABG closure was calculated by taking the difference between pre-operative ABG and post-operative ABG at average frequencies of 500, 1000 and 2000 Hz.

OBSERVATIONS

16 (53.333%) patients are in age group 21-30. 12 (40.00%) patients are in age group 31-40. 1 (3.33%)

patient is in age group 41-50. Mean age in our study of 30 patients is 30.13± 6.42. 13 (43.33%) were males and 17 (56.67%) were females. It was observed that left ear involvement was 50% and right ear involvement was also 50%. All patients presented with more than one symptom. Ottorhea was the most common symptom 26 (86.66%). Hearing impairment accounted for 24 (80%). Tinnitus was found in 20 (66.66%) patients and otalgia in 18 (60%) patients.

Table 1: Pre-operative PTA-AB Gap

Hearing loss (A-B gap)	No. of patients	Percentage (%)
>30dB	12	40
21-30	18	60
≤30	-	0

12 (40%) patients had per-operative PTA –AB gap>30dB. 18 (60%) patients had pre-operative PTA-AB gap from 21-30dB.[Table 1] 23 (76.66%) of surgery was done under general anaesthesia and 7 (23.33%) was done under local anaesthesia. In 26 (86.67%) patients post aural approach was used and transcanal approach was used in 4 (13.33%) of patients.

Table 2: Donor Site for Composite Cartilage Perichondrium Graft

Graft Harvested	No. of Patients	Percentage (%)
Tragal cartilage perichondrium	26	86.67
Conchal cartilage perichondrium	4	13.33

Composite cartilage graft was harvested from tragal cartilage in 26 (86.67%) of patients and 4 (13.33%) of patients in conchal cartilage perichondrium group.[Table 2]. 28 (93.33%) ears graft was taken which was intact and in place. While as there was 2 (6.67%) graft failure. P-value= 0.0 which is statistically highly significant.

Table 3: Post-operative A-B Gap Closure

Post-operative A-B Gap Closure	No. of Patients	Percentage (%)
≤20dB	24	80
21-30	5	16.66
<30dB	1	3.33
Total	**30**	**100**

24 (80%) patients were such in whom Air-Bone gap closure was 20dB. 5 (16.66%) patients had their Air-Bone gap closure from 21-30 dB. 1 (3.33%) patient had Air-Bone closure>30dB. Table 3

Table 4: Comparison between PTA-AB gap Pre-OP and PTA post-OP 3rd month

PTA	Mean± Standard Deviation
PTA-AB gap Pre-OP	31.06±6.29
PTA post OP 3rd month	14.27±6.43

Out of 30 patients 93.3% of patients had no complication and 2% had graft failure.

DISCUSSION

CSOM is one of the common causes of hearing loss. In the past, ear surgery was limited to address the disease part of CSOM and its complications. Any attempt at restoring the sound of conducting mechanism of middle ear was thought to be futile. But the last few decades has experienced a revolutionary change in otiologic surgery. Since the publication of Zollner[17] and Wullstein[6], different methods and usage of different graft materials have been promoted in myringoplasty. Although temporalis muscle fascia has been widely used, it can eventually become thin and atrophic. In addition due to lack of elasticity and resistance to pressure changes in the external ear canal, several authors have suggested that temporalis fascia should be replaced by cartilage. Cartilage being stiffer material which resists initial period of malnourishment and tubal dysfunction in the middle ear was put forward as a better substitute of graft material. In our study majority of patients lie in younger age of 21-30 years (40%). Exact cause was difficult to comment possibly the patients were more conscious about their hearing at this age. Remaining cases were of middle age worried about their hearing due to social cause. In our study there was female preponderance as compared to male. The male female ratio was 1:1:3. This ratio was comparable with the study carried by Ahmad *et al* (2003) in which the male female ratio was 1:1:3.[18] Postaural approach was used in 26 (86.67%) patients and transcanal approach was used in 4 (13.33%) patients. Transcanal approach was preferred in cases with wider external auditory canal while postaural approach provides better exposure and wider external auditory canal or anterior prominent bulge. In our study these approaches had almost equal success in terms of graft uptake. In our study composite cartilage graft was used as a graft material which was harvested from tragal cartilage in 26 (86.67%) patients and conchal cartilage in 4 (13.3%). In our series of 30 patients drum closure was achieved in 28 (93.33%) while as there were 2 (6.67%) patients with recurrent perforation at 3 months postoperatively. The table shows that graft uptake in our series was comparable to the following studies.[19,18,20]

Source	No. of subjects	Graft uptake
Dornhoffer (1997)	42	100%
Ahmad *et al* (2003)	46	91.3%
Demirpehalvin (2011)	120	85%
Our study	**30**	**93.3%**

Ahmad *et al* (2003) reported in his study of 46 cartilage myringoplasty cases. Otology results were compared with the results of 30 fascia myringoplasty operated at same period of time. Successful closure of tympanic membrane perforation was achieved in 91.3% of the cartilage group

as compared to 73.3% of the fascia.[18] Demirpehalivin *et al* (2011) studied the functional results after myringoplasty with temporalis muscle fascia, perichondrium/cartilage island and cartilage palisades in 120 patients Temporalis muscle fascia was used in 67 (55.8%), perichondrium/cartilage island flap was used in 34 (28.3%) and cartilage palisades were used in 19 (15.8%) patients. The graft take rate was 85% (102/120). In the perichondrium/cartilage island flap group, the graft take rate was 97.7% whereas the graft take rate for the fascia group and cartilage palisade group. [20] In our study preoperative mean AB gap was 31.06 ±6.29. Postoperative mean A- B gap third month was 14.27 ± 6.43. Mean improvement in hearing was 6.20 dB which was comparable to another studies conducted in 2011. [20] Demirpehalivan *et al* (2011) studied that in the perichondrium / cartilage island flap group, the pure tone average was 36.36%, whereas the pure tone average for the temporalis muscle fascia and cartilage palisade group was 36.07 and 39.79 dB. Preoperatively the post operative pure tone average were 24.54 dB for the perichondrium cartilage island flap group, 24.51 dB for the fascia group and 23.23dB for the cartilage palisade group. They concluded that cartilage may be preferred more often for myringoplasty with high graft rate and hearing improvement. Thus the cartilage may be preferred more often for primary myringoplasty with high graft rate and hearing improvement.[20] Mohamed al lakhany (2005) conducted a study that showed that mean postoperative air bone gap closure for composite cartilage perichondrium graft was 20.4 ± 3.4 where as that for fascia and perichondrium was 17.6 ± 5 and 20.8 ± 4.82 respectively.[21] In our study mean preoperative ABG was 31.06 ± 6.29 dB and mean postoperative ABG was 14.27 ± 6.43 dB which was statistically highly significant. And success rate in terms of graft uptake was 93.33% and hearing gain was 6.20 dB. In our study we achieved satisfactory anatomical and hearing gain results which are comparable to other reported studies in the literature.

CONCLUSION

It is concluded that the use of cartilage perichondrium graft is successful in perforation closure and hearing improvement. It does not carry any risk of atrophy or any other complication and can be reliably used as an alternate graft material to traditional fascia graft with excellent take rates

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