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Original Research Article

A COMPARATIVE STUDY OF CARTILAGE AND TEMPORALIS FASCIA IN BILATERAL SIMULTANEOUS MYRINGOPLASTY

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ABSTRACT

Background: Myringoplasty restores the integrity of the tympanic membrane and improves hearing in patients with chronic suppurative otitis media. The selection of graft material is an important factor influencing surgical outcomes. This study compared bilateral simultaneous myringoplasty using temporalis fascia and cartilage grafts and evaluated graft uptake, hearing improvement, and factors influencing surgical outcomes. **Materials and Methods:** This prospective study was conducted at the Rajiv Gandhi Government General Hospital in Chennai, from September 2010 to December 2012. Thirty patients with bilateral tubotympanic chronic suppurative otitis media underwent bilateral simultaneous myringoplasty using a tragal cartilage graft in the right ear and a temporalis fascia graft in the left ear. The patients were followed up for 12 weeks with otoscopic examinations and pure-tone audiometry. **Results:** Of the 30 patients, 18 (60%) were women and 12 (40%) were men, with most cases occurring in the 21–30-year age group (40%). Medium-sized perforations were observed in 22 patients (73.3%). At 12 weeks, graft uptake was higher with cartilage grafts, showing intact grafts in 23 ears (76.7%) and residual perforations in seven ears (23.3%) ($p = 0.036$). The temporalis fascia graft showed intact grafts in 16 ears (53.3%) and residual perforations in 14 ears (46.7%) ($p = 0.801$). Preoperatively, 29 patients (96.7%) had an airbone gap of 20–30 dB. Postoperatively, cartilage graft ears showed an airbone gap of 0–10 dB in 14 patients (46.7%), whereas fascia graft ears showed the same improvement in six patients (20%). These findings indicate better anatomical and hearing outcomes with cartilage grafts. **Conclusion:** Bilateral simultaneous myringoplasty produced satisfactory anatomical closure and hearing improvement. The cartilage graft demonstrated higher graft uptake and better hearing gain than the temporalis fascia graft, suggesting its suitability for bilateral tympanic membrane perforation repair.

INTRODUCTION

Myringoplasty is a surgical procedure used to repair a perforation of the tympanic membrane. The procedure restores tympanic membrane continuity and helps maintain an air-filled middle ear cavity. Closure of the perforation reduces recurrent ear discharge and improves sound transmission through the ossicular chain. Persistent tympanic membrane perforation is commonly observed in patients with tubotympanic chronic otitis media. The membrane defect reduces the effective vibrating area, resulting in conductive hearing loss.[1,2]

The repair of the tympanic membrane has changed over time with the use of different surgical techniques and graft materials. Early reconstructive work described by Miodoński, Zollner, and Wullstein established the basic principles of tympanic membrane repair using biological graft materials. The temporalis fascia has since become widely used for myringoplasty because the tissue resembles the fibrous layer of the tympanic membrane. The temporalis fascia can be harvested easily through the same operative field and can be placed over the remaining tympanic membrane without difficulty.[3,4] In many patients, the graft integrates with the remnant membrane and produces satisfactory closure of the perforation with improvement in hearing levels.[5]

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Cartilage has also been used as a graft material for tympanic membrane reconstruction. Tragal and conchal cartilage are commonly selected because they lie close to the surgical field and provide adequate structural strength. Different cartilage grafting methods have been described in middle ear surgery. These include the palisade graft, cartilage island graft, cartilage shield graft, and butterfly graft.[6] Cartilage maintains structural rigidity and shows resistance to retraction and recurrent perforation. This property becomes useful in ears with poor Eustachian tube function, larger perforations or bilateral middle ear disease.[7]

The stiffness of cartilage initially raised concerns about its ability to transmit sound vibrations through the tympanic membrane. Clinical experience later showed that thin cartilage plates maintain sufficient vibratory movement and provide acceptable hearing improvement after surgery. Cartilage, therefore, functions as a stable graft material during the healing phase and resists deformation caused by negative middle ear pressure.[8]

Bilateral perforations of the tympanic membrane are frequently observed in patients with chronic tubotympanic otitis media. Surgical management of such patients often requires repair of both ears. Bilateral simultaneous myringoplasty allows the reconstruction of both tympanic membranes during a single surgical session. This approach reduces repeated hospital visits and shortens the duration of treatment for the patient.[9]

When two different graft materials are used in opposite ears of the same patient, postoperative outcomes can be compared under similar physiological and environmental conditions. Such a comparison allows assessment of graft uptake and postoperative hearing improvement for each graft material.[10]

The temporalis fascia has remained a commonly used graft material for many years. Cartilage grafts have been increasingly used because of their mechanical stability and resistance to retraction. A direct comparison of cartilage and temporalis fascia grafts in bilateral simultaneous myringoplasty is limited by the availability of clinical observations. The assessment of graft uptake and hearing improvement in patients undergoing bilateral repair helps to clarify the performance of these two graft materials. Therefore, this study aimed to compare the outcomes of bilateral simultaneous myringoplasty performed using temporalis fascia versus cartilage and to compare the results in terms of graft uptake, hearing improvement, and various factors influencing these outcomes.

MATERIALS AND METHODS

This prospective study included 30 patients diagnosed with chronic suppurative otitis media of the tubotympanic type with bilateral ear disease and was conducted at the Rajiv Gandhi Government General Hospital, Chennai 600003, from September 2010 to December 2012. Approval for the study was obtained from the Institutional Ethical Committee of the Rajiv Gandhi Government General Hospital, Chennai, and written informed consent was obtained from all patients.

Inclusion and exclusion criteria

Patients aged > 12 years of both sexes with chronic suppurative otitis media of the tubotympanic type involving both ears, bilaterally diseased ears, dry ear for at least 6 weeks, pure-tone audiometric evidence of conductive hearing loss, and treated or controlled nasal and paranasal sinus disease were included.

Patients aged < 12 years, those with chronic suppurative otitis media attico antral disease, unilateral CSOM, actively discharging ears, pure-tone audiogram evidence of mixed or sensorineural hearing loss, other external or middle ear diseases, active nose and paranasal sinus diseases, and ear diseases requiring any procedure other than myringoplasty were excluded.

Methods

The clinical history, including age, sex, duration of ear discharge, duration of hearing loss, and duration of dry ear before surgery, was recorded for all patients. Clinical details were noted before surgery. Each patient underwent otoscopic examination to assess the external auditory canal and tympanic membrane perforation. The size of the perforation and the condition of the middle ear mucosa were recorded. Hearing was assessed using pure-tone audiometry to confirm conductive hearing loss and measure the air–bone gap. Radiological evaluation included radiography of the mastoids to assess mastoid air cell status. A CT scan of the nose and paranasal sinuses was done to identify sinonasal disease. Diagnostic nasal endoscopy was performed to examine the nasal cavity and Eustachian tube opening. The history of treatment for nose and paranasal sinus disease was recorded. An examination on the operating table was performed before surgery.

Surgery was performed under local anaesthesia with premedication using a 0 °Hopkins rod lens endoscope through a transcanal approach. Two per cent xylocaine with 1:100, 000 adrenaline was infiltrated into the four quadrants of the external auditory canal. Patients performed the Valsalva manoeuvre to assess Eustachian tube patency. The temporalis fascia harvested through a supra-aural incision was placed in the left ear. Tragal cartilage, approximately 1 mm thick with perichondrium, was used as an island graft in the right ear. The perforation margins were freshened, the tympanomeatal flap was elevated, grafts were placed, and the canal was packed. Follow-up occurred on days 14, weeks 3, 6, and 12. Otoscopy recorded graft status, and audiometry at 6 and 12 weeks measured hearing improvement.

Statistical Analysis

Statistical analyses were performed using SPSS v29. Categorical variables are presented as frequencies and percentages, whereas continuous variables are

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expressed as means with standard deviations. Differences in graft uptake and hearing outcomes between cartilage and TFG grafts were evaluated using the chi-squared test or Fisher's exact test, as appropriate. Preoperative and postoperative air–bone gap values were compared using the paired t-test. Statistical significance was set at P <0.05.

RESULTS

Females formed the majority (18 patients, 60%), while males accounted for 12 patients (40%). The most common age group was 21–30 years, with 12 patients (40%). Ear discharge most frequently lasted for 3–4 years and 9–10 years, with seven patients each (23.3%). Hearing loss was most commonly present for 1–2 years in 13 patients (43.3%). A dry ear period of 6 weeks before surgery was observed in most patients, with 18 cases (60%). [Table 1]

Table 1: Baseline demographic and clinical characteristics

Variable	Category	N (%)
Sex distribution	Male	12 (40%)
	Female	18 (60%)
Age distribution	<20 years	6 (20%)
	21–30 years	12 (40%)
	31–40 years	7 (23.3%)
	>40 years	5 (16.7%)
Duration of ear discharge	1–2 years	5 (16.7%)
	3–4 years	7 (23.3%)
	5–6 years	5 (16.7%)
	7–8 years	6 (20%)
	9–10 years	7 (23.3%)
Duration of hearing loss	<1 year	2 (6.7%)
	1–2 years	13 (43.3%)
	3–4 years	11 (36.7%)
	5–6 years	4 (13.3%)
Duration of dry ear before surgery	6 weeks	18 (60%)
	8 weeks	6 (20%)
	10 weeks	6 (20%)

A medium-sized perforation was the most common finding and was present in 22 patients (73.3%), while a small perforation was noted in eight patients (26.7%). A history of treatment for nose and paranasal sinus disease was present in 17 patients (57%) and absent in 13 patients (43%). Mastoid pneumatization showed a sclerosed pattern in the majority, with 26 patients (86.7%), while a pneumatized mastoid was seen in four patients (13.3%). The middle ear mucosal status was abnormal in 16 patients (53%) and normal in 14 patients (47%).[Table 2]

Table 2: Distribution of otological and associated clinical characteristics

Variable	Category	N (%)
Perforation size	Medium	22 (73.3%)
	Small	8 (26.7%)
History of treatment for nose and PNS disease	Present	17 (57%)
	Absent	13 (43%)
Mastoid pneumatization	Pneumatized	4 (13.3%)
	Sclerosed	26 (86.7%)
Middle ear mucosal status	Normal	14 (47%)
	Abnormal	16 (53%)

Twelve weeks after the surgery, graft uptake was higher in the right ear with a tragal cartilage graft, with an intact graft in 23 patients (76.7%) and residual perforation in seven patients (23.3%). In the left ear with a temporalis fascia graft, an intact graft was present in 16 patients (53.3%) and residual perforation in 14 patients (46.7%). [Table 3]

Table 3: Graft uptake status at 6 and 12 weeks after myringoplasty

Ear	Follow-up	Intact graft n (%)	Residual perforation n (%)
Right ear (Tragal cartilage graft)	6 weeks	17 (56.7%)	13 (43.3%)
	12 weeks	23 (76.7%)	7 (23.3%)
Left ear (Temporalis fascia graft)	6 weeks	16 (53.3%)	14 (46.7%)
	12 weeks	16 (53.3%)	14 (46.7%)

Eustachian tube function showed an intact graft in 11 cases and residual perforation in four cases in the right ear (p = 0.273), whereas the left ear showed an intact graft in five cases and residual perforation in 11 cases (p = 0.009). Middle ear mucosal status showed an intact graft in 11 cases and residual perforation in five cases in the right ear (p = 0.273) and an intact graft in five cases with residual

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perforation in 11 cases in the left ear (p = 0.009). Mastoid pneumatization, perforation size, duration of discharge, and duration of dry ear showed no association with graft uptake in either ear (p > 0.05). [Table 4]

Table 4: Factors influencing graft uptake following bilateral simultaneous myringoplasty

Factor	Ear	Intact graft		Residual perforation		P value
Eustachian tube function	Right	11		4		0.273
	Left	5		11		0.009
Middle ear mucosal status	Right	11		5		0.273
	Left	5		11		0.009
Mastoid pneumatization	Right	Pneumatized	3	Residual	1	0.933
	Left		3		1	0.351
Perforation size	Right	Medium	17		5	0.896
	Left		11		11	0.544
Duration of discharge	Right	5.87±2.78		6.29±3.09		0.735
	Left	5.81±2.9		6.14±2.98		0.767
Duration of dry ear	Right	7.3±1.66		6.86±1.57		0.54
	Left	6.6±0.96		7.14±1.7		0.285

Before surgery, most patients had an air–bone gap of 20–30 dB, observed in 29 patients (96.7%) in both ears, while one patient (3.3%) had an air–bone gap of 10–20 dB. After surgery, the right ear showed improvement with an air–bone gap of 0–10 dB in 14 patients (46.7%), 10–20 dB in six patients (20%), and 20–30 dB in 10 patients (33.3%), with p = 0.036. In the left ear, the postoperative air–bone gap was 0–10 dB in six patients (20%), 10–20 dB in eight patients (26.7%), and 20–30 dB in 16 patients (53.3%), with p = 0.801. [Table 5]

Table 5: Preoperative and postoperative air–bone gap distribution following myringoplasty

Ear	Air-bone gap	Preoperative N (%)	Postoperative N (%)
Right ear	0–10 dB (Excellent)	-	14 (46.7%)
	10–20 dB (Good)	1 (3.3%)	6 (20%)
	20–30 dB (Fair)	29 (96.7%)	10 (33.3%)
Left ear	0–10 dB (Excellent)	-	6 (20%)
	10–20 dB (Good)	1 (3.3%)	8 (26.7%)
	20–30 dB (Fair)	29 (96.7%)	16 (53.3%)

DISCUSSION

This study included mostly female patients, with the highest number of cases in the 21–30-year age group. Medium-sized tympanic membrane perforation was the most common finding. Many patients had a long duration of ear discharge and hearing loss before surgery. Most ears showed sclerosed mastoids and abnormal middle ear mucosa. At 12 weeks of follow-up, graft uptake was higher in ears that received a tragal cartilage graft than in those that received a temporalis fascia graft. Improvement in the air–bone gap was also higher in the cartilage graft group.

In this study, good outcomes were observed after bilateral simultaneous myringoplasty, with satisfactory graft uptake and improvement in hearing levels following surgery. Similar findings have been reported in previous studies on bilateral myringoplasty. Caye-Thomasen et al. reported successful closure of the tympanic membrane in 94% of ears, with improvement in hearing and reduction of the air–bone gap. Closure within 10 dB was observed in 92% of cases and within 20 dB in 100% of cases.[11] Kirazli et al. studied bilateral same-day surgery for patients with bilateral perforated chronic otitis media and reported a postoperative air-bone gap of < 10 dB in 29% of ears and < 20 dB in 88% of ears, while closure of the tympanic membrane in both ears was achieved in 91% of cases.[12] These findings show that bilateral myringoplasty can produce good anatomical and hearing results in patients with chronic otitis media.

In this study, medium tympanic membrane perforation was the most common, with a history of frequent sinonasal treatment, sclerosed mastoids, and abnormal middle ear mucosa. Similar observations have been reported in earlier studies on cartilage tympanoplasty. Dornhoffer reported in a series of 1,000 cartilage tympanoplasties that cartilage graft reconstruction showed good anatomical and hearing outcomes and was useful in high-risk perforations.[13] Altuna et al. studied the anatomical and functional results of 122 cartilage island graft procedures and reported successful closure of the tympanic membrane in 92% of cases with improvement in the air–bone gap.[14] These findings show that cartilage grafts can provide good results in different middle ear conditions.

In our study, cartilage graft showed better graft uptake than the temporalis fascia graft in bilateral simultaneous myringoplasty. Similar results have been reported in previous studies comparing cartilage and fascia grafts. Ozbek et al. reported a significantly higher graft acceptance rate of 100% with cartilage grafts compared with 70.2% with TFG in type I tympanoplasty, although the audiological outcomes were not significantly different between the groups (p > 0.05).[15] Gerber et al. reported successful closure

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of tympanic membrane perforation in 97% of the cartilage group compared with 94 inf the fascia group.[16] These studies indicate that cartilage grafts provide reliable graft uptake in tympanic membrane reconstruction.

In the present study, factors such as mastoid pneumatization, perforation size, duration of ear discharge, and duration of dry ear before surgery did not show a significant association with graft uptake in either ear ($p > 0.05$). Similar findings have been reported by Sapçi et al., who reported perforation closure rates of 91.3% in the cartilage group and 88.2% in the fascia group with comparable hearing gains of 12.3 dB in the cartilage-perichondrium group and 12.7 dB in the fascia group ($p > 0.05$).[17] Yung et al. reported graft uptake rates of 84.2% for fascia graft and 80% for cartilage graft with no significant difference in postoperative hearing outcomes between the two groups.[18] These findings suggest that multiple clinical factors may not significantly influence graft uptake when the appropriate surgical technique is used.

In our study, most patients had moderate preoperative hearing loss, and postoperative hearing improvement was greater in the cartilage graft ear than in the fascia ear. Similar findings have been reported by Dornhoffer, who showed significant hearing improvement after cartilage tympanoplasty with statistically significant hearing gains ($p < 0.001$), although the difference between cartilage and fascia groups was not statistically significant.19 Effat also reported that there was no statistically significant difference in speech reception threshold improvement or air–bone gap closure between cartilage and fascia grafts.[20] Mohamad and Khan et al. reported no statistically significant difference in postoperative frequency-specific air–bone gap improvement between cartilage and fascia grafts.[21] These findings indicate that cartilage graft provides comparable hearing outcomes while offering structural advantages in tympanic membrane reconstruction.

Limitations

This study had several limitations, including a relatively small sample size and a study population that may not represent the broader population. The procedures were performed by different surgeons, introducing variability, and the follow-up period was relatively short to assess long-term outcomes.

CONCLUSION

Bilateral simultaneous myringoplasty provides healing and hearing outcomes comparable to those of unilateral procedures, while reducing treatment costs and resource use. Cartilage grafts showed higher graft uptake than the temporalis fascia in bilateral tympanic membrane perforations. The temporalis fascia demonstrated lower success rates in bilateral disease, suggesting cartilage as a more reliable graft material in such cases. Fewer residual perforations were observed with cartilage grafts during the follow-up period. Future research should involve larger samples and longer follow-up periods to evaluate long-term graft stability and hearing outcomes. Further controlled studies are recommended to improve graft selection and surgical protocols for managing bilateral perforations.

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