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Original Research Article

Comparative study of tympanoplasty using endomeatal approach using tragal cartilage and perichondrium with postauricular approach using temporalis fascia graft

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ABSTRACT

Background: Chronic suppurative otitis media is a disease which is a major cause of morbidity in our country. A large proportion of patients have safe (mucosal) chronic suppurative otitis media which leads to ear discharge and deafness which hampers the productivity of many individuals. Otolaryngologists play an important role in its correction and amelioration by conservative or operative procedures. One such procedure is tympanoplasty.
Methods: Patients of either sex having symptoms and signs suggestive of chronic suppurative otitis media and fulfilling the inclusion and exclusion criteria are taken for the study My sample size is 60 and these 60 patients were divided into 2 groups. A. tympanoplasty with temporalis fascia graft. B. tympanoplasty with cartilage island graft. 30 patients were included in each group.
Results: In the cartilage island group, the graft uptake rate was 96.7% as compared to the temporalis fascia group in which the same was 90%. There is no significant difference in Air Bne gap between 2 groups.
Conclusions: Cartilage Island graft is as good a graft material as temporalis fascia for tympanoplasty.

Keywords: Chronic suppurative otitis media, Temporalis fascia, Cartilage Island graft

INTRODUCTION

Chronic suppurative otitis media is a disease which is a major cause of morbidity in our country. A large proportion of patients have safe (mucosal) chronic suppurative otitis media which leads to ear discharge and deafness which hampers the productivity of many individuals. Otolaryngologists play an important role in its correction and amelioration by conservative or operative procedures. One such procedure is tympanoplasty.

The potential seriousness of ear suppuration was first appreciated by 'Hippocrates' but the idea of operating to relieve the condition was first given by the great surgeon Ambrose Pars.The term myringoplasty was coined by Berthold in1878, first myringoplasty was performed by Marcus Bancer in 1640.[1]

Tympanoplasty' implies reconstruction of the tympanic membrane with eradication of middle ear disease and reconstruction of hearing mechanism.[2] Tympanoplasty was first introduced by Wullstein in 1952 for reconstruction of the middle ear hearing mechanism.

Various techniques of tympanoplasty: underlay technique - it is the technique of placing grafting material medial to the annulus and overlay technique - in this graft material is placed lateral to the fibrous layer of the tympanic membrane after carefully removing all the squamous epithelium from the lateral surface of the tympanic membrane remnant. Various graft materials are used for

tympanoplasty. Temporalis fascia is most commonly used.[3] Others include perichondrium from tragus, cartilage from tragus and concha, areolar tissue and fat from ear lobule, vein, cadaveric tympanic membrane, cadaveric pericardium, formalin preserved cadaveric temporalis fascia, cadaveric sclera. Most surgeons prefer the temporalis fascia graft for reconstruction of tympanic membrane. Certain factors are taken into consideration in the choice of graft material. These include the metabolic rate of graft material, accessibility from the surgical site and antigenic potential. Temporalis fascia is less antigenic and able to withstand prolonged anoxia better. The use of cartilage and perichondrium has been recommended on a limited basis to manage retraction pockets and high-risk perforations. The cartilage was first used to rebuild the ossicular chain in 1958, by Jansen.[4] Some years later, this material began to use as a graft in tympanoplasty, especially in cases of advanced middle ear diseases, because of their robustness, offering greater resistance to resorption.[5] The high risk comprises a revision surgery, perforation anterior to the annulus, perforation draining at the time of surgery, perforation larger than 50%, or bilateral perforation, all of which have been shown to be associated with increased failure rate using traditional techniques. So, it can be used in low and high-risk perforations.

Complications associated with tympanoplasty are usually the result of destruction caused by disease process itself and surgical accidents. Graft failure can be due to technical error, infectious complications or poor tubal functions. Other complications are chondritis, loss of taste sensation, sensorineural hearing loss and vertigo. Lateralization of graft and anterior blunting of the graft occurs most commonly with overlay technique.

The present study was undertaken to evaluate and compare the results of type I tympanoplasty using temporalis fascia and tragal cartilage and perichondrium grafts with respect to dry ear and hearing status using postauricular and endomeatal approach. The present study emphasizes the role of the approach and procedure in planning appropriate management for the patient with chronic suppurative otitis media.

Aims and objectives

The aim of the study was to evaluate improvement in hearing following tympanoplasty using temporalis fascia graft and cartilage island graft at 8 weeks after surgery. Graft status after tympanoplasty using temporalis fascia graft and cartilage island graft. Assess other complications after surgery in both groups.

METHODS

It is a prospective study. Department of otorhinolaryngology at Santhiram Medical College and General Hospital, Nandyal, Andhra Pradesh. Period of study was from November 2021 to April 2022. Sample size was approximate 60.

Method of collection of data

Patients of either sex having symptoms and signs suggestive of chronic suppurative otitis media and fulfilling the inclusion and exclusion criteria are taken for the study.

Sampling criteria

Inclusion criteria

Includes patients in the age group of 20-40 years, having good general physical condition. No evidence of active infection in nose, throat, or paranasal sinuses, central perforation of pars tensa of the tympanic membrane with a dry ear for a minimum period of 3 weeks before the day of operation. Patients having good Eustachian tube function with good cochlear reserve. Patients who are willing to participate and give informed written consent.

Exclusion criteria

Patients having blocked eustachian tube, with a polyp, granulations, or cholesteatoma. Failed myringoplasty in the same ear, otogenic intracranial complications in the past, evidence of otitis externa or otomycosis, per-operative ossicular discontinuity, fixed footplate, patients with evidence of focal sepsis and patients who are not willing to participate and give informed written consent. Preoperative evaluation of middle ear disease and eustachian tube function was made by clinical examination. A preoperative hearing evaluation was done by tuning fork (256, 512, 1024 Hz) and pure tone audiometry. Study groups were divided into 2 groups. Group A - tympanoplasty with temporalis fascia graft. Group B - tympanoplasty with cartilage island graft. 30 patients were included in each group.

In group 'A' temporalis fascia graft, measuring 3x3 cm was harvested by the postauricular William Wilde's or Lempert's endaural approach. A self-retaining mastoid retractor is placed in the upper part of the incision and further retraction of the uppermost part of the incision is done by a double hook retractor. Blunt dissection was carried out until temporalis fascia was reached. A small amount of saline is injected to balloon the fascia away from the muscle. The fascia was identified by the white glistening colour. The fascia of adequate size was removed using scissors and the fascia was then pressed and spread out. Using the underlay technique, the graft was placed under the annulus. The anterior mesotympanum is packed with gel foam. The external ear canal was packed with gel foam. In group B' the cartilage island flap was harvested from the tragus.[6] Incision was given over the skin of the medial side of the tragus. A piece of cartilage, with attached perichondrium, measuring about 15×10 mm in size was dissected free. A

complete strip of cartilage 2 mm in width is then removed vertically from the center of the cartilage to accommodate the entire malleus handle.

The cartilage was used as a full-thickness graft and was slightly less than 1 mm thick in most cases. Although it has been suggested that a slight acoustic benefit could be obtained by thinning the cartilage to 0.5 mm.[7] A flap of perichondrium was produced posteriorly that will eventually drape the posterior canal wall. Endomeatal approach was used and a graft was placed by underlay technique. Gel foam is packed in the middle ear space to support the graft. The external ear canal was packed with gel foam. In both groups, the external canal was cleaned of gel foam after 21 days. The status of the graft and the tympanic membrane was assessed. A hearing assessment was done after 8 weeks.

RESULTS

The age of the patient was between 20-40 yrs. The maximum number of patients in each group was between 20-25 yrs. In all, there were 13 males and 17 females in the temporalis fascia group and 18 males and 12 females in the cartilage island group. The time since onset of disease in both groups was mostly between 3 months to 5 yrs. The mode of onset in the vast majority of cases was after an attack of acute suppurative otitis media

All the 60 patients had a history of loss of hearing

In the temporalis fascia group, 7 patients had bilateral disease as compared to 10 patients having bilateral disease in the cartilage island group. In the temporalis fascia group, 16 patients were operated on in the left ear and 14 in the right ear. In the cartilage island group, 17 patients were operated on in the right ear and 13 in the left ear. In the temporalis fascia group, 15 patients had grade II, 10 had grade III and 5 had grade IV perforation and in the cartilage island group 14 had grade II, 9 had grade III and 7 had grade IV perforation.

Pre-operative A-B gap

The majority of patients in both groups i.e., 18 patients in the temporalis fascia group and 15 patients in the cartilage island group had a pre-op AB gap in the range of 21-30 dB.

Table 1: Pre-operative A-B gap.

Pre-operative AB gap (dB)	Temporalis fascia group	Cartilage island group
1-10	0	1
11-20	5	8
21-30	18	15
31-40	7	6
Total	30	30

10 days post-operatively

On the 10th postoperative day after removal of the antibiotic pack, it was seen that 4 patients in the temporalis fascia group and 2 patients in the cartilage island group had some ear discharge.

All the grafts seemed intact and 6 patients in the temporalis fascia group and 3 patients in the cartilage island group had pain at the donor site. Also, 6 patients in the temporalis fascia group and 5 patients in the cartilage island group had tinnitus.

3 weeks post-operatively

After 3 weeks of operation in the temporalis fascia group 3 patients (10%) had still ear discharge and among these 2 patients had residual perforations and in 1 patient graft was not seen.

In the cartilage island group, only one patient still had ear discharge and also had residual perforation.

6 weeks post-operatively

In the temporalis fascia group, 2 patients had residual perforation and the graft was completely absent in 1 patient. So in 3 (10%) patients, the graft was not uptaken in the temporalis fascia group.

While in the cartilage island group only 1 patient had residual perforation.

Post-operative AB gap at 8 weeks

In the temporalis fascia group, 14 patients had a postoperative AB gap of 0-10 DB and the same for 11-20 DB. In cartilage island majority 14 patients had an AB gap of 11-20 dB and 11 Patients had a 0-10 dB AB gap (Table 2).

Table 2: Post-operative AB gap at 8 weeks.

Post-operative AB gap (dB)	Temporalis fascia group	Cartilage island group
1-10	14	11
11-20	14	14
21-30	1	5
31-40	1	0
Total	30	30

Gain in AB gap after an operation

In the temporalis fascia group, 60% of patients had 11 - 20 dB gain and 33.3% had 0 - 10 dB gain and 6.7% had 21-30 dB gain.

In the cartilage island group, 60% of patients had 11- 20 dB gain, and 40% had 0 - 10 dB gain (Table 3).

Table 3: Gain in AB gap after an operation.

Gain in AB gap (dB)	Temporalis fascia group	Cartilage island group
1-10	10	12
11-20	18	18
21-30	2	0
31-40	0	0
Total	30	30

The mean gain in the AB gap in the temporalis fascia group is 14.33 dB and in the cartilage island group, it is 12 dB. The standard deviation of gain in the AB gap in the temporalis fascia group is ±6.66 and in the cartilage island group, it was ±6.37. For finding out whether there is any significant difference in the gain in the air-bone gap in the two groups we used the student t-test. Using this test, the value achieved was 1.36 which is 0.05. So it is statistically proved that there is no significant difference in the AB gap gain attained by using either temporalis fascia or cartilage island as graft material in tympanoplasty.

Graft takes up

In the temporalis fascia group, there was 90% uptake and in the cartilage island group, there was a 96.7% graft uptake rate. No significant difference was noted in both groups as the p value was>0.05.

Table 4: Graft takes up.

Graft take up	Temporalis fascia group	Cartilage island group
Yes	27	29
No	3	1
Total	30	30

Medialization of graft

Medialization of the graft was seen in 2 patients of the temporalis fascia group but not in the cartilage island group (Table 5).

Table 5: Medialization of graft.

Medialisation	Temporalis fascia group	Cartilage island group
Yes	2	0
No	28	30
Total	30	30

Complication at donor site

In the temporalis fascia group 6 patients complained of pain at the donor site but none in the case of the cartilage island group. In both groups, none of the patients developed any other complications at the donor site (Table 6).

Table 6: Complication at donor site.

Complications at donor site	Temporalis fascia group	Cartilage island group
Pain	6	0
Deformity	0	0
Wound infection	0	0

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 morbidity in the population. The patient also suffers socially due to deafness and faces embarrassment due to aural discharge. These patients come to ENT surgeons 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 patients.

A lot of graft materials have been used by various surgeons for covering the perforation in the eardrum. Nowadays the most commonly used graft material is temporalis fascia. Cartilage island graft is available locally, is tough, and easily harvestable with just a small incision which is given on the inner surface of the tragus and the scar is not even visible from outside. Also in revision cases in which temporalis fascia has already been taken, the cartilage island is still present to be used as a graft material. It is with this in mind that this study was carried out to compare the efficacy of cartilage islands as compared to that of temporalis fascia.

It was seen that there was a 90% take-up rate of temporalis fascia as compared to 96.7% in the case of cartilage island. According to various studies, there is no difference in the closure of perforation with the use of any graft material. The difference in uptake in our study may be due to type- II error.

In the cartilage island group, the grafted drum was completely opaque so we could not examine the middle ear. But we can examine the middle ear in a group of temporalis fascia grafted drum. Another disadvantage of cartilage island graft is that we can harvest only a limited size from tragus whereas in temporalis fascia graft there is no such limitation.

Medialization of the graft was noted in 4 patients of the temporalis fascia group but not in the cartilage island group.Cartilage left more fibrillar material of collagen so that grafted drum in the cartilage island group had more resistance to medialization.

Also, the mean gain in the A-B gap in patients who had undergone tympanoplasty using cartilage island as graft

material was 12±6.34 dB as compared to 14.33±6.66 dB in patients in whom temporalis fascia was used as a graft material. It was further seen that the t value was 1.36 and so there was no significant difference between the gain in the air-bone gap in either group.

So it can be inferred that cartilage island is as good a graft material, if not better, as temporalis fascia for tympanoplasty. Naveed et al reported a study of 34 cases of tubotympanic type of chronic suppurative otitis media with central perforation of the eardrum who were treated with Type l tympanoplasty with underlay technique using temporalis fascia as a graft material.[8] This underlay technique with temporalis fascia graft was found to be successful with total closure of perforation in 94% of cases and significant improvement in hearing thresholds in 74% of cases. Tayfun et al study purpose was to assess overall and frequency-specific hearing results after primary cartilage tympanoplasty with island technique in comparison to the hearing results after primary tympanoplasty with temporalis muscle fascia.[9] Fifteen patients were in the cartilage group, whereas 10 patients were in the fascia group.

Pre-operative and postoperative air-bone gaps at the frequencies of 0.5, 1, 2, and 4 kHz were compared. They found that both groups were statistically similar in the aspect of the severity of middle ear pathology and the preoperative hearing levels. Mean postoperative gains in the air-bone gap were 11.9 dB for the cartilage group and 11.5 dB for the fascia group. There were no statistically significant differences in the postoperative frequency-specific gains in the air-bone gap between the 2 groups. These results were consistent with earlier studies. In 1963, Goodhill et al did 19 cases of tympanoplasty using tragal perichondrial graft and in their preliminary report they have a 100% take-up rate in all cases and dry ear was obtained in a short period.[10] A study conducted by Divan Mikaelian in 1986, In the one-stage reconstruction of the tympanic membrane and the ossicular chain done by using a composite graft of tragal perichondrium with cartilage, was done.[11] The results indicated total closure of drum perforation in all cases, and closure of air-bone gap to within 0 to 10dB in 72% of the cases

In 1995, Quraishi et al used tragal perichondrium as graft material in daycare myringoplasty.[12] Their success rate was 94% in the perichondrial group as compared with 84% in the control group (no significant difference, p value>0.05). Sheehy and Glasscock 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.[13] 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%. Professor Zakzouk et al in 1992 got a graft take-up rate of 86.7% in cases where autologous temporalis fascia was used as graft material and a graft take-up rate of 78.1% was obtained in cases in which homologous dura was used as graft material.[14] Hence, it can be concluded from our study that cartilage island graft, though not better is as good a graft material as temporalis fascia graft. In the cartilage island group, we could not examine the middle ear because the grafted drum was completely opaque and also, we can harvest only a limited size from tragus whereas in temporalis fascia graft there is no such limitation. Medialization of the graft was noted in temporalis fascia group but not in the cartilage island group. Patients complained of pain at the donor site in the temporalis fascia group but none in case of the cartilage island group. So, the results obtained in our study are consistent with the results in previous studies using cartilage island as well as other graft materials in tympanoplasty.

CONCLUSION

The conclusions drawn by this study were in accordance with the previous studies published. In the cartilage island group, the graft uptake rate was 96.7% as compared to the temporalis fascia group in which the same was 90%. The postoperative air-bone gap between 0 to 10 dB was found in 46.7% cases of temporalis fascia group patients and 36.7% cases of cartilage island group patients. Air bone gap between 10 to 20 dB was found in 46.7% of both groups of patients. The mean gain in the air-bone gap in the cartilage island group is 12±6.37 dB, as compared to 14.33±6.66 dB in the temporalis fascia group (no significant difference p value>0.05). In all patients in the cartilage island group, the grafted eardrum was opaque but not in any patients in the temporalis fascia group. In the temporalis fascia group, 6 patients had pain at the donor site for 3 weeks. No other complication was seen in both groups. So it can be concluded that cartilage island graft is as good a graft material as temporalis fascia for tympanoplasty.

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