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Cartilage Tympanoplasty: Is it more effective than temporalis fascia grafting for tympanoplasty?

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ABSTRACT

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

AIMS AND OBJECTIVES

1. To evaluate improvement in hearing following tympanoplasty using temporalis fascia graft and cartilage island graft at 8 weeks after surgery.
2. Graft status after tympanoplasty using temporalis fascia graft and cartilage island graft.
3. Assess other complications after surgery in both groups.

This study was conducted in the Department of Otorhinolaryngology and Head and Neck Surgery, ST. STEPHEN'S HOSPITAL, DELHI between November 2010 to November 2012.

INCLUSION CRITERIA

1. Includes patient in the age group of 20-40 years, having good general physical condition.

2. No evidence of active infection in nose, throat or paranasal sinuses, central perforation of pars tensa of the tympanic membrane with dry ear for a minimum period of 3 weeks before the day of operation.

3. Patients having good eustachian tube function with good cochlear reserve.

Exclusion criteria:

1. Patients having blocked eustachian tube, with polyp, granulations or cholesteatoma
2. Failed myringoplasty in the same ear
3. Otogenic intra cranial complications in the past
4. Evidence of otitis externa or otomycosis
5. Per operative ossicular discontinuity, fixed foot plate
6. Patients with evidence of focal sepsis

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Introduction:

Chronic suppurative otitis media is a disease which is a major cause of morbidity in our country. A large proportion of these patients have safe (mucosal) chronic suppurative otitis media. It leads to otorrhoea and deafness which hampers productivity of many individuals. chronic suppurative otitis media. It leads to otorrhoea and deafness which hampers productivity of many individuals. Otolaryngologist 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 medieval surgeon Ambrose Pars. Although 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:-

1. Underlay technique - It is the technique of placing grafting material medial to the annulus.
2. Overlay technique – In this graft material is placed lateral to fibrous layer of tympanic membrane after carefully removing all the squamous epithelium from the lateral surface of 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 used 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.

Materials and Methods:

This study was conducted in the Department of Otorhinolaryngology and Head and Neck Surgery, ST. STEPHEN'S HOSPITAL, DELHI between November 2010 to November 2012. Patient in the age group 20- 40 years having middle ear disease and requiring tympanoplasty, were taken up in this study. The patients for the study were selected on basis of following inclusion and exclusion criteria. INCLUSION CRITERIA includes patient 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 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 having blocked eustachian tube, with polyp, granulations or cholesteatoma, failed myringoplasty in the same ear, otogenic intra cranial complications in the past, evidence of otitis externa or otomycosis, per operative ossicular discontinuity, fixed foot plate, any pathology in nose, throat or nasopharynx and any skin disease in the post aural region, temporal region or in the skin of face in front of ear were excluded from the study.

Preoperative evaluation of middle ear disease and eustachian tube function was made by clinical examination. Preoperative hearing evaluation was done by tuning fork (256, 512, 1024 hz) and pure tone audiometry. Study groups were divided into 2 groups. A. tympanoplasty with temporalis fascia graft. B. tympanoplasty with cartilage island graft. 30 patients were included in each group.

In Group 'A' Temporalis fascia graft, measuring 3 x 3 cm was harvested by the postauricular William Wilde's or Lempert's endaural approach. A self retaining mastoid retractor is placed in upper part of the incision and further retraction of the upper most part of the incision is done by a double hook retractor. Blunt dissection was carried out untill temporalis fascia was reached. The small amount of saline 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, graft was placed under the annulus. Anterior mesotympanum is packed with gel foam. External ear canal was packed with gel foam.

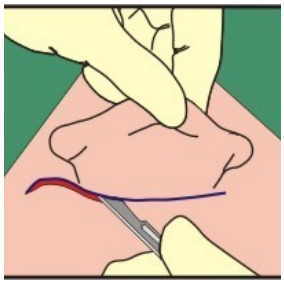

Fig 1 : Incision

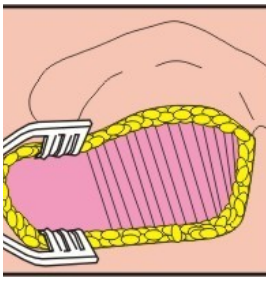

Fig 2: Temporalis fascia

Fig 3 : Harvesting temporalis fascia

In Group 'B' 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 x 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 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]

Flap of perichondrium was produced posteriorly that will eventually drape the posterior canal wall. Endomeatal approach was used and graft placed by underlay technique. Gel foam is packed in the middle ear space to support the graft. External ear canal was packed with gel foam. In both groups, external canal was cleaned of gel foam after 21 days. Status of the graft and the tympanic membrane assessed. Hearing assessment was done after 8 weeks.

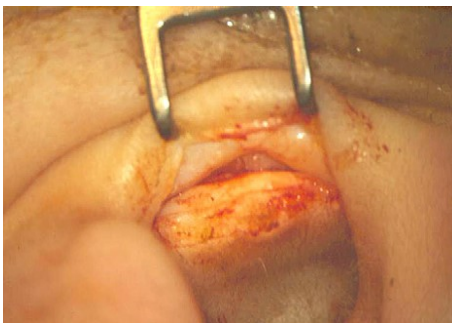

Fig 4 : Cartilage graft harvested

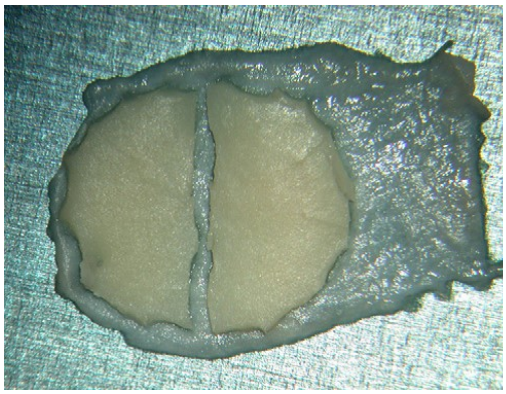

Fig 5 : Cartilage island graft

Observations and Result:

This study comprising of 120 patients was conducted in the Department of Otorhinolaryngology and Head and Neck surgery, St. Stephens Hospital, Delhi. These 120 patients were divided into two equal groups of 60 patients each. Each group was matched for age and size of perforation. Each group underwent tympanoplasty. In first group temporalis fascia and in the second group tragal cartilage island graft was used as graft material. Underlay technique was used in all cases. The patients were kept in follow up for 8 weeks in the ENT OPD. The following were the observations noted:

The age of patient was between 20-40 yrs. Maximum number of patients in each group was between 20-25 yrs. In all there were 26 males and 34 females in the temporalis fascia group and 36 males and 24 females in the cartilage island group. The time since onset of disease in both group was mostly between 3 months to 5 yrs. The mode of onset in vast majority of cases was after an attack of acute suppurative otitis media.

All the 120 patients had history of loss of hearing.

In the temporalis fascia group 23.3% of patients had bilateral disease as compared to 33.3% patients having bilateral disease in the Cartilage island group. In the temporalis fascia group 53.3% of patients were operated in the left ear and 47.7% in the right ear. In the cartilage island group 55.7% of patients were operated in right ear and 44.3% in the left ear. In temporalis fascia group 50% of patients had grade II, 33% had grade III and 13.3% had grade IV perforation and in cartilage island group 46.7% had grade II, 26.7 had grade III & 16.7 had grade IV perforation.

13. Pre Operative A – B Gap

Majority of patients in both groups i.e. 65% in temporalis fascia group and 45% in cartilage island group had pre op AB gap in the range of 21-30 dB. (Table - 1).

Pre Operative AB gap (dB)	No. of Patients	
	Temporalis Fascia Group	Cartilage island Group
1-10	0	2
11-20	10	16
21-30	36	30
31-40	14	12
	60	60

Table 1

14. 10 days Post operatively

On the 10th Post operative day after removal of antibiotic pack it was seen that 13.3% of patients in the temporalis fascia group and 6.7% of patients in the cartilage island group had some ear discharge. All the grafts seemed intact and 12patients in the temporalis fascia group and 6 patients in cartilage island group had pain at donor site. Also 12 patients of temporalis fascia group and 10 patients in cartilage island group had tinnitus.

15. 3 weeks post operatively

After 3 weeks of operation in the temporalis fascia group 6 patients (10%) had still ear discharge & among this 4 patients had residual perforations and in 2 patients graft was not seen. 2 had external auditory canal granulations. Also 2 patient of this group had a small pin point perforation. All 12 patients still had pain at donor site. In the cartilage island group only one patient still had ear discharge and also had residual perforation.

16. 6 weeks post operatively

In the temporalis fascia group 4 patients had residual perforation and the graft was completely absent in 2 patients. So in 6 (10%) patients graft was not uptaken in temporalis fascia group. Residual pin point perforation in 2 patient was healed without any active intervention which was present at 3rd week follow up. While in cartilage island group only 2 patient had residual perforation.

17. Post operative AB gap at 8 wks.

In temporalis fascia group 46.7% patient had post operative AB gap of 0-10 db & same for 11-20 db. In cartilage island majority 46.7 % had AB gap of 11-20 db and 36.7% had 0-10 db AB gap. (Table 2)

Post operative AB gap (dB)	No. of Patients	
	Temporalis Fascia Group	Cartilage island Group
0-10	28	22
11-20	28	28
21-30	2	10
31-40	2	0
	60	60

Table 2

18. Gain in AB gap after 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, 40% had 0 - 10 dB gain. (Table 3).

Gain in AB gap	**No. of Patients**	
	Temporalis Fascia Group	**Cartilage island Group**
0-10	20	24
11-20	36	36
21-30	4	0
31-40	0	0
	60	60

Table 3

The mean gain in AB gap in the temporalis fascia group is 14.33 dB and in the cartilage island group it is 12 dB. Standard deviation of gain in AB gap in the temporalis fascia group is ± 6.66 and in cartilage island group it was ± 6.37. For finding out whether there is any significant difference in the gain in air bone gap in the two groups we used the student t test. Using this test the value achieved was 1.36 which is <2 and so p value > 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.

In the temporalis fascia group there was 90% uptake and in the cartilage island group there was 96.7% graft uptake rate. No significant difference was noted in both groups as p value was >0.05 (Table 4)

Graft taken up	No. of Patients	
	Temporalis Fascia Group	Cartilage island Group
Yes	54	58
No	6	2
	60	60

Table 4

B. Medialization of graft

Medialization of graft was seen in 4 patients of temporalis fascia group but not in cartilage island group. (Table 5)

Medialization	**No. of Patients**	
	Temporalis Fascia Group	**Cartilage island Group**
Yes	**4**	**0**
No	**56**	**60**
Total	**60**	**60**

Table 5

20. COMPLICATION AT DONOR SITE

In temporalis fascia group 12 patients complaint of pain at donor site but none in case of cartilage island group.

In both groups none of the patient developed any other complication at donor site. (Table 6)

Complications at Donor site	Temporalis fascia Group	Cartilage island Group
Pain	12	0
Deformity	0	0
Wound infection	0	0

Table 5

Discussion:

Chronic suppurative otitis media is one of the major illness 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 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 operation 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 days 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 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 island as compared to that of temporalis fascia.

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

In cartilage island group, grafted drum was completely opaque so we could not examine middle ear. But we can examine the middle ear in group of temporalis fascia grafted drum. Another disadvantage of cartilage island graft is that we can harvest only limited size from tragus where as in temporalis fascia graft there is no such limitation. Medialization of graft was noted in 4 patients of temporalis fascia group but not in cartilage island group.

Cartilage left more fibrillar material of collagen so that grafted drum in cartilage island group had more resistance for medialization. Also the mean gain in 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 air bone gap in either group.

In temporalis fascia group 6 had pain at donor site that may be due to muscle injury at the time of graft harvesting. In all patients, pain subsided in 3 weeks but in one patient it persisted up to 8 weeks.

So it can be inferred that cartilage island is as good a graft material, if not better, as temporalis fascia for tympanoplasty.

Naveed et al8 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. 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.

Kirazli Tayfun et al[9] 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. Fifteen patients were in the cartilage group, whereas 10 patients were in the fascia group.

Preoperative 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 on the aspect of the severity of middle ear pathology and the preoperative hearing levels. Mean postoperative gains in 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 air-bone gap between the 2 groups.

These results were consistent with earlier studies. In 1963, Goodhill et al[10] 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 time.

A study conducted by Divan. 0. Mikaelian[11] in 1986, In one stage reconstruction of the tympanic membrane and the ossicular chain done by using a composite graft of tragal perichondrium with cartilage was done. 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, M.S. Quraishi et al[12] used tragal perichondrium as graft material in day care myringoplasty. 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[13] 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%.

Professor Zakzouk et al[14] 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.

Hence, it can be concluded from our study that cartilage island graft, though not better but is as good a graft material as temporalis fascia graft.

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.

Summary and conclusion:

This study was conducted in Department of Otorhinolaryngology of St. Stephen's Hospital, Delhi. It was basically a comparison between two groups. In one group temporalis fascia was used as graft material and in the other group cartilage island was used as graft material. Each group had 30 patients. All 60 patients underwent tympanoplasty by the underlay technique by the same surgeon.

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 temporalis fascia group in which the same was 90. The post operative 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 patients.

The mean gain in 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). All patients in cartilage island group the grafted ear drum was opaque but not in any patient of temporalis fascia group. In temporalis fascia group 6 patients had pain at 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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