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Original Research Article

Comparative study of anatomical and functional results of butterfly myringoplasty versus temporalis fascia underlay myringoplasty

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ABSTRACT

Background: Myringoplasty is traditionally been done by using temporalis fascia graft material. But in recent years understanding of physiology and pathology of middle ear cleft is drastically improved with technical advancement in surgical methods. Various grafts have been tried for myringoplasty time to time with varying results.
Methods: A case control study was conducted; where 52 patients underwent myringoplasty with butterfly graft and second group of 52 patients underwent myringoplasty with temporalis fascia graft under general anesthesia in major OT. All the patients were followed up for 3 months. The results of the procedure were assessed, with respect to closure of tympanic membrane perforations and improvement in the air bone gap post operatively.
Results: Butterfly group had statistically significant number of healed patients and hearing improvement compared to temporalis fascia group at the end of one month and with no statistical significance at the end of three months. The age group less than 18 years showed better uptake with butterfly graft. The difference of mean pre-operative, 1 month and 3 months post-operative air bone gaps in butterfly graft were 35.57±2.87 dB, 27.86±2.53 dB, 24.65±2.66dB and in temporalis fascia were 35.97±2.6dB, 29.36±1.54dB, 25.12±1.73 dB respectively.
Conclusions: Butterfly group had statistically significant hearing improvement in patients compared to temporalis fascia group at one month and with no statistical significance at three months post procedure. The age group less than 18 years showed better uptake with butterfly graft.

Keywords: Myringoplasty, Chronic otitis media, Tympanic membrane, Temporalis fascia, Butterfly graft, Cartilage

INTRODUCTION

Myringoplasty, correction of tympanic membrane perforation with graft material, is traditionally been done by using temporalis fascia graft material. But in recent years understanding of physiology and pathology of middle ear cleft is drastically improved with technical advancement in surgical methods. Various grafts have been tried for tympanoplasty time to time with varying results.

Cartilage was first used by Utech in 1959 and recent years especially with advent of endoscopic tympanoplasty it became graft of choice.[1-3] Cartilage differs from traditional graft material, such as fascia and perichondrium, primarily due to its increased thickness. This might suggest an increased rigidity, with resulting conductive hearing loss; however, several studies have demonstrated that hearing results are no different than with fascia.[1,4,5] Moreover, it is precisely this increased thickness and rigidity that makes cartilage an ideal graft material capable of resisting the resorptive and retracting forces of continuous eustachian tube dysfunction.

The versatility of cartilage as a graft material with different grafting technique has withstood the test of

time.[1] In 1998 Eavey proposed a novel interlay technique to tackle small to medium tympanic membrane perforations which traditionally were treated by either the overlay or the underlay method.[6,7] He was a proponent of a minimally invasive approach for the management of paediatric otitis media. Neto modified this technique by avoiding the need for split thickness skin grafting.[8] This technique was named so as the graft looks like a butterfly with wings.

Zahnert et al looked at the acoustic transfer characteristics of cartilage of varying thickness and its resistance when exposed to fluctuations of atmospheric pressure.[9] Tragal and conchal cartilage were compared; however, there was no statistical difference between these two types of cartilage. This argument is supported by a clinical study conducted by Kazikdas et al.[10]

Some authors compared both the graft materials in children alone and these studies show better morphological outcome with the use of cartilage when compared with fascia grafts.[11,12] This result is significant because in the pediatric population eustachian tube dysfunction creates the negative pressure in the middle ear cavity. It can be counteracted using cartilage, which is stiffer and more resilient when compared with temporalis fascia. The aim of this study was to compare the anatomical and functional results of butterfly myringoplasty versus temporalis fascia myringoplasty.

METHODS

Our study was a case control study.104 patients with small to medium tympanic membrane perforations attended the out-patient department of ENT, Navodaya Medical College Hospital and Research Centre, Raichur and had satisfied the inclusion criteria (small to medium perforation one to two quadrant perforation, airborne gap in pure tone audiometry less than 40 dB, good cochlear reserve, age group 15 years to 50 years) and exclusion criteria (attic and marginal perforations of tympanic membrane, large central and subtotal perforation, air bone gap in pure tone audiometry more than 40 dB, poor cochlear reserve, bleeding and clotting disorders, pregnancy, chronic systemic disorders like uncontrolled diabetes and uncontrolled hypertension) were taken for study. Study duration was 17 months (August 2020 to December 2021).

Patients who satisfied the above-mentioned criteria for selection were taken as subjects for the study, after taking an informed and written consent.

The collected data was entered into an excel sheet. After appropriate data cleaning, the data sheet was transferred and analysed using SPSS software version-20.

Descriptive statistics were used to describe the study variables of the subjects. To compare the categorical qualitative data variables among the two study groups, Chi-square test and Fisher exact test was used and to compare the continuous quantitative data variables t test was used.

The p values were corrected by the Bonferroni method and a p value <0.05 is statistically significant.

The patient was positioned and prepared in the same manner in both the groups. The patient was placed in the otologic position, with the head slightly elevated using a folded towel or head ring. Under aseptic precautions parts painted and draped. Operating endoscopic camera (Storz or Strykar) or Zeiss microscope was used based on convenience of the operating surgeon. Transcanal or post aural approaches were used to access the tympanic membrane

Surgical technique of butterfly graft

Cases were performed under general anesthesia. 2% lignocaine with 1 in 2,00,000 adrenalines was used for infiltration using Plester's technique. The edges of perforation were freshened imprint of the bleeding edge was taken on gel film and size of graft required measured. Tragal cartilage graft with perichondrium harvested and trimmed to the desired size. The cartilage graft was then held by forceps and a circumferential groove cut to an approximate depth of 2 mm. This forms the butterfly graft which was eased into the perforation using straight or curved picks and placed firmly into position (Figure 1). Once snuggly fitted direct pressure was applied on the graft to assess stability, if found to be wobbling slight rotatory motion was performed till it fit properly (Figure 2). Medicated gel foam was used to pack the ear and tragal incision closed with a small dressing given to cover the ear.

Figure 1: Butterfly graft.

Dressing was done to all post operative patients. The patients were discharged on second post-operative day with oral antibiotics and antihistamines for a period of two weeks. Suture removal was done on 8th POD.

Thereafter the patients were called at 1st and 3rd month. All the follow up findings were taken up for the analysis. Postoperative audiometry was done at 1st and 3rd month. The patients were studied for the following parameters.

Figure 2: Butterfly grafting.

Figure 3: Butterfly graft at 3 month follow up.

Graft acceptance at first and third month (Figure 3). Post-operative hearing levels at third month.

RESULTS

The total numbers of subjects enrolled for the study were 104. Group 1 included subject with Butterfly myringoplasty and Group 2 included subjects with Temporalis fascia myringoplasty, each group with 52 subjects. Four subjects were lost in the follow up, 2 subjects from each group. At the end of the study, 50 subjects were present in each group. Among the 104 patients, there were 55 male and 49 female patients. In the butterfly myringoplasty, 28 (53.8%) patients were males and 24 (46.15%) patients were females. In the temporalis fascia myringoplasty, 27 (51.2%) patients were males and 25 (48.07%) patients were females. The age of the patients ranged from 15 years to 50 years. Majority of the patients in both the age groups were from 18-50 years. Bilateral perforations were seen in 20 patients, with 10 patients in each group. Unilateral perforations were seen in 54 patients, with 42 patients in each group. Out of 104, right ear was involved in 47 patients and left ear in 57 patients. Butterfly myringoplasty had patients with 25 right and 27 left ear involved. Temporalis fascia myringoplasty group had patients with 22 right and 30 left ear involved. Out of 104 patients, butterfly myringoplasty had 44 patients with infective etiology and 8 due to trauma. Temporalis fascia myringoplasty had 38 patients with infective etiology and 14 due to trauma.

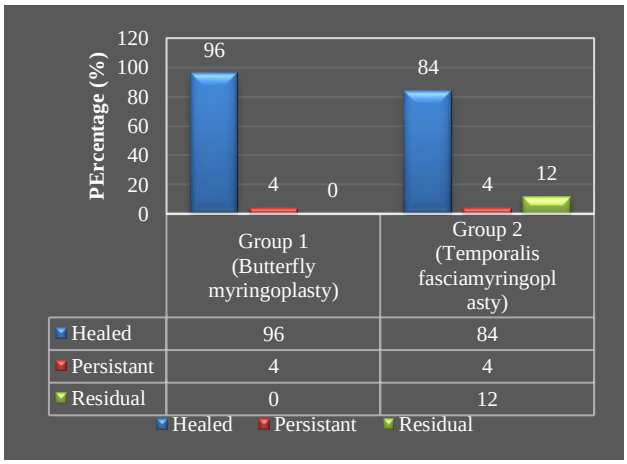

Figure 4: Closure of tympanic membrane perforation AT one month.

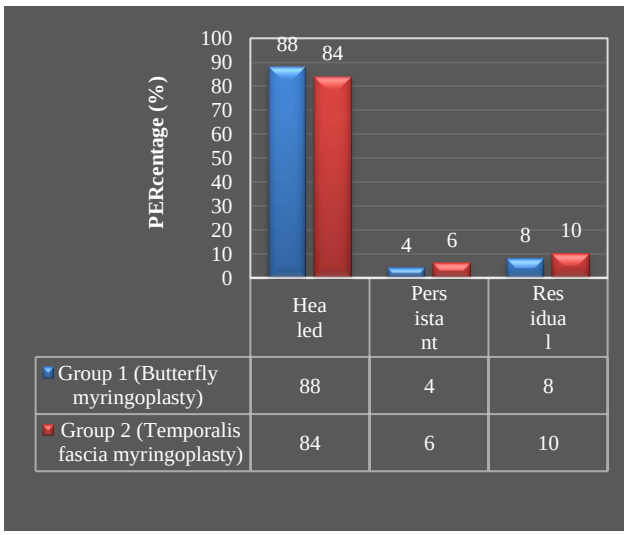

Figure 5: Closure of tympanic membrane perforation AT 3 months.

Graft uptake

In butterfly myringoplasty group out of 52 patients, 49 patients (96%) attained complete closure of the tympanic membrane perforation at one month (Figure 4), 2 patients (4%) had no significant improvement in the size within a period of one month. On the contrary in the Temporalis fascia myringoplasty group out of 52, only 42 patients (84%) attained complete closure, 2 patients (4%) had

persistent perforations and 6 (12%) patients had residual perforation. Hence butterfly myringoplasty group had statistically significant number of healed patients compared to only Temporalis fascia myringoplasty group at one month. In butterfly myringoplasty group out of 50 patients, 44 patients (88%) attained complete closure of the tympanic membrane perforation at 3 months (Figure 5), 2 patients (4%) had no significant improvement in the size, and 4 of them (8%) had significant improvement but could not attain complete closure within a period of 3 months. On the contrary in the temporalis fascia myringoplasty group of 50, 42 patients (84%) attained complete closure, 3 patients (6%) had persistent perforations and 5 (10%) patients had residual perforation. Hence butterfly myringoplasty group and temporalis fascia myringoplasty group had no statistically significant number of healed patients at 3 months.

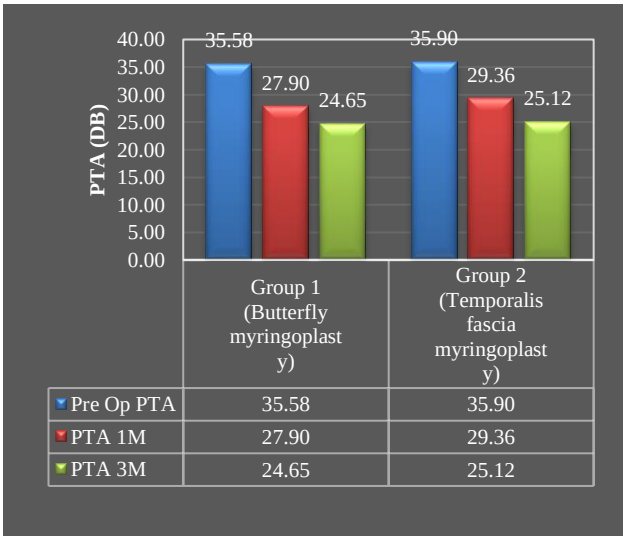

Figure 6: PTA progression in two groups.

Butterfly myringoplasty group age (<18 years) out of 10 patients, all patients (100%) attained complete closure of the tympanic membrane perforation at 3 months. 18-50 years group patients, 34 patients (85%) attained complete closure of the tympanic membrane perforation at 3 months, 2 patients (5%) had no significant improvement in the size, and 4 of them (10%) had significant improvement but could not attain complete closure within a period of 3 months.

In temporalis fascia myringoplasty group age (<18 years) out of 9, 6 patients (67%) attained complete closure of the tympanic membrane perforation at 3 months, 1 patient (11%) had no significant improvement in the size, and 2 of them (22%) had significant improvement but could not attain complete closure within a period of 3 months.

18-50 years group patients, 36 patients (88%) attained complete closure of the tympanic membrane perforation at 3 months, 2 patients (5%) had no significant improvement in the size, and 3 of them (7%) had significant improvement but could not attain complete closure within a period of 3 months.

The graft uptake results of first- and third-month post procedure were 96.95%, 88.3% in butterfly graft and 86.64%, 86.17% in temporalis fascia respectively. Butterfly group had statistically significant number of healed patients compared to temporalis fascia group at the end of one month and with no statistical significance at the end of three months. The age group less than 18years showed better uptake with butterfly graft.

Hearing results

The difference of mean pre-operative (Figure 6), 1 month and 3 months post-operative air bone gaps in butterfly graft were 35.57±2.87 dB, 27.86±2.53 dB, 24.65±2.66dB and in temporalis fascia were 35.97±2.6dB, 29.36±1.54dB, 25.12±1.73 dB respectively. The results were statistically significant, showing improvement in hearing after surgery. Butterfly group had statistically significant hearing improvement in patients compared to temporalis fascia group at one month and with no statistical significance at three months post procedure. The A-B gap benefit between the groups is not statistically significant.

DISCUSSION

Myringoplasty is one of the most commonly performed procedures in otolaryngology. The purpose of closing chronic dry perforations of the tympanic membrane was to improve hearing and prevent middle ear infections. Surgical closure of tympanic membrane perforation still remains the choice of management. In the temporalis fascia myringoplasty underlay technique was used in all cases. It is the most common technique nowadays.[13] It has advantages of ease of assessing the middle ear cavity including ossicular chain and its mobility.[14] It avoids failure because of anterior blunting and lateralization of graft.[15] The butterfly myringoplasty procedure in our study was similar to Maurya et al, Farzooq et al, Lee et al, Kaya et al and many other studies.[16-19]

The thickness and availability of tragal cartilage make it more ideal for butterfly cartilage myringoplasty. Grooving and placement of graft are easier with tragal cartilage perichondrium graft. This graft is well-tolerated and well-accepted as other grafts. It is nourished by diffusion and gets well-incorporated in tympanic membrane.[20] Ayache described butterfly cartilage myringoplasty by transcanal endoscopic procedure. He achieved 96% success rate with no cases of anterior blunting or lateralization, and the procedure were minimally invasive.[22] The procedure in our study was done using endoscope rarely under microscope, based on surgeons preference. Hashim et al found that the surgical success rates were 96.7% in microscopic and 100% in endoscopic. Significant postoperative hearing improvements were evident.[4]

Success rate of butterfly cartilage myringoplasty in our study were comparable to other studies, Eavey in 1998 demonstrated 100% results, but the sample size was very small, i.e., nine cases; Lin et al in 2007 and Kim et al in 2014 showed 82.1% in 28 and 96.4 in 29 patients, respectively.[21,23,24] In Maurya et al rate of successful closure of the perforation were 92.7% (52 patients) in butterfly cartilage group and 96.3% (53 patients) in temporal fascia group.[16] Bhattacharya et al reported 93.3% success rate, whereas Mauri et al reported 88.2% success rate in butterfly myringoplasty.[25,26]

The butterfly graft showed significant graft uptake in age group less than 18 years. The age group between 18-50 years in both the group at 3 month showed no difference in uptake of graft. Mogre et al studied 15 cases in our prospective cross sectional observational study performed in the department of ENT at a secondary health centre in the eastern suburbs of Mumbai between October 2016 and September 2017. Children aged between 12 to 18 years with chronic otitis media mucosal inactive type with a central, small to medium sized tympanic membrane perforation and mild to moderate conductive hearing loss were included in this study. Showed success rate of 86.66% at 6 months, which was quite similar to studies using fascia in similar aged population. And concluded that endoscopic butterfly graft myringoplasty in small to medium perforation in adolescent age group has good success rate and is safe, quick and minimally invasive day care procedure.

In our study we also assessed success of perforation closure in terms of improvement in pure tone audiometry of patients at 1 month and 3 months post procedure when compared to the pre procedure pure tone audiometry.

The mean difference between the two groups was statistically significant pre procedure and post procedure at 1 month but at 3 months there was no statistically significant difference between the two groups as shown in the above table. In the study Kaya et al all patients, including those with residual perforations, the mean preoperative bone conduction threshold was 15.9 dB (range, 5 to 50 dB) among all groups whereas mean air conduction threshold was 36.4±15.1 dB (range, 10 to 90 dB) preoperatively and 28.8±14.3 dB in 6th month follow-up and 24.9±14.1 dB 24th month follow-up.[19] Preoperative mean ABG was 22.1±7.1 dB (range, 5 to 40 dB) whereas 13.3±5.9 dB 6 months after surgery and 11.9±5.5 dB 24 months after surgery. There was a significant difference between pre- and postoperative ABG in both 6th and 24th month follow-up (P6 mo-24 mo<0.05). Furthermore, preoperative mean air conduction differed significantly from postoperative 6th and 24th month follow-up mean air conduction thresholds ($p<0.05$). Gerber et al the results of temporalis fascia tympanoplasty and cartilage tympanoplasty were comparable.[27] Mohamad et al and Lin et al better results were observed with cartilage in comparison to temporal fascia.[23,28]

CONCLUSION

Butterfly group had statistically significant hearing improvement in patients compared to temporalis fascia group at one month and with no statistical significance at three months post procedure. The age group less than 18 years showed better uptake with butterfly graft. Further studies involving a larger cohort of patients are needed to further clarify the efficacy of this technique.

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