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AREOLAR FASCIA WITH AND WITHOUT CONCHAL CARTILAGE IN TYMPANOPLASTY

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ABSTRACT

This retrospective study included 110 patients operated for chronic tympanic membrane perforations in the period between 1998 and 2004. Areolar fascia was used for central (small and medium sized) and posterior perforations (60 patients). Conchal cartilage was used in conjunction with areolar fascia for large, subtotal and anterior perforations (50 patients). The surgical success rates for areolar and fascia-cartilage graft groups were 90% and 91.6% respectively. There was significant improvement of air conduction levels after tympanoplasty for both groups. A significant improvement in air bone gap

(ABG) was noted at each frequency in both groups.

These findings revealed the overall gains of 15.3 dB for the fascia group and 12.6 dB for the cartilage-fascia group. ABG closure to within 20 dB was encountered in 51 (85%) patients of the fascia group whereas this was achieved in 41(82%) patients of the cartilage-fascia group. study showed that areolar fascia has comparable success rate to the standard temporalis muscle fascia. The present study has shown that cartilage tympanoplasty did not adversely affect hearing result

Key words : areolar fascia, cartilage tympanoplasty

INTRODUCTION

One of the common Sequalea of chronic otitis media is tympanic membrane (TM) perforation, which can cause hearing loss and otorrhea. It is important for every otolaryngologist to know how to repair tympanic membrane perforation. The two classic methods for reconstruction of TM perforation have been medial (underlay) or lateral (overlay) graft technique. The current gold standard for tympanoplasty graft is temporalis fascia. Since its introduction more than 50 years ago ¹, it has been the principal material used for both adult and pediatric tympanoplasty. Temporalis fascia's location within the operative field as well as its versatility makes it well suited for tympanoplasty. The biomechanical properties afforded by its acellular matrix enable it to provide an excellent substrate for epithelial migration. This is complemented by ample numbers of fibroblasts and cellular components necessary for proper healing. ²

Although temporalis muscle fascia is the most frequently used grafting material, with a success rate of approximately 90% in primary tympano-

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plasty, ^{3, 4} lower success rates for larger perforations have been reported. ⁵

Temporalis muscle fascia shows disorderly arrangement of elastic fibers (loose, crisscross, and interrupted). The irregular and unpredictable gaps between the elastic fibres are filled by the fibrous connective tissue, which shrinks and thickens more than elastic fibres do. Thus, shrinkage of the temporalis muscle fascia is unpredictable. ⁶

Patients undergoing multiple procedures often require more grafting material than the ipsilateral temporalis fascia can provide. In addition to a lack of material because of prior harvest of temporalis fascia, subsequent attempts to obtain additional graft are often limited because of scarring in the donor site. Although the contralateral side is available, harvesting an alternate material located in the operative field would be preferred. Identification of another grafting source would solve these problems as well as preserve the temporalis fascia for later use. An ideal alternative should be easy to harvest, readily available

in the operative field, and have similar biomechanical properties as temporalis fascia. The areolar connective tissue superficial to the temporalis fascia fulfills all of these requirements and provides an excellent graft source.

Aim Of The Work

To assess the efficiency of areolar fascia graft with and without conchal cartilage for management of chronic tympanic membrane perforations.

PATIENTS AND METHODS

Retrospective analysis of all patients operated for chronic tympanic membrane ear perforations by a single surgeon (Y.W.K) at Mansoura University Hospital and Saudi German Hospital, between 1998 and 2004.

Data extracted included the following: age; length of follow-up in months; preoperative diagnosis; details of surgical procedure; time to complete epithelization in weeks; and residual perforation, or any other complications or need for additional therapies. Areolar fascia was used for central (small and medium sized) and

posterior perforations. Conchal cartilage was used in conjunction with areolar fascia for large, subtotal and anterior perforations.

Surgical technique:

Operations were done under local anesthesia with lidocaine 2% with 1:50,000 epinephrine delivered with dental syringe. A rim of tissue is removed from the perforation edge to de-epithelialize and encourage migration of the mucosal layer and epithelium.

Vertical canal incisions are made at the 12- and 6-o'clock positions. The 6-o'clock incision can be extended right up to the annulus. The 12-o'clock incision is made down to a few millimeters above the annulus to preserve blood supply when anterior canal skin is used as the superiorly based flap. A posterior tympanomeatal flap is elevated, and ossicles are evaluated

The postauricular approach was used. The incision was deepened carefully to reach and not cut thru the areolar fascia. The Freer dissector was used to expose a large area of

the areolar fascia separating it from the overlying tissue. . An incision was made at the lower part and the fascia is dissected from the underlying temporalis fascia. An ample amount of areolar fascia was harvested; this was helped with the use of skin retractors held by the assistant to reach as far as possible. In cases where the conchal cartilage was used, dissection continued through the same incision and a circular piece of flat cartilage was chosen. The fascia was left to dry. The grafting procedure was performed in an over-underlay fashion (over the malleus, under the annulus) in both groups. Gelfoam (Pharmacia & Upjohn Inc., Kalamazoo, MI, USA) was the material used to support the graft medially in the area of anterior annulus, eustachian tube, hypotympanum, and mesotympanum. The external auditory canal was also packed with Gelfoam at the end of the operation.

Surgical success was defined as the presence of an intact graft without perforation, failure, or lateralization for a minimum of 12 months. Grafts with partial retraction or anterior blunting were considered surgical suc-

cesses. Recurrent episodes of otitis media not leading to tympanic perforation were also regarded as successful.

Audiometric evaluation included preoperative and postoperative pure-tone audiometric findings of the patients. Preoperative air conduction thresholds at 4 frequencies (0.5, 1, 2, and 4 kHz) were assessed to compare the preoperative hearing levels of the groups. The audiologic results of the 2 grafting materials were made by means of the preoperative and the postoperative frequency-specific air-bone gaps (ABGs) and the postoperative frequency specific hearing gain in air conduction levels. Hearing results were calculated according to the recommendation of American Academy of Otolaryngology Head and neck Surgery,⁷ therefore the success was calculated when ABG closed to within 20 dB. Statistical analysis was undertaken with the statistics program SPSS for Windows (version 10; SPSS, Inc., Chicago, IL).

RESULTS

One hundred and ten patients were included in the study. The study

population was divided into 2 groups on the basis of grafting material: Areolar fascia group (60 patients) or areolar fascia with conchal cartilage group (50 patients). The average age was 24 years (range 15 - 56, median 36). There were 62 males (56%) and 48 females (43%). Length of follow-up ranged from 12 to 62 months, with an average length of 32 months. 85.4% (94 patients) were done under local anesthesia. General anesthesia was used in non-cooperative patients or those who refuse local anesthesia.

The surgical success rates for areolar and fascia-cartilage graft groups were 90% and 91.6% respectively. Postoperative infection was directly involved in most of the cases of surgical failure. The average time for complete epithelization was 3.7 and 5.6 weeks for both areolar fascia and areolar-cartilage groups respectively. Post-operative otitis media (in successful cases) were recorded in only two cases (one in each group).

Table (1) shows the significant improvement of air conduction levels at 4 frequencies (0.5, 1, 2, and 4 kHz) after tympanoplasty for both groups.

Figure (1) shows the mean air bone gap in both groups. The mean preoperative air-bone gap was 20.5, 21.2 for areolar and areolar-cartilage groups respectively. Mean post operative A-B gap was 9.2; 8.9 for both groups respectively

Preoperative air conduction thresholds at 4 frequencies (0.5, 1, 2, and 4 kHz) for the areolar fascia group were 39.5 dB, 32.5 dB, 27.8 dB, and 28.0 dB, respectively. Preoperative means of air conduction thresholds for the fascia-cartilage group were as follows: 41.3 dB, 33.6 dB, 29.5 dB, 30 dB (Figure 2).

Postoperative air conduction thresholds at 4 frequencies (0.5, 1, 2, and 4 kHz) for the areolar fascia group were 22.5 dB, 17.5 dB, 14.5 dB, and 13.2 dB, respectively. Postoperative means of air conduction thresholds for the fascia-cartilage group were as follows: 25.3 dB, 19 dB, 18.2 dB, and 17.3 dB (Figure 3)

A significant improvement in ABG was noted at each frequency in both groups.

The overall mean pre and postopera-

tive air conduction levels for areolar fascia were 32.2 and 16.9 and for areolar-cartilage group were 33.6 and 20 respectively. (Figure 4) These findings revealed the overall gains of 15.3 dB for the fascia group and 12.6

dB for the cartilage-fascia group. ABG closure to within 20 dB was encountered in 51 (85%) patients of the fascia group whereas this was achieved in 41(82%) patients of the cartilage-fascia group.

Table (1) Pre and postoperative frequency specific air conduction levels (in dB) in both groups

Group Frequency	Areolar fascia group		Areolar -conchal cartilage group	
	Pre-op AC	Post-op AC	Pre-op AC	Post-op AC
500 Hz	39.5	22.4	41.3	25.5
1 KHz	32	17.5	33.6	19
2 KHz	28.7	14.5	29.5	18.2
4 KHz	28.7	13.2	30	17.3

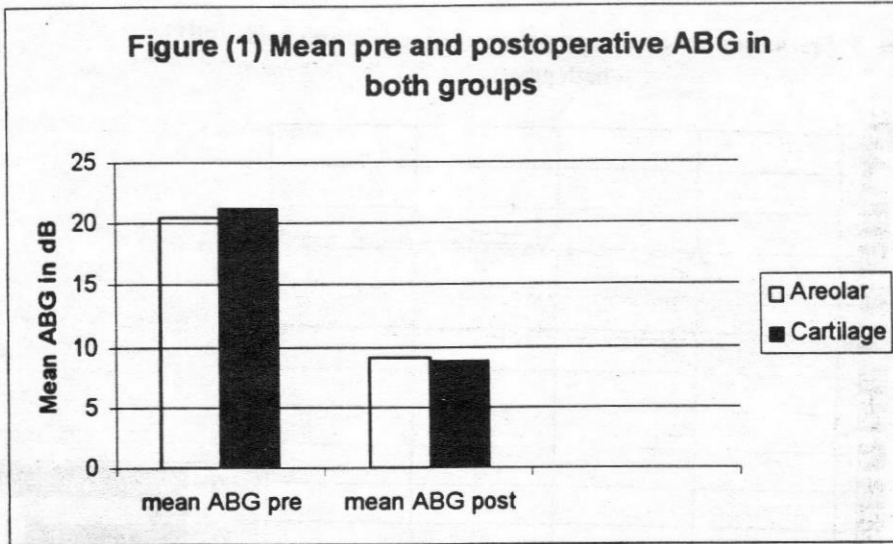


Figure 2: Frequency specific mean pre operative AC thresholds (dB) in both group

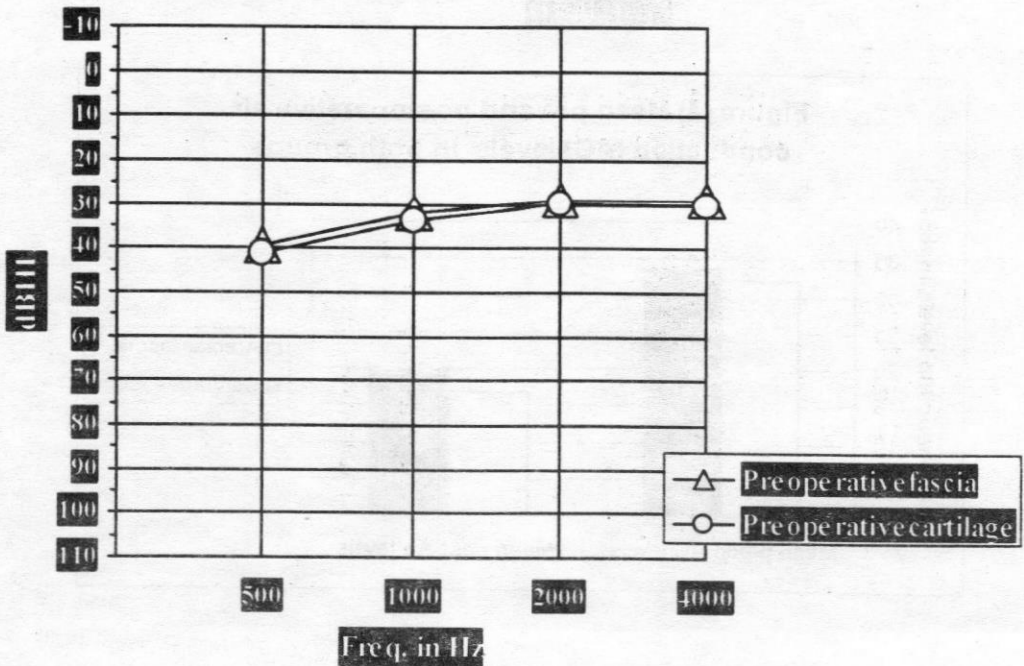


Figure 3: Frequency specific mean postoperative AC thresholds (dB) in both group

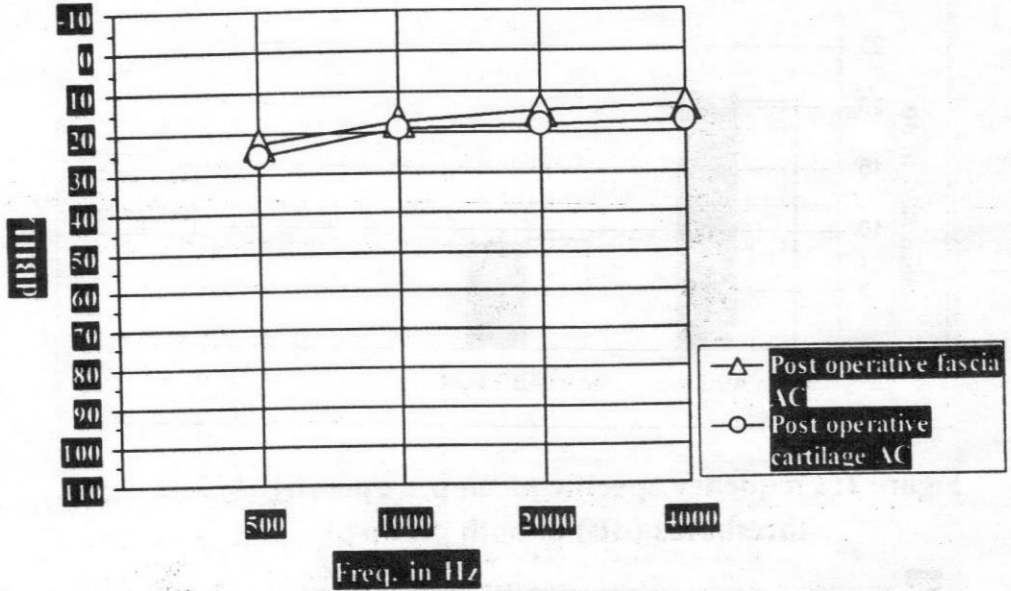
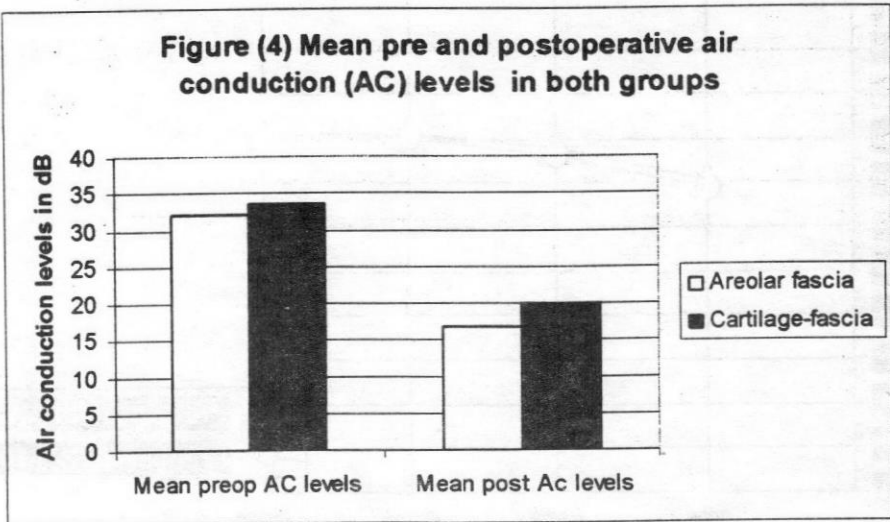


Figure (4) Mean pre and postoperative air conduction (AC) levels in both groups



DISCUSSION

Although a number of alternate materials for tympanic membrane grafting have been proposed, none have proven as dependable as temporalis fascia. Skin, perichondrium, vein grafts, and a variety of homologous and allographic materials have been attempted but none have proven superior to temporalis fascia. The aim of this study was to assess the efficiency of areolar fascia (as a grafting material) alone and in combination with cartilage graft. It was not aimed at comparing both groups in the study as the indications for the use of either graft were different.

Areolar connective tissue is a distinct fascial layer located immediately superficial to the temporalis fascia. It is a thin layer of reticulated fibers that is easily identified during the harvest of temporalis fascia. Although less substantial than temporalis fascia, it is nonetheless an excellent graft material. In addition to containing abundant collagen and reticular fibers, the areolar connective tissue houses the fibroblasts and macrophages necessary for proper graft incorporation.⁸ This study showed that

areolar fascia has comparable success rate and hearing results to the standard temporalis muscle fascia. Numerous authors have reported its success in the adult population. Glasscock⁹ reported surgical success rates of 96% and 91% for underlay and overlay tympanoplasty, respectively. He also noted that harvest of this layer was relatively bloodless and technically easy to perform. In addition to its convenient location in the operative field, ample material was available for repair of extensive perforations. It has been also used with good results in pediatric population.¹⁰ Our experience with areolar fascia for more than ten years for grafting of tympanic membrane perforation was very rewarding. It was also used during canal wall down mastoidectomy to cover the mastoid bone. The healing was noted to be fast. Incorporation of the graft was noted to be completed after one month of the operation.

Cartilage has been proved to be well tolerated by the middle ear and to survive for long periods.^{11, 12} It is nourished largely by diffusion and becomes well incorporated in the tym-

panic membrane. Thus, its use has been established particularly in cases of chronic eustachian dysfunction, adhesive process, draining ears, or recurrent perforations of the tympanic membrane.¹³ Because increased mass and stiffness of the cartilage-reconstructed tympanic membrane might adversely affect its acoustic transfer characteristics, the acceptance of routine reconstruction of the tympanic membrane with cartilage has been hampered.¹⁴ On the other hand; hearing results after tympanic membrane reconstruction with cartilage have received less attention than its anatomic results. Adkins¹⁵ stated that cartilage-grafting the entire posterior portion of the tympanic membrane would cause a 5- to 10-dB conductive hearing loss. However, other reports, suggest that hearing results of cartilage tympanoplasty are fairly good. Glasscock et al¹² reported that hearing did not appear to be adversely affected after cartilage tympanoplasty in cases with recurrent retraction pockets, although absolute hearing levels were lacking in their study. The present study has shown that cartilage tympanoplasty did not adversely affect hearing results. How-

ever, the healing after cartilage tympanoplasty was found to be slower. The size and thickness of the cartilage used are important factors affecting the healing and success for cartilage tympanoplasty. The use of thin plates of cartilage in an incomplete circular or in palisade fashion have been used for this study as this was found to be helpful in decreasing the healing time and improving the success rate.

CONCLUSION

Areolar fascia is an excellent source for grafting for tympanic membrane perforations. It has an excellent success rate, good hearing results and rapid healing time. It should not be overlooked as an available source for grafting in cases of tympanoplasty and mastoidectomy. It can be used alone or in combination with conchal cartilage for repair of different types of tympanic membrane perforations.

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استخدام لفافة النسيج الضام الفجوى مع (ويدون) غضروف صوان الأذن فى عمليات ترقيع طبلة الأذن

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اشتملت هذه الدراسة الاستيعادية على مائة وعشرة مرضى أجريت لهم عمليات ترقيع طبلة الأذن وذلك لوجود ثقب مزمن بها.

وقد استخدمت لفافة النسيج الضام الفجوى فى حالات الثقب المركزى (الصغير والمتوسط الحجم) والثقب الخلفى وذلك فى (٦٠) مريض (المجموعة الأولى) وقد استخدم غضروف صوان الأذن مع لفاف النسيج الضام الفجوى فى حالات ثقب الطبلة الكبير والكامل والأمامى وذلك فى (٥٠) مريض (المجموعة الثانية) وقد كانت نسبة نجاح العملية فى المجموعة الأولى ٩٠% وفى المجموعة الثانية ٩٦% وقد كان هناك تحسن ملحوظ فى فجوة التوصيل الهوائى والعظمى فى كل الترددات فى المجموعتين .

وقد أظهرت النتائج زيادة فى التوصيل الهوائى قدرها ١٥٣ ديسبيل فى المجموعة الأولى ١٢٦ ديسبيل فى المجموعة الثانية كما بينت النتائج علق بفجوة التوصيل الهوائى والعظمى الى ما دون ٢٠ ديسبيل فى ٥١ مريض (٨٥%) وفى مرضى المجموعة الأولى وفى ٤١ مريض (٨٢%) من مرضى المجموعة الثانية.

وقد أظهرت النتائج نسب نجاح مماثلة كما أن استخدام غضروف صوان الأذن لم يؤثر سلبياً على نتائج السمع فى هذه العمليات..

