

Fat Plug Myringoplasty: Cost effective surgery with high success rate for small central perforation

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Abstract:

Introduction: Temporalis fascia is the most common material used for the closure of tympanic membrane perforation. However for a dry, small central perforation the adipose tissue fat is a good alternative. The objective of this study is to know the usefulness of adipose tissue fat for the closure of dry, small central perforations.

Methods: A retrospective study was done in 24 patients who underwent this procedure. The age of the patient varies from 15 to 45 years. All the surgery was done under local anesthesia. A large single piece of fat, approximately double the size of the perforation was harvested from the posterior side of the lobule. The margin of perforation was freshened. The fat was placed like a dumbbell, equal portion lies medial and lateral to the perforation. The patient is discharged after 2-3 hours.

Results: The closure of the perforation was considered successful criteria for this type of surgery. There was complete closure of perforation in 23 patients. One patient developed an upper respiratory tract infection with discharging ear after two weeks. The size of the perforation had reduced but there was residual perforation. The success rate was 95.8%.

Conclusion: The fat tympanoplasty can be performed under local anesthesia while avoiding general anesthesia. The harvesting of the graft is very quick and there is no visible scar and minimum donor site morbidity. It avoids extensive middle ear manipulation. It is a safe, simpler procedure for the closure of a dry, small central perforation. Its success rate is as good as tympanoplasty using temporalis fascia.

Introduction:

A myringoplasty is one of the most common operations performed in Otolaryngology due to the high incidence of tympanic membrane perforation and temporalis fascia is the most common material used for the closure of tympanic membrane perforation. The first attempt to close the tympanic perforation was done by Banzer in 1640 who inserted a small tube of elkhorn covered with pig's bladder.¹ Berthold in 1878 used a full-thickness free skin graft for tympanic membrane closure.² Ringenber used a fat tympanoplasty for the first time for the closure of a small tympanic perforation.³ The fat graft tissue tympanoplasty has certain advantages as this procedure can be done in an office basis or on an outpatient basis. The patient goes home on the same day. There is very limited postoperative care. Fat can be harvested in a very short time and it avoids invasive extensive surgical manipulation of the middle ear.⁴ It avoids general anesthesia and is very safe for a dry, small, central perforation. It is a simple and cost effective technique in managing small tympanic membrane perforation and the success rate of a fat-plug myringoplasty is comparable with the results of temporalis fascia tympanoplasty.⁵

Material and methods:

A retrospective study was done in the Department of Otorhinolaryngology, M.P.Shah Medical College Jamnagar, India to evaluate myringoplasty using only adipose tissue to close the eardrum perforation. All the surgeries were done by the first author. A total of 24 cases that underwent consequent fat-plug myringoplasty were included in the study. Only adult patients were selected for this procedure. There were seventeen male patients and seven female patients. A male/female ratio of 2.4: 1 and all the cases had a small dry central perforation. The perforation was situated in the anterior inferior quadrant in 13 cases, posterior inferior quadrant in six cases. Five cases had perforation at the junction of the anterior inferior and the posterior inferior quadrant of the tympanic membrane and these were relatively larger size perforations. The criteria for the small perforation was that the size of the perforation be approximately 5 by 5 mm or 25 to 30% of the drum's surface. The bigger sized perforation occupying more than 30% of the drum's surface was avoided for this type of procedure. Only those patients who had no significant hearing loss as tested by tuning fork test and pure-tone audiometry were selected for this type of surgery. The closure of the perforation was considered successful criteria for a fat-plug myringoplasty.

Surgical steps: All the cases were done under local anesthesia with 2% xylocaine with adrenaline (1 in 200,000) injected by using the standard technique of local tympanoplasty. An additional amount was injected on the posterior surface of the lobule and a small incision was made on the posterior aspect of the ear lobule. A single piece of fat, approximately twice the size of the perforation, was harvested (Figure 1) taking care not to make a buttonhole on the anterior surface of the lobule. The skin incision was sutured with silk. Using the operative microscope, the margin of the perforation was rimmed and de-epithelialized using a sickle knife (Figure II). Small pieces of gelfoam were placed in the middle ear through the perforation. The piece of fat was positioned in such a way that equal proportion lied medially and laterally to the tympanic membrane and fit the perforation snugly like a dumbbell (Figure III). The fat plug was overlaid with antibiotic soaked gelfoam. These gelfoam pieces prevent the displacement of the fat plug by supporting it from the both sides. The patient was discharged after 2-3 hours with the instructions to keep the ear dry.

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Figure I: Incision on the posterior surface of the lobule and fat harvesting

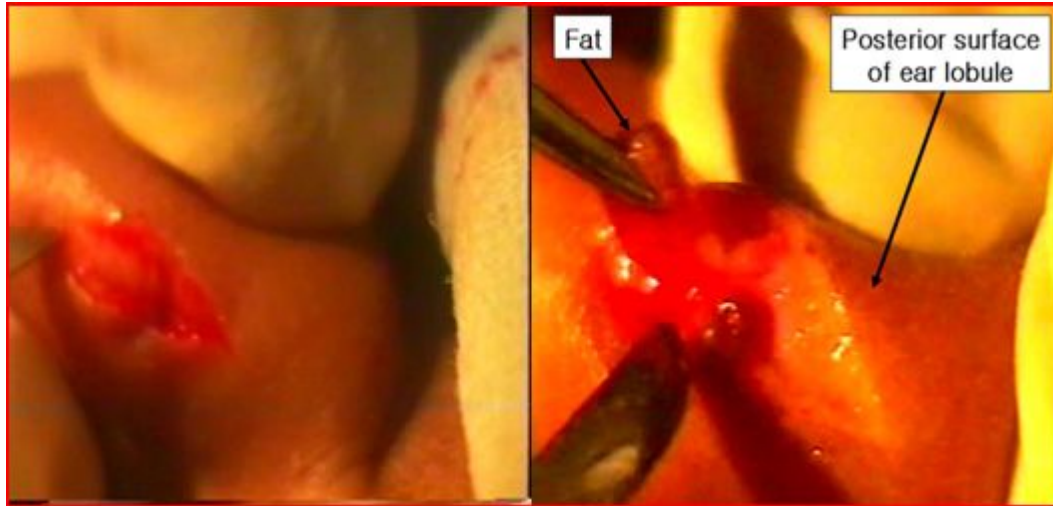


Figure II: Small central perforation and using sickle knife to freshen the edges of perforation

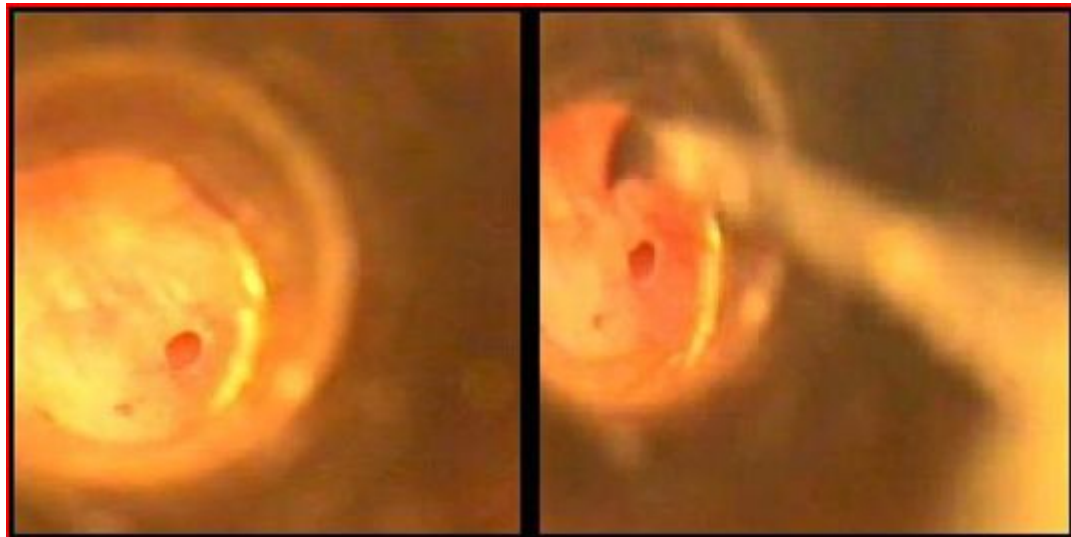
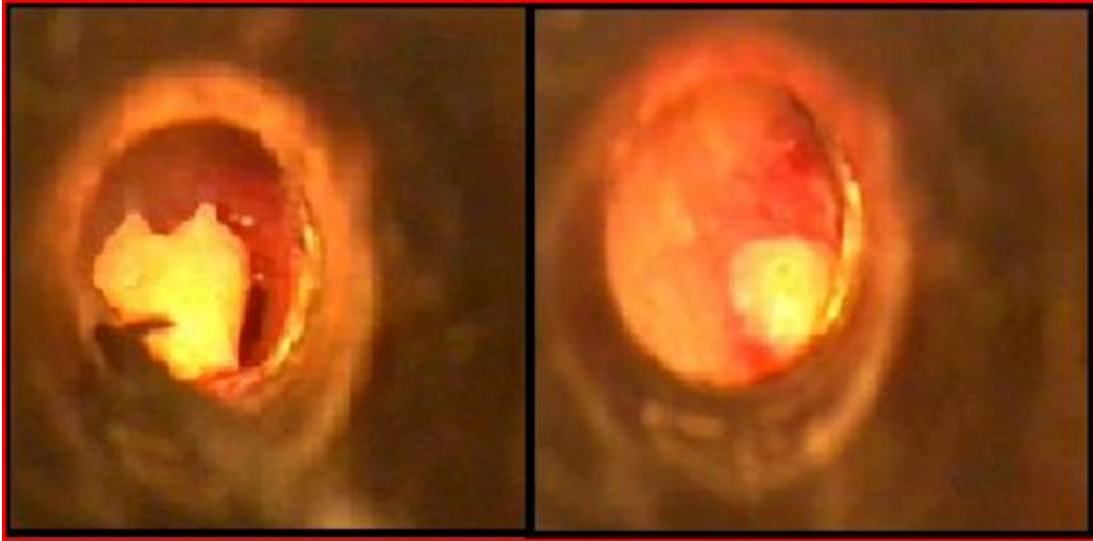


Figure III: Fat plugging the perforation



Results:

All the patients were examined again after a month. Twenty-three patients had complete closure of the tympanic membrane perforation while one patient developed an upper respiratory tract infection with discharging ear. The size of the perforation in this patient was reduced but there was a residual perforation. The success rate was 95.8%.

Table I: Results of myringoplasties with fat graft

Author (Reference)	Number of Cases	Success Rate
Liew, et al.(6), 2002	15	100%
Ayache, et al.(7), 2003	45	91.9%
Hagemann & Hausler(8), 2003	44	91%
Ozgursoy & Yorulmaz(4), 2005	18	82.4%
Author's Study	24	95.8%

Discussion:

The overall success rate in our series is 95.8 % which is comparable with the study of Liew, et al⁶ who used adipose tissue in the persistent perforation following tympanostomy tube removal (Table I). He had a 100% success rate in his series of 15 children. He harvested fat by placing a small horizontal incision along the inferior aspect of the lobe. Ayache, et al,⁷ harvested fat from the abdomen, making a separate skin incision to close the center of the umbilicus, in 91% of the cases and from the pretragal area in 9% of the cases. They also affixed the fat with biologic glue. Hagemann and Hausler⁸ found a 91% success rate in their large study. Though our study is small, 24 patients only, a bigger study is required to establish its success rate. We restricted our case selection to those perforations with a size of 25-30% of the drum surface or approx 5 by 5 mm. in size. The larger perforation was avoided for this type of procedure due to the

possibility of failure. Dedden, et al⁹ found that the size of the perforation is a crucial factor and 30% of the drum surface is a good prognostic factor for the fat graft. Perforations larger than one quadrant of the tympanic membrane are unfavorable for the insertion of the fat plug.⁴ All our cases had the perforation in the anterior inferior and posterior inferior quadrant of the tympanic membrane and the success rate was not related with any particular quadrant of the tympanic membrane as shown in the result. We did not consider the long term followup criteria for the success of fat tympanoplasty as once the closure of the perforation is achieved; the role of adipose tissue for the closure of small perforation is accomplished.

It is important to note the property of the fat tissue for the fat tympanoplasty procedure. Although it can be harvested from the abdomen, buttock and ear lobule, the ear lobule fat harvesting is much simpler than the other sites. It can be harvested from the same sterile area of surgical field prepared for the fat tympanoplasty. Its scar is almost invisible as incision is given on the posterior aspect of lobule. The fat of ear lobule is denser and has better epithelial and mucosal tympanic growth. It presents a big revascularization activity³ as seen by otoscopy a few days after the procedure. There is significant bulging on the tympanic membrane⁴ till the end of the third month postoperatively and after three months bulging of the fat graft progressively disappeared and converted into a smooth sclerotic area on the tympanic membrane at the fifth month. This phenomenon was also seen in all our successful patients in the postoperative period of 1-3 months. There are two histological theories of fat grafts.¹⁰ 'The host cell replacement theory' of Neuhof¹¹ and 'The cell survival theory' of Peer.¹² The host cell replacement theory states that all the original cells die and are totally replaced by new wandering adipocytes or by fibroblasts. The cell survival theory states that not all the original adipose cells die. Those fat cells which receive adequate blood supply survive whereas remaining degenerate, thus explaining loss of volume. The transplanted fat cells are not replaced by scar tissue, instead a connective tissue capsule outside the fat graft begins three weeks after transplantation, which becomes progressively thinner over the course of a year. Fat tissue provides the basic requirement for the grafting of the tympanic membrane with its own favorable characteristics.⁴

Conclusion:

The temporalis fascia is the most common material used for tympanoplasty and the surgery requires extensive middle ear manipulation. However, myringoplasty, using adipose tissue is a quick procedure and avoids middle ear manipulation. The harvesting of fat tissue is easy without any donor site morbidity. It avoids general anesthesia and the patient is discharged on the same day with minimal postoperative care. Fat-plug myringoplasty is very cost effective with the success rate as good as with tympanoplasty using temporal fascia for the small dry central perforation.

1. It is a very safe and simpler procedure for the closure of a dry, small central perforation.
2. The harvesting of fat takes a very short time. There is no visible scar and minimum donor site morbidity.
3. It avoids extensive middle ear manipulation.
4. It can be done under local anesthesia and avoids general anesthesia.
5. Its success rate is very high and comparable with tympanoplasty using temporalis fascia.
6. The fat-plug myringoplasty is a very cost effective surgery as the patient goes home the same day.

References:

1. Benzer M. Disputatio de audicione laesa. Trans Am acad Ophthalmol otolaryngol. 1963; 67:233-259 (cross reference)

2. Berthold E. Uber Myringoplastic. Med-chir centralb. 1879; 14: 195-207(cross reference)
3. Ringeberg JC. Fat graft tympanoplasty. Laryngoscope. 1962; 72:188-192 (cross reference)
4. Ozgursoy OB. Yorulmaz. Fat graft myringoplasty: a cost-effective but underused procedure. The journal of laryngology & Otology. 2005;119:277-279
5. Gross CW. Bassila M. Lazar RH. Long TE. Stagner S. Adipose plug myringoplasty: an alternative to formal myringoplasty techniques in children. Otolaryngol Head Neck Surg. 1989; 101: 617-620
6. Liew L. Daudia A. Narula AA. Synchronous fat plug myringoplasty and tympanostomy tube removal in the management of refractory otorrhea in younger patients. International journal of pediatric Otorhinolaryngology. 2002; 66:291-296
7. Ayache S. Braccini F. Facon F. Thomassin JM. Adipose graft: An original option in myringoplasty. Otology & Neurotology. 2003; 24:158-164
8. Hagemann M. Hausler R. Tympanoplasty with adipose tissue. Laryngoscope. 2003; 82:393-6
9. Deddens AE. Muntz HR, Lusk RP. Adipose myringoplasty in children. Laryngoscope. 1993; 103: 216-219(cross reference)
10. Boyce RG, Nuss DW, Kluka EA. The use of autogenous fat , fascia, and nonvascularized muscle grafts in the head and neck. Otolaryngol Clin North Am. 1994; 27: 39-68
11. Neuhof H. The transplantation of tissues. Newyork:Appleton & Co., 1923 (cross reference)
12. Peer LA. Transplantation of tissues, Vol 2: Transplantation of fat. Baltimore: Williams &Wilkins, 1959 (cross reference)