A Comparative Study of Various Office Procedures for the Management of Small to Medium Size Tympanic Membrane Perforations

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Abstract A hospital based prospective study to compare and evaluate the efficacy and convenience of various office procedures like chemical cauterization, fat plug myringoplasty and butterfly cartilage tympanoplasty. This interventional, prospective, longitudinal study carried out on 300 patients in the ENT department of a tertiary care medical college hospital in central India between January 2009 and January 2015. The success rate was found to be 94.54, 91.12 and 97% in chemical cauterization, fat plug and butterfly cartilage tympanoplasty respectively (p value 0.246). In all the groups there were significant improvement in terms of hearing in decibels and AB gap postoperatively. No statistically significant association was found in between the failure rates in all the groups. From this study we conclude that all the procedures were simple, rapid, reliable, cost effective, takes less time and minimum hospital stay (day care) than conventional tympanoplasty. We strongly recommend these procedures in place of tympanoplasty in small to medium size central tympanic membrane perforations according to condition and convenience of the patients.

Keywords Chemical cauterization · Fat plug myringoplasty · Butterfly tympanoplasty · Office procedure

Introduction

Persistent tympanic membrane perforations closure has always been a challenge for otolaryngologists [1]. In 1853 Toynbee used a rubber disc attached to a silver wire to close tympanic membrane perforation. Berthold, in 1878 coined the term myringoplasty and used thick skin graft. Wullstein and Zollinger in 1950s described the technique of tympanoplasty, using split thickness skin graft. In 1961 Storrs reported a series of cases using temporalis fascia as an outer surface graft. Glasscock and Sheehy (1967) further developed and refined the techniques used for lateral graft tympanoplasty. Shea (1957) discovered medial graft tympanoplasty by chance while performing stapedectomy. He successfully repaired an accidental tear using medial vein graft. Storrs later replaced the vein graft with temporalis fascia for in medial grafting [2].

The earliest treatment of tympanic membrane perforations with chemical cauterization was done by Roosa (1873) using silver nitrate, and by O’Keeffe (1895) by using TCA [1, 2] (Trichloroacetic acid). Yearsley (1863) used cotton ball, while Blake (1877) used paper patch to cover the perforation. Ear lobe has been used for the last 15 years. On microscopic comparison the fat from other body parts and ear lobe, ear lobe fat cells were found more compact and contain more fibrous tissue. It provides scaffolding for the growth of tympanic membrane epithelium and mucous membrane by bridging the gap. Ringenberg (1962) successfully used adipose tissue fat to repair small tympanic membrane perforation [3, 4]. Butterfly cartilage tympanoplasty is another day care office procedure which is found to be very effective.

Butterfly cartilage tympanoplasty was introduced by Eavey in 1998, as inlay cartilage tympanoplasty in children with very good results [5]. Toss classified this inlay

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cartilage tympanoplasty in “F” group and “A” subgroup in the classification of tympanoplasty [6].

Materials and Methods

This prospective, longitudinal and comparative study was conducted in a tertiary care hospital in central India. This study was carried out on 300 patients, from January 2009 to April 2015. The patients of both sexes between 10 and 60 years of age with small and medium size tympanic membrane perforations (2–5 mm) were included in the study. To evaluate the efficacy and convenience of the office procedures like chemical cauterization, fat plug myringoplasty and butterfly cartilage tympanoplasty this study was designed.

All the patients with chronic suppurative otitis media with small to medium sized central perforations, not more than 5 mm size, were included in the study.

Any patient with the history of previous ear surgery, attico-antral disease, active ear discharge, Eustachian tube dysfunction and more than 5 mm size perforations were excluded. Any sinonasal problem was taken care of before the procedure.

Before any procedure a well informed, written consent was taken. Follow up period and criteria of success were similar for all the procedures.

After achieving local anaesthesia with the help of 4% xylocaine soaked cotton wick kept in EAC, chemical cauterization was done using Trichloroacetic Acid (saturated), soaked cotton tip on applicator was used to apply the acid all around the perforation margins, 1 mm blenching observed then sterile butter paper or cigarette paper of more than 2 mm size of perforation size was kept over cauterized perforation for scaffolding action. The patient asked to come at 10th day for 1st follow up and next sitting if required. The patient with healed perforation asked to come after 12 and 24 weeks for follow ups. At 24th week, the patient with healed perforation considered as a successful procedure.

For fat plug myringoplasty, local anaesthesia was achieved by infiltrating 2% xylocaine with adrenalin (1:200,000) and fat was harvested from an incision on posterior aspect of ear lobe, then incision was closed with 4-0 chromic cat gut suture. The fat was wedged into the de-epithelised perforation like a dumbbell, and supported with antibiotics soaked gel foam pledges.

For butterfly cartilage tympanoplasty, local anaesthesia was achieved by 2% xylocaine with (1:100,000) adrenalin, tragal cartilage with perichondrium harvested and trimmed in appropriate size (more than 2 mm of perforation size). The size of perforation measured by taking imprint of methylene blue painted over margins of the perforation on

gel-foam sheet and measured with the help of scale. A 2 mm deep groove created in cartilaginous rim all around, without peeling the peri-chondrium on both sides. The margins of the perforation were de-epithelised and the grooved cartilage graft fitted antero-inferiorly than posteriorly with the help of micro-elevator.

The graft checked whether it is in position or not by pressing the graft medially with the help of micro elevator. Graft supported by antibiotic soaked gel-foam. After postoperative monitoring of 4 h, patient was allowed to go home with oral medication.

Results

In present study, 300 patients were included of which 110 underwent chemical cauterization, 90 fat plug myringoplasty and 100 underwent butterfly cartilage tympanoplasty.

In the study 171(57%) were male and 129 (43%) were female (p value 0.082 which is non significant). The mean age was 28.25 years. 179 (59.66%) patients were from urban area and 121(40.33%) were from rural background.

The most common site of perforation was inferior quadrant in 158 patients (52.67%), followed by central perforations in 73 patients (24.34%). Commonest perforation size was falling in 2-3 mm group in 115 patients (38.34%). The p value for this was 0.002 which was highly-significant (Fig. 1).

Etiologically majority of the patients belongs to inflammatory perforations (251/83.66%) and rest 49 (16.34%) were of traumatic origin.

The mean threshold of hearing preoperatively in TCA cauterization group was 32.19 ± 12.54 improved to 33.57 ± 7.75 . There was statistically significant improvement of hearing postoperatively (mean 8.61 ± 8.22 , $t = 7.02$, $R = 0.77$).

In the fat plug myringoplasty the mean threshold of hearing preoperatively was 27.22 ± 8.96 , it was improved

Fig. 1 Perforation size

Fig. 2 Success and failure rates

by 21.50 ± 7.24 . the mean improvement was statistically significant postoperatively (mean 5.72 ± 5.21 , $t = 7.76$, $R = 0.81$).

In butterfly cartilage tympanoplasty the mean threshold of hearing was improved significantly from 32.28 ± 12.87 to 28.34 ± 8.23 (mean 6.82 ± 6.32 , $t = 7.85$, $R = 0.79$).

All the statistical analysis was done by using SPS software, Chi square test applied and p value obtained.

The success rate in TCA cauterization was 94.55%, in fat plug myringoplasty it was 91.12% and in butterfly cartilage tympanoplasty 97% (p value 0.246) (Fig. 2).

Discussion

Central perforations of tympanic membrane are a quite common problem in general population. It is commonly seen in the developing countries and lower socio-economic strata. The treatment of tympanic membrane perforation is tympanoplasty, but not always, we have options in small to medium size perforations. Some day care procedures like chemical cauterization, fat plug myringoplasty and butterfly cartilage tympanoplasty can be adapted according to size of perforation and need of the patient.

Dursun et al. [7] established that there is no statistically significant difference in tympanic membrane perforation closure rate between paper patching, fat and prichondrium myringoplasty which were concluded by our study. Imamoglu et al. working on rat concluded that fat plug and paper patch myringoplasty have not been found that effective, which is contradictory with our study findings. Landsberg et al. [8] performed fat plug myringoplasty on a population comprising of 27 adults and 11 children. Speech reception threshold improved significantly as in this study.

Golz et al. [9] performed paper patch myringoplasty on 77 patients with chronic perforations of the ear drum and found that small perforations needed less no. of repeated

applications and less time for closure, which is consistent with our study.

Eavey [4] used tragal cartilage, with both side perichondrium in children with good results, as children are more susceptible for upper respiratory tract infection.

Conclusion

From this study we conclude that all the above mention procedures are reliable, among them butterfly cartilage tympanoplasty is better than chemical cauterization, and chemical cauterization is better than fat plug myringoplasty. The chances of graft extrusion are more in fat plug, and multiple sittings are required for chemical cauterization causes inconvenience to the patient. On the other hand butterfly cartilage tympanoplasty and fat plug myringoplasty is invasive procedures as incision and graft harvesting is required but these methods are good alternative methods of tympanoplasty.

Above all, these procedures are less time taking, cost effective, requires no pre and post auricular preparations, less hospital stay, day care procedures. So we recommend the office procedures to be tried first in small to medium size perforations before conventional tympanoplasty. This will reduce the economic burden on patient, waiting in hospitals and the most important thing; they are convenient to the patients.

Compliance with Ethical Standards

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

Conflict of interest Ashish Mourya, Leena Jain, Shalini Jadia, Sadat Qureshi, declare that they have no conflict of interest.

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