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Original Research Article

Endoscopic malleus button hole myringoplasty

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ABSTRACT

Background: Myringoplasty or type-1 tympanoplasty is surgical procedure that is used for repair of the tympanic membrane. The result outcome of myringoplasty depends on several variables such as method of tympanoplasty taken whether endoscopic and microscopic, of size of perforation, bony overhang, eustachian tube function, state of the middle ear mucosa, degree of pneumatization of mastoid and technique of graft placement.
Methods: Our study was conducted at G.G.S. Medical College, Faridkot from January 2017 to April 2018. Patients were taken for endoscopic tympanoplasty and graft was placed with buttonhole technique. Results were compared in form of preoperative audiometry and post-operative audiometry done after 3 months.
Results: In our study patients done with endoscopic tympanoplasty with buttonhole technique graft placement showed postoperative audiometry with decreased air bone gap till 10 db in maximum number of patients and 97% patents with graft uptake.
Conclusions: The use of endoscopes has brought a new perspective to ear surgery. The use of endoscopes along with different technique as mentioned of placing graft to prevent all the complications.

Keywords: Tympanoplasty, Endoscope, Buttonhole technique, Malleus

INTRODUCTION

Myringoplasty or type-1 tympanoplasty is surgical procedure that is used for repair of the tympanic membrane and is one of the commonest operations performed in otological practice. The result outcome of myringoplasty depends on several variables such as size of perforation, bony overhang, eustachian tube function, state of the middle ear mucosa, degree of pneumatization of mastoid. The operating microscope provides a magnified image in a straight line, hence the surgeon cannot visualize the hidden areas of the middle ear in a single operating field.

The endoscope on the other side when placed in the external auditory meatus, the entire tympanic membrane can be viewed in one field, and assessment can be made of the entire tympanic membrane, with the fibro cartilaginous ring and the tympanomeatal angle. It also allows to visualize all areas without the need to repeatedly reposition the patient's head as in otomicroscopy. Otoendoscopy also gives better visualization of depth of retraction pockets, fluid level due to middle ear effusion, movements of ear drum as compared to conventional otoscopy.[1] Since then endoscopes are increasingly used for various middle ear surgeries.

Another important advantage of endoscopic surgery is that it can visualize structures parallel to its axis; this is not possible with a microscope, the use of which requires that the structures be at a right angle to the axis for adequate visualization. Otoendoscopy accesses the inaccessible "sees round corners".[2] Direct endoscopy through the middle ear space has been used successfully

as an alternate procedure for second-look mastoidectomy, middle ear exploration for perilymphatic fistula, and limited removal of epitympanic cholesteatoma and as an intraoperative aid to visualize the attic, eustachian tube, and sinus tympani.

Apart from use of microscope/endoscope the neotympanic membrane plays important role in physiology of hearing postoperatively. Temporalis fascia being composed of biologically inert collagen fibres and its ability of easy uptake, easy availablilty is most commonly used. In routine surgeries it is placed either by underlay or overlay techniques which have their own pros and cons as discussed below. The overlay technique has been associated with a higher incidence of blunting of anterior sulcus and graft lateralization, which may result in significant conductive hearing loss. The most widely used and accepted method is underlying graft of temporalis fascia. The main drawback of underlay technique, is medialisation and adherence to promontory. The technique used here, where the graft is anchored in position by the manubrium of the malleus, avoids these complications. It is especially important to position the graft tightly in the anterior sulcus, where failure of graft occurs most commonly as a result of technical error. It is here that the branches of the anterior tympanic and deep auricular arteries provide a critical blood supply to the graft

In our study we have used unique technique of buttonhole tympanoplasty with endoscope and studied the results.

METHODS

Our study was conducted at G.G.S. Medical College, Faridkot from January 2017 to April 2018. Patients attending ENT outpatient department with chief complain of decreased hearing and ear discharge were screened. Patients having dry and safe chronic suppurative otitis media and willing for surgery were selected after taking written and informed consent. Patents with active ear discharge, cholesteatoma, revision surgery patents were excluded. Pre-operative pure tone audiometry was done in every case. All tympanoplasty were type 1 tympanoplasty and were performed under local anaesthesia. Temporalis fascia was used as graft material. Temporalis fascia graft was harvested through 3 cm incision in hairline just above helix. All tympanoplasties were performed by transcanal route using 0-degree nasal endoscope.

All endoscopic surgeries were performed by direct visualization on the monitor. All patients were given prophylactic dose of injectable antibiotic and oral decongestant. Dryness of the middle ear was confirmed preoperatively. Margins of the perforation were freshened. Vascular strip incision was given starting from posterior to anterior 6 mm lateral to annulus sparing from 11’º clock to 1’º clock. tympanomeatal flap was elevated along with fibrous annulus. Flap was only attached from 11’º clock to 1’º clock. Annulus was retrogradely elevated from medial to lateral from 11’º clock to 1’º clock thus exposing lateral process of malleus (Figure 1 and 2).

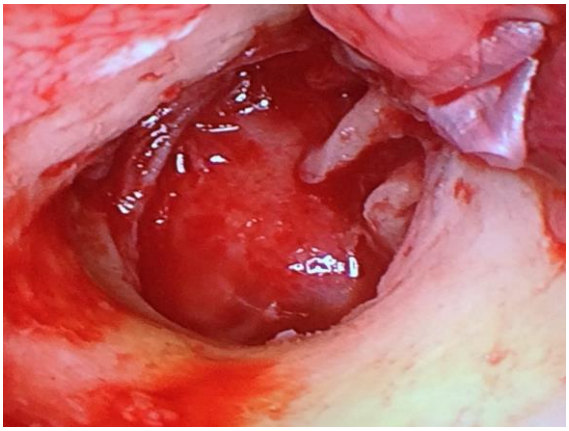

Figure 1: Left ear complete 360 elevation of flap.

Figure 2: malleus button hole in graft.

The round window reflex was visualized and continuity of the ossicular chain was confirmed. Small hole was created and graft to hook in the handle of malleus

Malleus was passed through button hole created in graft (Figure 3a, b)

The graft was placed all over bony EAC. Now the fibrous annulus along with flap was repositioned. Medicated gelfoam was placed over the graft to stabilize the graft. Medicated wick was kept in EAC. Mastoid bandage was given. All patients were kept overnight, given injectable antibiotics and on next day operative wound was checked and sterile dressing was given. All patients were discharged on oral antibiotics for one week and called for regular follow up. Final assessment of graft uptake was done at 3 months and hearing was assessed by postoperative pure tone audiometry. Successful results were considered as patient having complete graft uptake and post-operative air bone gap ≤15 db. Those patients not fulfilling above criteria were considered as failure.Results obtained were tabulated and statistically analyzed using descriptive statistics.

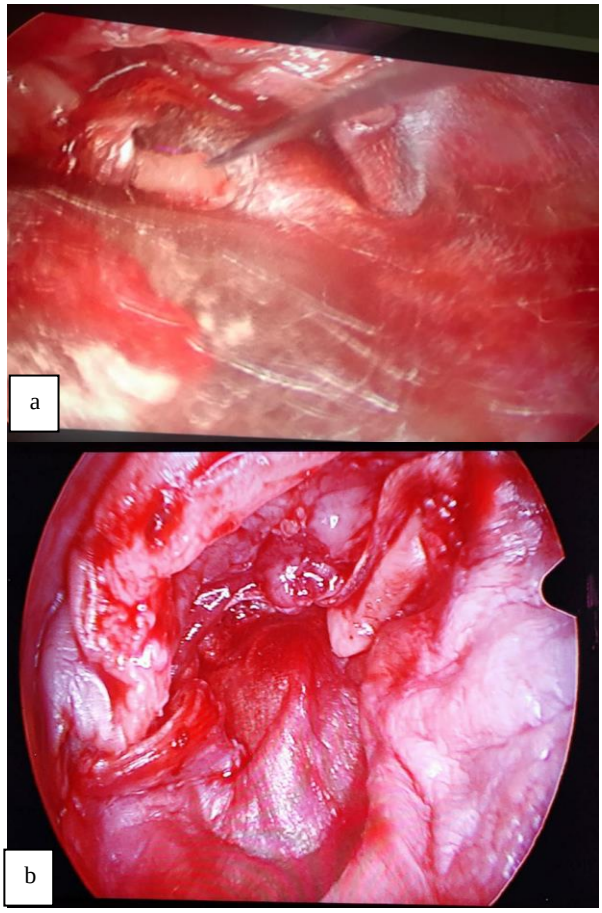

Figure 3(a, b): Malleus through button hole.

RESULTS

The present study was conducted on 50 patients of age group 20 to 50 years with dry perforation of any size. Most of the patients were in their 2nd or third decade of life as mentioned in Table 1.

Table 1: Age distribution (n=50).

Age in years	N (%)
20-30	20 (40)
30-40	18 (36)
40-50	12 (24)

Table 2: Sex distribution (n=50).

Gender	N (%)
Male	30 (60)
Female	20 (40)

Males outnumbered female as shown in Table 2.

Patients were followed up after 1 week for suture removal then 4th week, 8th week for follow up for any complaint if any, finally patients were called at twelfth week for pure tone audiometry and otoscopy.

Only 46 patients reported for follow up with 4 being defaulter as most of our patients are from country side. With regard to tympanic membrane continuity, 45 out of the 46 patients had an intact tympanic membrane in the twelfth postoperative week, accounting for 97% success rate as shown in Table 3.

Pure tone audiometry was used to assess the average air-bone gap preoperatively as shown in Table 4 and postoperatively, excluding the failed cases as shown in Table 5.

Table 3: Follow up of patient after twelfth week (n=46).

	N (%)
Healed perforation and intact neo-tympanum	45 (97)
Non-healed perforation and deficient neo-tympanum	1 (3)

Table 4: Pre-op A-B gap in dB (n=50).

A-B gap (dB)	N (%)
<10	0
11-20	10 (20)
20-30	30 (60)
>30	10 (20)

Table 5: Post-op A-B gap in dB at Twelfth week (n=45).

A-B gap (dB)	N (%)
<10	35 (77)
11-20	5 (11)
21-30	4 (8)
>30	1 (2)

None of the patients had an air-bone gap <10 dB prior to surgery, but postoperatively at twelve weeks, 35 patients had an improved air-bone gap <10 dB and 10 were in the range of 11–20 dB preoperatively and 5 were in similar range postoperatively. Preoperatively, 30 patients had an air-bone gap in the range of 21–30 dB, whereas the same level was found in 2 cases postoperatively. In the twelfth week, 40 patients had an air-bone gap <20 dB. Thus, out of the patients with a healed perforation, 77% showed an air-bone gap below 10 dB in the twelfth postoperative week and 11% had an air-bone gap in the range of 11–20 dB, while 10% still had an air bone gap in the range of 21–30 dB (Table 5).

DISCUSSION

Myringoplasty is one of the most common forms of surgery in ENT. It yields very satisfying results for both the patient and the surgeon. The results are usually expressed in terms of the take-up rate of the graft and hearing improvement, which is assessed both subjectively

and objectively. Conventionally, middle ear microsurgery is performed with microscope. Since microscopy provides a linear view, visualization of deep recesses of the middle ear is not possible. If the external ear canal is narrow, a middle ear operation can be performed only after surgical enlargement of the canal.

Endoscopes can provide magnified views of the surgical field. Microscopes require image adjustment during operation, whereas back-and-forth movements of the endoscope can easily produce close-up and angled images when needed. Moreover, rotational movement of angled endoscopes can provide panoramic images of the deep and hidden regions of the middle ear. An endoscopic approach to the middle ear can improve visualization of structures, such as the tubal orifice, incudostapedial joint and oval/round window niches.

Advantages of the endoscopic approach include shorter operation time, reduced exposure to anesthetic agents and associated side effects, and improved surgeon concentration (Huang et al., 2016).[3] The endoscopic approach is less invasive, as it does not require incision or canaloplasty. Compared with the microscopic approach, an endoscopic approach is associated with less postoperative bleeding and pain, and it provides improved cosmetic outcomes by Plinkert et al.[4] El-Guindy (1992) reported that graft success rate was 91.7% among their patients.[5] In our study graft success rate is 97%.

Nonetheless, there are still some limitations on the implementation of endoscopy in middle ear surgeries. There is a long learning curve, and there are also some challenges and inconveniences associated with instrumentation and endoscopic techniques. Use of small-diameter endoscopes within the ear can be challenging for inexperienced surgeons and this hinders the opportunity to obtain large-angled views, which is the main advantage of endoscopy over microscopy by Rosenberg et al and Yung et al.[6,7] There are major drawbacks with endoscopic ear surgery. The first is heat generated by the light source, particularly, the heat released by xenon light sources. As a solution to this problem, the routinely used light source can be adjusted to operate at a lower power level. Another drawback is the trauma, which may result from unintentional head movements by the patient by Raj et al.[8]

Discussing demerits of endoscopic ear surgery another worth mentioning is a one-handed technique. Surgeon has to hold the scope in one hand during the surgery while only one hand is free to operate and moreover at time of excessive bleeding it becomes very difficult to operate with one hand. Moreover, blood soils the tip of microscope which obscures the surgical field. Thus, tip of endoscope has to be cleaned frequently. Similar observation was made in studies of Tarabichi et al and Karhuketo et al.[9,10]

This problem can be solved by developing a stand for endoscopes, which can fix the scope in particular position so both hands are free to operate. Endoscopes provide monocular vision which leads to loss of depth perception. Hence one needs to be extra careful, while close to vital structures and positioning of the graft. This difficulty may be overcome by experience.

Coming over to technique of positioning graft by overlay technique we know there is blunting of sulcus along with chances of lateralization and hence significant hearing loss.[11] 77% showed an air-bone gap below 10 dB in our study. Sheehy et al has suggested such grafts will have a lower "take" rate, being more prone to retract away from the anterior margin and leaving a gap.[12] Most of the surgeons place graft by underlay technique which is widely used method of placing the graft.[13] The main drawback is medialisation and adherence to the promontory. Now the technique used here is anchoring the graft to handle of malleus which avoids above said complications. In our study we did not find any case with graft medialisation and lateralization.

This technique is described by Gersdoff et al in their text on ‘Atlas of middle ear surgery’.[14] The technique described here is different from the above techniques. The various advantage of anchoring the temporalis fascia graft to the handle of the malleus through the buttonhole is: on table - on placing the graft and anchoring it to the handle of the malleus, all around 360 degree movement of the graft is possible, does not fall back over the medial wall of middle ear as it is held in position. Aids in creation of neotympanum. It prevents inadvertent movements and displacement of the graft while maneuvering intra-operatively. Easy to learn and follow. Post-operatively graft lateralization and hence hearing loss as mentioned with overlay technique have no chance of taking place. Moreover, since the graft is firmly held in position, chances of medialisation and adherence to promontory are prevented. As every technique has limitations too similarly this technique cannot be done where handle of malleus is eroded.[15]

Numerous authors have reported that the failure rate in anterior perforations is higher. However, this failure rate can be greatly reduced by anchoring the anterior margin of the graft beneath the annulus.[16] In our study, this complication was avoided since the fascia graft was anchored to the handle of malleus. This is a new technique, and studies are needed with long term results and comparisons needed with well-established techniques of underlay and overlay.

CONCLUSION

In conclusion, as we all know otology surgeons have spent years endeavoring to obtain improved surgical outcomes both objectively and subjectively. Although several technical improvements have been made to surgical microscopes, there remain a number of

limitations. The use of endoscopes has brought a new perspective to ear surgery. The use of endoscopes along with different technique as mentioned of placing graft to prevent all the abovesaid complications would be great method of reducing complications.

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