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A study on endoscopic type 1 tympanoplasty in tubotympanic chronic suppurative otitis media

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ABSTRACT

Background: Chronic suppurative otitis media (CSOM) attributes to 71.6% of hearing impairment in which most of them only have central perforation without any ossicular erosion or middle ear pathology. Tympanoplasty has evolved to provide and reconstruct better hearing mechanism, avoid complications as well as recurrence. Traditionally over the decades, tympanoplasty has been done using an operating microscope. Middle ear endoscopy was first introduced by Mer and colleagues in 1967, since then middle ear surgeries which were traditionally done using the microscope can be done using the endoscope also.
Methods: This prospective study was conducted at Basaweshwar Teaching and General Hospital, Kalaburagi between March 2016 to November 2017. Endoscopic type 1 tympanoplasty was performed in all the cases using temporalis fascia.
Results: There were 30 patients between 15-65 years with average being 29.6 years in which 17 were females and 13 were males. Pre and post-operative PTA at 1, 3 and 6 months were analyzed. The mean duration of surgery was 50.13 mins. The mean duration of hospital stay was 2.23 days. The mean duration of wound healing was 12.23 days. The average pre-operative PTA was 32.47±4.79 dBHL and postoperative PTA at 1, 3 and 6 months was18.3±3.22 dbHL, 16.5±2.2 dbHL and 16.35±2.22 dBHL. The graft uptake at end of 6 months was 100%.
Conclusions: We here by conclude that endoscope can be a better alternative for microscope in type 1 tympanoplasty as it provides a wide panoramic view, less operating time and hospital stay with minimal visible scar post operatively.

Keywords: Endoscope, Tympanoplasty, PTA

INTRODUCTION

Chronic suppurative otitis media (CSOM) attributes to 71.6% of hearing impairment in which most of them only have central perforation without any ossicular erosion or middle ear pathology.[1,2] These patients present usually either as recurrent ear discharge or as hard of hearing or as both, with advent of better antibiotics the control over disease pathology has been successful with absolute reduction in ear discharge. Thus only thing is to bring back hearing to near normal which remains main objective through repair of perforation i.e., myringoplasty or tympanoplasty.

Tympanoplasty is an operation in which inspection and repair of middle ear sound conductive apparatus with reconstruction of tympanic membrane. Tympanoplasty has evolved to provide and reconstruct better hearing mechanism, avoid complications as well as recurrence. In 1640 Marcus Benzer first documented covering ear drum perforations using a piece of pig's bladder. Wullstein and Zollner revolutionized the field in 1950's where they

used split-thickness skin grafts.[3,4] Storz in 1960 performed autologous temporalis fascia graft which is now one of the most commonly used grafting material.[5] This had solved most of the problems of skin graft. Traditionally over the decades, tympanoplasty has been done using an operating microscope. Despite the continuous technical advancements, the basic optical principles of the microscope and their limitations like large post auricular incision, frequent adjustment of head and microscope. To overcome these problems of limited visualization and improve outcome endoscopes were tried. Middle ear endoscopy was first introduced by Mer and colleagues in 1967, since then middle ear surgeries which were traditionally done using the microscope can now be done using the endoscope also.[6]

Endoscopes have immediate advantage with inherently wide field of view that extend from the tip of lens offering surgeon extended field with minimal exposure like visualizing deep anterior canal wall, anterior recess, anterior marginal perforation, sinus tympani, facial recess, hypotympanum as well as attic.

The current study was done to know advantages, feasibility of endoscopic tympanoplasty and its results in terms of audiological outcome as well as graft uptake.

METHODS

The present prospective study was conducted at Basaweshwar Teaching and General Hospital, attached to M. R. Medical College, Kalaburagi (Karnataka) between March 2016 to November 2017. Patients attending to ENT OPD with chief complaints of ear discharge and/or hearing impairment were screened. Those patients aged 15-65 years with chronic otitis media with central perforation in inactive stage were included in the study. Those patients with SNHL, active COM, tympanosclerosis and the patients who were unfit for surgery were excluded from the study. Informed and written consent was taken. Pre-operative otoendoscopic findings of all patients were noted. In central perforation, size of the perforation was noted as per 3 quadrant classification. Type and degree of hearing loss was assessed by pure tone audiometry. Endoscopic type 1 tympanoplasty was performed under local anaesthesia in all the cases. Infiltration done with 2% lignocaine with adrenaline (1:1,00,000). Freshening of the epithelized margins of perforation was done using curved pick. Tympanomeatal flap elevated by 6 and 12 o'clock vertical incision joined by posterior horizontal incision about 6 mm away from the annulus on canal wall. Middle ear entered under the annulus and middle ear pathology if any cleared. Temporalis fascia graft harvested by taking a 2 cm incision in the superior part of post auricular groove avoiding visible scar. Incision above pinna over scalp was taken and temporalis fascia graft harvested. This graft was placed by underlay technique. Finally, gel foam placed to stabilize the graft and TM flap repositioned. Post-auricular groove sutured. Mastoid dressing was done. Rigid endoscopes used for the procedure were 0 degree, 30 degree and 45 degree with 4mm width (17 cm long). 0^0 endoscope was used mainly for surgery. 30^0 and 45^0 were used in cases of bony overhang of anterior wall, attic visualization and disease in hypotympanum. After the surgery a regular follow up for 1st, 3rd and 6th month was done in all the patients for hearing assessment, graft uptake and for any complications. Pure tone audiometry was done at the end of 1st, 3rd and 6th month to know the improvement in the hearing.

Successful outcome was considered in patients having complete graft uptake and AB gap closure. Those patients not fulfilling the above criteria were considered as failure. The data collected was analyzed using student t-test for comparing pre and post-operative AB gap.

RESULTS

There were 30 patients in the study between 15-65 years with average being 29.6 years in which 17 were females and 13 were males. All patients underwent type 1 tympanoplasty under endoscopic visualization. Pre and post-operative PTA at 1, 3 and 6 months were analyzed. Otoscopy was done at every visit to see for retraction or residual perforation. There were 19 right ears and 11 left ears operated. There were 10 small perforations, 18 medium size perforations and 2 large perforations of pars tensa. The minimum period of dry ear was 1 month. Intraoperatively structures like attic, eustachian tube opening, round window and oval window, sinus tympani were visible in all cases. The mean duration of surgery was 50.13 mins. The mean duration of hospital stay was 2.23 days. The mean duration of wound healing was 12.23 days. The average pre-operative PTA was 32.47±4.79 dBHL and postoperative PTA at 1, 3 and 6 months was18.3±3.22 dbHL, 16.5±2.2 dbHL and 16.35±2.22 dBHL. The graft uptake at end of 6 months was 100%. There were 2 patients who had retraction at 3 month follow up but consequently improved at 6 months.

Table 1: Sex distribution.

Males	Females	Total
13	17	30

There were 30 patients in the study in which 17 were females and 13 were males (Table 1).

There were 10 small perforations, 18 medium size perforations and 2 large perforations of pars tensa (Table 2). The mean duration of surgery was 50.13 minutes (Table 3). Table 4 shows that the mean duration of hospital stay was 2.23 days.

Table 5 presented that the average pre-operative PTA was 32.47±4.79 dBHL and postoperative PTA at 1, 3 and 6 months was 18.3±3.22 dbHL, 16.5±2.2 dbHL and 16.35±2.22 dBHL.

Table 2: Showing distribution of patients in endoscopic type 1 tympanoplasty based on the central perforation.

Central perforation						Total
Small anterior	Small posterior	Small inferior	Medium anterior inferior	Medium posterior inferior	Large	
N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
1 (3.3)	5 (16.7)	4 (13.3)	18 (60.0)	0 (0.0%)	2 (6.7)	30 (100.0)

Table 3: Duration of surgery (in minutes).

Duration of surgery (in minutes)			Total
30-60	61-90	91-120	
29 (96.7%)	1 (3.3%)	0 (0.0%)	30 (100.0%)

Table 4: Postoperative hospital stay.

Surgery	Postoperative hospital stay				Total
	1 day	2 days	3 days	4 days	
	N (%)	N (%)	N (%)	N (%)	N (%)
Endoscopic type 1 tympanoplasty	5 (16.6)	19 (63.3)	6 (20.0)	0 (0.0)	30 (100.0)

Table 5: Improvement in hearing.

Surgery	Postoperative improvement (preop PTA-postop PTA at 6 m) (in db)			Total
	0-10	11-20	21-30	
	N (%)	N (%)	N (%)	N (%)
Endoscopic	2 (6.7)	24 (80.0)	4 (13.3)	30 (100.0)

DISCUSSION

Endoscopic ear surgery is one of the minimally invasive surgeries which is increasing since the last decade to bring out various otologic procedures with minimal complications.

Patient selection for endoscopic ear surgery is very important. Patient should be cooperative for surgery under local anesthesia. There should not be any canal abnormalities. Otoendoscopic preoperative examination provides more precise information than naked eye or otoscopic examination. This has been explained in other studies like Badr-El-Dine et al, satyawati Mohindra et al who have adopted the same method.[7,8]

Intraoperative visualization has helped us to localize the disease more precisely and with less manipulation of ossicles or injury to corda tympani and facial nerve.

The International working group on endoscopic ear surgery (IWGEES) formed as consortium of otologists interested in endoscopic ear surgery. It promotes endoscopic ear surgery and provides educational materials and seminars.

Endoscopic ear surgery advocates the following principles that using ear canal as natural conduit to tympanic membrane, restoring normal middle ear and mastoid ventilation routes and preserving as much normal anatomy as possible by minimizing unnecessary dissection of bone and soft tissue, avoiding post auricular incision.

Advantages of the endoscopic approach include shorter operation time, reduced exposure to anaesthetic agents and associated side effects, and improved surgeon concentration. The endoscopic approach is less invasive, as it does not require postaural incision or canaloplasty.

In patients who were selected for the study 1 month period of dry ear was ensured prior to the surgery, as it is generally believed that a wet ear has a direct bearing on the graft take up rate. If there was active ear discharge at presentation patients were treated with appropriate antibiotics according to culture and sensitivity of discharge which reduces the period of active infection and also the complications caused by any organism if improperly or empirically treated.[9,10]

Patients with tubotympanic CSOM with only conductive hearing loss were included in the study because previous endoscopic surgeries suggested either incomplete clearance or recurrence if there was atticoantral disease thus causing bias in results of type 1 tympanoplasty. Revision cases will need more time as previous surgery would have created fibrosis thus affecting overall results.

In our study we were able to visualize, document most of the structure in each wall of middle ear which were hardest to reach and visualize if disease were present in

such areas through microscope thus increasing the capability of surgeon to clear disease from these areas and achieving better results in tympanoplasty which was documented in other studies also.[11]

In terms of operating time from initial endoscopic visualization till the last gel foam kept in the external auditory canal in endoscopic tympanoplasty was taken as the duration. In Lakpathi et al study took mean duration of 96.32 mins for endoscopic tympanoplasty.[11] In another study by Raj took mean duration of 90 mins for endoscopic tympanoplasty.[12] In Haung et al study, the average operation in endoscopic tympanoplasty was 50.4 mins.[13] In our study mean duration of surgery in endoscopic tympanoplasty (50.13 mins) thus reducing the duration of exposure of patient to anesthetic drugs and side effects, minimizing surgeons time with similar results.

Regarding choosing a graft material for type1 tympanoplasty, temporalis fascia is universally accepted graft material with good overall functional results as the thickness and fibres in this facia are similar to middle fibrous layer thus enhancing healing of both epithelial surfaces. There are studies that have shown that underlay technique gives good overall hearing results.[14] For the same reason this was followed in our study.

In Choi et al study, graft success rate in the endoscopic tympanoplasty 100%.[15] In Satyawati et al study, the success rate regarding perforation closure is 91.5%, In Anoop et al study, graft uptake is 90%.[12] In Thirumaran et al study, the graft uptake rate was 93.3% in the endoscopic group.[8,16] Our study had much better results because the patients with dry perforation were treated with antibiotics 2 days prior to surgery to create a sterile environment during surgery and prevent any sort of infection postoperatively along with proper graft placement avoiding any chance of displacement of graft which were reasons of successful graft uptake in case of type 1 tympanoplasty suggesting the importance of technique of graft used and placement by underlay method.

One of the important outcomes which every patient expects is best hearing which cannot be compromised with any procedure. In terms of hearing results, the below table shows Type 1 tympanoplasty is a procedure of least complications. But some studies have shown certain complications like graft failure, infections, sensory neural hearing loss, ossicular discontinuity, facial nerve palsy, chorda tympani damage, external auditory canal stenosis, serous otitis media, perichondritis, retraction of tympanic membrane and tinnitus. Sade et al showed 11% incidence of retracted tympanic membrane in successful myringoplastiesusing temporalis fascia graft.[18] Glasscocket al reported 1% incidence of EAC stenosis in his study.[19] Packer et al observed one case of debilitating tinnitus post operatively which was associated with sensorineural hearing loss.[18] In our study 2 patients had retracted tympanic membrane which was attributed to their allergy.

In terms of comparision with microscopic type1 tympanoplasty the overall results are better with endoscope as compared with microscope.

Thus advantages of the endoscope include a wide angle of view, endoscopic view includes the whole tympanic ring and ear canal at same time, complete view of middle ear, tympanic membrane, and ear canal without the need for continuous repositioning of the surgeon's head and the microscope, better visualization of structures that are parallel to the axis of microscope. The 30˚ and wide 0˚ provide excellent visualization of structures such as ear canal without any incision as in microscope (postauricular, endaural incisions), visualization of hidden structures such as anterior tympanic membrane perforation and sinus tympani, facial recess, attic, and hypotympanum thus help in training students, operation time is shorter and provide less postoperative pain and sooner recovery with good cosmetic results.

Disadvantages of the endoscope include the loss of depth perception and binocular vision, this is easily compensated with experience and one handed surgical technique.

CONCLUSION

From this study we concluded that endoscope can be a better alternative for microscope in type 1 tympanoplasty as it provides a wide panoramic view, less operating time and hospital stay with negligible scar post operatively with good hearing improvement. Endoscope also offers a less invasive option for the patient as well as surgeon.

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