## **Original Research Article**

 $DOI: \ http://dx.doi.org/10.18203/issn.2454-5929.ijohns20182708$ 

# Tympanoplasty revolutionized: my experience with a series of 500 cases

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Received: 11 April 2018 Revised: 30 May 2018 Accepted: 01 June 2018

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#### **ABSTRACT**

**Background:** Tympanoplasty has been the mainstay in management of chronic suppurative otitis media for decades with invent of microscopes in ear surgeries, which traditionally have been giving good results when in good hands. However, after the introduction of endoscopes in the field of otology, it has completely revolutionized my outlook and approach to the pathophysiology of the disease as well as its management. The aim of the present study was to discuss the advantages of endoscopes over microscopes and the science of endoscopic minimally invasive middle ear surgery.

**Methods:** A retrospective study was conducted on 500 cases where we did endoscopic endomeatal tympanoplasty for chronic suppurative otitis media – mucosal type with central perforation, between May 1996 and May 2017 in our tertiary medical centre.

**Results:** Among 500 cases operated, 99 % of our cases had excellent graft take up. Pure tone audiometry done before and after 2 month of surgery showed an improvement in the conductive hearing with reduced air bone gap. 97% patients with moderate conductive hearing loss had their hearing within normal limit postoperatively. Endoscope provided better visualization, avoided canalplasty, reduced operative time, shorter hospital stay and was cost effective **Conclusions:** Minimally invasive endoscopic tympanoplasty provided better visualization, avoided canalplasty, reduced operative time, shorter hospital stay and was cost effective and thereby finds itself at a futuristic level over microscopes. Nevertheless, it does require a long learning curve, and experience to expertise for optimal patient satisfaction and overcome complications.

Keywords: Endoscopic, Tympanoplasty, Ear surgery

#### INTRODUCTION

For the past decades, operating microscopes had glorified the field of otology to a great extent and gave good results when in good hands due to the enhanced abilities that the microscopes offered. There were yet some shadows that had to be explored to define several newer emerging concepts in disease and disease management, and that called for a new revolution with the advent of endoscopes in the hand of every otorhinolaryngologist. The endoscope has enabled visualization of the hidden areas of the ear and has helped us to not just see but to understand the middle ear, its contents and its physiology.

Introduced initially for diagnostic purposes by Mer and colleagues in 1967, the use of endoscope in middle ear surgeries that I ventured on from the year 1996 had revolutionized the way of doing tympanoplasty endomeatally.<sup>1</sup>

This study aims at discussing the advantages of endoscopes over microscopes in the revolutionised era of otology and the science of endoscopic minimally invasive middle ear surgery which aims at not just tympanic membrane repair but also clearance of the middle ear pathology to regain the functionality of the middle ear.

#### **METHODS**

This retrospective study was conducted on 500 cases, in Krishna Eye and ENT hospitals, Chennai, where we did endoscopic tympanoplasty from May 1996 till May 2017.

#### Inclusion criteria

- 1. All age groups and both sexes
- 2. Patients diagnosed with chronic suppurative otitis media mucosal type with central perforation with conductive hearing loss (moderate, moderately severe, severe)
- 3. Size of the perforation small, medium, large and subtotal perforations
- 4. Unilateral or bilateral CSOM

#### Exclusion criteria

- 1. Patients with active ear discharge- wet ear
- 2. Features of squamosal disease, cholesteatoma
- 3. Total, marginal perforations
- 4. Coexisting focus of infection like chronic sinusitis, chronic adenotonsillitis etc. left untreated
- 5. Known case of TB, DM, HTN, or bleeding disorders

Patients with CSOM in inactive stage with a central perforation were first evaluated for any coexisting illness or foci of sepsis. After a thorough ENT examination, patients were counselled for endoscopic tympanoplasty under GA or LA

**Preoperative evaluation:** Otoendoscopic evaluation was done to confirm the otoscopic findings with a 0 degree endoscope. The external auditory canal, tympanic membrane, margins of the perforation, the status of middle ear mucosa and contents, presence of any tympanosclerotic patches, and assessment of tympanomeatal angle were done.

Audiological evaluation with pure tone audiogram were done for all preoperative cases. The pure tone average was assessed with air and bone conduction thresholds—500 db, 1000 db and 2000 db

Routine blood and general investigations were done and anaesthetic fitness was obtained

Instruments used: Standard 0 degree nasal endoscope (4 mm) with a 3chip high definition camera and light source [Halogen/LED/xenon] were used for optimal magnification and visualization. The set of micro ear instruments used are same as that used for routine microscopic ear surgeries.

#### Procedure

The procedure was done under general or local anaesthesia based on patient preference and anaesthetist

opinion. The technique of endoscopic tympanoplasty is similar to the traditional microscopic method except for single handedness of the surgeon holding the endoscope in the other.

Local infilitration was given along the 4quadrants of the canal. Temporalis fascia graft harvested with a small horizontal incision 1cm above the helix in the temporal region and sutured.

Using 0 degree endoscope the external auditory canal, tympanic membrane and middle ear were examined and aural toileting done to clear off any debris. The margins of the perforation were freshened and edges were made raw. Tympanomeatal flap raised by a curvilinear incision connecting the 5'o clock and 7'o clock positions in EAC and middle ear entered after elevating the annulus, malleus was skeletonised, ossicular mobility was confirmed.

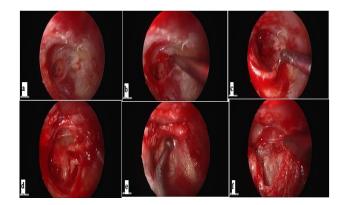


Figure 1: a) Intraop picture of left ear showing central perforation in antero inferior quadrant, b) Intraop picture left ear showing freshening of margins of the perforation using a sickle knife, c) Intraop picture showing elevation of the tympanomeatal flap with Rosens Knife, d) Intraop picture showing the middle ear cavity after elevation of the annulus, e) Intraop picture showing placement of the temporalis fascia graft lateral to the handle of malleus, (f) Intraop picture showing graft placed in situ covering the middle ear cavity and tympanomeatal flap reposited.

The ventilatory pathway between the handle of malleus and incus and the anterior epitympanum was cleared off any disease or adhesions. Eustachian tube patency was maintained. The graft was placed based on the position of perforation; for large and subtotal perforations, graft placed medial to the handle of malleus; for anterior placed perforations, graft was placed lateral to the handle of malleus. Anterior tunnelling was done separately for tucking the graft anteriorly. A 180 degree tympanomeatal flap was elevated for subtotal perforations, anterior tunnelling was not required. The middle ear and External auditory canal were packed with gelfoam. Complete hemostasis was attained throughout the procedure, and patients recovered well from anaesthesia. The patients were discharged the same day with a merocel pack in the

EAC and a small dressing over the graft harvest site. No mastoid or external ear dressing was required.

At discharge, patients were advised a course of oral antibiotics with antihistamine and anti-inflammatory medicines and were advised not to apply any topical drops or let any water entry into the ear.

**Follow up:** The patients were reviewed after 1 week for EAC pack removal and suture removal. They were followed up after 1 month, and otoendoscopy and pure tone audiometry were repeated to compare the results.

The success rate of the surgeries was tabulated with review visit after 1<sup>st</sup> and 2<sup>nd</sup> month with otoendoscopic documentation and PTA.

#### **RESULTS**

Among the 500 endoscopic tympanoplasty cases, 240were done in males and 260 were done for males. All age groups were included, and 75 cases were done for patients below 16 years of age, and 50 patients were above 60 years of age. The age distribution has been plotted in the graph below [Figure 2]. Based on size of the perforation, the distribution is illustrated below [Figure 3].

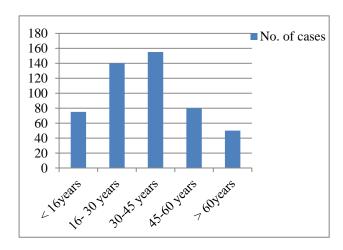


Figure 2: Age distribution.

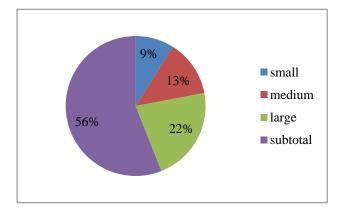


Figure 3: Size of perforation.

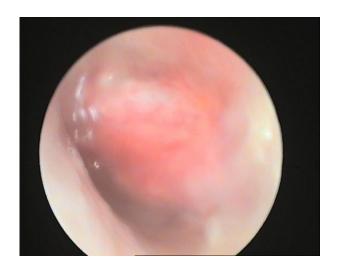


Figure 4: Otoendoscopic image of postoperative tympanoplasty done for right ear showing graft take up after 1 month of surgery.

Table 1: Postoperative results after 1 month follow up on otoendosocpy.

Size of perforation	Pre-op	No. of postop cases with complete graft take up after 1 month
Small	45	45
Medium	65	65
Large	110	108
Subtotal	280	277

Our patients were discharged on the same day with no postoperative pain or discomfort. 37 cases reported with soakage of the ear pack in the follow up after 1 week. These patients were between the age group of 30-50 years and were given a course of oral clindamycin for a week. The patients did not have any ear discharge in the subsequent visits. With our cases followed up after 1 month, we had a 99% result with graft take up. The patients were symptom free with no ear discharge or earache. Pure tone audiometry repeated after 2 months showed a decrease in the air- bone gap, with 97% of the cases with moderate conductive loss improved to normal limits of hearing, 92% improvement among moderately severe and 89% cases among severe hearing loss improved to normal hearing. Most patients with severe hearing loss also had a sensorineural component which did not improve after surgery, but helped in improving the air bone gap and thereby their hearing. The patients with posteriorly placed perforations had a better subjective evaluation of their hearing improvement. Patients with mild and moderate hearing loss preoperatively had hearing within normal limits after 1 month of surgery. Out of 500 cases, 140 patients had bilateral CSOM and both ears were operated with a 45 day interval. A very satisfying factor for our patients was the lack of any postoperative pain or discomfort due to absence of postauricular incision.

Table 2: Audiological evaluation done at 2nd month follow up.

Degree of hearing loss	No. of cases preoperative evaulation	% of post- operative cases with air bone gap reduced to 10
Moderate	114	97%
Moderately severe	256	92%
Severe	130	89%

#### DISCUSSION

Transtympanic middle ear endoscopy was first reported by Nomura and Takahashi.<sup>2,3</sup> Poe and Bottrill used transtympanic endoscopy to diagnose perilymphatic fistulae and to identify other middle ear pathology.<sup>4</sup> Kakehata used microendoscopy and transtympanic endoscopy to evaluate conductive hearing loss and inspect retraction pockets.<sup>5</sup> Thomassin reported on the use of operative ear endoscopy for mastoid cavities and designed an instrument for that purpose.<sup>6</sup>

The most commonly used rigid endoscopes are 18 cm long and 4 mm (as used for all operations in this case series). Some surgeons find this endoscope difficult to manoeuvre due to its length and larger diameter, and advocate using a paediatric nasal endoscope which is 2.7 mm diameter and 11 cm long.<sup>7</sup>

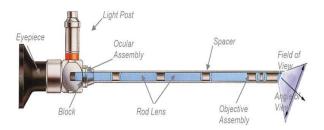


Figure 5: Design of a Hopkins rod endoscope (Photo courtesy of Karl Storz Endoscopy-America, Inc. 2013).

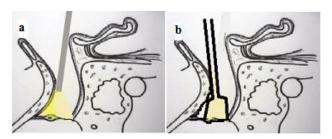


Figure 6: a) an otoendoscope provides a panoramic view of theanterior angle, which is sometimes inaccessible to microscopic examination due to an anterior canal bony bulge, b) view provided by the microscope.

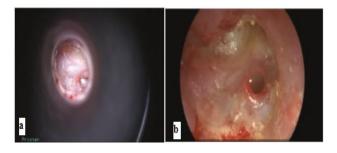


Figure 7: a) Intraoperative view of a tympanic membrane using a binocular otomicroscope, b) Intraoperative view of the same ear as viewed with the 4 mm, zero-degree endoscope.

Endoscopic ear surgery can be applied to a variety of operations including; grommet insertion, myringoplasty, attic retractions, cholesteatoma surgery, stapedectomy, benign neoplasms of the middle ear and neuro-otological procedures.<sup>8-12</sup>

The endoscope offers the following advantages over microscopes: 1) it gives a good panoramic view and helps visualizes the tympanic membrane and the middle ear without having to manipulate the patient's head, 2) it extends the operative field in transcanal procedures into structures usually hidden from the microscope (anterior tympanic perforation, posterior retraction pocket, facial recess, and hypotympanum), 3) with the help of angled endoscopes, we can get a good view of the epitympanum, mesotympanum and protympanum.<sup>13</sup> 4) the canal skin is visualized better and tympanomeatal flap elevation is made easier, 5) by being able to visualize and clear off the disease from the aditus via atticotomy in selected cases, the drainage pathways can be cleared and hence can be done for wet ears also, 6) it helps us to accurately place the graft especially in anterior perforations, thereby nullifying the complications of graft displacement or lateralization, 7) canaloplasty is rarely necessitated as narrow canals can be easily manoeuvred, 8) a post auricular scar can be avoided.

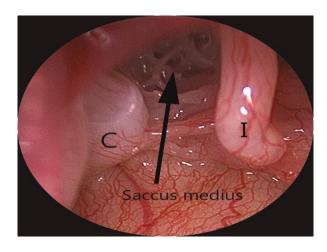


Figure 8: Intraoperative endoscopic view of a left ear.

The arrow marks the location of the epitympanic isthmus between the cochleariform process and incus, essentially following the path of the saccus medius. This is the main ventilation route between the eustachian tube and mastoid antrum.

Microscopic ear surgery does offer us some benefits like providing a binocular vision along with an excellent magnified surgical view. Using a microscope, two-hand surgery is possible, which is extremely useful to remove blood from the operation field. However, visualization of deep and hidden spaces involving sinus tympani, epitympanum, facial recess, and the attic area are limited with a microscope. The postoperative recovery period is longer for those undergoing microscopic ear surgery .the bony overhangs or the tortousity of the EAC often brings a hindrance for the surgeons while using the microscope which is easily manoeuvred with endoscope without the need for canaloplasty.<sup>14</sup>

The disadvantages that come along with use of endoscopes i.e., the monocular vision and loss of depth perception which is better with microscopes were also overcome with expertise in manoeuvring of the scope and by the feel of tissues with the tip. The chance of the scope tip being soiled by blood may also hinder our visual field but that can be overcome with expertise and with minimal manipulation as is possible with an endoscope. <sup>14</sup>

The complications associated with traditional tympanoplasty are greatly nullified with this technique. The chance of graft lateralization is less than 1 percent. We have got 99% result in terms of successful graft take up and a 100% result in all our cases in terms of patient compliance. With a clear view and feel of the disease, the avoidance of a postauricular scar or a mastoid dressing, the lack of postoperative pain or discomfort and only necessary intervention and instrumentation in the middle ear has negated the need of a prolonged hospital stay there by making this procedure a very minimally invasive surgery and a very affordable one.

#### **CONCLUSION**

Minimally invasive endoscopic tympanoplasty have brought the Middle ear and its pathology closer to the surgeon's eyes to be treated with utmost gentleness and meticulousness but, as any new concept in a scientific field, this technique too comes with its need to be well studied and grasped with a long learning curve, and experience to expertise for optimal patient satisfaction and overcome complications

Funding: No funding sources Conflict of interest: None declared

Ethical approval: The study was approved by the

Institutional Ethics Committee

#### REFERENCES

- 1. Mer SB, Derbyshire AJ, Brushenko A, Pontarelli DA. Fiberoptic endotoscopes for examining the middle ear. Arch Otolaryngol. 1967;85(4):387-93.
- 2. Nomura Y. Effective photography in otolaryngology-head and neck surgery: endoscopic photography of the middle ear. Otolaryngol Head Neck Surg. 1982;90:395-8.
- 3. Takahashi H, Honjo I, Fujita A, Kurata K. Transtympanic endoscopic findings in patients with otitis media with effusion. Arch Otolaryngol Head Neck Surg. 1990;116:1186-9.
- 4. Poe DS, Bottrill ID. Comparison of endoscopic and surgical explorations for perilymphatic fistulas. Am J Otol. 1994;15:735-8.
- 5. Kakehata S, Futai K, Sasaki A, Shinkawa H. Endoscopic transtympanic tympanoplasty in the treatment of conductive hearing loss: early results. Otol Neurotol. 2006;27(1):14-9.
- 6. Thomassin JM, Korchia D, Doris JM. Endoscopic-guided otosurgery in the prevention of residual cholesteatomas. Laryngoscope. 1993;103:939-43.
- 7. Sarkar S, Banerjee S, Chakravarty S, Singh R, Sikder B, Bera SP. Endoscopic stapes surgery: our experience in thirty two patients. Clin Otolaryngol. 2013;38:157–60.
- Balasubramanian T, Venkatesan U. Endoscopic Otology A supplement. Otolaryngology. 2012;2:1– 25.
- 9. Marchioni D, Alicandri-Ciufelli M, Molteni G, Genovese E, Presutti L. Endoscopic tympanoplasty in patients with attic retraction pockets. Laryngoscope. 2010;120:1847–55.
- 10. Migirov L, Wolf M. Endoscopic transcanal stapedotomy: how I do it. Eur Arch Otorhinolaryngol. 2013;270:1547–9.
- 11. Marchioni D, Alicandri-Ciufelli M, Gioacchini FM, Bonali M, Presutti L. Transcanal endoscopic treatment of benign middle ear neoplasms. Eur Arch Otorhinolaryngol. 2013;270:2997–3004.
- 12. Rosenberg SI, Silverstein H, Willcox TO, Gordon MA. Endoscopy in otology and neurotology. Am J Otol. 1994;15:168–72.
- 13. Tarabichi M. Endoscopic Middle Ear Surgery. Annals of Otorhinolaryngol. 1999;108(1):39-46.
- 14. Patel J, Aiyer RG, Gajjar Y, Gupta R, Raval J, Suthar PP. Endoscopic tympanoplasty vs microscopic tympanoplasty in tubotympanic csom: a comparative study of 44 cases. International J Res Med Sci. 2015;3(8):1953-7.

**Cite this article as:** Krishnan GS, Joseph NA. Tympanoplasty revolutionized: my experience with a series of 500 cases. Int J Otorhinolaryngol Head Neck Surg 2018;4:1035-9.