Original Research Article

Endoscopic exploratory tympanotomy findings in conductive hearing loss: a surgical review

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Abstract

Background: Conductive hearing loss continue to remain undiagnosed in a large number of patients with intact membrane. Endoscope assisted tympanotomy provides an alternative technique for diagnosis and also facilitates treatment. **Methods:** A prospective analysis over a 5 year period of 72 exploratory tympanotomies for conductive hearing loss was performed in patients with intact tympanic membrane. Per operative findings were treated in the same sitting. Post-operative follow up of the patient was done up to 6 months**. Results:** The most common operative diagnosis was found to be otosclerosis (66%), followed by traumatic ossicular dislocation, tympanosclerotic patch, middle ear adhesions, foreign bodies etc. Small fenestra Stapedotomy with prosthesis insertion was the preferred surgical procedure performed in this study, resulting in perceptible hearing improvement post operatively. **Conclusion:** Endoscope assisted tympanotomy and associated middle ear surgeries serves as an effective diagnostic and therapeutic option. This study is of value in assessing the surgical challenges in diagnosis and definitive treatment for conductive hearing loss with an intact tympanic membrane.

Key words: Conductive hearing loss, Exploratory tympanotomy, Endoscope assisted tympanotomy, Otosclerosis, prosthesis

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Introduction

The otologist has been challenged over decades when it came to diagnosing the cause of conductive hearing loss in an intact tympanic membrane. The aetiology of conductive hearing loss in an intact tympanic membrane includes middle ear pathologies like otosclerosis, ossicular chain fixation, tympanosclerosis, middle ear adhesions etc. A direct inspection of the middle ear provides adequate clues for the surgeon. Some patients present a middle ear problem that can be diagnosed and resolved per operatively.

During exploratory tympanotomy, additional findings are encountered which are of doubtful significance or which may come in the way of correction of the cause of conductive hearing loss [1]. For the surgeons, mastery of tympanotomy requires adequate knowledge about the microanatomy and the deft surgical skill to handle the rigid endoscope and perform intricate surgeries in the middle ear. Operative microscope revolutionized the surgical management of the diseases of ear but the optical properties of microscope have remained the same past 30 years [2]. The role of endoscopes in otology as a diagnostic, surgical and a teaching tool is increasingly being recognized because of its superior optical properties and its capacity to have panoramic visualization of areas as compared to the microscopes.

The transtympanic middle ear endoscopy was initially described by Nomura and Takashi [3,4]. Transtympanic endo-scopy was used to diagnose conditions like perilymphatic fistulae by Poe and Bottrill [5]. Kakehata made use of endoscope to investigate conductive hearing loss and inspect retraction pockets for cholesteatoma [6,7]. In 1982, Paparella observed that

Manuscript received: 2nd June 2016
Reviewed: 10th June 2016
Author Corrected: 17th June 2016
Accepted for Publication: 23rd June 2016

one would assume that much had been written about the findings at exploratory tympanotomy, allowing 'a comparison of past and current findings so as to keep pace with developments of otology' [8]. He noted that, in reality, a review of literature revealed very little data about operative findings that were seen at exploratory tympanotomy.

An understanding of the frequency of occurrence of various etiologies would help in better counselling of the patient and also in a more thorough inspection of the middle ear at the time of the procedure. In this study, we investigated the middle ear anatomy via exploratory tympanotomy in patients with conductive hearing loss with an intact tympanic membrane and tried to determine the various pathologies involved that could present a diagnostic dilemma. Such knowledge would help us to improve treatment protocols for such patients, who usually go untreated for long durations.

Methodology

Objective: To ascertain the usefulness of rigid tele-scopes (nasal endoscopes) in exploratory tympano-tomy and to outline the causes for conductive hearing loss in an intact tympanic membrane.

Study design: Prospective cohort study

Inclusion Criteria:

Patients with exclusive conductive hearing loss with intact tympanic membrane
Patients with mixed hearing loss with Air Bone gap of >20 dB with intact tympanic membrane

Exclusion Criteria:

Acute middle ear infections
Eustachian tube dysfunction
Previous history of ear surgery

It is a single institution study done by a single surgeon over a period of 5 years. All procedures were standardized through an endo meatal approach. All cases were followed up for a period of 6 months. A total of 72 patients were included in the study. All patients were clinically evaluated and were subjected to pure tone audiometry and tympanometry.

Results

Out of 72 patients, 47 were females and 25 were males. 5 patients were between the age group 10-19 years, 10 patients between 20-19 years, 11 between 30 – 19 years, 36 between 20-49 years n 10 patients were above 50 years. In a total of 72 patients, about 48 patients were diagnosed to have otosclerosis. For these patients supra structure of stapes was removed and stapedotomy done with Teflon piston [Fig 1]. The hearing of these patients improved post operatively. 6 of them had middle ear adhesions contributing to their conductive hearing loss which was carefully released intraoperatively. Adhesions were noted between the ossicles and the promontory [Fig 2]. 3 patients were found to have incudo stapedial joint dislocation.

A total of 4 patients had incudo malleolar disruption in which 3 of them were traumatic and one was congenital [Fig 3]. There were 2 patients with tympanosclerosis as the cause for their conductive hearing loss which was dissected and removed by endoscopic ear surgery [Fig 4]. We encountered 2 patients with glomus tympanum [Fig 5]. Middle ear adenoma was the aetiological factor in 1 patient and 1 patient had hemotypanum following trauma. 3 patients had foreign body impaction in the middle ear [Fig 6] while 3 patients had normal middle ear status both in structure and function as evidenced intraoperatively.

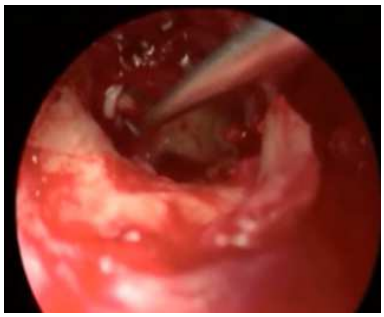

Fig 1: Stapedotomy

Fig 2: Middle ear adhesions

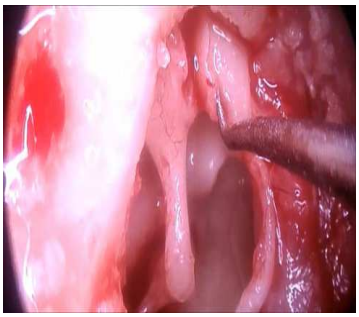

Fig 3: IM joint disruption

Fig 4: TS patch

Fig 5: Glomus tympanum

Fig 6: Foreign body [grommet]

Discussion

Preoperative clinical assessment remains the cornerstone in diagnosing middle ear disease and determining appropriate treatment However, in some patients, diagnostic dilemma remains, even after a complete audiological battery. Conductive hearing loss results from a derangement in the transmission of sound through EAC and the tympano – ossicular chain. There are various etiology for this.

The evolution of exploratory tympanotomy was facilitated by the development of the tympanomeatal flap. Initially used for fenestration surgery, its use has expanded to adequately expose and visualize the middle ear cleft. Lempert, in 1946, recognized the usefulness of this flap and started using an inferiorly based tympanomeatal flap. The commonly used posterior based tympanomeatal flap was later developed by Shea [8]. The surgeries which followed showed that tympanomeatal flap elevation could be used not only for stapedial procedures, but also as a diagnostic procedure for evaluating congenital malformations and other pathological conditions in the middle ear.

Paparella [8] had reported a series of 316 exploratory tympanotomies of which 94 cases were performed for conductive hearing loss with intact tympanic membrane. The most common cause was found to be otosclerosis (79.7 per cent) followed by congenital fixation of the stapes (10.6 per cent). Robertson had conducted a study of 340 exploratory tympanotomies, which found otosclerosis to be the main cause of conductive hearing loss [9]. Ossicular discontinuity was found to have a higher incidence in this series (30.3%). A study by Kim et al of 67 exploratory tympanotomies showed that stapedial fixation with non-progressive hearing loss was most frequently encountered [1].

According to our study, conductive hearing loss due to middle ear pathology was found more in females (65.27%). The fifth decade was the most commonly affected (50%). Otosclerosis was the most common cause of hearing loss in our study (66.67%) followed by ossicular disruption and middle ear adhesions. In our study no abnormality was found in 3 patients during the procedure. This may be due to inner ear problems causing conductive hearing loss. S. C. Kim et al found pathologic third windows to be a cause of conductive hearing loss in 20% of patients who failed to improve following exploratory tympanoptomy [10]. These conditions can result in a lack of improvement following ossiculoplasty. A preoperative HRCT of temporal bone can help in diagnosing such cases.

Otological surgeries have undergone a sea change with time. The use of rigid telescope in the form of nasal endoscope in middle ear surgical procedures has been a boon. The advent of better optics has helped and the addition of wide angled endoscopes has widened the scope of surgeries with panoramic view [2]. An endoscopy procedure need to frequently adjust the patient's head or do canalplasty thus saving operative time. Similar observations were made in other studies by Usami S, Iijima N, Fujita S et al [11] and Tarabichi M [12].

Visualization by endoscopes gives a detailed description of anatomic structures, even the smallest structures like middle ear folds and ligaments are distinctly visible [2]. The most important advantage of endoscopes in otology is its direct, quick and easy access to accessible hook and corners of middle ear cavity which are hidden to the surgeons view even with the use of microscope [12]. The use of endoscopes

results in lesser operation time, less bleeding, less post operative time, easy recovery and less hospital stay and better cosmesis [13]. The intense light, excellent image, good resolution, panoramic view, rapid change of field and higher magnification when compared to microcopes are points favouring the use of endoscopes in otology [14].

The main limitation of endoscopic ear surgery is that it is a one hand cumbersome surgery that may lead to left arm fatigue for a right hand surgeon [14]. The monocular vision of endoscope is associated with inferior depth perception as compared to the binocular vision of microscope [15].

Meticulous hemostasis is essential in endoscopic ear surgery as even a drop of blood can obscure the field [16]. Drilling with an endoscope is challenging and use of multiple instruments is difficult.

It has been accepted that some pathological changes as a result of chronic otitis media can occur behind a normal intact tympanic membrane. Inspite of the various current advances that has taken place in imaging and audiometry, there is still a need to directly visualise the middle-ear space to establish a diagnosis. This will also play a role in the further treatment that is needed for the patient.

Having a differential diagnosis of the common findings at exploratory tympanotomy will enable informed pre-operative discussion with the patient and will serve as a guideline for a routine endoscopic evaluvation of the ear. It will also enable a better detection of sequelae of chronic otitis media and cholesteatoma, which may be encountered behind a normal tympanic membrane.

Conclusion

There is a tremendous enthusiasm in the quest for the perfect surgical tool to aid the otologic surgeon despite the current advances in imaging and audiology. Per operative assessment of the middle ear structures by direct visualization still holds good to diagnose and treat purely conductive hearing loss with and intact tympanic membrane.

There is a growing trend towards endoscope assisted ear surgeries especially in difficult to reach anatomical zones of the middle ear Though microscopes are here to stay, key benefits offered by the rigid telescope make it a significant alternative with proven results.

Funding: Nil, Conflict of interest: None
Permission of IRB: Yes

References

1. Kim SH, Cho YS, Kim HJ, Kim HJ. Operative findings of conductive hearing loss with intact tympanic membrane and normal temporal bone computed tomography. Eur Arch Otorhinolaryngol. 2014 Jun; 271 (6): 1409-14. doi: 10.1007/s00405-013-2585-y.

2. Harugop AS, Mudhol RS, Godhi RA. A comparative study of endoscope assisted myringoplasty and micrsoscope assisted myringoplasty. Indian J Otolaryngol Head Neck Surg. 2008 Dec; 60(4):298-302. doi:10.1007/s12070-008-0099-5.Epub 2008 Nov 7.

3. Nomura Y. Effective photography in otolaryngology-head and neck surgery: endoscopic photography of the middle ear. Otolaryngol Head Neck Surg. 1982 Jul-Aug; 90(4):395-8.

4. Takahashi H, Honjo I, Fujita A, Kurata K. Transtympanic endoscopic findings in patients with otitis media with effusion. Arch Otolaryngol Head Neck Surg. 1990 Oct;116(10):1186-9.

5. Poe DS, Bottrill ID. Comparison of endoscopic and surgical explorations for perilymphatic fistulas. Am J Otol. 1994 Nov;15(6):735-8.

6. Kakehata S, Hozawa K, Futai K, Shinkawa H. Evaluation of attic retraction pockets by micro-endoscopy. Otol Neurotol. 2005 Sep;26(5):834-7.

7. Kakehata S, Futai K, Kuroda R, Shinkawa H. Office-based endoscopic procedure for diagnosis in conductive hearing loss cases using OtoScan Laser-Assisted Myringotomy. Laryngoscope. 2004 Jul;114(7):1285-9.

8. Paparella MM, Koutroupas S. Exploratory tympanotomy revisited. Laryngoscope. 1982 May; 92 (5) : 531-4.

9. Robertson G, Mills R. Findings at exploratory tympanotomy for conductive hearing loss. J Laryngol Otol. 2009 Oct; 123 (10): 1087-9. doi: 10.1017/ S00 22215109005696. Epub 2009 Jul 1.

10. Kim SC, Lee WS, Kim M, Jeon JH, Kim J, Choi JY. Third windows as a cause of failure in hearing gain after exploratory tympanotomy. Otolaryngol Head Neck

Surg. 2011 Aug;145(2):303-8. doi: 10.1177/ 0194599 811403076.

11. Usami S, Iijima N, Fujita S, Takumi Y. Endoscopic-assisted myringoplasty. ORL J Otorhinolaryngol Relat Spec. 2001 Sep-Oct;63(5):287-90.

12. Tarabichi M. Principles of Endoscopic ear surgery. ENT and Audiology News 2012;21[3]:42-44.

13. Thiagarajan B, Ulaganathan V. Endoscope assisted myringoplasty. Otolaryngology online journal 2012; 2 (1) www.jorl.net

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How to cite this article?

Sanjeev Mohanty, Vinay Raj T, C Sreenivas, Devipriya V. Endoscopic exploratory tympanotomy findings in conductive hearing loss: a surgical review. *Int J Med Res Rev* 2017;5(03):261-265 doi:10.17511/ijmrr. 2017.i03.08.

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