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Original Research Article

A Comparative Study to Evaluate the Outcomes in Endoscopic Assisted Vs Conventional Middle Ear and Mastoid Surgery

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Abstract

Aim: A comparative study of endoscopic assisted versus conventional middle ear and mastoid surgery at a tertiary care teaching hospital.

Methods: This comparative study was carried out in the Department of ENT, Anugrah Narayan Magadh Medical College and Hospital, Gaya, Bihar, India Cases of chronic otitis media, inactive mucosal disease for tympanoplasty, cases of chronic otitis media, active or inactive squamosal disease for mastoidectomy and patients with the age between 10 to 60 years were included. Total 60 patients; among them 30 cases were of endoscope assisted middle ear surgery and 30 cases with conventional microscopic middle ear surgery.

Results: Out of 30 cases; tympanoplasty was performed in 16 patients and mastoidectomy (canal wall up/canal wall down) performed in 14 patients both groups. In patient of endoscopic assisted tympanoplasty mean preoperative A-B gap was 30.61±9.19 dB while post operative mean A-B gap was 17.85±7.28 dB. In patient of non-endoscopic assisted tympanoplasty mean preoperative A-B gap was 26.76±8.82 dB while post operative mean A-B gap was 18.38±9.56 dB. In present study mean preoperative A-B gap was 41.11±2.13 dB and 36.76±3.42 dB for endoscopic assisted mastoidectomy and non-endoscopic assisted mastoidectomy respectively. While post operative mean A-B gap was 33.18±4.71 dB and 28.92±5.14 dB for endoscopic assisted mastoidectomy and non-endoscopic assisted mastoidectomy respectively. In present study mean A-B gap closure for endoscopic assisted tympanoplasty was 13.76±5.00 dB, while 9.38±4.78 dB for non-endoscopic assisted tympanoplasty. Mean A-B gap closure for endoscopic assisted Mastoidectomy was 8.93±3.16 dB, while 8.84±2.27 dB for non-endoscopic assisted mastoidectomy

Conclusion: This study concluded that the endoscope can be successfully applied to ear surgery for most of the ear procedures with a reasonable success rate both in terms of perforation closure and hearing improvement and with minimal exposure.

Keywords: Mastoid, Surgery, Endoscopy, Perforation.

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Introduction

Chronic suppurative otitis media is an important middle ear disease since prehistoric times. CSOM is the commonest cause of persistent mild to moderate hearing impairment in children and young adults in developing countries. The presence of a tympanic membrane perforation that does not heal spontaneously as in chronic otitis media represents an anatomical and functional defect that needs surgical correction in the majority of cases. Myringoplasty is indicated in cases with and without otorrhea, with a small or a large air-bone gap, and with no age limit. The aim of reconstructing a tympanic membrane perforation is twofold; first, to allow the patient to have a normal social life with no restrictions, even regarding water entry into the ear, and second, to correct the hearing loss resulting from the perforation. Tympanoplasty is the surgical operation performed for the reconstruction of the eardrum (tympanic membrane and/or the small bones of the middle ear (ossicles).The term myringoplasty is reserved for the simple repair of a tympanic membrane perforation in which no ossicular reconstruction is involved. It is also called tympanoplasty-I.

The concept of surgical repair of tympanic membrane is attributed to Berthold who performed myringoplasty operation with thick skin graft and introduced the term [1]. Later Wullstein and Zollner published a method for closing TM with split thickness skin graft [2,3]. They introduced the use of operating microscope, significantly enhancing surgical results by improving the accuracy of the technique. Mer first described the use of endoscopes for the middle ear and fibreoptic system delivered through the existing tympanic membrane perforations in two patients [4].

Anterior, marginal tympanic membrane perforations can be operated using a post auricular approach to maximize exposure. The visualization of far anterior perforations may be especially difficult, and the anterior margin may be completely hidden from direct view behind a prominent anterior canal bony overhang. Anterior perforations may be managed through a trans canal approach, using the endoscope to visualize the anterior margin [5,6].

Material and methods:

This comparative study was carried out in the Department of ENT, Anugrah Narayan Magadh Medical College and Hospital, Gaya, Bihar, India for 1 year. Cases of chronic otitis media, inactive mucosal disease for tympanoplsty, cases of chronic otitis media, active or inactive squamosal disease for mastoidectomy and patients with the age between 10 to 60 years were included. Cases of chronic otitis media with active discharge, patients with sensorineural hearing loss and patients with any other medical condition leading to unfit for the surgery e.g., cardiovascular disease was excluded from the study.

Methodology

Total 60 patients; among them 30 cases were of endoscope assisted middle ear surgery and 30 cases with conventional microscopic middle ear surgery.

Endoscope assisted tympanoplasty

All endoscope assisted tympanoplasty were done through the per meatal route. All were purely endoscopic and at no point of time the microscope was used. All patients had a 2 cm incision in the hairline, above the superior attachment of pinna to harvest the temporalis fascia graft. The endoscope was introduced through the external auditory canal and the edges of the perforation were freshened with a sickle knife. An incision was taken 5 mm from the tympanic annulus from 6’clock to 12’clock position with a circular knife. The tympanomeatal flap was elevated and kept superiorly with the flag knife and circular knife. Middle ear was visualized and ossicular status was checked. Dried

temporalis fascia was placed by underlay technique and the tympanomeatal flap was replaced. Gel foam was placed to stabilize the graft.

Endoscope assisted cholesteatoma surgery

After completing surgery with conventional microscopic approach middle ear hidden areas were visualized by using endoscope and remaining disease was cleared with help of endoscope. Sutures were removed on 7th day. A 4 mm diameter, 18 cm long rigid, zero-degree endoscope and operating microscope was used in all ear surgery cases. Every patient was evaluated in an outpatient setting after 15 days, one month, two month and three months. On every visit, patients were asked about subjective improvement in hearing and watched for development of any complications. Audiometric evaluation (PTA) was made at third postoperative month in every patient. Primary outcomes include mean average pre- and post-operative air-bone gap hearing thresholds. Intra operative visualization and duration of surgery was noted. Pre- and post-operative audiometric data using both air and bone conduction threshold (at 500 Hz, 1 KHz, 2 KHz frequencies) was compared.

Statistical analysis:

The data was presented as number (percentage) or mean ± standard deviation wherever appropriate. Suitable statistical test was used to analyze the data. $P<0.05$ was considered significant.

Results:

Out of 30 cases; tympanoplasty was performed in 16 patients and mastoidectomy (canal wall up/canal wall down) performed in 14 patients both groups (Table 1).

In patient of endoscopic assisted tympanoplasty mean preoperative A-B gap was 30.61±9.19 dB while post operative mean A-B gap was 17.85±7.28 dB. In patient of non-endoscopic assisted tympanoplasty mean preoperative A-B gap was 26.76±8.82 dB while post operative mean A-B gap was 18.38±9.56 dB. In present study mean preoperative A-B gap was 41.11±2.13 dB and 36.76±3.42 dB for endoscopic assisted mastoidectomy and non-endoscopic assisted mastoidectomy respectively. While post operative mean A-B gap was 33.18±4.71 dB and 28.92±5.14 dB for endoscopic assisted mastoidectomy and non-endoscopic assisted mastoidectomy respectively (Table 2).

Table 1: Distribution of cases according to procedure

Procedures	Endoscopic assisted, (Group A)	Non-endoscopic assisted, (Group B)
Tympanoplasty	16	16
Mastoidectomy	14	14
Total	30	30

In present study mean A-B gap closure for endoscopic assisted tympanoplasty was 13.76±5.00 dB, while 9.38±4.78 dB for non-endoscopic assisted tympanoplasty. Mean A-B gap closure for endoscopic assisted Mastoidectomy was 8.93±3.16 dB, while 8.84±2.27 dB for non-endoscopic assisted mastoidectomy (Table 3).

In present study mean intraoperative time duration for endoscopic assisted tympanoplasty was 71.23±3.17 min, while 78±8.80 min for non-endoscopic assisted tympanoplasty. Mean intraoperative time duration for endoscopic assisted

Mastoidectomy was 152.92±13.30 min, while 148.17±12.18 min for non-endoscopic assisted mastoidectomy (Table 3).

Residual cholesteatoma remnants on Endoscopy were found in 6 cases (42.86%) out of 14 mastoidectomy cases performed via endoscopy assistance. Residual cholesteatoma remnants were found in sinus tympani in 5 cases and in anterior attic space in 1 case.

Table 2: A-B gap in tympanoplasty cases and mastoidectomy cases

Variables	Preoperative (A-B gap) dB (Mean±SD)	Post operative (A-B gap) dB (Mean±SD)	Preoperative (A-B gap) dB (Mean±SD)	Post operative (A-B gap) dB (Mean±SD)
	Tympanoplasty cases		Mastoidectomy cases	
Endoscopic assisted (Group A)	30.61±9.19	17.85±7.28	41.11±2.13	33.18±4.71
Non-endoscopic assisted (Group B)	26.76±8.82	18.38±9.56	36.76±3.42	28.92±5.14
P value	0.16	0.82	<0.001*	<0.01*

Table 3: A-B gap closure at 3-month follow-up

Variables	Closure (A-B gap) dB (Mean±SD)	P value	Intra-op duration (mins) (Mean±SD)	P value
Endoscopic assisted tympanoplasty	13.76±5.00	0.05	71.23±3.17	0.03*
Non-endoscopic assisted tympanoplasty	9.38±4.78		78.00±8.80	
Endoscopic assisted mastoidectomy	8.93±3.16	0.93	152.92±13.30	0.38
Non-endoscopic assisted mastoidectomy	8.84±2.27		148.17±12.18	

Graft uptake rate for endoscopic assisted tympanoplasty was 93.75% while 81.25% for non-endoscopic assisted tympanoplasty. In present study dry cavity achieved in 92.86% cases endoscopic assisted mastoidectomy (Group A) while 85.71% in non-endoscopic assisted mastoidectomy cases.

Discussion:

The main objective of CSOM surgery is to achieve symptomatic relief, relieve drainage, rehabilitate hearing and minimize complication. The main advantages of the microscopic approach are stereo vision and bimanual handling. However, despite providing direct exposure, microscope requires frequent adjustment and may still not be sufficient when encountering protruding structures, particularly the anterior wall. Hidden area that cannot be seen under microscope can be better observed via thin rigid endoscope with different angles [7].

In present study mean preoperative A-B gap was 30.61±9.19 dB and 16.76±8.82 dB for endoscopic assisted and non-endoscopic assisted tympanoplasty respectively. There were no significant differences between the two groups

(p=0.16). Huang et al in 2016 studied 100 ears of 95 patients who underwent tympanoplasty and found similar results. Preoperative A- B gaps were 21.4±10.6dB and 21.6±11.2 dB, for non- endoscopic assisted tympanoplasty and endoscopic assisted tympanoplasty respectively. There were no significant differences between the 2 groups (p=0.93) [8].

In present study post operative mean A-B gap was 17.85±7.28 dB and 18.38±9.56 dB for endoscopic assisted tympanoplasty and non-endoscopic assisted tympanoplasty respectively. There were no significant differences between the two groups (p=0.84). Kumar et al in 2015 studied 60 patients 30 with conventional microscopic approach tympanoplasty and 30 with endoscopic assisted tympanoplasty and found similar results. Mean post-operative A-B gap was 16.03 dB and 15dB for conventional microscopic and endoscopic assisted myringoplasty respectively. There were no significant differences between the two groups [9].

In present study mean A-B gap closure for endoscopic assisted tympanoplasty was 13.76±5.00 dB, while 9.38±4.78 dB for non-endoscopic assisted tympanoplasty. There was no significant difference between both groups (p=0.05). Kanona et al in 2015 studied 70 patients and found similar results. There was a significant difference between pre- and post-operative mean air-bone gaps in both surgical groups (p=0.02) [10]. They reported the mean A-B closure in the range of 10-30 dB in both groups that is supporting our study.

In present study mean intraoperative time duration for endoscopic assisted tympanoplasty was 71.23±3.17 min, while 78±8.80 min for non-endoscopic assisted tympanoplasty. There was a significant difference between both groups (p=0.03). Kanona et al in 2015 found similar results. They reported the shorter mean operating times in group A as compared to group B (non- endoscope assisted surgery), 85.8 min vs 107.8 min for group A vs B respectively [10]. Endoscopic tympanoplasty can take longer time duration than microscopic group in initial phase due to learning curve and less practice of surgeon with single handed surgery.

In our study graft uptake rate for endoscopic assisted tympanoplasty was 93.75% while 81.25% for non-endoscopic assisted tympanoplasty which showed better outcome in endoscopic assisted group. Choi et al in 2016 reported graft success rate in the endoscopic tympanoplasty and microscopic tympanoplasty group was 100% and 95.8%, respectively, which was not statistically significant (p=0.304) [11]. Hence graft uptake rate in endoscopic tympanoplasty were comparable to microscopic tympanoplasty.

In our study mean preoperative A-B gap was 41.11±2.13 dB and 36.76±3.42 dB for endoscopic assisted mastoidectomy and non-endoscopic assisted mastoidectomy respectively. While post operative mean A-B gap was 33.18±4.71 dB and 28.92±5.14 dB for endoscopic assisted mastoidectomy and non-endoscopic assisted mastoidectomy respectively. There was no significant difference between both groups. Mean A-B gap closure for endoscopic assisted mastoidectomy was 8.93±3.16 dB, while 8.84±2.27 dB for non-endoscopic assisted Mastoidectomy. There was no significant difference between both groups. Kanona et al also reported similar results; the mean A-B closure in range of 10- 30 dB and no significant difference between both groups [10].

In our study mean intra operative time duration for endoscopic assisted mastoidectomy was 152.92±13.30 min, while 148.17±12.18 min for non-endoscopic assisted mastoidectomy. There is slightly higher time duration in endoscopic group because in endoscopic

group endoscope was used after completion of work with microscope. Kanona et al reported mean operating time was shorter in group A (endoscopic) compared to group B (microscopic), 171 min *vs* 217.2 min respectively. Since total number of operations were not equal (n=15 vs n=10), it is unreliable to claim the difference between these figures is of clinical significance [10].

In our study residual cholesteatoma remnant on endoscopy was found in 42.86%. Sajjadi et al present a retrospective chart review of 249 primary cholesteatoma cases and found similar results [12]. The objective was to evaluate the effectiveness of otoendoscopy in reducing the cholesteatoma remnant at the time of primary surgery. Endoscopy at the time of primary operation revealed a 20% incidences of hidden cholesteatoma remnants despite apparent total microscopic eradication in close cavity cases and, and 10% in open cavity cases Intra-operative endoscopic evaluation of patients with cholesteatoma has clearly demonstrated a significant reduction in "immediate remnants" of cholesteatoma at the time of the primary operation. However endoscopic resection of cholesteatoma following detailed microscopic surgery has reduced incidence of residual cholesteatoma. Sinus tympani remain a hot spot for residual cholesteatoma despite removal of the posterior ear canal wall.

In present study dry cavity achieved in 92.86% cases in endoscopic assisted mastoidectomy while 85.71% in non-endoscopic assisted mastoidectomy cases. This shows comparable results in both groups. Cholesteatoma can vary in anatomical spread and severity of disease. In widespread, severe cases, canal wall up mastoidectomy or modified radical mastoidectomy can be performed. Our case series shows a variation in the number of these procedures between both groups. Performing mastoidectomy exclusively with an endoscope is impossible, and therefore drawing comparisons between these groups is difficult, as the endoscope will not have been used during a proportion of surgery in endoscopic assisted.

The endoscopic technique in ear surgery undoubtedly gives better quality images and access to blind sacs around the middle ear space that would otherwise not have been visualized adequately using a microscope, irrespective of surgical approach. It is minimally invasive thus providing better cosmetic in patients who do not wish to have a scar [10].

Conclusion:

This study concluded that the endoscope can be successfully applied to ear surgery for most of the ear procedures with a reasonable success rate both in terms of perforation closure and hearing improvement and with minimal exposure. It offers an advantage of minimal exposure, thereby avoiding unnecessary incisions on the patient.

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