A comparative study of endoscope assisted myringoplasty and microscope assisted myringoplasty

A. S. Harugop · R. S. Mudhol · R. A. Godhi

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Abstract

Objective to determine the advantages and disadvantages of the endoscope as compared to the microscope in myringoplasty surgery and to compare the results of both groups.

Methods Between January 2003 and September 2006, 100 patients underwent myringoplasty, 50 were endoscope assisted and 50 were microscope assisted. Results of surgery were compared at the end of six months post operation.

Results In the endoscope group 82% of patients had a successful outcome and in the microscope group 86% of patients had a successful outcome.

Conclusion In myringoplasty surgery the endoscope has several advantages and a few disadvantages. The surgical outcome of endoscope assisted myringoplasty was comparable to the conventional microscope assisted myringoplasty, but in terms of cosmesis and post operative recovery patients in the endoscope group had better results.

Keywords Myringoplasty · Endoscope · Microscope

Introduction

Tympanoplasty is one of the commonest operations performed on the middle ear. Over the last hundred years continued efforts have been made by otologists all over the world to attain the perfect surgical outcome. 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 have remained the same over the last three decades [1]. Middle ear endoscopy was first introduced by Mer and colleagues in 1967 but till the last decade endoscopes have been mainly used for diagnostic and photographic purposes [1]. The recent years have witnessed surgeons experimenting with the endoscope in ear surgeries. Middle ear surgeries which were traditionally done using the microscope are now increasingly being done using the endoscope [2].

Methodology

The present study was conducted at KLES Prabhakar Kore Hospital and MRC, Belgaum between January 2003 and September 2006. Patients attending the ENT outpatient department with the chief complaints of ear discharge and hearing impairment were screened. Those patients more than 12 years of age with a medium size to subtotal dry central perforation of the tympanic membrane and willing for surgery were included in the study after taking a written and informed consent. Patients with marginal or attic perforations, patients with cholesteatoma, otitis externa, otomycosis, uncontrolled diabetes mellitus, ossicular fixation, ossicular discontinuity, revision cases and those with upper respiratory tract infections at the time of surgery were excluded from the study. Size of the perforation was determined according to the number of quadrants it occupied. Tuning fork tests were done to determine the type and degree of hearing loss. Pure tone audiometry (PTA)

A. S. Harugop · R. S. Mudhol · R. A. Godhi
Dept of E.N.T & H.N.S
K.L.E.S University's J. N. Medical College
Belgaum - 590 010.
India

A. S. Harugop (✉)
E mail: anilharugop@yahoo.co.in

was done as per the method outlined by the American speech and hearing association (ASHA). Air-Bone (A-B) gap at frequencies 500 Hz, 1 KHz and 2 KHz was noted and hearing loss was calculated by taking the average of three. A computer generated random number table was used to determine which patients would undergo endoscope assisted myringoplasty and which patients would undergo microscope assisted myringoplasty.

Of the total 100 patients, ninety (90%) patients underwent surgery under local anaesthesia and the remaining 10 (10%) patients were operated under general anaesthesia. All patients in this study underwent underlay myringoplasty with dried temporalis fascia graft. In the microscope group 45 (90%) patients were operated by post aural route and only 5 (10%) patients were operated by the endaural route.

Technique of endoscopic myringoplasty

Zero degree, 17 cm long, 4 mm wide Hopkin's rod endoscope was used. All surgeries were done by visualization using the monitor.

- Approach - all endoscope assisted myringoplasties were done through the permeal route (Fig. 1). All were purely endoscopic and at no point of time the microscope was used. All patients had a 2 cm incision in the hairline just above the helix to harvest the temporalis fascia graft.
- Freshening the margins of the perforation (Fig. 2) – the endoscope was introduced through the external auditory canal and the edges of the perforation were freshened with a sickle knife.
- Elevation of the tympanomeatal flap – in all the 50 cases we used the superiorly based flap. An incision was taken 5mm from the tympanic annulus from 10'clock to 2'clock position with a circular knife (Fig. 3). The tympanomeatal flap was elevated and

flapped superiorly with the flag knife and circular knife (Fig. 4).

- Graft placement - dried temporalis fascia was placed by underlay technique and the tympanomeatal flap was replaced (Fig. 5). Hearing was checked on table. Gelfoam was placed to stabilize the graft.

Follow up

All patients in both the groups were followed up for minimum six months. Final assessment of the tympanic membrane and hearing was done at six months post-operation. An intact mobile tympanic membrane with closure of air-bone gap less than or equal to 13dB at six months post-operation was considered as a successful outcome. Presence of a defect in the tympanic membrane or air-bone gap greater than 13dB or both at six months was considered to

Fig. 2 Freshening the margins of the perforation

Fig. 1 Showing the details of the middle ear

Fig. 3 Canal wall incision

be a failure. Subjective and objective assessment of the scar was done at six months post-operation.

Results

The age of patients ranged from 15–65 years. Majority (75%) of our patients were in their second and third de-

Fig. 4 Elevation of the tympanomeatal flap

Fig. 5 Replacement of the tympanomeatal flap after graft placement

acades of life and the male to female ratio was 1.5:1. The average pre operative hearing loss (air-bone gap) (Table 1) was 32.2 dB in the endoscope group and 31.5 dB in the microscope group. In the endoscope group with the wide angle zero degree endoscope we were able to visualize the tympanic annulus in all 50 (100%) patients and hence no patient required canalplasty, but in the microscope group the tympanic annulus was not completely visualized in 10 (20%) patients and they required canalplasty. Endoscope assisted myringoplasty required an average 128 mins (range 90–180 mins) and microscope assisted myringoplasty needed an average time of 106 mins (range 80–135 mins). Post operative complications were seen in 5 (10%) patients in the endoscope group and in 15 (30%) in the microscope group. There was negligible difference in the cost of surgery in the two groups (in the endoscope group it was Rs. 5030 and in the microscope group it was Rs 5280). Patients in the endoscope group returned to routine activity in 2.4 days and those in the microscope group took 5.4 days for the same. At six months follow up 41(82%) patients had a successful outcome in the endoscope group and 43 (86%) patients had a successful outcome in the microscope group. At the end of six months all (100%) patients in the endoscope group rated their cosmetic result as excellent whereas in the microscope group 10 (20%) patients rated their cosmetic result as poor, 25 (50%) patients rated the cosmetic result as satisfactory and 15(30%) patients rated their cosmetic result as excellent (Chart 1). Objective analysis of cosmesis was done by us at the end of six months and it revealed that in the endoscope group none (0%) of the patients had a visible scar, whereas in the microscope group 38 (75%) patients had a visible scar and in 13 (25%) patients the scar was not visible.

Statistically significant differences in favour of the endoscope were found in terms of post operative return to activity of patients ($p = 0.00$) and cosmetic results ($p = 0.01$). Differences between the 2 groups were not statistically significant in terms of success rate, complication rate and cost of surgery.

Discussion

This study was undertaken with the objective of determining the advantages and disadvantages of the endoscope

Table 1 Pure tone audiometry results

Average conductive hearing loss (in dB)	Endoscope group (number of patients)		Microscope group (number of patients)	
	Pre operative	Post operative	Pre operative	Post operative
0–10 dB	0 (0%)	23(46%)	0(0%)	10(20%)
11–20 dB	20(40%)	22(44%)	20(40%)	35(70%)
21–30 dB	28(56%)	5(10%)	30(60%)	5(10%)
31–40 dB	2(4%)	0(0%)	0(0%)	0(0%)

Chart 1 Subjective cosmetic result at the end of six months.

when compared to the conventional operating microscope in myringoplasty surgery.

Variations of the external auditory canal like tortuosity, stenosis, bony overhangs etc hamper the view of the tympanic membrane when visualized through the microscope. Therefore a need to manipulate the patient's head or the microscope repeatedly to visualize all the parts of the tympanic membrane. Sometimes, inspite of the manipulations, the tympanic membrane will not be fully visualized and canalplasty has to be done. This in turn may increase the operative time. In sharp contrast, the endoscope brings the surgeon's eye to the tip of the scope. Hence the view through the endoscope is not restricted by the narrowest segment of the external auditory canal. The wide angle of the zero degree scope visualizes the entire tympanic membrane in one frame. There is no need to frequently adjust the patient's head or do canalplasty thereby saving operative time. Similar observations were made in two separate studies by Tarabichi M [3] and Usami S, Iijima N, Fujita S et al [4]. With angled endoscopes, it is possible to visualize other structures like round window niche, eustachian tube orifice, incudo-stapedial joint etc that are difficult to observe through the operating microscope. Authors Raj A, Meher R [5] reported similar observations in their study.

In the endoscope group, we took a 2 cm incision in the hair to harvest the graft, whereas the conventional microscope technique requires a 5 cm long post aural incision. Thus in the endoscope group by avoiding the post aural incision there is less dissection of normal tissues, less intra operative bleeding, less incidence of post operative pain and the cosmetic result is better. Avoiding the post aural route also reduces the chance of auricular displacement and asymmetry of pinna. We found that positioning the graft

was much easier and faster with the endoscope as it gives a wide angled view which includes the entire tympanic membrane, the graft and medial end of external auditory canal.

Unlike the microscope, the endoscope is easily transportable and hence is ideal for use in ear surgery camps that are conducted in remote places.

Endoscopic ear surgery is a one handed technique. The scope has to be held in the left hand and only the right hand is free to operate. This becomes especially cumbersome when there is excessive bleeding. Excessive bleeding can be managed easily in microscope assisted ear surgery where one hand can be used to suck the blood and simultaneously the other hand can be used to operate; but only one hand is available to do both the jobs in endoscopic ear surgery. We confirm these observations which were reported in studies by Tarabichi M [3] and Karhuketo TS, Ilomaki JH, Puhakka HJ [6]. This problem can be solved by developing a stand for the scope which will fix it in the desired position so that both the hands will be free to operate. Another disadvantage of the endoscope is that even a small amount of blood can totally obscure the view of the operating field by soiling the scope. Meticulous haemostasis is therefore a must in endoscopic ear surgery. We found that it was difficult to operate directly off the endoscope. It produced neck strain and backache. Therefore at all times we used the monitor. For this, the camera had to be fixed to the scope. This increased the weight of the scope, thereby producing left arm fatigue. This disadvantage of the endoscope can also be solved by developing a stand for the scope. Endoscope provides monocular vision which leads to loss of depth perception compared to the binocular vision provided by the microscope [1]. Therefore we were extra careful to ascertain that the graft had been lifted enough to make contact with the

edges of the perforation. The difficulty associated with the loss of depth perception will be noticed more by a beginner. For an experienced endoscopic sinus surgeon there will be no difficulty. Endoscopic ear surgery requires investment in endoscope, camera and monitor. But for a surgeon doing endoscopic sinus surgeries, there will be no added cost as the same scope can be used for ear surgeries as well.

Savlon is routinely used as a defogging agent in endoscopic ear surgeries. Safety of savlon in the middle ear has not been established. More studies need to be done to evaluate the absorption of savlon through the round window niche and its subsequent effect.

Conclusion

The telescopic, wide angle, magnified view of the endoscope overcomes most of the disadvantages of the microscope. In our study, the success rate of endoscope assisted myringoplasty was comparable to that of microscope assisted myringoplasty. In terms of cosmesis and post-operative recovery, endoscope produced superior results without added expenditure. Loss of depth perception

and one handed technique are some of the disadvantages of the endoscope that can be easily overcome with practice. Endoscope is ideal for ear surgery camps held in remote places. We feel that the endoscope has a definite place in myringoplasty

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