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A performance evaluation of the endoscopic assisted myringoplasty in comparison to the conventional myringoplasty

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Abstract
Background: Tympanoplasty is one of the most commonly used techniques performed on the middle ear. Endoscopes are increasingly used in various middle ear surgeries.
Objective: The objective was to evaluate the benefits and drawbacks of using an endoscope against a microscope in myringoplasty surgery.
Methods: 60 patients underwent myringoplasty, 30 with endoscope assistance and 30 with microscope assistance. The surgical outcomes were compared three months later. 24 weeks after surgery, 86.67% of group 1 and 83.3% of group 2 had intact tympanic membranes. Both groups had similar outcomes. Graft uptake showed comparable results (86.67 percent versus 83.33 per cent).
Conclusion: The endoscope's panoramic, wide-angle, and enlarged picture, as well as its ability to efficiently go through EAC and offer an uninterrupted image, alleviate most of the drawbacks of the microscope. In our study, the success rate of endoscopic and microscopic procedures remained the same. In terms of morbidity and postoperative recovery, the endoscope produced better result. Endoscope 'scope main drawbacks include loss of depth perception and one-handed technique, which can be overcome with the procedure. Thus, endoscopic tympanoplasty may be a viable alternative to microscopic tympanoplasty.

Keywords: ENT, CSOM, radiology, tympanoplasty, myringoplasty

Introduction

Tympanoplasty is a procedure that involves the reconstruction of the tympanic membrane and/or the ossicular chain. Myringoplasty is a type of tympanoplasty that does not include ossicular reconstruction. Many methods for closing perforations have been used over the years. The underlay graft of temporalis fascia or, on occasion, perichondrium is the method that has gained the most popularity and is generally recognised as being effective [1, 2]. 1 In 1952, Wullstein *et al*., and Zollner *et al*., were the first to describe tympanoplasty, which has since become the most common method for reconstructing the tympanic membrane [3, 4]. As a result of the fact that the operating microscope only provides a magnified image in one direction, the surgeon is unable to view the innermost recesses of the middle ear in a single operating field. There have been some attempts made to use endoscopes in otology ever since they became commonplace in other subspecialties of surgery. Mer *et al*., in their paper from 1967, provided the first published description of imaging performed on the middle ear using endoscopy [5, 6]. Myringoplasty and other procedures involving the middle ear are typically done with the assistance of a microscope. However, a microscope only provides a view in one direction, which narrows one's field of vision while looking into the deep recesses of the middle ear [7, 8]. The conventional method calls for a procedure that aims to uncover and visualise the features that are located behind a canal that is either narrow or projecting. Because of this, surgery on the middle ear is increasingly being done endoscopically, and it was recently proposed that endoscopy may replace the use of a microscope. Endoscopes provide a magnified and expansive view of the area being examined. In addition, surgeons can quickly obtain close-up and wide-angle views by inserting or withdrawing the endoscope, but using a microscope takes adjusting to achieve the desired effect. Additionally, surgeons can twist an angled endoscope to provide all-round vision, which enables viewing of the anterior boundary of the perforation [9, 10]. Additionally, the anterior canal wall, attic, and hypotympanum in the middle ear can also be viewed during this procedure. As a result of this, a study was carried out in which conventional microscopic myringoplasty and endoscopic myringoplasty were compared with one another.

Materials and Methods

From December 2017 to November 2018, this study was conducted at Pratima Institute of Medical Sciences hospital. Patients who presented to the ENT OPD with complaints of ear discharge and those who were patients who had given their informed and written consent for surgery were screened. Tuning forks with frequencies of 256, 512, and 1024 Hz were used for the test, and pure tone audiometry was performed to determine the type and degree of hearing loss. The average of the A-B gap at frequencies of 500, 1, and 2 kHz was used to calculate hearing loss [9, 10].

Criteria for Inclusion

- Non discharging dry ear
- Age range 16-50 years

Criteria for Exclusion

- Wet ear discharge
- Wet ear discharge
- Cholesteatoma
- SNHL
- Thyroid disease
- Under the age of 16 years

Endoscopic tympanoplasty was used in 60 cases, while conventional microscopic tympanoplasty was used in 60 cases. In all cases, type 1 tympanoplasty was performed. All microscopic tympanoplasty procedures used temporalis fascia as graft material, whereas endoscopic tympanoplasty used either TF or tragal perichondrium as graft material. The postural route was used for all microscopic tympanoplasty procedures.

Results

Table 1 shows that in total, 60 subjects participated in the study duration from December 2017 to November 2018. Endoscopic myringoplasty was conducted on 30 patients (group 2) and conventional myringoplasty was conducted on 30 patients (group 1). The mean age in Group 1 was 27.2 years old, while it was 32.60 years old in Group 2. (Table 1). The age distribution of the subjects in the two groups was not significantly different (p=0.30).

Table 1: Age Distribution

Age in years	Group I	Group II	Total
11-20	5(16.66%)	6 (20.0%)	11(18.33%)
21-30	14(46.67%)	14(46.67%)	28(46.67%)
31-40	9(30.0%)	4(13.33%)	13(21.66%)
41-50	0(0%)	3(10.0%)	3 (5%)
>50	2 (6.67%)	3(10.0%)	5 (8.33%)
Total	30 (100%)	30 (100%)	60 (100%)
Mean ± SD	27.2±9.35	32.60±14.41	29.40±12.16

(p=0.30)

Table 2 indicates that the female to male ratio in both groups was not significantly different (8:7 vs 17:13; p=0.78) (Table 2). Table 3 shows that both groups had comparable proportions of patients with low and upper-middle socioeconomic status (p=0.75).

Table 2: Gender Distribution (P=0.78)

Gender	Group I	Group II	Total
Male	16(53.34%)	17(56.67%)	30 (50%)
Female	14(46.67%)	13(43.33%)	30 (50%)
Total	30 (100%)	30 (100%)	60(100%)

(p=0.75)

Table 3: Socioeconomic Status

Socio economic status	Group I	Group II	Total
LMC	17(48%)	16(52%)	30 (50%)
UMC	13(52%)	14(48%)	30 (50%)
Total	30 (100%)	30 (100%)	60(100%)

(p=0.78)

Table 4 reveal that the proportion of patients with ear discharge (p=0.10) or hearing loss (p=1.0) prior to surgery did not differ significantly between the two groups. The median hearing loss in groups 1 and 2 was 29.5 (SD=2.78) and 29.64 (SD=2.54) decibels, respectively, during preoperative audiometry (Table 4). This was comparable, with no statistically significant difference between groups (p=0.521).

Table 4: Preoperative A-B gap

Preoperative audiometry (decibel)	Group I	Group II	Total
25-30	23(76.66%)	22(73.33%)	45(75%)
31-35	7 (23.34%)	8(26.67%)	15(25%)
Total	30 (100%)	30(100%)	60 (100%)
Mean ± SD	29.50±2.78	29.65±2.54	28.94±2.52

(p=0.1, Not significant)

Table 5 shows that the mean hearing loss in both groups improved to 17.02 decibels (SD=2.78) and 16.92 decibels (SD=2.34, respectively, in post-operative audiometry. The group difference remained non-significant (p=0.108). As a result, the degree of improvement in the A-B gap after myringoplasty was same between groups. In post-operative audiometry, both groups' mean hearing loss improved to 17.02 decibels (SD=2.78) and 16.92 decibels (SD=2.34), respectively. The difference between groups remained non-significant (p=0.108). As a result, the degree of improvement in the A-B gap following myringoplasty was similar between groups.

Table 5: Postoperative A-B gap

Post-operative audiometry at 24 weeks (decibel)	Group I	Group II	Total
10-14	3(5%)	0 (0%)	2 (3.33%)
15-19	20(66.67%)	14 (46.67%)	32 (53.33%)
20-25	7 (2.33%)	16 (53.33%)	28 (9.34%)
Total	30 (100%)	30 (100%)	60 (100%)
Mean ± SD	17.02±2.78	16.92±2.34	18.20±2.80

(p=0.108, Not significant)

Table 6 shows that the mean duration of surgery in group 1 was 2.60 hours (SD=0.52) while that in group 2 was 3.03 hours (SD=0.44) (Table 6). There was a significant difference in the duration of surgery between the two groups (p=<0.001). In all the subjects, temporalis fascia was the source of graft.

Table 6: Mean Duration of Surgery

Duration of surgery (hrs)	Group I	Group II	Total
1-2	13 (43.33%)	0 (0%)	14 (23.33%)
2-4	17 (56.67%)	25 (83.34%)	44 (73.34%)
4-6	0 (0%)	5 (16.66%)	2 (3.33%)
Total	30 (100%)	30 (100%)	60 (100%)
Mean ± SD	2.60±0.52	3.03±0.44	3.05±0.89

(*p*<0.001**)

Table 7 shows that the mean number of hospital days in group 1 was 2.60 days (SD=0.52), while it was 3.03 days (SD=0.44) in group 2. There was a significant difference in hospitalization duration between the two groups (p=0.001).

Table 7: Mean Duration of Hospitalization

Duration of hospitalization (days)	Group I	Group II	Total
3	3(10%)	0(0%)	4(6.67%)
4	22 (73.33%)	4 (13.33%)	24(40.0%)
5	5 (16.64%)	26(86.67%)	32 (53.33%)
Total	30 (100%)	30 (100%)	60(100%)
Mean ± SD	2.23±0.51	3.87±0.45	4.5±0.59

(*p*<0.001**)

The tympanic membrane was found to be intact in 86.67% of group 1 cases and 83.33 percent of group 2 cases 24 weeks after surgery. The results did not differ significantly between the two groups. The same figures were found for graft uptake status (86.67 percent versus 83.33 percent).

Table 8: Tympanic membrane status after surgery

Tympanic membrane status	Group I	Group II	Total
Intact	26(86.67%)	25 (83.33%)	52 (86.67%)
Perforation	4(13.33%)	5 (16.67%)	8 (13.37%)
Total	30(100%)	30(100%)	60(100%)

(P=1.000, Not significant)

Table 8: demonstrates that there were no correlations found between the type of surgery and outcome measures such as improvement in audiometry scores or graft status at 24 weeks. The duration of surgery and hospitalization had no significant correlation with the change in audiometry scores before and after surgery or graft status. Furthermore, no correlations were observed between the type of graft and surgical outcome measures.

Discussion

Tympanoplasty was previously performed using a microscope, but an endoscope is often used. Duration December 2017 to November 2018, the present study has been conducted in the Department of ENT at Pratima Institute of Medical Sciences. In the study, the surgical outcomes of conventional myringoplasty were compared to those of endoscopic myringoplasty in patients with Chronic Suppurative Otitis Media (CSOM). Each of these groups had 25 subjects with Chronic Suppurative Otitis Media, and the outcome variables were assessed 24 weeks after surgery.

Sociodemographic Variables:-

Age

In terms of age distribution, both groups were comparable. The majority of patients were between the ages of 21 and 30. The mean age of group 1 was 27.2 years, and the mean age of group 2 was 32.6 years. The vast majority of patients in both groups were between the ages of 18 and 40, which is consistent with Myoin R *et al*., study. In the Dhungana, A *et al*., study, there were 70 cases, 33 of which were male and 37 of which were female [7, 10].

The Patel J *et al*., study included 44 patients aged 15 to 65 years with small and medium- sized dry central perforations. The majority of the patients were in their second or third decade of life, and the male to female ratio in the endoscopic and microscopic groups was 1:1.75 and 1:2.14, respectively [11].

Gender

Both of the groups had a gender distribution that was comparable to one another. The male to female ratio in our study is 8:7. The first group had endoscopic myringoplasty, while the second group (17:13) had conventional myringoplasty, which is consistent with the Myoin R *et al*., studies [7]. The male to female ratio in the Caye Thomasen *et al*. (2007)41 study was 1.36. John Mathai (1999) found a male to female ratio of 1.85 in his study of 200 cases [12].

Dhungana conducted a study of 70 cases, 33 of which were male and 37 of which were female [10]. Graft uptake rate in the endoscopic group was 91.4%, while it was 88.5% in the microscopic group, which is similar to a study done by Gaur *et al*, who included 60 patients, 38 males, and 22 females, with surgical success rates of 26 (88%) patients in the endoscope group and 27 (90%) patients in the microscope group, respectively. Lakpathi *et al.*, compared the outcomes of endoscopic versus microscopic myringoplasty in 60 patients (40 men and 20 women) ranging in age from 15 to 55 years [6].

Choi *et al* [24] compared 73 patients who underwent type I tympanoplasty (35 males and 38 females). Endoscopic tympanoplasty (ET, n=25) and microscopic tympanoplasty (MT, n=48) were performed on the subjects [15].

Socioeconomic Status

In terms of socioeconomic status, the two groups were comparable. According to Browning GG (1991), there is a clear association between chronic otitis media and low socioeconomic status. This is most likely due to poor overall health, malnutrition, and overcrowding. This may have implications for postoperative care and prognosis [16]. However, because both groups were comparable, it is unlikely that such sociocultural factors influenced the comparison of surgical outcomes between the groups.

Perioperative Variables

Duration of Surgery

The duration of surgery was significantly shorter in the endoscopic surgery group compared to the conventional myringoplasty group. In this present study found that the mean number of days of hospitalisation in group 1 was 2.60 days (SD=0.52), while it was 3.03 days (SD=0.44) in group 2. Similar to previous studies, approximately 40% of patients in the Myoin R *et al*., study had a 2-hour surgery [7]. More than 90% of conventional surgery cases were

completed in 4 hours or less. Kumar M *et al*. observed that the average time for conventional myringoplasty was 90 minutes (60-120 minutes), whereas the time for endoscopic myringoplasty was 102 minutes (60-140 minutes) [17]. This suggests that endoscopic myringoplasty can reduce surgery time and associated morbidity. In the immediate post-operative period, none of the subjects experienced any complications.

Surgical Outcomes: Duration of Hospitalization

Myoin R *et al*., observed a significant difference in the duration of hospitalization after surgery between the two groups in their study. Endoscopic myringoplasty patients required significantly fewer hospital days than conventional myringoplasty patients. 76% of patients who had endoscopic surgery stayed in the hospital for three days, whereas 96% of patients who had conventional surgery stayed in the hospital for four days [7]. This difference has been observed in other studies as well. Kumar M found out that the average hospital stay time in the microscopic myringoplasty group was 5 days, while the average hospital stay time in the endoscopic myringoplasty group was 2.8 days [17]. In the study by Harugop *et al*, subjects who underwent endoscopic surgery took an average of 2.4 days to return to a daily routine, whereas subjects who underwent conventional surgery took an average of 5.4 days [14]. An endoscopic myringoplasty is thus a viable option for patients who insist on early mobility.

Graft Status

Choi N *et al*., noticed that the mean operation time of the MT (88.928.5 minutes) was statistically significant (P=0.002) greater than that of the ET (68.222.1 minutes). The graft success rate was 100% in the ET group and 95.8% in the MT group; however, there was no statistically significant difference between the two values (p=0.304) [15].

According to the findings of the Myoin R *et al*., study, approximately 90% of subjects in both groups had healthy graft status after 6 months. In the endoscopic group, 23 patients had healthy tympanic membranes, while 22 patients in the conventional group did. The rates of success following myringoplasty are on par with those seen in other studies [7]. Lade *et al*., observed that graft update occurred in 83 percent of cases across both groups [18]. In the study by Harudop *et al*, the success rate at 6 months was 82% in conventional myringoplasty and 86% in endoscopic myringoplasty [14]. The Dadul, R *et al*., study obtained similar results with 85% graft take-up in endoscopic tympanoplasty (ET) and 82.9% take-up in microscopic tympanoplasty (MT), indicating no statistical significance between the two methods [9].

According to the findings of the Patel J study, complete graft uptake was seen in 16 (72.72%) of the patients in the endoscopic group, while 20 (90%) of the patients in the microscopic group [11]. The present findings revealed that the tympanic membrane was intact in 86.67% of cases in group 1 and 83.33% of cases in group 2. The outcome was identical for both of the groups, indicating that there was no discernible difference between them.

We recommend that the use of endoscopes will be better in hospitals as well as in camps because they are lighter, more easily transportable, show improved visualisation, and reduce the amount of time needed for surgical procedures. Both endoscopic and microscopic techniques produced comparable results in terms of hearing and graft uptake rate; however, endoscopic techniques required less time to perform the operation than microscopic techniques did.

Improvement in A-B gap

In the study by Myoin R *et al*, there was an improvement in the A-B gap from the preoperative condition at 24 weeks in both groups. This suggests that myringoplasty was effective in improving these patients' hearing deficits [7]. The research found no significant differences in the extent of improvement in the A-B gap between the two groups. This is consistent with previous research. So, at the end of 6 months, the clinical improvement in hearing is comparable in both conventional and endoscopic myringoplasty. The method chosen may be influenced by other factors related to the patient and surgery. A. Dhungana and colleagues the increases in ABG before and after surgery were linked. At the end of 6 months, all (100%) Group 1 patients rated their cosmetic results as excellent when compared to Group 2. The endoscope, unlike the microscope, is easily transportable and thus ideal for use in ear surgery camps held in remote locations [10]. The study by Patel J *et al*., observed a t three months, 10 (45.45%) patients in the endoscopic group had a postop A-B gap of 0 to 10 db, while 11 (50%) patients had a postop A-B gap of 11 to 20 db. In the microscopic tympanoplasty group, 10 (45.45%) patients had a postop A-B gap of 0 to 10 db, while 8 (36.36%) patients had a postop A-B gap of the complete uptake rate for tragal perichondrium and temporalis fascia was 69.23% and 77.77%, respectively. While both study groups had an equal number of patients (15 patients (68.18%) who met the criteria for successful results [11].

The present research showed that after surgery, the mean hearing loss improved in both groups to 17.02 decibels (SD=2.78) and 16.92 decibels (SD=2.34), respectively.

Qualitative Aspects of Endoscopic Surgery

Endoscopic myringoplasty offers the surgeon both quantitative and practical benefits. These pragmatic and qualitative factors must be considered when choosing endoscopic or conventional myringoplasty for a patient. Endoscopic cameras are more mobile than microscopes with heavy stands. It gives a movie-camera-like image by moving easily to the site of interest, unlike a microscope [7]. Angled scopes increase visibility and access to difficult areas like canal wall, anterior recess, anterior perforation, Eustachian tube, and ossicular chain.

This helps with flap elevation and other shifts. Endoscopes don't require repeated adjustments like microscopes. Vision beyond the instruments' shafts is possible, so they don't obstruct vision like in a microscope. The TV's magnification is very high. Monitors improve the surgeon's posture. Everyone sees the same image, improving surgeon-assistant, peer, and student communication. Medical and teaching purposes benefit from recording. Endoscope- assisted myringoplasty had comparable graft uptake and hearing improvement to conventional microscope-assisted myringoplasty, but better cosmesis and postoperative recovery [2, 5].

The magnification is very high through the T.V. monitor. Physical posture of the surgeon is also better because of the monitor. Communication between the surgeon and

assistants, peers and students are also better as everyone sees the same image. Recording is possible which is useful for medico-legal and teaching purposes.

Conclusions

In terms of hearing improvement and graft uptake, the success rate of endoscope assisted myringoplasty was comparable to that of microscope assisted myringoplasty in our study. Endoscopic myringoplasty outperformed conventional myringoplasty in terms of surgery time and hospital stay without incurring additional costs. Using endoscopes, we were able to gain good access to the least accessible nooks and corners of the middle ear cavity, such as the sinus tympani, facial recess, and so on, even in narrow canals and overhangs. The endoscope's limitations, such as loss of depth perception and one-handed technique, are easily overcome with practice. We believe that the endoscope has a significant role to play in all ear and mastoid surgeries. Endoscope-assisted myringoplasty had comparable graft uptake and hearing improvement to conventional microscope-assisted myringoplasty, but better cosmesis and postoperative recovery.

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