Comparative study between endoscopic myringoplasty and microscopic myringoplasty in tubotympanic chronic suppurative otitis media

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Abstract: **Background:** The use of the rigid endoscope in the management of dry central perforation of the drum represented a significant advance in middle ear surgery. It replaces the operating microscope in observation and surgery of the tympanic membrane perforation. It provides an extremely sharp image with high resolution. **Aim:** Comparative study between endoscopic myringoplasty and microscopic myringoplasty in tubotympanic chronic suppurative otitis media. **Methods**: 30 patients (30 ears) with tympanic membrane perforation safe type under went Type1 Tympanoplasty (myringoplasty) met the inclusion criteria; Patients with traumatic perforation, Patients with mucosal chronic otitis media associated with central perforation that is dry for at least 3 months, Patients more than 12 years old and younger than 50 years old. **Results**: This study shows that no significant difference between the endoscopic and microscopic technique in myringoplasty with the superiority to the endoscopic for being better visualizing the field especially the anterior perforations and less traumatic. **Conclusion**: Success rate was found equal for both endoscopic and microscopic techniques. Endoscopic technique has a panoramic, wide angle, and magnified view as well as ability to easily negotiate through external auditory canal and provide uninterrupted picture that overcomes most of the disadvantages of microscope.

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1. Introduction

Chronic suppurative otitis media (CSOM) is an inflammatory process of the mucoperiosteal lining of the middle ear space and mastoid. The mucus membrane may be thickened by edema, submucosal fibrosis, and infiltration with chronic inflammatory cells **(Smyth GD. 1976).**

Unrepaired TM perforations can significantly impair the quality of life as hearing loss, recurrent infections, recurrent otorrhoea, cholesteatoma formation, tinnitus and possible infection of the middle ear space **(Liew L. et al. 2002).**

Different approaches were used for closure of tympanic membrane perforations mainly the postauricular, the endaural and transcanal with placement of the harvested graft **(Rizer FM. 1997).**

The most commonly used materials are the temporalis fascia, perichondrium, cartilage and fat plugs specially for small perforations **(Gross CW. et al. 1989).**

2. Patients and methods

30 patients (30 ears) with tympanic membrane perforation safe type under went Type1 Tympanoplasty (myringoplasty) met the inclusion criteria; Patients with traumatic perforation, Patients with mucosal chronic otitis media associated with central perforation that is dry for at least 3 months, Patients more than 12 years old and younger than 50 years old. Patients were distributed through sequence generation and random allocation in one of two groups (group I & II) with 15 patients in each group.

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All patients were subjected to routine ENT examination and pre-operative audiological evaluation including PTA (pure tone audiometry) and tympanometry. After obtaining signed informed consent, procedure was done under general anesthesia. In the first group (group I), endoscope was used while in the second group (group II) operating microscope was used to perform myringoplasty. Cartilage perichondrium was used as graft material. The patients were kept in follow-up for 8 weeks. Risks and benefits of each procedure were discussed with participants as infection, graft rejection and minor bleeding.

3. Results:

30 patients were included in the study after fulfillment of inclusion criteria. (Group I) included 6 male and 9 female patients. The mean age was (27 ± 8.24) While (Group II) included 5 male and 10 female patients. The mean age was (30.53 ± 11.93). Demographic data for both groups is represented in **Table 1, 2.**

Table (1):

Age	Groups		T-Test	
	Endoscopic	Microscopic	t	P-value
Range	12 - 44	15 - 50	-0.943	0.354
Mean ±SD	27 ± 8.246	30.533 ± 11.934		

Table (2):

Sex	Groups						Chi-Square	
	Endoscopic Group "I"		Microscopic Group "II"		Total			
	N	%	N	%	N	%	X^2	P-value
Male	6	40	5	33.33	11	36.67	0.14	0.70
Female	9	60	10	66.67	19	63.33		
Total	15	100	15	100	30	100		

Regarding duration of the operations, the time of operation in (group I) ranged from (40-90 minutes) with mean (65.66± 14.74) where it ranged in (group II) from (50-90 minutes) with mean (71 ± 11.37). There was no statistically significant difference between both groups. (p-value = 0.27).

As regard to graft taking, post-operative follow up after 8 weeks revealed quite similar rate of healing with the graft has been taken in (14 cases) in group I (Endoscopic) and (12 cases) of group II (Microscopic) --- (p-value is 0.28).

Regarding the functional outcome, audiological evaluation revealed that mean air bone gap (A.B GAP) for group I was preoperatively (26.53 ± 3.80) and postoperativelywas (11.96 ± 3.58),, while in group II it was pre operatively (27.43±3.02) and postoperatively (13.76 ± 5.09). **(Table 3)**

Table (3):

A.B GAP		Groups		T-Test	
		Endoscopic	Microscopic	T	*P*-value
Pre	Range	20 - 33	21 - 33	-0.91	0.36
	Mean ±SD	26.6 ± 3.81	27.8 ± 3.32		
Post	Range	7 - 22	10 - 27	-1.18	0.24
	Mean ±SD	12.2 ± 3.84	14.06 ± 4.77		
Paired Differences	Mean ±SD	14.4 ± 6.88	13.73 ± 6.07		
Paired Test	P-value	<0.001*	<0.001*		

4. Discussion

Many ENT surgeons perform myringoplasty under an operating microscope. However, despite providing direct exposure, microscopy may be insufficient in viewing certain areas during surgery. Although there are no exposure problems in the posterior and inferior areas, there may be exposure problems and hidden areas that cannot be seen under a microscope especially most anterior perforations and can be better observed via thin and rigid endoscopes with different angles. In the endoscopic myringoplasty procedure, a thin, rigid endoscope allows for functional reconstruction during surgery and the performance of minimally invasive procedures and conservative surgeries with protection of the anatomy **(Dundar R. et al. 2014)**.

Variations of the external auditory canal like stenosis, tortuosity, bony overhangs etc. make the view of the tympanic membrane difficult when visualized through the microscope. Therefore the surgeon needs to manipulate the patient's head or the microscope repeatedly to be able to see all the parts of the tympanic membrane. Sometimes, in spite of the manipulations, the tympanic membrane will not be fully visualized and canaloplasty has to be done. This in turn will increase the operative time **(Wullstien H. 1953).**

In sharp contrast, the endoscope brings the surgeon's eye to the tip of the scope. Hence the view through the endoscope will not be restricted by the narrowest segment of the external auditory canal. The wide angle 0º 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 **(Harugop AS1. et al. 2008).**

Also on the economic view, the endoscope is easily transportable and hence is ideal for use in ear surgery camps and more cheaper than the microscope that will be difficult in transporting **(Godhi RA. 2008).**

In our study, we have attempted to evaluate the efficacy of oto-endoscopy, in terms of operative feasibility and post-operative outcomes, as an alternative tool to traditional microscope.

thirty patients eligible for myringoplasty were included in the study. They were distributed randomly in two groups. (Group I) included 15 cases underwent endoscopic myringoplasty while (group II) included 15 cases underwent microscopic myringoplasty. There was no significant difference between both groups regarding the duration of operation, the graft taking and the hearing outcomes using pure tone audiometry.

Comparable to our study, In a study by Ghaffaret al., the mean operation duration was (65.667 minutes) among 15 patients who underwent endoscopic myringoplasty **(Ghaffar S. et al. 2006).**

The duration of the operation is an important parameter in terms of the duration of anesthesia, the surgeon's concentration, and the increased risk of iatrogenic complications.

In our study, the mean time of surgery in minutes in both groups was comparable, as it was (65.66 ± 14.74) minutes in (Endoscopic group "I") where it was in (Microscopic group "II") (71 ± 11.37) minutes so we can notice that there was no significant difference in the mean time of the two groups. Also in our study, the graft take rate in (Endoscopic group "I") was 93% with failure of 1 cases, while it was 80% in (Microscopic group "II") with failure of 3 cases. There was no significant difference in the graft take rate between two groups.

Ayache S. et al 2013 reported a graft success rate of 96% in patients undergoing transcanal endoscopic cartilage tympanoplasty, and this procedure was reportedly a minimally invasive, safe, and effective treatment method.

As regards of hearing, postoperative hearing gain is an important indicator of treatment success in patients who have undergone myringoplasty. In our study, the mean preoperative (A.B GAP) was (26.6 ± 3.81) and it was (12.2 ± 3.84) postoperatively in the (Endoscopic group "I"). Whereas in (Microscopic group "II") the mean preoperative (A.B GAP) was (27.8 ± 3.32) and postoperatively was (14.06 ± 4.77).

All these results were recorded by pure tone audiometry done to all 30 cases pre operatively and 8 weeks postoperatively.

These results showed significant postoperative hearing improvement, while there was no significant difference in the postoperative (A.B GAP) between both groups.

In comparison to our study, many studies have reported successful results regarding postoperative hearing gain in patients. **Friedman et al 2013** performed type 1 tympanoplasty in 119 patients. Using cartilage grafts, the preoperative and postoperative (A.B GAPs) were calculated to be 20.7 and 8.5, dB respectively.

In a study by **Yilmaz MS. et al 2015** the (A.B GAPs) were 30.6 dB preoperatively and 17.8 dB postoperatively in 45 pediatric patients who underwent type 1 cartilage tympanoplasty.

Karhuketo et al 2001 emphasized that the use of endoscopic methods in ear surgery fulfills the requirements of minimally invasive surgery, and the least trauma to the normal tissues can be achieved in this way.

Lade et al 2014 compared 60 patients undergoing myringoplasty (type 1 tympanoplasty) using either a microscopic or endoscopic procedure. They concluded that the results of endoscopic myringoplasty were similar to those of microscopic myringoplasty and that endoscopic myringoplasty is more tolerable in terms of the cosmetic appearance. Thus, this technique was considered a potential alternative to microscopic tympanoplasty.

From all the above we can notice that there is no significant difference between the endoscopic and microscopic technique in myringoplasty with the superiority to the endoscopic for being better visualizing the field especially the anterior perforations and less traumatic.

Concerning the advantages of endoscopic technique, The microscope is the standard instrument used for myringoplasty and its major advantages over the endoscope are the binocular vision and the double-handed technique.

On the other hand, the endoscope has multiple advantages over the microscope as follows:

The advantage of the endoscope in obtaining a wide, panoramic intraoperative view of the middle ear cleft cannot be overstated.

It provides a magnified vision and hence enables the surgeon to change rapidly from a close-up to a wide angle view, just by going closer or by withdrawing the scope. Further, it provides the surgeon with an all-round vision. The angled endoscope can be used to visualize the deep anterior canal wall, anterior recess, anterior marginal perforations, sinus tympani, facial recess, hypotympanum and the attic **(Ayache S. 2013).**

It is less traumatic, less morbid and requires less operating time as there is no post auricular incision

especially skilled surgeons. It is less expensive in terms of the cost of equipment and easily transportable.

Variations of external auditory canal such as stenosis, tortuosity, bony overhangs, etc., hamper the view of TM when visualized through microscope. Therefore, there is a need to manipulate the patients head or the microscope repeatedly to visualize all the parts of TM. Sometimes, in spite of manipulation, TM will not be fully visualized, and canaloplasty has to be done. This in turn may increase the operative time. But, the endoscope brings the surgeons eye to the tip of the scope. The wide angle of zero degree scope visualizes the entire TM. There is no need to frequently adjust the patients head or to do canaloplasty thereby saving operative time **(Gaur RS. 2016).**

5-Conclusion

Success rate was found equal for both endoscopic and microscopic techniques. Endoscopic technique has a panoramic, wide angle, and magnified view as well as ability to easily negotiate through external auditory canal and provide uninterrupted picture that overcomes most of the disadvantages of microscope. Furthermore, the cost of the endoscope is much less than the operating microscope, thus it is more cost-effective, especially in developing countries. In terms of cosmosis, The scar by endoscopic myringoplasty is invisible as transcanal endoscopic myringoplasty does not require surgical exposure such as a postauricular skin incision to obtain an anterior view or canaloplasty to bypass the bony hump. Loss of depth of perception and one handed technique are some of the disadvantage of endoscope that can be overcome with practice. Thus endoscopic myringoplasty can be a good alternative of microscopic myringoplasty.

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