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Otolaryngology

KEY WORDS: Chronic supparative otitis media(CSOM), Endoscopic Tympanoplasty,Microscopic Tympanoplasty

A COMPARATIVE STUDY OF ENDOSCOPIC TYMPANOPLASTY TO MICROSCOPIC TYMPANOPLASTY

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ABSTRACT

AIM: To evaluate the effectiveness of Endoscopic tympanoplasty compared to Microscopic tympanoplasty.
METHODS
TYPE OF STUDY: open-label (non-blinded) intervention study.
SOURCE OF SAMPLE: All patients seeking services from ENT specialty at Government General Hospital Kurnool, came with a diagnosis of CSOM were recruited into the study.
INTERVENTION: A) MICROSCOPIC TYMPANOPLASTY B) ENDOSCOPIC TYMPANOPLASTY
SAMPLE SIZE: 30 (15 in the microscope group and 15 in the endoscope group).**RESULTS:** Pre and postoperative results were not significant in both groups(p>0.05) but post operative airbone gap results improved in both groups than preoperative airbone gap average operative time was significant statistically as group A (MT) 110 min and group B(ET) 132 minutes. P value <0.05.complications between two groups was clinically significant but it is not statistically significant (p value >0.05).graft success rate is same in both groups (80%). **CONCLUSION:** The telescopic, wide angle, magnified view of the endoscope overcomes the disadvantages of the microscope. In our study, the outcomes of endoscopic tympanoplasty were equal to the outcomes of microscopic tympanoplasty.

INTRODUCTION:
Most common cause of perforation of the tympanic membrane is due to Chronic suppurative otitis media. Chronic suppurative otitis media (CSOM) is a widespread disease of the developing countries like India, hence treating CSOM with surgical treatment by tympanoplasty is one of the common procedures in ENT. CSOM is defined by world health organization foundation workshop (1996) as a stage of ear disease in which there is a chronic infection of the middle ear cleft i.e Eustachian tube, middle ear, and mastoid, and in which a nonintact tympanic membrane and discharge are present . Surgical management of perforation by myringoplasty is needed if the perforation fails to heal by conservative therapy, since the introduction of tympanoplasty by WULLSTEIN (1953). The introduction of the binocular operating microscope by Holmgren (1922) was the singular most important event in the history of middle ear Surgery. Although the microscope has been efficiently used in otology for many years there has been no significant improvement in their basic optical characteristics. Their limitations have remained the same over the last three decades.Over the years endoscopes have mainly been used for diagnostics and photographic purpose in otology. After the introduction of middle ear endoscopy by MER and colleagues,there has been a recent increase in Middle ear surgeries. There is only a limited number of studies have been done till now regarding comparative study between the microscopic and endoscopic Myringoplasty.

METHODS: TYPE OF STUDY: open-label (non-blinded) intervention study. **SOURCE OF SAMPLE:** All patients seeking services from ENT specialty at Government General Hospital Kurnool, came with a diagnosis of CSOM were recruited into the study.

INTERVENTION: A) MICROSCOPIC TYMPANOPLASTY B) ENDOSCOPIC TYMPANOPLASTY.PREOPERATIVE PREPERATION:
SAMPLE SIZE: 30 (15 in the microscope group and 15 in the endoscope group)

Pure tone audiometry (PTA) was done as per the method outlined by the American speech and hearing association (ASHA). Air-bone (A-B) gap at frequencies 500Hz, 1KHz, 2KHz was noted and hearing loss was calculated by taking an average of 3.Patch test was done followed by repeat PTA to rule out the presence of otosclerosis, ossicular discontinuity, and ossicular fixation. **X-RAY mastoid:** Bilateral Schuller's view was done and radiological features of mastoids was noted. Mastoid showing clear cells were labeled as pneumatic, those showing no air cells were called as sclerotic, those showing mixed pattern labeled as diploiec.

Routine blood investigations: complete blood count, ESR, bleeding time, clotting time, random blood sugar, urine routine has done and sent for all patients.

CHOICE OF ANAESTHESIA: Only anxious patients received general anesthesia. All patients including those who received general anesthesia received local anesthesia. 26 gauge 1.5-inch needle is used to inject a mixture of 2% xylocaine and adrenaline at the following points: Post aurally,Incisura terminals.In the canal wall at the bony-cartilaginous junction at four points - 3'clock, 6'clock, 9'clock, 12'clock positions.

INCISION : Majority of the patients in the microscope group were operated by the postaural route and only a few were operated by the endaural route. The temporalis fascia graft was harvested through the same incision. Patients in Endoscope group had one small incision in the hairline just above the helix to harvest the temporalis fascia graft.

SURGERY: All patients underwent underlay tympanoplasty with dried temporalis fascia graft.

THE TECHNIQUE OF ENDOSCOPIC TYMPANOPLASTY
Approach- All the endoscopic tympanoplasties were done through the permeatal route. Also, all were purely endoscopic and at no point of time, the microscope was used. Freshening of the margins of the perforation - The endoscope was introduced through the external auditory canal and the TM with its perforation was visualized. The edge of the Perforation was incised with a fine pick or a sickle knife and circumferentially freshened to remove the epidermis and promote local bleeding. When the perforation was large, care was taken to avoid damaging the chorda tympani and the incudo-stapedial joint. The margins of the perforation were removed with a crocodile forceps.(Figure 5).

Elevation of tympanomeatal flap - In all the 15 cases we used the superiorly based flap. An incision was taken 5mm from the tympanic annulus from 10'clock to 2'clock position. The incision was not extended superiorly above these sutures. A circular Knife was used to make the incision. Elevation of the tympanomeatal flap was done with the following instruments.(Figure 6).Elevation till the annulus was done with the circular knife. Elevation of the fibrous layer from the sulcus tympani was done with a circular knife and a side knife. Elevation of the fibrous layer from the mucosa was done with a Fine TM elevator Mucosa was preserved as much as possible. The tympanomeatal flap was elevated and flapped superiorly. The handle of malleus and umbo were bared of mucosa using a sickle knife. Skin of the pars flaccida and the adjacent attic

bone was also elevated. Thus, the handle of malleus, ossicles, middle ear mucosa and deep 5mm of the EAC were completely exposed. They formed the bed for the graft placement. The entire flap was pressed on to the anterosuperior canal wall so that it did not obstruct the vision, touch the scope or interfere during the graft placement.

Inspection of the middle ear - The middle ear was inspected for the presence of any pathology like granulations, polyps, pale / hypertrophied mucosa, and tympanosclerosis. The ET opening, facial recess, and the sinus tympani were visualized if possible. The ossicular mobility and the round window reflex were confirmed.

Graft Placement - Dried temporalis fascia was placed medial to the fibrous layer of TM. A slit was made in the graft to hug the handle of malleus. Before placing the graft, the bed for the graft was made dry. Care was taken to put the tympanomeatal flap away from the path of the graft. The anterior edge of the graft was held with a crocodile forceps and the graft was maneuvered along the posterior canal wall. A spud was used to manipulate the graft. The tympanomeatal flap was placed back hearing was checked on table gelfoam was placed to stabilize the graft.(Figure7).

POSTOPERATIVE CARE: All the patients received oral analgesics and antibiotics. When deemed fit, patients were discharged with the following postoperative orders:To avoid soiling or wetting the bandage. To avoid lifting heavy weights. To avoid blowing the nose Forcibly. To report Immediately to the hospital in case of pain, fever, soakage of the dressing and upper respiratory tract infection.

RESULTS: Average operative time: Average time taken for surgery in group A was 110 min. In group B, the average time taken was 132mins. The difference in the operative time was significant statistically.

Table 1: Average operative time

	Group A	Group B
Average Time (mins)	110	132

chi-square = 11.25 (p valve < 0.05).

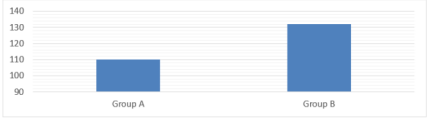

Fig 1 : Average operative time

Complications: In the present study 4 patients (13.33%) had skin infections, 3 patients (10%) had graft infections,1 patient (3.33%) had perichondritis and 1 patient (3.33%) had canal stenosis. Although the difference between the two groups was clinically significant it was not statistically significant. (p= >0.05).

Table 2:

COMPLICATIONS	GROUP A	GROUP B	TOTAL
Skin infections	2	2	4(13.33%)
Graft infections	2	1	3(10%)
perichondritis	1	0	1(3.33%)
Canal stenosis	1	0	1(3.33%)

chi-square = 1.4286. (p valve >0.05).

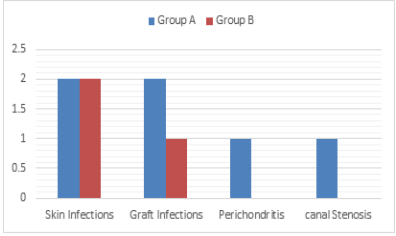

Fig 2: Complications

Post Operative Audiometry: In the present study, 10 patients(33.4%) had closure of A-B gap to less than 10dB,16 patients(53.33%) had closure between 11-20 dB and 4 patients (13.33%) had closure between 21-30dB.The difference between the two groups was statistically not significant (p>0.05).

Table 3: Post Operative Audiometry

A-B Gap	Group A	Group B	Total
0-10dB	4	6	10(33.4%)
11-20dB	9	7	16(53.33%)
21-30dB	2	2	4(13.33%)
Total	15	15	30(100%)

chi-square = 0.65. (p valve >0.05).

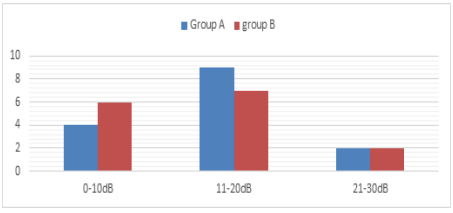

Fig 3: POST OPERATIVE AUDIOMETRY

DISCUSSION:

The present study was conducted at the Department of E.N.T and Head and neck surgery, Government General Hospital, and Medical Research Centre, Kurnool from January 2017 to December 2017.This study was undertaken with the objective of determining the advantages and disadvantages of the endoscope when compared to the microscope in tympanoplasty surgeries.A total of 30 patients with dry central perforation of the TM were selected for the study. Patients were allocated in to two groups depending on the criteria included. Group A patients underwent microscopic tympanoplasty and Group B patients underwent endoscopic tympanoplasty,In our study males and females are in equal ratio.(1:1).Hearing loss was the most common symptom (100%). As discharge present in all patients they were treated by giving medications and only dry ears were taken into consideration.All patients had TM perforations due to CSOM (100%). Medium sized perforations were present in 36.67% of patients,30% had large size perforations and 33.33% had subtotal perforations.Majority of our patients (70%) had a normal TM remnant, remaining patients (27.5%) had abnormalities of the TM remnant.Normal middle ear mucosa was present in 76.66% of patients; remaining 23.33% had abnormal middle ear mucosa.The average pre-operative conductive hearing loss in the Group A was 32.33dB and 30.6dB in Group B.X-ray Mastoid revealed that majority of our patients (76.67%) had sclerotic mastoid.In Group A, patients were operated by post aural incisions and In Group B, all patients were operated by a 2cm long supra-aural linear skin incision.Average time taken for surgery in Group A was 110 mins, and 132 mins in Group B. The difference was statistically significant.We correlated with other studies as

Table 4 : AVERAGE OPERATIVE TIME.

Author's Name	Year	Microscopic Tympanoplasty	Endoscopic Tympanoplasty
Jenina Rachel D.J et al[2].,	2018	140.6 min	86.7 min
Saggu et al[3]	2018	120 mins	93 mins
A.C. Jyothi et al[4]	2017	120 mins	60 mins
Nayeon Choi et al[5].,	2017	88.9 ± 28.5 min	68.2 ± 22.1 min
Raveendra et al.,	2016	60 min	90 min
Manish et al[6]	2015	90 mins	102 mins
Patel et al[7].,	2015	90 min	75 min
Huang et al[8].,	2013	75.5 min	50.4 min

chi-square=11.25 ($p < 0.05$).

The complication rate in Group A was 26.67 % and 10% in Group B. It was not statistically significant.Average A-B gap at 6 months post-op was 10dB in Group A,12.46dB in Group B.The graft take rate was 80% In both the groups. So, we correlate with other studies as

Table 4:

Author's Name	Year	Graft uptake	
		Microscopic Tympanoplasty	Endoscopic Tympanoplasty
Pandey et al[9]	2018	93.30%	91.60%
Manish et al	2018	85%	90%
Saggu et al[2]	2018	90%	86%
Nayeon Choi et at[3]	2017	95.80%	100%
Sinha et al[10]	2017	95%	95%
Raveendra P. Gadag et al.[4]	2016	80%	73%
Shoeb et al11	2016	93%	93%
Gadag et al[4]	2016	80%	74%
Kumar et al[12]	2015	86%	83%
Lakhpathi et al[13]	2016	90%	80%
Jamin Patel et al[14]	2015	69%	69%
Lade et al[15]	2014	83%	83%
Yadav et al[5]	2009	90%	90%

OUTCOMES

The success rate was 80% in both the groups.Only 20 % of patients rated their cosmetic result as excellent in Group A, whereas in Group B all patients rated their cosmetic result as excellent.Objective assessment by us revealed that the scar was visible in 73.33 % of patients in Group A; whereas in Group B the scar was invisible in all patients (100%).We made the following observations in our study

The endoscope provides an excellent picture with high resolution.In the endoscope group, we took only a small 2cm incision in the hair to harvest the graft, whereas conventional microscope technique uses the 5cm long post aural incision. Thus in the endoscope group by avoiding the post aural incision there is a lesser dissection of normal tissues, lesser intraoperative bleeding, lesser operative time, lesser incidence of postoperative pain and infection and better cosmetic result. Avoiding the post aural route also reduces the chance of auricular displacement and asymmetry of the pinna. In the endoscope group, since the skin incision does not directly communicate with the external auditory canal, theoretically there is no chance of spread of infection from the skin to the graft. With an endoscope, 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.We found that positioning the graft was much easier and faster with the endoscope given its wide angle view which includes the entire tympanic membrane, the graft and medial end of external auditory canal.Endoscopic ear surgery is a one-handed technique. The scope is held in the left hand and the surgery is done with the right hand. This becomes very cumbersome especially when there is excessive bleeding. Because unlike a microscope where one hand can be used to suck the blood while performing surgery with the other hand, only one hand is available to do both the jobs in endoscopic ear surgery. 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.For the same reason, we could not remove diseased hypertrophied mucosa of the middle ear. Meticulous hemostasis 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.Another disadvantage of the endoscope is that it provides monocular vision which leads to loss of depth perception compared to the binocular vision provided by the microscope. 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 an 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 middle ear has not been established. More studies should be done evaluating the absorption of savlon through round window niche and its subsequent effect.

CONCLUSION:

The telescopic, wide angle, magnified view of the endoscope overcomes the disadvantages of the microscope.In our study, the outcomes of endoscopic tympanoplasty were equal to the outcomes of microscopic tympanoplasty.In terms of cosmesis and postoperative recovery, endoscope produced superior results. We feel that the endoscope has a definite place in tympanoplasty.

Limitation of the Study : The statistical conclusion drawn from this study suffer from a handicap of small numbers(15) in either group, hence, this should be considered as a pilot study and further large scale needs to be undertaken to clarify the issues raised in this pilot study. The study should include paediatric population as it is not taken in the present study.

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