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### RESEARCH ARTICLE

#### ENDOSCOPIC VERSUS MICROSCOPIC APPROACH TO TYPE 1 TYMPANOPLASTY.

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#### Manuscript Info

#### Abstract

#### Manuscript History

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#### Introduction:-

Chronic otitis media is the chronic inflammation of mucoperiosteal lining of the middle ear cleft characterized by ear discharge, a permanent perforation of the tympanic membrane and impairment in hearing. It is one of the most common ear diseases encountered in developing countries due to poor socio-economic standards, poor nutrition, lack of health education and unhygienic habits. Other causes of tympanic membrane perforation include trauma, blast injury etc. According to the American Academy of Ophthalmology and Otolaryngology Subcommittee on conservation of Hearing 1965 definition Tympanoplasty is ‘‘a procedure to eradicate disease in the middle ear and to reconstruct the hearing mechanism with or without tympanic membrane grafting’’<sup>1</sup>. The term Tympanoplasty was introduced in 1953 by Wullstein to describe surgical techniques for reconstruction of the middle-ear hearing mechanisms that had been impaired or destroyed by chronic ear disease<sup>2</sup>. Tympanoplasty can be considered the final step in the surgical conquest of the conductive hearing loss and represents the culmination of over 100 years of evolution of surgical procedures on the middle ear to improve hearing. The surgical application of the operating microscope, first by Nylen<sup>3</sup> in 1921 as a monocular instrument, and then by Holmgren, who introduced the binocular operating microscope in 1992, was an important advance destined to play an increasing role in the perfection of fenestration, stapes operations and tympanoplasty. With the advent of the rigid endoscopes for sinus surgery, its extended applications in other fields have emerged. Mer and colleagues introduced the middle ear endoscopy<sup>4</sup>. Since then endoscopes are increasingly used for various middle ear surgeries. Transcanal endoscopic approaches of middle ear provide wide angled view for inspecting the anatomy of the middle ear and redefining of the ossicles, which allows a better understanding of the ligaments and folds of the middle ear and help to understand the physiology of different spaces<sup>5</sup>. In the surgical repair of tympanic membrane perforations several variables come into play such as size of perforation, overhang, eustachian tube function, state of the mucosa, wound healing, degree of pneumatization etc.

#### Aims and Objectives:-

The objective was to determine merits and demerits of the endoscope as compared to the microscope in tympanoplasty type-1 surgery and to compare the results of both groups in terms of the duration of surgery, graft success rate and the post operative hearing gain.

## Materials and methods:-

### Inclusion criteria:-

- Patient age-15-45 years
- A-B gap less than 45 dB .
- Ear should be dry at least for 3 weeks
- Functioning Eustachian tube.
- Wide External Auditory canal.
- Perforation size less than 5mm.

### Exclusion Criteria-

- Patient age <15 & >45 years.
- Pts with A-B gap > than 45 dB .
- Patients with cholesteatoma, active ear discharge, ossicular discontinuity or fixation.
- Significantly narrow EAC and
- Revision /previously operated cases.
- Sensorineural /mixed hearing loss.
- Those having only hearing ear .

## Methods:-

A prospective study was conducted at SCB medical college, Cuttack between June to December 2016. Patients attending ENT outpatient department with chief complain of decreased hearing and ear discharge were screened. Those patients having dry central perforation were chosen for the study. 82 patients were taken up for the study. All patients had detailed clinical examination, endoscopic examination, pure tone audiometry, as preoperative work-up and had postoperative follow-up with endoscopic or microscopic examination and pure tone audiometry at 3 months after surgery. Patients were randomly divided into two groups. Group A consisting of 38 patients underwent endoscopic tympanoplasty and Group B consisting of 44 patients underwent microscopic tympanoplasty. Either microscopic or endoscopic tympanoplasty were performed by experienced otologists.

Pure tone audiometry tests were performed at preoperatively and 3 months postoperatively. Hearing thresholds including air conduction and bone conduction were measured at 0.5, 1.0, 2.0 kHz, and the pure tone averages were calculated. TM perforation size was expressed as a percentage of the entire TM area using Image J software (National Institutes of Health, Bethesda, MD, USA)<sup>6</sup>. X-ray mastoid was done to know the cellularity of mastoid. Detailed operative data were collected including type of operation (ET, MT), operation time, visualization of middle ear structures, external auditory canal widening requirement. During the postoperative follow-up, pain scale score was collected immediately after surgery, at 3 hours, and 1 day postoperatively. The graft success rate was also determined. Pain scale was scored using an 11-item, patient-reported numeric rating scale of pain intensity (NRS-11, range 0 to 10)<sup>7</sup>. Graft success as well as healing status of the EAC was evaluated at 3 months. Tympanoplasties were performed under Local Anesthesia. Temporalis fascia was used as graft material in all microscopic and endoscopic tympanoplasty. Microscopic tympanoplasty were operated by post aural Approach. Endoscope assisted tympanoplasty were done through permeal approach. Zero degree & 30 degree 4 mm wide 10 cm long Hopkins rod endoscopes were used. All endoscopic surgeries were performed by direct visualization on the monitor.

Postoperative follow-up evaluations were performed after 1, 3, and 6 months; they included pure tone audiometry, and endoscopic or microscopic evaluation of the status of the graft. Hearing thresholds, including air conduction threshold and bone conduction threshold, were evaluated by the averages at 0.5, 1.0, and 2.0 kHz. The air-bone gap (ABG) was also calculated in each examination. Final assessment of graft uptake was done at 3 months and hearing was assessed by postoperative Pure tone audiometry. Successful results were to be considered as patient having complete graft uptake and post operative air bone gap  $\leq 15$  dB. Those patients not fulfilling above criteria were considered as failure.

## Results:-

**Table 1:-** Gender Distribution in both the groups:

GENDER	GROUP A (n=38)	GROUP B (n=44)	TOTAL
MALES	20	26	46

FEMALES	18	18	36
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**Table 2:-** showing age distribution:

AGE	GROUP A(n=38)	GROUP B(n=44)	TOTAL(n=82)
15-30 YEARS	17	23	40
30-45 YEARS	21	21	42

**Table 3:-** showing preoperative air conduction levels, bone conduction levels and the air-bone gap.

STUDY GROUP	PRE-OPERATIVE MEAN AIR CONDUCTION LEVELS	PRE-OPERATIVE MEAN BONE CONDUCTION LEVELS	MEAN A-B GAPS
GROUP-A	34.4 db	13.6db	20.8db
GROUP-B	38.6 db	16.0db	22.6db
P-VALUE			

**Table 3:-** Showing Properties In The Post –Operative Phase In Both The Groups

PROPERTIES	GROUP-A	GROUP-B
MEAN AIR-CONDUCTION	18.6db	18.8db
MEAN-BONE CONDUCTION	12.2db	12.6db
MEAN A-B GAP	6.4 db	6.2 db
MEAN OPERATION TIME	53 mins	64.2 mins
GRAFT FAILURE	1	1
IMPROVEMENT IN A-B GAPS	14.4 db	16.4 db
EAC WIDENING REQUIREMENT	0	2

### Discussions:-

In total 82 patients, comprising of 46 males and 36 females, 38 were subjected to endoscopic (ET) and 44 underwent the microscopic technique.

51 (62%) left ears and 31 (46%) right ears were analyzed.

Preoperatively, mean air conduction levels of the pathological ears in GROUP- A & GROUP-B were 34.4 dB and 38.6 dB respectively. The bone conduction levels of the pathological ears in GROUP -A and GROUP-B group were 13.6 dB and 16.0 dB respectively. There were no significant differences between the two groups. The ABGs were 20.8 and 22.6 dB respectively. Postoperatively, the mean air conduction level of the pathological ears in GROUP-A and GROUP-B were 18.6 dB & 18.8 dB respectively. The mean bone conduction levels in both the groups were 12.2 dB and 12.6 dB. The improvement in the A-B gaps were 14.4 & 16.4 dB for A & B GROUPS respectively. The results were statistically insignificant for all other variables ( $p < 0.05$ ) except the time requirement and the requirement for EAC widening ( $p = 0.06$ ).

The average operation time in ET group 53 minutes and in MT group was 64.2 minutes with a statistical significance. EAC widening was not necessary in the ET group and was performed in 3 patients in the MT group. Graft failure was found to be equal for both the groups.

The main goals of treatment for COM are to relieve symptoms, rehabilitate hearing, and minimize complications and drainage. Conventionally, tympanoplasty is performed under an operative microscope. The main advantages of the microscopic approach are stereo vision and bimanual handling. However, despite providing direct exposure, microscopes require frequent adjustment and may still not be sufficient when encountering protruding structures, particularly the anterior wall. Ayache 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.<sup>8</sup> This finding is similar to that of ours. In a study conducted by Furukawa et al<sup>9</sup> the circumference of the perforation could not be confirmed with a microscope before denuding in 12.0% of cases. Furthermore, the entire perforation was not visible in 20.0% of cases after refreshing the edges. The ear canal is narrow or protruding. Using a thin, rigid endoscope, a surgeon can perform minimally invasive procedures with protection of the anatomy, which allows for functional reconstruction during surgery. When exploring the middle ear, the endoscope approach can provide more information regarding the orifice of the tube, the incudostapedial joint, and

the round-window niche, which are usually difficult to observe under an operating microscope. The advantages of the endoscopic approach also include a decrease in the operative time, which results in a decrease of the duration of anesthesia and related side effects, and a lower effect on the surgeon's concentration. In a study by Ghaffar et al.<sup>10</sup> the mean operative time was 62.85 minutes among 34 patients who underwent endoscopic tympanoplasty. In our study, the mean operative time among the cases those received the endoscopic approach was 53.4 minutes, compared to 64.2 minutes for the microscopic approach; this shows a significant difference. In our institution, the preparation of the microscope and the time to harvest the graft and adjust the microscope were the major factors responsible for this difference. A higher level of experience can shorten the duration of surgery. Besides the patients who were operated through the endoscopic approach complained of lesser post-operative pain and were cosmetically more satisfied than those operated with the microscope.

### **Conclusion:-**

The use of endoscope in type-1 tympanoplasty can be advocated as an alternative approach to the use of microscope.

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