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A 5 YEAR PROSPECTIVE COMPARATIVE STUDY OF ENDOSCOPIC VERSUS MICROSCOPIC TYMPANOPLASTY IN A TERTIARY CARE CENTRE OF SOUTH INDIA.

Otorhinolaryngology

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ABSTRACT

CONTEXT: Type 1 tympanoplasty is one of the commonest performed surgeries by otolaryngologists across the world. Endoscopic ear surgeries (EES) are gaining more popularity in recent times. **AIMS:** The objective of this study is to evaluate the outcomes of endoscopic type 1 tympanoplasty and compare with that of microscopic tympanoplasty **SETTINGS AND DESIGN:** A prospective observational comparative study of two surgical techniques was conducted in a tertiary care hospital of south India from 2015- 2019. **METHODS AND MATERIAL:** All patients underwent type 1 tympanoplasty either endoscopic or microscopic using temporalis fascia graft. **STATISTICAL ANALYSIS USED:** Statistical package for the social sciences (SPSS) version 17 was used to analyse the data. Chi square test/Fisher's exact test was used to analyse the qualitative data. Student t test was used to analyse the quantitative data. **RESULTS:** A total of 152 patients who satisfied the study criteria were included in this study. 80 patients underwent endoscopic tympanoplasty (Group A), while 72 patients microscopic tympanoplasty (Group B). Both the groups were comparable with respect to age gender, size and location of perforation. The mean operative time for group A and group B were 45.3 ± 7.1 and 50.2± 8.1 mins respectively (P=0.01). Successful graft uptake was observed in 75/80(93.75%) and 68/72(94.4%) in group A and group B (P= 0.45). Mean pre and post operative ABG were 30.2 ± 3.2 dB &29.8± 3.6 dB and 11.6± 1.8 dB & 11.9± 2 dB respectively (p= 0.32 and P=0.24). Group A had better post-operative VAS scores(P=0.01) and lesser canalplasty requirement(p=0.04) **CONCLUSIONS:** In this study, the hearing results of endoscopic and microscopic tympanoplasty were comparable and no significant difference was observed. However, endoscopic tympanoplasty had better outcomes in terms of lesser canalplasty requirement and post operative pain scores.

KEYWORDS

Endoscopic Tympanoplasty; Endoscope Vs Microscope; Type 1 Tympanoplasty

1.INTRODUCTION:

Type I Tympanoplasty is a surgical procedure done to repair the perforated tympanic membrane with inspection of the ossicular integrity and middle ear status (1). Myringoplasty sounds similar but the surgeon grafts the tympanic membrane perforation without inspecting the middle ear. Type 1 Tympanoplasty is most widely preferred, while myringoplasty is preferred in patients where the aim is only to make ear dry especially in patients with co-existing neural deafness. Temporalis fascia is the commonly used graft material followed by perichondrium, cartilage, vein, periosteum and fat. Fascia is preferred because of its advantages like low basal metabolic rate, thinner nature, availability in larger size and no requirement of separate incision(2).

Microscopes have been the preferred option for most ear surgeries. However, recently endoscopic ear surgeries(EES) are gaining more popularity(3). The major limitations of microscope include lack of depth perception, narrow field of vision, difficult visualisation in narrow ear canals and bony overhangs which can be offset by endoscopes in ear surgeries(4–6). Surgeon operating using a single hand and requirement of a steep learning curve are considered as drawbacks for EES. EES have been evolving rapidly in the recent past and have been used beyond tympanoplasties and have been proven effective with acceptable results in mastoidectomy, stapedotomy and even lateral skull base surgeries(4). Further studies are required to analyse the results of endoscopic tympanoplasty, which is a basic surgical technique an otolaryngologist should know before venturing into more advanced ear surgeries. Most studies in literature are retrospective in nature and lack comparative groups. This study was designed to evaluate the outcomes of endoscopic type 1 tympanoplasty and compare with that of microscopic tympanoplasty.

SUBJECTS AND METHODS:

A prospective observational study comparing the two surgical techniques was conducted in a tertiary care hospital of south India from 2015- 2019. The following inclusion and exclusion criteria were used and patients were enrolled in the study.

Inclusion criteria:

1. Patients who require type 1 tympanoplasty for dry central perforations of ear drum using temporalis fascia graft.

Exclusion criteria:

1. Patients having cholesteatoma and ossicular chain discontinuity.
2. Patients requiring revision tympanoplasty or mastoidectomy.
3. Patients of age < 18 and >60 years.

Ethical committee clearance was obtained prior to the study. (IEC-231/2015). Informed consent was obtained from all the study participants. Patient's age, sex, size and location of tympanic membrane perforation, operative time, graft success rates hearing outcomes and complications were analysed. Based on the number of quadrants involved, perforations were classified as small (1 quadrant), medium (2 quadrants), large (3 quadrants) and subtotal (4 quadrants). Based on location, perforations were classified as anterior, posterior and anteroposterior with respect to handle of malleus. Hearing was assessed within a week of surgery using pure tone audiogram. Bone and air conduction thresholds were calculated at 0.5, 1 2 and 4 kHz and mean Air Bone Gap (ABG) was calculated. Post -operative hearing was assessed after 3 months. Operative time was considered as the time taken from beginning of graft harvest to placement of gelfoams in the ear canal. Patients were randomly divided into 2 groups based on surgical technique. Group A patients underwent endoscopic tympanoplasty while group B patients underwent microscopic tympanoplasty.

Surgical technique:

All patients were operated under general anaesthesia. In group A patients, a horizontal supra-aural incision was given about a cm above pinna and temporalis fascia was harvested. Then by using Karl Storz 0 °nasal telescope the ear drum was visualised. The margins of perforations were freshened. The tympanomeatal flap was elevated along with fibrous annulus. ossicular integrity was inspected by gently moving the ossicles and checking the round window reflex. Then the fascia graft was placed medial to handle of malleus by underlay

technique (Figure 1). The graft was stabilised using gelfoams in middle and external ear. The incision was closed in 2 layers.

In group B patients, temporalis fascia graft was harvested by post aural incision. Posterior meatotomy was done. Rest of the steps were similar as performed in Group A.

Statistical analysis:
Statistical package for the social sciences (SPSS) version 17 was used to analyse the data. Chi square test/Fisher's exact test was used to analyse the qualitative data. Mean and standard deviation (SD) were used to express the quantitative data. Student t test was used to analyse the quantitative data. "p" value <0.05 was considered significant.

RESULTS:
A total of 152 patients who satisfied the study criteria were included in this study. 80 patients underwent endoscopic tympanoplasty (Group A), while 72 patients underwent microscopic tympanoplasty (Group B).

The mean age of study was 35.9± 3.9 years (Group A -35.4 ±4.2 years; Group B- 36.2 ± 4years). Male: Female sex ratio in the study was 68: 44 (Table 1).

Location and size of perforation:
According to size, perforations were classified as small, medium, large and subtotal. The number of patients with respect to perforation size in group A and group B were 10:28:26:16 and 12:26:24:10 respectively (figure 2).

With respect to location, patients were categorised as anterior, posterior and anteroposterior. The number of patients in group A and group B were 22:18:40 and 26:16:30 respectively (Figure 3).

Outcomes:
The mean operative time in group A and group B were 45.3 ± 7.1 and 50.2± 8.1 mins respectively(P=0.01). This shows that Group A had significantly lower operative time when compared to Group B.

With regards to graft success, group A had 75/80(93.75%) success rate while group B had 68//72(94.4%) success. Though Group B had slightly higher success rates, the difference was not statistically significant (P= 0.45)

The mean pre-operative ABG in both groups were 30.2 ± 3.2 dB and 29.8± 3.6 dB respectively. The mean post-operative ABG in both groups were 11.6± 1.8 dB and 11.9 ± 2dB respectively. Both the groups had significant post operative ABG improvement (p<0.01 in both groups). However the difference in ABG closure between the 2 groups was not statistically significant.

Requirement of canalplasty and post operative pain scores:
1/80 (1.25%) required canalplasty in group A while 8/72(11.1%) in group B(P=0.04). Visual analog scale (VAS) scores were measured 24 hours after surgery. VAS scores were 1.5 and 5 respectively (P=0.01)

In group A, who had graft failures, 2/5 had subtotal, 2/5 had large and 1/5 had medium sized perforations.

In Group B, 2 had subtotal while 2 had large perforations.

Table 1 – table summarising results of the study.

Parameters	Group A	Group B	P value
Sample size	80	72	
Age	35.4± 4.2	36.2± 4	0.43
Male: female	37:43	31:41	0.06
Mean operative time	45.3 ± 7.1	50.2± 8.1	0.01
Size of perforation (small: medium: large: subtotal)	10:28:26:16	12:26:24:10	
Location of perforation	22:18:40	26:16:30	
Overall Success rate	75/80	68/72	0.45
ABG Pre-operative Post-operative	30.2 ± 3.2 11.6± 1.8	29.8± 3.6 11.9± 2	0.32 0.24
Requirement of canalplasty	1	8	0.04
Mean VAS scores (24 hours post op)	1.5	5	0.01

DISCUSSION:
Type 1 Tympanoplasty is a widely done surgery to treat COM mucosal disease by reconstructing the tympanic membrane and looking for the ossicular chain integrity and middle ear status. Conventionally the surgery was done with the microscope, with various approaches and graft materials mentioned earlier. EES has been gaining more popularity in the recent past. It offsets the disadvantages of microscope like narrow vision, requirement of canalplasty and increased morbidity. Though endoscopes have advantages like better visualisation and cosmesis it has few limitations(6–8). Single handedness and steeper learning curve are considered as its disadvantages. The success rates of endoscopic tympanoplasty ranges between 80-100%, while that of microscopic tympanoplasty ranges between 83-100%. However prospective cohort studies comparing the results of two techniques are lacking in literature.

A total of 152 patients were taken into the study according to the inclusion and exclusion criteria as discussed in materials and methods under standardised protocols after thorough history taking and clinical evaluation.

Tseng et al conducted a meta-analysis and concluded that the results of endoscopic tympanoplasty were comparable with microscopic tympanoplasty (graft success rates of 85.1 % vs 86.4%; mean difference of improvements of ABG: -2.73). They also concluded that canalplasty rates were significantly lower (0% vs 18.8%) in endoscopic groups(9).

Plodpai conducted a randomised controlled trial comparing the outcomes of endoscopic versus microscopic overlay tympanoplasties. He concluded that post operative pain was significantly lesser in endoscopic tympanoplasty groups. He also concluded that ABG closure was better with endoscopic technique especially in larger perforations because of better visualisation of middle ear structures(10).

Zhang et al and Huang et al did comparative studies of endoscope versus microscope and concluded that endoscopic tympanoplasties are minimally invasive and safer with comparable hearing outcomes(11).

Kaya et al conducted a randomized controlled trial comparing endoscopic versus microscopic tympanoplasty in patients with bilateral ear drum perforations. They concluded that endoscopic tympanoplasty offered significantly shorter operative time, lesser morbidity and post-operative pain(12).

Okhi et al conducted a case control study and concluded that Transcanal endocopic ear surgery (TEES) had similar outcomes as post auricular microscopic ear surgery (PAMES) when middle ear risk index score is low. However they concluded that TEES had better outcomes than PAMES when MERI scores are higher(13).

Interestingly Lucidi et al observed that surgeons shifting to endoscope from microscopic ear surgeries. They concluded that surgeons faced lot of challenges in initial 5 endoscopic ear surgeries following which the learning curve improved sharply and appeared to be reversing the initial trend(14).

Endoscopic Type I tympanoplasty when compared to Microscopic Type I tympanoplasty requires time to achieve expertise. Learning curve for Endoscopic Type I tympanoplasty is little longer, but once the expertise is acquired it becomes easier to handle the endoscope in tympanoplasty.

Endoscopic Type 1 tympanoplasty is useful in case of anterosuperior perforations which are difficult to visualise through microscopes. Endoscope is capable of negotiating bony overhangs in EAC reducing the need for canaloplasty.

CONCLUSION:
In this study, the outcomes of endoscopic and microscopic tympanoplasty were comparable and no significant difference was observed in terms of hearing gain and graft success rate. However, endoscopic tympanoplasty had better outcomes in terms of lesser canalplasty requirement and post operative pain scores To conclude, Endoscopic tympanoplasty is a suitable alternative to the conventional microscopic technique for Type I tympanoplasty.

Key Messages:

Endoscopic tympanoplasty is a versatile technique with results comparable to traditional microscopic tympanoplasty. The hearing results are desirable with lesser post-operative morbidity.

Acknowledgement: Nil

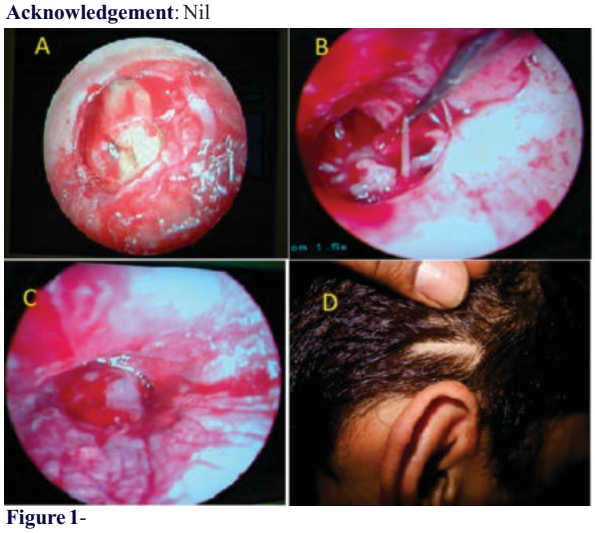

Figure 1-
Figure showing images of endoscopic tympanoplasty. A- endoscopic image of a large central perforation on left ear. B- visualization of ossicles and chorda tympani nerve after elevation of tympanomeatal flap. C- Graft placed by underlay technique. D- right sided supra-aural scar after 3 months.

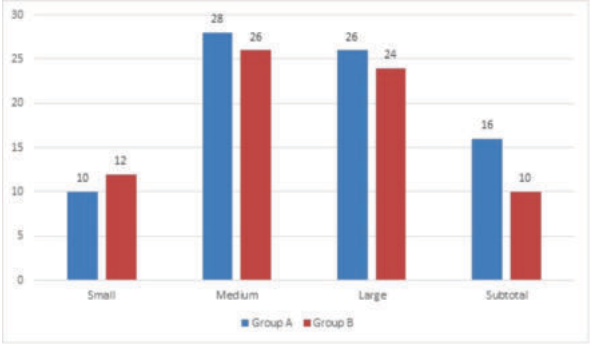

Figure 2 – Comparison Of Two Groups Based On Size Of Tympanic Membrane Perforation

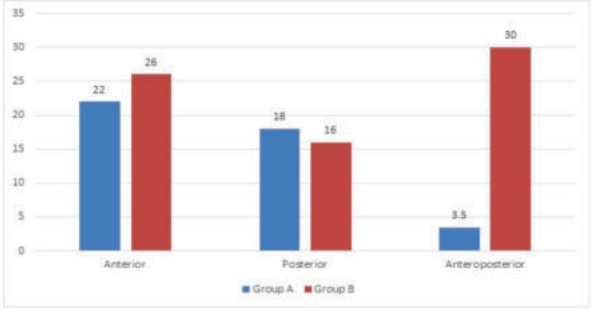

Figure 3 – Comparison Of Two Groups Based On Site Of Tympanic Membrane Perforation.

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