

## Original Research Article

# An overview of endoscopic stapedotomy in a tertiary care centre

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### ABSTRACT

**Background:** Stapedotomy is now one of the most popular and common surgeries done worldwide. Otosclerosis remains the most common single cause of conducting hearing loss in adult population. Females are more frequently affected than males with an approximate 2:1 ratio.

**Methods:** This study consists of 30 patients who underwent stapedotomy for otosclerosis. This study was conducted at Dr Shankarrao Chavan Government Medical College, Nanded, during the period of 2 years (2017-2019). Patients were evaluated and operated. The various anatomical variations, diagnostic dilemmas, intraoperative complications, its management and follow-up were done systematically.

**Results:** Age of patients included in this study ranged from 15 to 50 years. Youngest patient was a 17-year-old male. Age of presentation was most commonly seen in third decade of life. Male to female ratio was 1:2. The most common symptom was hard of hearing followed by tinnitus. In this study, 76.67% of the patient's had bilateral disease. 66.66% of patients had hearing loss between 41-55 dB with mean pre-operative pure tone average was 51.16 dB. About 80% of patients had successful air bone closure between 0-10 dB after the surgery.

**Conclusions:** Endoscopic stapedotomy seems a feasible and relatively safe surgical technique in limited case series. Cosmetically this procedure was more compliant by the patients however endoscopic stapedotomy requires a significant learning curve and an extreme expertise.

**Keywords:** Endoscopic, Otosclerosis, Stapedotomy, Air bone gap

### INTRODUCTION

Otosclerosis is the disease involving the otic capsule characterised by alternating phases of bone resorption and new bone formation was first described by Valsalva in 1704. Historically stapes surgery dates way back to 1853. It was Toynbee who gave the first description of ankylosis of stapes and changes that took place in the foot plate area. Traditionally stapedectomy is performed using operative microscope. Even though it is a time-tested procedure, it has its own drawbacks. In patients with excessive bony overhang it would be difficult to assess middle ear cavity. Whereas on endoscopic procedure there is excellent exposure with better resolution of

images and better visualization of entire middle ear cavity. Advantages of using endoscope include excellent exposure, visualization of entire middle ear cavity with ease, excellent crystal-clear images. All the steps of stapedectomy could easily be performed using endoscope. The prevalence of clinically apparent otosclerosis is 0.3 to 0.5%.<sup>1,2</sup> Otosclerosis has 1.4 to 2 times the incidence in women as compared to men. Otosclerosis will eventually involve both ears in 85 to 90% of patients. The treatment modalities include medical and surgical management. Medical management is usually indicated in patients with active foci and when the patient is not fit for surgery like old debilitated patients, unilateral dead ear etc. While surgical management is more widely accepted and practiced.

Stapedotomy is the new procedure of choice. Previously stapedectomy was widely followed. Endoscopic Stapedotomy has an added advantage over microscopic procedure as it is a scar less surgery, patient compliance is better, hospital stay of patient is reduced and therefore the cost. With the help of endoscope the difficult angles can be easily approached.

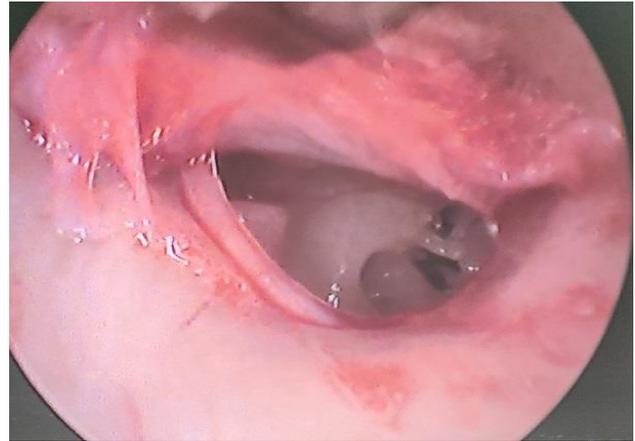
## METHODS

This study is a prospective cross-sectional observational study of patients with conductive hearing loss who were expected to undergo stapedotomy at the Department of Otorhinolaryngology of Dr Shankar Rao Chavan Government Medical College, Nanded between January 2018 to June 2019. Institutional Ethics Committee approval for the study was obtained.

Patients included in this study were those diagnosed with otosclerosis and fulfilled the following criteria of having normal external ear canal, normal otoscopy and the audiograms showing conductive hearing loss, normal bone-conduction thresholds at 500, 1000, 2000, and 4000 Hz, and absent stapedius reflex on impedance audiometry (4) Absent history of past middle ear infection diseases. Patients not fulfilling the inclusion criteria or requiring a revision surgery or surgery on the only hearing ear were excluded.

All patients with complains of decreased hearing with intact tympanic membrane will be subjected for pure tone audiometry (PTA). Patients showing conductive deafness on PTA will be further subjected to Impedance audiometry. Patients showing “As” or “A” type of graph were diagnosed as a case of otosclerosis and are included in study. After diagnosing otosclerosis patients will be considered for Endoscopic Stapedotomy. All routine investigations will be done. Pre anaesthetic evaluation (PAE) will be done. After PAE, patient will be posted for surgery. After which endoscopic stapedotomy will be performed by using teflon piston. After the surgery, all patients will be discharged on the same day as a day care procedure except patients with post-operative vertigo will be discharged on 2nd post-operative day and will be recalled in ENT OPD after 7 days. PTA will be done at 1st and 3rd month.

Following the above procedures, the findings were recorded in the proforma (case record form). These findings were entered in Microsoft Excel 2010. Statistical analysis was carried out with the help of SPSS (version 20) for Windows package (SPSS Science, Chicago, IL, USA). The results were compiled by using suitable tables and graphs wherever necessary. The variations were analyzed as a percentage of the total and reported. Quantitative data is presented with the help of mean, standard deviation qualitative data is presented with frequency and percentage tables. Charts and diagrams were drawn wherever necessary.



**Figure 1: Elevation of tympanomeatal flap during endoscopic stapedotomy.**



**Figure 2: Crimping of teflon piston during endoscopic stapedotomy.**

## RESULTS

Total number of patients in study was 30. Out of which 23.33% of patients were in age group of 26-30, whereas 20% of patients were between the age of 21 and 25. According to our observation maximum number of patients are in third decade of life (43.33%). Minimum age of the patient in the study was 17 years and maximum being 46 years. There were 5 (16.66%) patients each in age group of 15-20 and 41-45, whereas 4 patients and 2 patients in 31-35 years and 36-40 years respectively (Table 1).

Maximum patients in this study were females 20 (66.66%) as compared to males 10 (33.34%). Ratio of male to female being 1:2 (Table 2).

All the patients in the study either have moderate degree of hearing loss 16 (53.33%) or moderately severe type of hearing loss 14 (46.66%). None of the patient was having minimal, mild, severe or profound hearing loss. Among males 6 (60%) had moderate hearing loss and 4 (40%) had moderately severe hearing loss while 10 (50%) out of

20 females were having moderate hearing loss and 10 (50%) had moderately severe hearing loss as per the pure tone audiometry results (Table 3).

**Table 1: Age distribution amongst the study subjects.**

Age in years	Number of patients	Percentage
15-20	5	16.66
21-25	6	20
26-30	7	23.33
31-35	4	13.33
36-40	2	6.66
41-45	5	16.66
46-50	1	3.33
<b>Total</b>	<b>30</b>	<b>100</b>

27 patients (90%) had intraoperative finding of immobile stapes. 1 (3.33%) patient each had finding of absent stapes suprastructure, dehiscent facial canal, absent stapes footplate (Table 4). Out of 30 patients 0.5 mm Teflon

piston were used in 18 (60%) patients whereas 0.4 mm piston were used in 12 (40%) of patients (Table 5).

**Table 2: Gender distribution amongst the study subjects.**

Sex	Number of patients	Percentage
Male	10	33.34
Female	20	66.66
<b>Total</b>	<b>30</b>	<b>100.00</b>

As mentioned earlier pre-operative PTA and air bone (AB) gap was  $53.03 \pm 5.56$  and  $35.16 \pm 7.24$ . After which the study subjects were subjected to surgery and were evaluated at 4th and 12th post-operative week. At 4th post-operative week PTA and AB gap were  $42.90 \pm 4.11$  and  $25.66 \pm 4.86$  whereas at 12th post-operative week PTA and AB gap were  $39.86 \pm 3.88$  and  $23.13 \pm 5.94$ . These pre and post-operative findings were subjected to paired T test and was found to be statistically significant ( $p < 0.05$ ) (Table 6).

**Table 3: Degree of hearing loss on the basis of pure tone audiometry.**

Hearing loss (in dB)	Right		Left		Bilateral		Total
	Male	Female	Male	Female	Male	Female	
Minimal (15-25)	00	00	00	00	00	00	00
Mild (26-40)	00	00	00	00	01	00	01
Moderate (41-55)	01	00	02	02	03	12	20
Moderately severe (56-70)	00	00	01	01	02	05	09
Severe (71-90)	00	00	00	00	00	00	00
Profound (>91)	00	00	00	00	00	00	00
<b>Total</b>	<b>01</b>	<b>00</b>	<b>03</b>	<b>03</b>	<b>06</b>	<b>17</b>	<b>30</b>

**Table 4. Intraoperative findings among study subjects.**

Intraoperative findings	Number of patients	Percentage
Immobile stapes	27	90
Absent stapes suprastructure	01	3.33
Dehiscent facial canal	01	3.33
Absent stapes footplate	01	3.33
<b>Total</b>	<b>30</b>	<b>100</b>

**Table 5. Teflon piston size used intraoperatively among study subjects.**

Piston size (in mm)	Number of patients	Percentage
0.4	12	40
0.5	18	60
<b>Total</b>	<b>30</b>	<b>100</b>

**Table 6: Preoperative and postoperative hearing finding (n=30).**

	Preoperative		After 4 weeks		After 12 weeks		Paired T test result
	Mean±SD	Min-Max	Mean±SD	Min-Max	Mean±SD	Min-Max	T value, Sig. (2 tailed)
PTA	$53.03 \pm 5.56$	35-60	$42.90 \pm 4.11$	30-50	$39.86 \pm 3.88$	30-48	9.88, 0.00001
AB gap	$35.16 \pm 7.24$	10-50	$25.66 \pm 4.86$	20-35	$23.13 \pm 5.94$	10-30	14.29, 0.000001

## DISCUSSION

After thorough evaluation of 30 patients with otosclerosis we found that more than 43% patients were in between 21-30 years followed by 19.99% patients were 31 to 40 years and 41 to 50 years each. The third decade was the most common age group of presentation. This data was quite similar to a study by Kumar et al and Rao et al wherein third decade was the most common age of presentation.<sup>3,4</sup> Out of 30 patient's male to female ratio came out to be 1:2, Nematy et al in his study concluded male to female ratio as 1:2, which is similar to our study. In our study 76.67% of patients had disease in both ears.<sup>5</sup> Similar to a study done by Kumar et al, where in 83.7% of patients had disease in both ears.<sup>3</sup> In our study 100% of patients had impaired hearing which is similar to a study done by Rao et al, 3.33% of patients reported with giddiness along with impaired hearing in our study whereas Rao et al reported 11.6%.<sup>4</sup> In a study conducted by Skarzynski et al, 68.2% of patients had symptoms of tinnitus and impaired hearing while in our study subjects 56.67% had symptoms of tinnitus and impaired hearing.<sup>6</sup> All the patients in the our study had intact tympanic membrane. 16.66% patients had myringosclerosis whereas in a study done by Kumar et al, 8.16% of patients had myringosclerosis.<sup>3</sup> On hearing assessment of patients we found that. 66.66% patients had moderate hearing loss (41 to 55 dB hearing loss). Mean pre-operative pure tone audiogram air conduction threshold level was  $51.16 \pm 7.86$  dB in present study whereas in a study done by Crompton et al, mean air conduction threshold level was found to be 57 dB, which is similar to observation of our study.<sup>7</sup> When the patients in our study were subjected to impedance audiometry we observed that 53.34% patients had type A tympanogram whereas 46.66% had type As type of tympanogram. This observation is quite similar to a study done by Kumar et al<sup>3</sup> who observed that type A tympanogram is found in 55.08% of the patients and as type of tympanogram is seen in 42.86% of the patients. As the middle ear aeration is un-affected in otosclerosis type a tympanogram is seen usually and "as" type of curve is seen in later stages. Out of 30 patients in study 53.33% patients had an AB gap between 31 to 40 decibels similar to results of Kumar et al<sup>3</sup> who reported 55.10% patients in similar range of AB gap. Mean AB gap was  $35.16 \pm 7.25$  dB (mean $\pm$ SD). We used Teflon piston in all patients. 0.4 mm diameter piston was used in 40% and 0.5 mm diameter piston was used in 60% patients. Neha et al concludes in her study that 0.4 mm piston diameter is best suited for obtaining adequate air-bone gap closure which is found to be similar in our study as well.<sup>8</sup> 4.5 mm length of piston was most commonly used in present study which is similar to a study done by Kumar et al where 4.5 mm length was used most frequently.<sup>3</sup> Endoscopic stapedotomy was performed on 30 patients out of which only 2 patients had intra-operative complications. One patient (3.33%) had an iatrogenic tear in tympanic membrane, whereas one patient suffered from a complication of perilymph leak. In our study 3.33% patients had abnormal facial nerve

(overhanging facial nerve) which was consistent with 3.125% reported by Fakir et al.<sup>9</sup> Kumar et al reported 10.2% patients with abnormal facial nerve.<sup>3</sup> Due to low prevalence of otosclerosis worldwide and less sample size there are inconsistent findings. 16.67% patients complained of post-operative complaints of vertigo as compared to 7.5% reported by Rao et al in his study.<sup>4</sup> Vertigo was managed conservatively with labyrinthine sedatives and was relived in 2 days. Mean post-operative AB gap in present study was  $25.66 \pm 4.866$  dB (mean $\pm$ SD) compared to mean post-operative AB gap of  $19.73 \pm 14.067$  (mean $\pm$ SD) in a study done by Ramalingam et al.<sup>13</sup> This difference is due to a longer follow up period of Ramalingam et al.<sup>13</sup> In present study 80% patients had AB closure between 0-10 dB which is considered a success according to a grading given by Kartush.<sup>14</sup> Similar results were established in studies done by Rao et al, Kumar et al, Moneir et al, Özdek et al, Dursun et al where 70%, 72.2%, 71.4%, 79%, 61.3% respectively were the success rates (Table 7).<sup>3,4,10,11,14</sup>

**Table 7: Grades of AB closure by Kartush.<sup>14</sup>**

AB gap closure (in dB)	Number of patients	Inference	Percentage
0-10	24	Excellent	80
10-20	06	Good	20
20-30	00	Fair	0
>30	00	Poor	0

## CONCLUSION

Endoscopic stapedotomy seems a feasible and relatively safe surgical technique and is possible to perform a transcanal endoscopic procedure nearly in all patients, even in the cases, which have narrow ear canal and bony overhangs. Overall procedure timing was between 60 to 90 minutes. Patients had significant improvement in terms of hearing. However endoscopic stapedotomy requires a significant learning curve and an extreme expertise.

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