

THE EFFICIENCY OF STAPEDOTOMY FOR OTOSCLEROSIS TREATMENT

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Article Received on 27/07/2020

Article Revised on 17/08/2020

Article Accepted on 07/09/2020

ABSTRACT

Introduction: This study reviews the cases of stapedotomy and evaluates its effectiveness at improving hearing loss in patients with otosclerosis. **Objectives:** This study aims to hearing improvement after stapedotomy and evaluation of tinnitus. **Materials and methods:** Prospective study of patients who had clinical and audiometric diagnosis of otosclerosis from November 2016 to November 2017. **Results:** A total of 12 stapedotomy surgeries (unilateral) were studied. Average post-operative ABG for 0.5, 1 and 2 KHz showed that 50 % had complete closure of ABG (ABG < 10 dB) and 41.6% had closure of ABG to within 20dB. 91.6% had hearing improvement and 83.3% had ABG closure greater than 10 dB postoperatively. Only 8.3% had hearing deterioration. 41.6% of the patients reported complete remission of tinnitus. 33.3% of the patients had decreased and 8.3% had increased tinnitus. 16.6% had no change of tinnitus. **Conclusion:** Stapedotomy is an effective surgical procedure for the treatment of otosclerosis which leads to improvement in patient's quality of life. A favorable hearing outcome can be obtained by the combination of experienced hands with minimal surgical trauma and appropriate surgical technique.

KEYWORDS: Otosclerosis, Stapedotomy, conductive hearing loss, air-bone gap (ABG), tinnitus.

INTRODUCTION

Otosclerosis is a primary disease of the temporal bone that leads to fixation of stapes by abnormal bony deposit. Hearing loss and Tinnitus are the main symptoms. Treatment includes surgery, medical treatment, and sound amplification therapy alone or in combination.^[1-3] John Shea in 1956 first to perform stapedectomy and introduced concept of ossicular chain reconstruction, oval window vein graft and Teflon prosthesis. The use of the piston prosthesis soon followed with the development of the small-fenestra stapedotomy technique in the early 1970s.^[4] In 1978, the small-fenestra technique was further refined to incorporate the use of a laser to make the fenestra.^[5] Over time, there were many modifications in the material and architecture of stapes prostheses. The piston style prosthesis, however, remains the dominant device in use today. A recent study that examined the competence of novice and experienced surgeons in performing stapedectomy revealed substantial differences in their respective skill sets, thus supporting this contention.^[6] From this review, it is clear that otosclerosis is a major pathological diagnosis associated with tinnitus, and this symptom is very common in otosclerosis patients. Even though some papers have

been published about the effect of stapes surgery on tinnitus, we still need to clarify important issues regarding tinnitus, otosclerosis, and stapes surgery: What is the prevalence of tinnitus in otosclerosis patients? What proportion of the symptom is severe disabling tinnitus (SDT)? Do patients with SDT improve after stapes surgery? If so, for how long? We have attempted to answer these questions in a prospective study. We quantified tinnitus on a visual analog scale^[1-10] preoperatively and after stapes surgery at two points: 4--14 months and 14-48 months postoperatively. We studied gender, age, and several audiometric parameters, searching for correlations with tinnitus changes after stapes surgery. In this study our main goal is to evaluate the efficiency of stapedotomy for otosclerosis treatment.

Objectives**General objective**

- To assess the efficiency of stapedotomy for otosclerosis treatment.

Specific objective

- To detect laterality of the ears.
- Hearing improvement after stapedotomy

- Evaluation of tinnitus.

METHODOLOGY

Type of study	Prospective observational longitudinal study
Place of study	National Institute of Ent, Tejgaon, Dhaka, Bangladesh
Study period	November 2016 to November 2017 (One year)
Study population	Twelve cases were selected by random sampling
Sampling technique	Purposive

Inclusion Criteria

- **Otomicroscopy:** TM Intact
- **Tuning fork tests:** Rinne negative
- **Audiometric tests:**
BC level 0-25dB,
AC level 45-65dB and
ABG 15dB or more

Exclusion Criteria

- Hearing loss >65dB
- Cochlear otosclerosis

MATERIALS AND METHODS

Stapedotomy were done from November 2016 to November 2017 at National Institute of ENT. Diagnosis of otosclerosis was based on the history, clinical examination, otoscopic and microscopic examinations, Tuning fork and Audiometric tests. We compiled data on the preoperative and postoperative Air-Bone gap (ABG) at 0.5, 1 and 2 KHz. The ABG was calculated using AC and BC thresholds on the same audiogram. Postoperative hearing gain was then calculated from the ABG before the operation minus the ABG of the last follow-up examination.

A questionnaire was made for Tinnitus:

- Complete remission
- Decreased
- Increased
- No change of tinnitus
- Follow up after surgery:
 - 1st Follow up: At 1st Week, Stitch off, Pack removal, Tuning fork test
 - 2nd Follow up: At 4th Week, Otoscopic examination, Tuning fork test, Audiological tests
 - 3rd Follow up: At 8th Week, Otoscopic examination, Tuning fork test, Audiological tests

Statistical analysis

- Collected data was collated and appropriate statistical analysis was done using computer-based SPSS (Statistical program for scientific study) package.

RESULTS

A total of 12 stapedotomy surgeries (unilateral) were studied.

In Table 1 shows age range of the patients where 7(58.33) % patients belong to 15-30yrs old age group

and 5(41.66%) belong to 31-45yrs old age group. The following table is given below in detail:

Table 1: Age distribution of the patients.

Age range	No. of patients	Percentage (%)
15-30yrs old	7	58.33%
31-45yrs old	5	41.66%
Total	12	100%

In figure 1 shows gender distribution of the patients where male patients were 06(50%) and female patients were 06(50%). The following figure is given below in detail

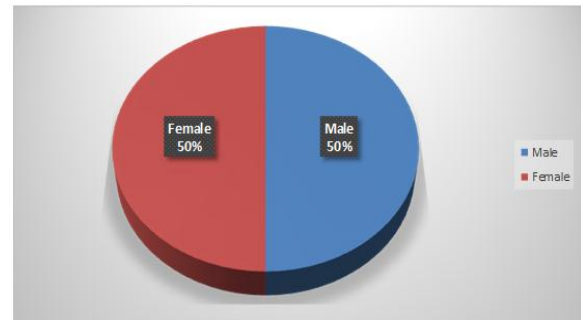


Figure-1: Gender distribution of the patients.

In figure 2 shows laterality of the ears where left ear was 41.66% and right ear was 58.33%. the following figure is given below in detail:

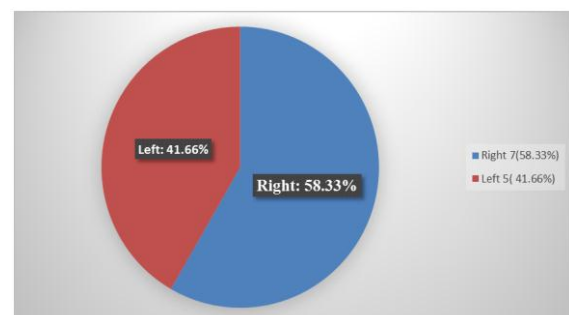


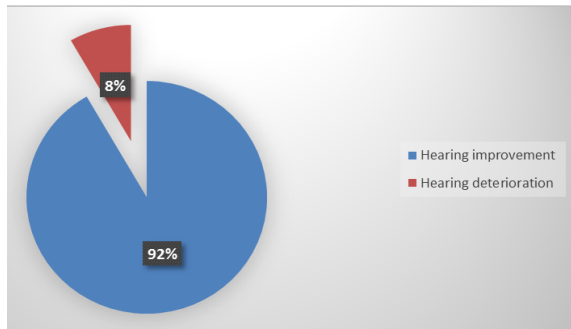
Figure-2: Laterality of the ears.

In table 2 the average post-operative ABG for 0.5, 1 and 2 KHz showed that 50 % had complete closure of ABG, 41.1% had within 20dB and 8.3% had >20dB ABG. The following table is given below in detail:

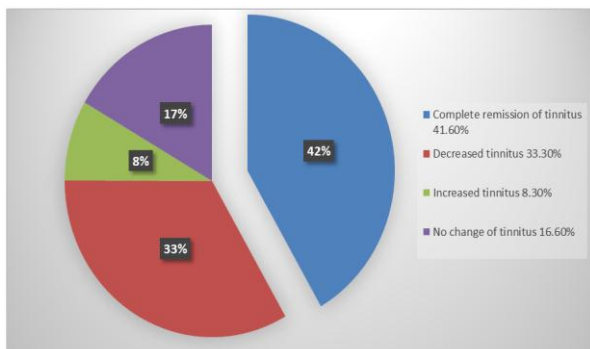
Table 2: Average post-operative ABG.

Air Bone gap	No. of Patients with Total Remission (%) ¹
ABG<10dB	50%
ABG within 20dB	41.1%
ABG>20dB	8.3%

In figure 3 shows hearing status of the patients where 91.6% of patients had hearing improvement and 8.3% of patients had hearing deterioration. The following figure is given below in detail:

**Figure-3: Hearing status of patients.**

In figure 4 shows overall status of tinnitus after surgery, where after surgery complete remission of tinnitus were 41.60%, decreased tinnitus were 33.30%, increased tinnitus were 8.30% and no change of tinnitus were 16.50%. The following figure is given below in detail:

**Figure-4: Overall status of tinnitus after surgery.**

DISCUSSION

In our study 7(58.33) % patients belong to 15-30yrs old age group and 5(41.66%) belong to 31-45yrs old age group. Also, 50% were male and 50% were female. In one study reported mean age of the patients was 44.5 year and 58% were female.^[7]

During the study, average post-operative ABG for 0.5, 1 and 2 KHz showed that 50 % had complete closure of ABG, 41.1% had within 20dB and 8.3% had >20dB ABG. In one study reported that, after surgery ABG improved in all frequencies on immediate postoperative care ($p < 0.01$). ABG changed with time, and tended to increase at 1000, 2000, and 4000 Hz, albeit.^[8]

During the study we found that 91.6% of patients were hearing was improved in 91.6% patients and 8.3% of patients had hearing deterioration. Which was supported by one study.^[7] Another study reported that, after surgery on late follow-up, 49% of the patients had normal hearing or mild hypoacusis and therefore did not require hearing aids. Only 14.6% of the patients reported subjective hearing worsening, but none wore hearing aids in their operated ears.^[8]

One study mentioned in their study that, 26 patients contacted from 14 to 48 months after surgery reported no change in tinnitus status in relation to early follow-up. Seven of these patients had SDT before surgery. Six patients had an airborne gap greater than 20 dB after surgery.^[7] Another article said that, they found better results for tinnitus abatement with stapedotomy than with stapedectomy.^[9] One article said that, 2.9% incidence of worsening of tinnitus after surgery.^[10] In our study after surgery complete remission of tinnitus were 41.60%, decreased tinnitus were 33.30%, increased tinnitus was 8.30% and no change of tinnitus were 16.50%.

we can say that tinnitus is a very prevalent and significant symptom in otosclerosis patients. we find no difference between male and female patients. Possibly women are more sensitive to the symptom and therefore have a heightened perception of tinnitus, or cochlear otosclerosis is more severe among them. Age did not influence the incidence of tinnitus in otosclerosis patients preoperatively or affect reduction of the symptom postoperatively. Larger air-bone gaps preoperatively had no influence on the intensity of tinnitus but correlated with greater decrease of the symptom (including SDT) after successful surgery. Lower preoperative bone conduction correlated with a higher incidence of SDT preoperatively and a higher number of total remissions in SDT patients after surgery. the only way in which stapes surgery can influence tinnitus in otosclerosis patients is by changing the conductive part of the equation. This is precisely what we found in our patients: Larger preoperative gaps when closed by successful stapes surgery allow effective masking of the symptom.

CONCLUSION

Stapedotomy is an effective surgical procedure for the treatment of otosclerosis which leads to improvement in patient's quality of life. A favorable hearing outcome can be obtained by the combination of experienced hands with minimal surgical trauma and appropriate surgical technique.

Limitations: Small study population and short period of time.

CONFLICTS OF INTEREST: The authors have no funding, financial relationships, or conflicts of interest to disclose.

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