Hearing status before and after Stapes surgery in otosclerotic patients

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Abstract

**Background:** Otosclerosis is a disease of the otic capsule that is characterized by resorption and redeposition of bony tissue. Stapes surgery has established its position as the primary treatment of conductive hearing loss in otosclerosis. It is anticipated that the hearing level of approximately 90% of patients should improve after surgery.

**Objective:** To evaluate the hearing status of an otosclerotic patient and compare their preoperative and postoperative hearing status.

**Methods:** In this prospective study, 34 patients with otosclerosis from head-Neck Surgery department of Sir Salimullah Medical College & Mitford Hospital, Bangladesh ENT Hospital, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka. Period from January 2008 to December 2008. The patients were examined and hearing assessment after admission into the hospital pre-operatively and in the post operative period.

**Results:** In this study most of the cases were age group 21-30 years (50%), male (64-71%), middle socio economic condition (67-71%), rural (58-82%), primary educated (35-29%). It was observed that most common symptom was progressive deafness, duration of hearing loss was 2-5 years, pre-operative conductive type of hearing loss (50-55 dB). It was also observed that after surgery, hearing status were improved in 82.35% cases, the most of the patients were within 21-30 years age group.

**Conclusion:** Stapedotomy obtaining closure of the air-bone gap to within 10dB of the pre-operative bone conduction level in 90% of their patients. So, it is superior to other procedures.

**Key words:** Otosclerosis, conductive hearing loss, A-B gap, Stapedotomy.

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fenestration) and then total ankylosis of the stapes resulting in conductive hearing loss. It is the most common etiology of conductive hearing loss in 15-50 years old patients with intact tympanic membrane. A higher incidence of the disease in families and homozygotic twins. Women are frequently affected by this pathology than men in at a 2:1 ratio.

Stapes surgery has established its position as the primary treatment of conductive hearing loss in otosclerosis. Stapes surgery gained its actual definition in the 1950s with the stapedectomy operation proposed by Rosen in 1953 and the stapedotomy operation introduced by Shea. Adequate bones conduction is a fundamental prerequisite for a successful outcome of a subsequent operation for Otosclerotic disease. Surgery may be inadvisable in cases in which there is pre-existing bone conduction deficit. Complications following stapes surgery are rare.

The techniques used for stapes surgery have evolved gradually over four decades, with multiple variable to contend with including fenestration size and technique, graft material, prosthesis diameter and design, tendon repair, pathological severity and surgical expertise. Regardless of the technique, it is anticipated that the hearing level of approximately 90% of patients should improve after surgery and that less than 1% of patients should have severe sensorineural hearing impairment following surgery.

**Objectives**

1. To evaluate the hearing status of an otosclerotic patient at the time of presentation.
2. Comparison between pre-operative and post-operative hearing level.

**Methods**

Type of study: Prospective study.

Number of cases: 34

Study population: Patients admitted in the hospital with Otosclerosis for stapes surgery.

Duration of study: January 2008 to December 2008.

Places of study: Department of Otolaryngology and Head-Neck Surgery in Sir Salimullah Medical & Mitford Hospital, Dhaka, Bangladesh ENT Hospital, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka.

**Inclusion Criteria:**

- Air bone gap was not less than 20 dB.
- Air conduction loss was not more than 70 dB.
- Bone conduction loss was not more than 30 dB.

Exclusion criteria: Patients dropped out from follow up.

Data collection method: By questionnaire, clinical examination and audiological investigations.

Data analysis: By computer and manual calculator.

## Results

### Table I

*Age of patients (n=34)*

| Age         | 11-20 years | 21-30 years | 31-40 years | 41-50 years |
|-------------|-------------|-------------|-------------|-------------|
| Number of patients | 2           | 17          | 13          | 2           |
| Percentage  | 5.88%       | 50%         | 38.23%      | 5.88%       |

Most common age group were 21-30 years (50%). This table shows 22 (64.71%) patients were male.
Table II
Common symptoms of patients (n=34)

| Symptoms               | No of patients | Percentage |
|------------------------|----------------|------------|
| 1. Progressive Deafness| 34             | 100%       |
| 2. Tinnitus            | 4              | 11.76%     |
| 3. Vertigo             | 08             | 23.53%     |
| 4. Paracusis willisii  | 32             | 94.12%     |

Most common symptom was progressive Deafness.

Table III
Duration of Hearing loss

| Duration of Hearing loss | No. of patients | Percentage |
|--------------------------|-----------------|------------|
| Less than 1 year         | 4               | 11.76%     |
| 1-2 years                | 10              | 29.41%     |
| 2-5 years                | 12              | 35.29%     |
| 5 years to 10 years      | 8               | 23.53%     |

Most common duration of hearing loss was 2-5 years (35.29%)

Table IV
Hearing status before surgery

| Age in yrs | No. of patients | Mean AC | Mean BC | AB gap |
|------------|-----------------|---------|---------|--------|
| 11-20      | 2               | 45dB    | 15dB    | 30dB   |
| 21-30      | 17              | 50dB    | 20dB    | 30dB   |
| 31-40      | 13              | 55dB    | 20dB    | 35dB   |
| 41-50      | 2               | 65dB    | 25dB    | 40dB   |

Most of the patients had conductive type of hearing loss in between 50-55 dB.

Table V
Complications of Surgery

| Name of complications                  | No. of patients | Percentage |
|----------------------------------------|-----------------|------------|
| 1. Facial Nerve palsy                  | 01              | 2.94%      |
| 2. Perilymph Fistula                   | 0               | 0          |
| 3. Dead ear                            | 0               | 0          |
| 4. Tinnitus                            | 0               | 0          |
| 5. Significant Vertigo                 | 0               | 0          |
| 6. Chorda tympani nerve injury (taste disturbance) | 03              | 8.82%      |
| 7. Tympanic Membrane Perforation       | 0               | 2.94%      |
| 8. Infection                           | 0               | 0          |

Most common complication was chorda tympani nerve injury (8.82%)
Table VI

Hearing status after surgery

| Age in yrs | No. of patients | Mean AC | Mean BC | AB gap |
|------------|-----------------|---------|---------|--------|
| 11-20      | 2               | 45dB    | 15dB    | 30dB   |
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Table VI

Hearing status after surgery

| Age in yrs | No. of patients | Mean AC | Mean BC | AB gap |
|------------|-----------------|---------|---------|--------|
| 11-20      | 2               | 25dB    | 15dB    | 10dB   |
| 21-30      | 12              | 25dB    | 15dB    | 10dB   |
|            | 02              | 25dB    | 20dB    | 05dB   |
|            | 03              | 50dB    | 20dB    | 30dB   |
| 31-40      | 10              | 30dB    | 15dB    | 15dB   |
|            | 03              | 55dB    | 20dB    | 35dB   |
| 41-50      | 02              | 40dB    | 25dB    | 15dB   |

Table shows hearing status were improved in 28 cases (82.35%).
Table VII
Comparison between pre-operative and post-operative hearing status.

| Age in yrs | No. of patients | Mean AC | Mean BC | AB gap |
|------------|-----------------|---------|---------|--------|
| 11-20      | 2               | 25dB    | 15dB    | 10dB   |
| 21-30      | 12              | 25dB    | 15dB    | 10dB   |
|            | 02              | 25dB    | 20dB    | 05dB   |
|            | 03              | 50dB    | 20dB    | 30dB   |
| 31-40      | 10              | 30dB    | 30dB    | 15dB   |
|            | 03              | 55dB    | 55dB    | 35dB   |
| 41-50      | 02              | 40dB    | 40dB    | 15dB   |

Table shows hearing status were improved in 28 cases (82%.35%).

Table VIII
Comparison between preoperative and postoperative Hearing status

| Age in years | No. of patients | Preoperative AB gap | AB gap | Hearing surgery status after | Percentage |
|--------------|-----------------|---------------------|--------|------------------------------|------------|
| 11-20        | 2               | 30dB                | 10dB   | Improved                     | 5.88%      |
| 21-30        | 12              | 30dB                | 10dB   | Improved                     | 38.29%     |
|              | 02              | 30dB                | 05dB   | Improved                     | 5.88%      |
|              | 03              | 30dB                | 30dB   | Not Improved                 | 8.82%      |
| 31-40        | 10              | 35dB                | 15dB   | Improved                     | 35.29%     |
|              | 03              | 35dB                | 35dB   | Not Improved                 | 8.82%      |
| 41-50        | 02              | 40dB                | 15dB   | Improved                     | 5.88%      |

Hearing status improved in most of the patients within age of 21-30 years.

Table IX
Hearing results in patients with otosclerosis treated by stapedotomy

| Parameter     | Preoperative | Postoperative | Improvement |
|---------------|--------------|---------------|-------------|
| Air conduction| 52.5dB       | 32.21dB       | 20.29 dB    |
| Bone conduction| 20dB        | 16.76dB       | 3.24dB      |
| Air bone gap  | 32.5         | 15.44dB       | 17.06dB     |

Discussion
In the series most common age group was 3rd decade. The next common group was 4th decade. This is supported by Gray and Smyth. The sex ratio varies from series to series. But our finding is almost similar to Lid and Cao.

In the present series the common symptoms were progressive hearing loss (100%), tinnitus (11.76%) and vertigo (23.53%). This
is supported by most of authors like Katjenmayer, Smyth and Gray\textsuperscript{2,5,11}. The paracusis Willisii was noticed by most of the patients (32) this finding is similar to most authors (Ozgirgin)\textsuperscript{6}. Here 12 patients (35.29\%) had hearing loss of 2-5 years duration and 8 patients (23.53\%) had hearing loss of 5-10 years duration.

In this series one patient (2.94\%) had facial palsy which was transient in nature and taste disturbance occurred in 3 cases due to injuries to chorda tympani nerve. Li and Fisch observed similar type of injuries\textsuperscript{4,12}.

Analysis of the audiological results showed that most study patients achieved considerable auditory gain after surgical operation. The presented data demonstrates a major improvement of air bone gap in younger patients. Among the improvement, the largest improvement was of 25 dB and least improvement was of 20 dB.

Hearing gain was obtained in 28 cases that is about 20-25 dB and no gain was recorded in 6 cases. Improvement was 82.35\% where as no improvement was 17.65\%. There was no reported case of deterioration of hearing in this study. This findings correlates with the findings of MH Baradaranfar and P Dabirmoghaddam, Mahfuz Z and Lokman S, Song HM, Choi SJ and Lee KS\textsuperscript{13}. None of the patients complained of significant vertigo and tinnitus in post operative follow up. This indicates that hearing status was improved after stapes surgery in otosclerotic patients.

**Conclusion**

There has been much debate regarding results of total stapedectomy vs. partial stapedotomy vs. stapedotomy. Recent stapedotomy technique (with fewer complications) and thus there has been a recent shift toward this procedure. Most consider stapedotomy to be technically easier to perform with less potential damage to the vestibule. So, it is superior to other procedures.

**References**

1. Singhal Sk, Mann SBS, Datta U, Panda NK, Gupta AK. Genetic Correlation in Otosclerosis. American Journal of Otolaryngology, 1999; 20(2):102-5.

2. Nielsen TR, Thomsen J. Meningitis following stapedotomy: a rare and early complication. The Journal of Laryngology & Otology, 2000, 114:781-83.

3. Marcos V, Goycoolea M. Otosclerosis In: Paparella MM, editor. Otolaryngology. 3rd ed. Philadelphia: WB Saunders, 1991; 1489-1522.

4. Larson A. Genetic correlation in otosclerosis. Acta Otolaryngol Suppl, 1960, 1:154-57.

5. Altmann F, Glascok A. The incidence of the otosclerosis as related to race and sex. Ann Otol Rhinol Laryngol, 1967; 76:377-92.

6. Shea JJ. Thirty years of stapes surgery. J Laryngol Otol, 1988; 102:14-19.

7. Rosen S. Mobilisation of stapes to restore hearing in otosclerosis. NY State J Med, 1953; 53:18-23.

8. Shea JJ. Fenestration of the oval window. Am J otol, 1958; 67:932-51.

9. Browning GC, Gatehouse S. Sensorineural hearing loss in stapedial otosclerosis. Ann otol Rhinol Laryngol, 1984; 93:13-16.

10. Glasscock Me, Storper IS, Haynes DS, Bohere PS. Twenty-five years of experience with stapedotomy. Laryngoscope, 1995; 105:899-904.

11. Soifer NN. Otosclerosis: A review. Acta Otolaryngol Suppl, 1970; 209:1-25.

12. Morrison AW. Genetic factors in otosclerosis. Ann R Coll Surg Engl, 1967; 41:202-237.

13. Baradaranfar MH, Dabirmoghaddam P. The hearing results in otosclerosis after stapedotomy. Carhart R. Atypical audiometric configurations associate with otosclerosis. Acta Medical Iranica, 2004; 42(4):277-80.