

## Original Article

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# 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 pre-operative 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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### Introduction

Otosclerosis is a familial and genetically determined process inherited as an autosomal dominant Penetrance. It is a disease of the otic capsule that is characterized by resorption and redeposition of bony tissue<sup>1</sup>.

Otosclerosis was first described in 1861 by J. Toynbee<sup>2</sup>. The characteristic lesion of otosclerosis first causes fixation of the anterior portion of the foot plate (fistulae ante

fenestram) 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<sup>3</sup>. A higher incidence of the disease in families and homozygotic twins<sup>4</sup>. Women are frequently affected by this pathology than men in at a 2:1 ratio<sup>5</sup>.

Stapes surgery has established its position as the primary treatment of conductive hearing loss in otosclerosis<sup>6</sup>. Stapes surgery gained its actual definition in the 1950s with the stapedectomy operation proposed by Rosen<sup>7</sup> in 1953 and the stapedotomy operation introduced by Shea<sup>8</sup>. Adequate bone 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<sup>9</sup>. Complications following stapes surgery are rare<sup>10</sup>.

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.

## 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.

## Objectives

1. To evaluate the hearing status of as 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 70dB.
- Bone conduction loss was not more than 30dB.

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.

**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 (teste 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%)

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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 Post Operative	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 improvd 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	17.06 dB

**Discussion**

In the series most common age group was 3<sup>rd</sup> decade. The next common group was 4<sup>th</sup> 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<sup>2,5,11</sup>.

The paracusis Willisii was noticed by most of the patients (32) this finding is similar to most authors (Ozgirgin)<sup>6</sup>. 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<sup>4,12</sup>.

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 20dB.

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<sup>13</sup>. 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 stapedectomy 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.

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