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Does Patient Gender Influence Hearing Gains After Small Fenestra Stapedotomy? A Prospective Study of 110 patients

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ABSTRACT:

Purpose: To study the effect of patient gender on hearing outcomes after stapes surgery.

Background: Otosclerosis is an osseous dyscrasia of the temporal bone that often leads to conductive hearing loss. The hearing deficit is correctable by surgery or hearing aids. While various surgical factors are documented to influence surgical outcomes, there remains a paucity of data on whether patient characteristics play a role in influencing hearing outcomes.

Methods: 110 patients underwent small fenestra stapedectomy. Pre and post-operative audiometric data was recorded at 250 Hz, 500 Hz, 1 KHz, 2 Khz, 3 KHz, 4 Khz, 6 Khz and 8 Khz. Frequencies were categorized as low (250 Hz), speech (500 Hz to 4 KHz) and high (6 KHz and 8 KHz). A standard stapedotomy using a 0.6 mm Teflon piston was inserted. Air-Bone Gaps were calculated preoperatively and at each follow-up. The last follow-up at six months was taken for final analysis.

Results: There was no statistically significant difference in pre-operative hearing gaps or post-operative hearing gain at low, speech or higher frequencies.

Conclusion: Gender does not influence hearing gain after stapes surgery. The authors recommend a larger sample size to further examine and validate this conclusion.

Keywords: Otosclerosis; Air bone gap; Stapedotomy; Gender

Introduction:

Sites and symptoms of otosclerosis:

Otosclerosis is the primary focal spongifying lesion of the human temporal bone (Glassock and Shambaugh)[1] and results in conductive hearing loss owing to fixation of the footplate of the stapes by a focus located usually in the area of the fissula ante fenestrum. The fissula is an extension of the periotic tissue and was first linked to otosclerosis by Anson and Cauldwell[2]. While stapedial otosclerosis is most common (Derlacki and Valvassori)[3] and (Balle and Linthicum)[4] have argued for the presence of cochlear foci of otosclerotic bone. However (Gross)[5] and (Shucknecht)[6] have failed to demonstrate otosclerotic foci of significant size in the temporal bones of patients with sensorineural deafness of unknown cause.

Factors influencing outcomes after stapes surgery:

A number of modifications to Shea's original procedure have been made, either in the material used to cover the oval window or in the prosthesis used. These include stapedotomy or small fenestra stapedectomy studied by (Portmann and Aramann-Tucoo)[7] and (Spandow and Soderberg)[8] among others. The influence of piston diameter was evaluated by Grolman and Tange[9], Fisch[10], Sennaroglu[11] and more recently in a systematic review by Laske et

al.[12]. Farrior and Temple[13] compared stainless steel pistons with Teflon wire, Tange and DeBruijn et al.[14] studied gold pistons versus Teflon. Other factors studied include preservation of the stapedius tendon studied by Giereck and Bielecki[15], Colletti and Fiorino[16]. However, there are few studies that focus on patient demographics as potential factors influencing hearing gain after a stapes surgery. In this study, we evaluated the effect of gender on hearing outcomes in 110 patients with otosclerosis who underwent small fenestra stapedotomy.

Patients and Methods:

Exclusion criteria:

Consecutive patients presenting to the outpatient department of a busy tertiary hospital in India over a two year period with hearing loss as a primary complaint were included in the original sample.

The following exclusion criteria were applied as a primary filter. Exclusion was done by clinical examination and laboratory tests.

- Patients with mixed or pure sensorineural hearing loss
- Patients with middle ear infection and/or tympanic membrane perforation
- Patients with conductive hearing loss due to causes other than otosclerosis
- Presence of active otosclerotic focus
- Patients undergoing stapedectomy, either partial or total.
- Patients with uncontrolled systemic diseases.
- Pregnant patients

Patient evaluation:

A total of 110 patients were included by this process over the study period. Written consent for inclusion was obtained in each case. A careful history was elicited including predominant symptoms (hearing loss, vertigo, and tinnitus) and any other related complaints. The presence of a family history was also enquired. History suggestive of sinonasal or laryngo-pharyngeal pathology was also taken to exclude potential sources of infection. Each patient was evaluated by routine examination including tuning fork testing. All results were noted on a previously prepared proforma. The GSI (Grason Stadler Inc.) Clinical cum Research Audiometer was used to record audiometric data in all patients. This was fully calibrated for all frequencies analyzed. In addition, the GSI 33 Impedance Audiometer was used to record impedance levels for all patients. Findings of the latter test, however, were not used for analysis in the study and were used only for confirmation and documentation. The tests were done in a soundproofed room with adequate masking applied to the non-test ear. All tests were done by the same audiologist wherever possible to exclude inter-observer variation.

Audiometric categorization:

Audiometric frequencies were grouped into 3 categories as under:

- 250 Hz Low Frequency
- 0.5 Khz, 1 KhZ, 2 Khz, 3 Khz Speech frequencies
- 4 KHz, 6 Khz and 8 Khz High frequency.

The hearing levels at frequencies from 500 Hz to 3000 Hz were taken as the levels in speech frequencies as per the recommendations of the American Academy of Otorhinolaryngology-Head and Neck Surgery's Committee on Hearing and Equilibrium (Balkany et al.)[17]. Preoperative Air and Bone conduction thresholds were recorded and Air Bone Gaps calculated in each of the three categories as recommended by Laitakari and Laitakari[18]. A Pure tone average was used as a single figure for Speech frequencies and High frequencies. Recordings were done at 5 dB increments preoperatively and at 2 dB increments at the six month follow-up.

Surgery:

Patients were admitted overnight. Consent and side of surgery were reconfirmed. All cases were performed under Local anaesthesia. A standard stapedotomy was performed after intraoperative conformation of stapes footplate fixation. A 0.6 mm Teflon piston was inserted in all cases. Standard postoperative precautions were advised. Patients were followed up at 1 month, 3 months and 6 months. As described above, Pure Tone audiometry was performed at each follow-up and the results of the 6 month follow-up were taken for analysis.

Statistical analysis:

All data was analyzed with the help of SPSS for Windows, Ver18 on a Windows 7 platform. Descriptive frequency distributions and means of audiometric data were calculated wherever relevant. The Mann-Whitney U Test was done to

evaluate the effect of gender on gain as our data was not parametric in distribution.

Results and Discussion:

Otosclerosis is generally considered to affect females more frequently than men are (Glasscock and Shambaugh)[1]. Grolman et al.[9] reported a larger number of female patients in their study groups. Our study had a male: female ratio of 1:1.17 (Table 1**)** which made comparison of gain between genders less subject to bias because of distribution in the sample. It is also possible that we may see a shift in gender distribution as the sample increases.

We analyzed the effect of the patient's gender. However, there seemed to be other confounding variables as outlined in subsection 1.2. We thus performed a standard stapedotomy using the same piston in all cases. The stapedius tendon was cut in all cases in accordance with the surgical preference of the operating surgeon and to ensure uniformity when reporting results. We were thus able to analyze the effect of gender on hearing gain without any of the above-mentioned variables confusing the issue.

The hearing levels in dB pre-operatively are shown in (Table 2). These were analyzed for significance using the Mann-Whitney U test (Table 3). There was no statistical difference.

Hearing gains were analyzed at intervals of 1 month, 3 months and 6 months. The final follow-up for the study was taken at the 6 month interval. At this time, hearing gains were recorded and assessed for significance (Tables 4 and 5). While there was some gain in significance, it did not reach a statistically important figure.

Gender has not been studied in detail as a possible factor affecting hearing gains after stapes surgery. Ueda et al.[19] reported no significant difference in hearing gains between genders. In their study, 127 ears were subjected to the Shuknecht-type Teflon wire piston (87 ears), the House-type wire loop (29 ears), and the Cawthone-type Teflon piston (11 ears). Similarly, no gender-related differences in either air or bone thresholds were recognized post-surgically. However, in a study of 33 patients by de Ataide et al.[20], females had a statistically significant gain especially in the lower frequencies.

However, while age at onset or surgery has been studied, there is a paucity of data on gender influencing hearing gain after stapes surgery. We

Age Distribution	Male	Female
20-24	6	12
25-29	4	8
30-34	18	24
35-39	6	0
40-44	2	8
45 and above	10	2
Total	46	54

Table 1: Age and gender distribution of patient sample.

Frequency	Gender	Mean± 2 S.D.
	Male	56.96 ± 10.95
250 Hz		
	Female	60.00 ± 13.80
	Male	45.16 ± 9.23
Speech Frequency		
	Female	47.92 ± 7.19
	Male	46.88 ± 8.01
High Frequency		
	Female	43.88 ± 11.37

Table 2: Preoperative air bone gaps in db.

Frequency	U Statistics	P value
250 Hz	290	0.667
Speech Freq.	259	0.319
Higher Freq.	245	0.205

Table 3: preoperative air bone gaps between genders at differing frequency categories.

Frequency	Gender	Mean ± 2 S.D
	Male	43.48 ± 9.26
250 Hz		
	Female	47.48 ± 11.57
	Male	35.27 ± 8.24
Speech Frequency		
	Female	38.84 ± 7.87
	Male	36.81 ± 6.70
High Frequency		
	Female	34.73 ± 11.57

Table 4: mean postoperative hearing gains at 6 months follow-up.

Frequency	U Statistics	P value
250 Hz	240	0.172
Speech Freq.	243	0.189
Higher Freq.	238	0.161

Table 5: Postooperative hearing gains between genders does not reach statistical significance

were limited by our sample size and recommend either a longer study duration or pooled multi-centric data to increase the power of the study. At face value, however, gender does not appear to play a role in affecting hearing gains amongst otosclerotic patients undergoing stapes surgery.

Conclusion:

Otosclerosis remains a key diagnostic consideration among patients with conductive hearing loss in the absence of external physical signs and obvious aetiological causes. Surgical treatment can improve or normalize hearing but does not halt disease progress. Gender of the patient does not appear to influence hearing gain after stapes surgery but further studies with a larger sample may be needed to fully examine the effect.

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Conflicts of Interest:

Nones

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