Print ISSN: 2321-6379
Online ISSN: 2321-595X

Original Article

Audiological Analysis of 62 Patients with Otosclerosis Undergoing Stapedotomy with Slow-speed Microdrill

V Satyanarayana Sharma[1], S Pravin Tez[2], M V Subba Rao[3], K. Usha Rani[4], M Vamshi Krishna[2], Basireddy Dheeraja[4]

[1]Associate Professor, Department of ENT, Mediciti Institute of Medical Sciences and Hospital, Hyderabad, Telangana, India, [2]Assistant Professor, Department of ENT, Mediciti Institute of Medical Sciences and Hospital, Hyderabad, Telangana, India, [3]Professor, Department of ENT, Mediciti Institute of Medical Sciences and Hospital, Hyderabad, Telangana, India, [4]Junior Resident, Department of ENT, Mediciti Institute of Medical Sciences and Hospital, Hyderabad, Telangana, India

Abstract

Background: Otosclerosis is not an uncommon condition in Telangana. Various methods such as perforator and laser are used in performing stapedotomy during its surgical management. Stapedotomy performed with slow-speed microdrill technique for otosclerosis, and difficulties encountered during surgery, complications, and auditory gain in the post-operative period were analyzed in this study.

Aim of the Study: The aim of this study was to use low-speed microdrill technique in stapedotomy and to analyze the difficulties, complications, and audiological evaluation in the post-operative period of 18 months.

Materials and Methods: A prospective study of 62 patients undergoing stapedotomy for otosclerosis over a period of 2 years was reviewed. Stapedotomy with skeeter microdrill was evaluated using audiometric results (air conduction thresholds, bone conduction thresholds, air-bone gap closure, and pure tone average) and the incidence of complications during post-operative period. Teflon prosthesis was used in all the patients.

Observations and Results: Among the 62 patients, there were 37 females (59.67%) and 25 males (40.32%) with a male-to-female ratio of 1:1.48. The patients belonged to the age group of 25–55 years with a mean age of 32.65 ± 4.15 years.

Conclusions: Stapedotomy performed with microdrill technique for otosclerosis was a safe surgical technique to perforate the stapes footplate. The microdrill (skeeter) has low noise intensity and low torque. For duration of a few seconds, it seems to be a safe tool in creating a perforation in the footplate of the stapes, without causing acoustic trauma.

Key words: Micro drill and auditory gain, Otosclerosis, Stapedotomy

INTRODUCTION

Otosclerosis is defined as an autosomal dominant and familial, progressive otic capsule disease, characterized by fixation of stapes footplate due to the replacement of compact bone with spongy bone. It is characterized by slow progressive conductive hearing loss and/or associated sensorineural type of deafness. It is observed commonly in women of childbearing age. It occurs between the second and third decades of life. Surgery is the treatment of choice. In properly selected patients, stapes surgery would yield 95% hearing improvement.[1] The preliminary step in the stapes surgery includes stapedotomy which was achieved by early surgeons by 0.1-mm perforators. Nowadays, surgeons are using laser to create fenestration in the footplate of stapes as it improves precision. In patients with greater thickness and diameter of the footplate to be charred while creating a fenestration, the usage of high precision laser results in fewer complications as reported by few authors.[2,3] However, several earlier and later studies showed no significant differences between laser-assisted, microdrill, and manual microsurgical stapedotomies in regard to auditory gain.[4-10] Certain authors using laser

Access this article online

IJSS
www.ijss-sn.com

Month of Submission : 02-2019
Month of Peer Review : 03-2019
Month of Acceptance : 03-2019
Month of Publishing : 04-2019

Corresponding Author: Dr. S Pravin Tez, Department of ENT, Mediciti Institute of Medical Sciences and Hospital, Medchal, Hyderabad - 501 401, Telangana, India.

opined that, apart from giving better hearing outcome, it was very helpful in providing greater accuracy during precise manipulations and thereby reduced surgical trauma, which has important advantage over patients' safety compared to handheld instruments.[11-13] Similar reports were also published in terms of low-speed microdrills.[14] The present study was done to use low-speed microdrill technique in stapedotomy and to analyze the difficulties, complications, and audiological evaluation in the post-operative period of 18 months.

MATERIALS AND METHODS

A total of 62 patients attending the ENT Department of Mediciti Institute of Medical Sciences and Hospital, Medchal, Hyderabad – 501 401, who were diagnosed with otosclerosis after thorough audiological investigation, were included in the present prospective study. An ethical committee clearance was obtained before the commencement of the study. An ethical committee cleared consent form was used in the study.

Inclusion Criteria

(1) Patients aged >25 years and <55 years, (2) patients undergoing primary stapedotomy only, and (3) patients with purely conductive deafness alone were included in the study.

Exclusion Criteria

(1) Patients aged <25 and >55 years, (2) patients with cochlear otosclerosis, (3) patients with a history of tinnitus and vertigo, (4) patients with a history of previous middle ear surgery, (5) patients with a previous history of intake of ototoxic drugs, and (6) patients with sensorineural deafness were excluded from the study. The diagnosis of otosclerosis was confirmed on a history of progressive hearing loss, negative Rinne's test, conductive hearing loss in pure tone audiometry, normal speech discrimination, and the absence of acoustic reflex. Computed tomography scan temporal bones were done preoperatively, especially, when there was a history of previous middle ear pathology and/or where their congenital inner ear anomalies were suspected. The surgery was performed using stapedotomy techniques using the microdrill (skeeter drill) system, and the procedure was usually performed under local anesthesia. General anesthesia was used only in apprehensive patients. Antibiotics were given after surgery. The surgical approach was endaural. A tympanomeatal flap was elevated. Incudostapedial joint was exposed. Visibility of the entire footplate of stapes was achieved with a proper elevation of the tympanomeatal flap and removal of the scutum. In all patients, small fenestra stapedotomy technique was used in the stapes footplate for the placement of prosthesis.

Procedure

Endomeatal skin incision was carried out using a plesters flag knife and circular knife. Tympanomeatal flap was elevated up to tympanic annulus. Middle ear cavity was entered after incising the middle ear mucosa taking care not to injure the chorda tympani nerve. The chorda tympani were left attached to the retracted drum. After elevation of the tympanomeatal flap, the bone covering the oval window niche (scutum) was removed with the small end of a sharp curette. A malleable measuring rod is used to determine the distance between the footplate and the lateral surface of the incus. The prosthesis is trimmed on the cutting block to reach the desired length. Footplate was perforated using the microdrill (skeeter otologic drill system, Medtronic Xomed Surgical Products) with balanced speed. The rotation speed used was 6000 rpm. Incudostapedial joint was separated using a right angle 0.2 mm pick. Stapedial tendon was cut using small iris scissors. The stapes crura are fractured using a 1.5-mm, 90 hooks. The correct size of the prosthesis was determined, and it was moved over the stapedotomy opening and advanced into the vestibule. The loop of the prosthesis was crimped over the incus with alligator forceps. Subcutaneous connective tissue from the post-aural wound was harvested and minced with 15 number scalpels and used to pack and seal the stapedotomy opening around the prosthesis. The tympanomeatal flap is repositioned, and gelfoam pledgets soaked in neosporin ear drops are used to keep the tympanomeatal flap in place. The endaural incision is closed and a strip of gauze impregnated with antibiotic ointment is introduced into the lateral external canal. Chorda tympani nerve was preserved in all cases. The external canal packing was left undisturbed for 4 weeks. Tuning fork was used to assess the auditory gain on the operation table. Audiometric evaluation was done after 8 weeks. All the data were analyzed using standard statistical methods.

OBSERVATIONS AND RESULTS

Among the 62 patients, there were 37 females (59.67%) and 25 males (40.32%) with a male-to-female ratio of 1:1.48. The patients belonged to the age group of 25–55 years with a mean age of 32.65 ± 4.15 years. Pre- and post-operative audiological evaluation was done using 500 kHz, 1000 kHz, and 1500 kHz frequencies to assess the air conduction, bone conduction thresholds, pure tone average values, and air bone gap (a-b Gap). All the values are tabulated in Tables 1 and 2. In two patients, the footplate was very thick. In two patients, due to partial break of the stapes footplate, the posterior part of the footplate was removed intraoperatively. Two patients developed vertigo postoperatively and three patients developed sensorineural hearing loss. None of the patients developed post-operative facial nerve paralysis.

Table 1: The pre-operative mean hearing threshold values in the study group (*n*=62)

Age groups (year)	Number	Air conduction (dB)	Bone conduction (dB)	a-b Gap	PTA (dB)	*P* value
25–35	29	15±2.75	40±3.30	25±2.50	31.75	0.021
35–45	22	15±1.90	40±4.10	25±2.65	33.05	0.036
45–55	11	15±4.15	40±5.25	25±5.20	34.10	0.047

PTA: Pure tone average, a-b gap: Air bone gap

Table 2: The post-operative mean hearing threshold values in the study group (*n*=62)

Age groups (year)	Air conduction (dB)	Bone conduction(dB)	a-b Gap	PTA (dB)	*P* value
25–35	10±1.75	15±1.20	5±1.40	24.25	0.031
35–45	10±1.0	15±1.05	5±1.35	23.00	0.041
45–55	10±1.15	15±1.15	5±1.25	25.15	0.020

PTA: Pure tone average, a-b gap: Air bone gap

DISCUSSION

The present study was conducted to use low-speed microdrill technique in stapedotomy and to analyze the difficulties, complications, and audiological evaluation in the post-operative period of 18 months. The skeeter micro rill used has low noise intensity, low torque, and when used over short duration seems to be a safe tool in the perforation of the footplate of the stapes, without causing acoustic trauma. There was no intraoperative monitoring of the facial nerve done during stapedotomy. In their study, Sedwick *et al.*[6] observed that there was no significant difference audiological gain in their subjects whether the fenestra was created by microdrill or laser. In a similar study by Somers *et al.*,[7] no statistically significant difference was found between the laser stapedotomy and the micro rill technique while creating a calibrated stapedotomy hole. However, Mangham[14] claimed improved hearing results in patients in whom fenestration of the footplate was done with a microdrill compared to results with a hand drill. Gjuric[5] opined that the microdrill when used by experienced surgeons was not more traumatic than the perforator to the inner ear. Barbara *et al.*[15] observed that microdrill stapedotomy showed a good hearing result. Three different devices used to perforate the stapes footplate in otosclerosis patients were compared by Cuda *et al.*;[10] the study showed that the use of the CO_2 laser does not differ significantly from that obtained with microdrill stapedotomy, whereas the piezoelectric stapedotomy was associated with a slight but significant deterioration of bone conduction at high frequency and higher vertigo rate. Yavuz *et al.*[9] compared microdrill and pick stapedotomy techniques. Their study revealed that the microdrill and pick stapedotomy techniques produced similar hearing results and complication rates and no evidence of micro drill-induced acoustic trauma. The present study showed post-operative audiological gain in patients of all age groups comparable to other studies in the literature. The mean post-operative air conduction thresholds, bone conduction thresholds, and a-b Gap closure were statistically significant with $P < 0.05$. The overall auditory gain in all patients was subjectively inquired and found to be satisfactory.

CONCLUSIONS

Stapedotomy performed with microdrill technique for otosclerosis was a safe surgical technique to perforate the stapes footplate. However, the question as to which surgical method is better depends on the experience of the surgeon. The incidences of complications are similar to other methods. The microdrill (skeeter) has low noise intensity, low torque, and the duration of a few seconds, and it seems to be a safe tool in the perforation of the footplate of the stapes, without causing acoustic trauma.

Acknowledgements

We thank the management of Mediciti Institute of Medical Sciences for providing the clinical material for conducting this study

REFERENCES

1. Shea JJ. Fenestration of the oval window. Ann Otol Rhinol Laryngol 1958;67:932-51.
2. Perkins RC. Laser stapedotomy for otosclerosis. Laryngoscope 1980;90:228-41.
3. Lesinski SG, Palmer A. Lasers for otosclerosis: CO_2 vs argon and KTP532. Laryngoscope 1989;99:1-8.
4. McGee TM. The argon laser in surgery for chronic ear disease and otosclerosis. Laryngoscope 1983;93:1177-82.
5. Gjuric M. Microdrill versus perforator for stapedotomy. Clin Otolaryngol Allied Sci 1990;15:411-3.
6. Sedwick JD, Louden CL, Shelton C. Stapedectomy vs stapedotomy. Do you really need a laser? Arch Otolaryngol Head Neck Surg 1997;123:177-80.
7. Somers T, Vercruysse JP, Zarowski A, Verstreken M, Offeciers E. Stapedotomy with microdrill or carbon dioxide laser: Influence on inner ear function. Ann Otol Rhinol Laryngol 2006;115:880-5.
8. Brace C, Keil I, Schwitulla J, Mantsopoulos K, Schmid M, Iro H, *et al*. Bone conduction after stapes surgery: Comparison of CO_2 laser and manual perforator. Otol Neurotol 2013;34:821-6.
9. Yavuz H, Caylakli F, Ozer F, Ozluoglu LN. Reliability of microdrill stapedotomy: Comparison with pick stapedotomy. Otol Neurotol

2007;28:998-1001.
10. Cuda D, Murri A, Mochi P, Solenghi T, Tinelli N. Microdrill, CO_2-laser, and piezoelectric stapedotomy: A comparative study. Otol Neurotol 2009;30:1111-5.
11. Palva T. Argon laser in otosclerosis surgery. Acta Otolaryngol 1987;104:153-7.
12. Rothbaum DL, Roy J, Hager GD, Taylor RH, Whitcomb LL, Francis HW, *et al*. Task performance in stapedectomy: Comparison between surgeons of different experience levels. Otolaryngol Head Neck Surg 2003;128:71-7.
13. Mathews SB, Rasgon BM, Byl FM. Stapes surgery in a residency training program. Laryngoscope 1999;109:52-3.
14. Mangham CA Jr. Reducing footplate complications in small fenestra microdrill stapedotomy. Am J Otol 1993;14:118-21.
15. Barbara M, Monini S, de Seta E, Filipo R. Early hearing evaluation after microdrill stapedotomy. Clin Otolaryngol Allied Sci 1994;19:9-20.

How to cite this article: Sharma VS, Tez SP, Rao MVS, Rani KS, Krishna MV, Dheeraja B. Audiological Analysis of 62 Patients with Otosclerosis Undergoing Stapedotomy with Slow-speed Microdrill. Int J Sci Stud 2019;7(1):15-18.

Source of Support: Nil, **Conflict of Interest:** None declared.