INTRODUCTION

Otosclerosis was first described in the writings of Antonio Maria Valsalva. From 1704, it is one of the commonest causes of conductive hearing loss in young adults. The patients with otosclerosis may present with tinnitus and vertigo in addition to hearing loss. The disease is bilateral in about 80% cases and has a female predisposition of 2:1. Stapes surgery (stapedotomy and stapedectomy) is commonly performed at all major otological and hearing restorative centers in the world. Most centers use instruments such as loupes to perform this surgery. Endoscopes have evolved as a tool of safe and effective surgery in otological practice and surpass the microscope in middle ear procedures owing to better visualization of anatomy in the middle ear. Stapes surgery is no different and is increasingly being performed with endoscopes. We share our experience if 45 cases of total endoscopic stapes surgery. This is first series of endoscopic stapes surgery in Pakistan.

METHODOLOGY

This descriptive study was carried out at Pakistan Naval Ship Hafeez Islamabad Pakistan, from June 2016 to June 2020.

Inclusion Criteria: A total of 45 cases of surgically confirmed otosclerosis (Fixed foot plate of stapes on anterior tympanotomy) and Bone conduction threshold better than 40 and air conduction threshold holds better than 60 were included in the study.

Exclusion Criteria: Patients with malleo-incudal fixation ossicular discontinuity, A-B (Air bone gap) <10 decibel, bone conduction >40 decibel and patients with only hearing ear were excluded from the study. Informed consent was obtained from all patients before including them in the study and Approval of Hospital Ethics Committee taken. The objective of the study was to document the results of total endoscopic stapes surgery. This is the first series on this topic in the country. Pure Tone Audiograms of all patients were done preoperatively and 12 weeks postoperatively. CT Scan of Temporal Bone were conducted in all patients to visualize sclerosis of stapedial foot plate. Endoscopic stapedotomy was performed using a 0-degree 3mm 14cm rigid endoscope with 3 chip Camera. Fat from ear lobule was harvested from a small posterior incision.
for sealing the stapedotomy and wound was closed with 5/0 prolene sutures. Trans-canal approach was used for all cases. Canal incisions were made at 12-6 o'clock and tympanomeatal flap was elevated chorda tympani was identified middle ear entry was made. Posterior bone removal was done with a curette or micro drill. Pyramidal process, Stapedius tendon, facial nerve stapes supra structure and foot plate were exposed. Stapedius tendon was divided with micro scissors (Figure-1). Incudostapedial joint was divided with joint knife. Crurotomy and stapedotomy was done with 0.8mm foot plate perforator/0.7mm diamond burr using a stapes drill (Figure-2). Footplate distance from the incus was measured and appropriate size Teflon piston 0.6 mm diameter was placed in the stapedotomy (Figure-3). Piston position and mobility was confirmed with bending sign (Figure-4) and round window reflex. Fat graft was placed around the piston to seal stapedotomy (Figure-5). Tympanomeatal flap was repositioned and spongeston was filled in the external auditory canal. Operative time was noted from start of transcanacl incision’s to repositioning of tympanomeatal flap. and Postoperative facial nerve function and nystagmus was documented. All data was entered in SPSS and mean was calculated for age, gender, A-B Gap, injury to chorda tympani, vertigo and anatomical variations like dehiscent facial canal and persistent stapedial artery.

**RESULTS**

Mean age of patients was 34 years and standard deviation was 12.34 (range 21 to 52 years). Out of total 45 cases 13 were males (28.8%) and 32 females (71.1%). Preoperative Average Air Conduction thrash hold on PTA was 50dB, A-B gap was 30 db. Postoperative average air conduction thrash hold was 15db. A-B gap was reduced to < than 10 db in 39 (86.6%) patients whereas A-B gap was brought to < 20db in 100% patients. Average postoperative A-B gap was 9 db. Four (8.8%) patients had dehiscent facial canal and 1 (2.2%) patient had persistent stapedial artery (Figure-6 & 7). One patient (2.2%) patient had floating foot plate, stapedotomy was converted into stapedectomy. Mild postoperative vertigo was present and Air Bone Gap was reduced to less than 10 db in this patient. One (2.2%) patient com-
explained of altered taste lasting 3 months and (4.4%) patients had postoperative vertigo lasting for up to 72 hours. Mean operative time was 62 minutes.

**DISCUSSION**

Otosclerosis is a one of the commonest diseases causes conductive hearing loss in young adults. Etiology if the disease is unknown but researchers attribute measles virus for initiating the disease process. It thought to be an autosomal dominant disorder with a potential genetic transposition. Stapedotomy is a safe effective procedure with 95% hearing restoration results reported. Traditionally stapes surgery has been done using a microscope. Endoscopes were introduced in middle ear surgery in 1990’s by Dr Muaz Tarabichi, reported that endoscopic stapes surgery in 12 cases with 87% patients reporting audiological improvement. Endoscopic stapedotomy required minimal bone removal as compared to microscopic stapedotomy. Marchioni et al reported 100% A-B gap closure to <20 db and 83% and Noguira et al, reported 93% A-B gap closure of <25 db. Hunter et al, reported 50 cases of endoscopic stapedotomies with 87% A-B Gap closure to <20db. Sarkar et al, reported A-B Gap closure of <10 dB in 57% patients and <20 db in 100% patients. Our series of 45 cases of total endoscopic stapedotomy is first in Pakistan and we report similar results as documented by Marchioni, Tarabichi and Hunter et al, Migirov et al, and Daneshi et al, reported 100% chorda tympani preservation, whereas Hunter et al, reported 88% preservation of chordatympani. We also report 100% preservation of chordatympani and stretch paresis in one case that recovered over 12 weeks. Floating foot plate is a difficult situation in stapes surgery and its incidence has been reported between 2-5.5% similar to 2.2% of our study. Numerous options have been described to successfully complete surgery in a case of floating foot plate including partial stapedectomy, complete stapedectomy and making a stapedotomy in a floating foot plate. In our case we converted the stapedotomy into stapedectomy and used a vein graft to cover the footplate before placing the piston. Average operating time in our series is 62 minutes but has been reported between 37-77 minutes.

**LIMITATION OF STUDY**

The study is first local publication on endoscopic tympanoplasty and has no local references for comparison.

**CONCLUSION**

Endoscopic stapedotomy is a safe and affective procedure with better visualization of middle ear structures. Endoscopes are increasingly being used for performing stapes surgery and advantages include minimal bone work and handling of chorda tympani. Limitation of single hand use and lack stereoscopic vision add to steep learning curve.
**Conflict of Interest:** None.

**Authors’ Contribution**

MAN: Lead Author, Operating surgeon, data collection, US: Data assemilation and result compilation, MR: Data collection, discussion writing, HS: Discussion writing, NSN: Data collection, MR: Discussion and statistical analysis, NR: Discussion and statistical analysis.

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