

Endoscopic stapedotomy: Surgical and audiological outcome

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Abstract

Background: Otosclerosis is common cause of conductive hearing loss in middle age group females. Microscopic and endoscopic stapedotomy surgical procedures or approaches are being practiced by ENT surgeons which are cost effective, on the other hand safer post surgically

The aim of the study is to analyse surgical and audiological outcomes of endoscopic stapedotomy.

Material and methods This is a study of 30 patients aged between 18 to 60 years over a period of three years having features of otosclerosis with hearing loss who under went endoscopic stapedotomy. preoperative and postoperative air-bone gap were compared

Results: A total of 30 endoscopic stapedotomy was performed on 30 patients Improvement in air bone gap is taken as criteria for audiological improvement. 24(80%) postoperative ABG < 10db 5(16.6) ABG between 10-20. Sensory neural hearing loss observed in 1(3%), vertigo 5(16.66%).

Conclusion- Endoscopic minimal invasive surgery is particularly suitable for stapedial diseases. The telescope used provide good illumination, bird's eye view of middle ear structures with minimal manipulation of chorda tympani nerve, without bony wall curettage surgery can be completed in most cases. The demerits are mainly single handed operation, lack of depth perception and has long learning curve.

Keywords: - Stapedotomy, otosclerosis, Endoscopic, ABG, SND

Date of Submission: 15-04-2020

Date of Acceptance: 30-04-2020

I. Introduction

Endoscopic stapedotomy for otosclerosis is a fast developing concept and gaining popularity as it provides a direct targeted approach to the anatomic deformed foot plate area allowing a minimally invasive procedure with limited mucosal flap dissection and minimal or no bony curettage. Historically stapes surgery dates way back to 1853. It was Toynbee who gave the first description of ankylosis of stapes and changes that took place in the foot plate area¹. Lempert performed the fenestration surgery in 1938. Rosen performed mobilisation in 1952. Evolution and standardization of modern stapedectomy operation should be credited to Shea in 1958, who was responsible for making it a universally followed standard treatment procedure for otosclerosis². Dr Jean-Rene Cause, France pioneered use of Teflon pistons prostheses. Fully fledged Endoscope-assisted stapedotomy was first described by Poe in 2000³. Fully endoscopic stapedotomy performed by João Flávio Nogueira Júnior, in 2008⁴. The aim of the study is to analyse surgical and audiological outcomes of endoscopic stapedotomy. There are still very few papers in the literature discussing the possible benefits of stapes surgeries made solely with the use of the endoscope so here we are doing study of the endoscopic stapedotomy.

II. Materials And Methods

This is Prospective controlled study 30 patients regularly attending ENT Department of Mount Zion Medical College, Ezankulum, Adoor Kerala- from 23-10-2015 to 30-6-2018 having signs and symptoms of otosclerosis were studied. Consent of patient and ethical clearance were obtained. All the patients underwent Endoscopic Stapedotomy by the same surgeon. Follow-up period ranged from 12 to 18 months.

Inclusion Criteria Progressive deafness of conductive type, Normal tympanic membrane. Pure tone audiogram Air-bone gap > 25 db, Impedance As or A type curve, Absent acoustic reflex

Exclusion Criteria: Only hearing ear, Poor cochlear reserve, pt with prior stapes surgery, syndromic conductive hearing loss

Criteria for success⁵

One month after surgery audiogram was repeated and airbone gap (ABG) average was determined for 500, 1000, 2000, and 4000 Hz.

Results were classified into three groups

Group :A = ABG < 10 dB

Group :B =ABG 11 -20dB

Group :C = ABG >21 dB

Statistical analysis- Surgery time in minutes from incision to reposition of flap, was noted. One month after surgery Post op audiometry ABG and any complication was recorded patients followed for a period 18 months. The data collected and statistical analysis was done using SPSS software 2007.

III. Procedure

All cases are done under local anaesthesia after premedication with pentazocine 1 cc and promethazine 1 cc IM injection 30 minutes before surgery. The patients in supine position, the head turning away from surgeon.

Local infiltration was done with 1 in 100000 1% lignocaine with adrenaline. Adrenaline (1: 2000)-soaked cottonoids are placed into the external auditory canal for 5 minutes after infiltration. 30degree 4 mm diameter 18 cm long endoscope , high definition camera systems, high definition monitors and xenon light source were used in all cases. Instruments are same as in traditional microscopic ear surgery are used. The classical Rosen's permealal incision few mm away from annulus tympanomeatal flap gently elevated with Rosen's knife towards the annulus. adrenaline soaked cottonoids used to control minor bleeding. Mobility of ossicles tested otosclerosis diagnosis conformed. If horizontal part of facial nerve, base of pyramid and stapedial tendon are made out easily no bony curetting done. Incudostapedial joint is dislocated with right angle prick stapedial tendon cutting with curved micro scissors stapes suprastructure is removed after controlled fracturing of posterior and anterior crura of stapes with right angle prick. Controlled fenestra is made over posterior 1/3 of foot plate using perforator once fenestra is made over foot plate The distance between long process of incus and foot plate is measured with measuring rod. In our study, in most of the cases the distance between long process of incus and foot plate of stapes was 4 mm to this 2.5mm is added and 4.25long piston is placed in fenestra and piston is anchored to long process of incus. In case of large fenestra Soft tissue seal was done with ear lobule fat. The tympanomeatal flap was repositioned, and the external auditory canal was filled with Gelfoam.. Post operatively Antihistamines, systemic corticosteroid given for one month Neosporin ear drops instillation advised after 10 days Post-operative audiometry done after one month. Follow up was done after 1 month and 3 months. Advised to follow for period of 18 months. Following points were noted on during post operative period (a)complete hearing loss (b) Persistence of tinnitus (c) Persistence of vertigo (d)alteration of taste

IV. Results

In this study of 30 patients Male;female ratio was 18:12, The mean age of the patients was 36 ± 12 (range 18- 60) years (Table 1). The mean follow-up period was 12-18 months The time-tested, readily available, and cost-effective Teflon piston used in 29(96.66)patients one(3.3%) patent titanium long malleus to oval window prosthesis was used. Preoperative and postoperative average air conduction thresholds (AC) were 40.0 ± 5.8 dB and 10.5 ± 5.9 dB respectively. Preoperative and postoperative average bone conduction thresholds (BC) were 4.4 ± 3.6 dB and 3.5 ± 4.0 dB respectively. Preoperative and postoperative average ABG were 35.6 ± 4.7 dB and 7 ± 4.9 dB respectively .The average pre-operative ABG was 30 dB (25-45 dB). The average postoperative ABG was within 10 dB in 24 (80%) patients and between 10–20 dB in the remaining 5 patients (13.33%) (Table 2). Tear in the tympanic membrane was encountered during the elevation of the tympanomeatal flap in 2(6.6%) patients it was successfully managed by approximating edges and placing gelfoam around the tear. Intraoperative complication of perilymph gusher observed in 1 (3.3%) patient who had Postoperative BC thresholds of 43 dB compared to preoperative BC thresholds of 8 dB. .This patient had severe vertigo and tinnitus Sensorineural hearing loss (SNHL) was identified in this patient. Vertigo observed in 6(20%) intra operatively and managed conservatively. Tinnitus observed 4(13.3) in immediate post period ,it persisted in 2(6.6%)beyond one month

V. Discussion

Microscopic stapedectomy procedure is very well defined surgical procedure with a high success rate⁸. Stapes surgery over period of time has gone through various stages initially it was microscopic stapedectomy ,then came stapedotomy now is the era of endoscopic stapedotomy. The main demerits of microscopic stapes surgery are many times patients requires endaural or post auricular approach in narrow ear canals . It is usually very difficult to see completely suprastructure of stapes footplate, pyramid and facial canal without curettage of scutum. Endoscopic approach can overcome these limitations in stapedotomy

Since last decade Endoscopes is being used extensively in middle ear surgery in particular for stapedial diseases. Most important advantage of endoscope use in otology is its direct and easy access to hidden areas of the middle ear such as foot plate ,facial recess and sinus tympani. 30 Degree Endoscopes provide wide angle view ,with minimal manipulation the entire area of the operation can be seen in one field. Light located at the tip of the endoscope provide better illumination of middle ear structures. Another advantage of endoscope is that it

is a minimal invasive technique requires no incision, chance of chorda tympani nerve injury is less and easy portability of equipment.

Chorda tympani nerve CTN preservation is very essential in stapes surgery. Endoscopic stapedotomy avoids unwanted trauma to CTN, preserves taste sensation and prevents lateral displacement of piston. Once piston is placed in fenestra and anchored to long process of incus if CTN is placed over piston it prevents lateral displacement of piston. In endoscopic stapedotomy most cases scutum curettage is not needed if at all curettage is needed it should be done from medial to lateral direction and also from superior to inferior direction to prevent injury to nerve⁶. 25-27. In our study 6 (20%) needed scutum curettage one (3.3%) had CTN injury and postoperative altered taste in 3 (10%)⁷.

Main drawback of endoscopic stapedotomy is single handed surgery^{9 10}. In stapes surgery operating field should be dry their exists correlation between intraoperative bleeding and post operative sensory neural hearing loss this was reported by Shea in his study. In our study we encountered bleeding at two sites one during elevation of the tympanomeatal flap it was controlled by keeping abjel pieces soaked in 4% xylocaine with adrenaline the other site where bleeding was encountered was over foot plate area while making fenestra bleeding this site was successfully managed by placing adrenaline soaked cottonoid.

The time duration of surgery is very important in stapedectomy. Duration of surgery is always proportional to the post-operative sensorineural hearing loss. The more the time taken for surgery greater is the chance of sensorineural hearing loss postoperatively. Two factors which contribute for SND are first being once fenestra is made on foot plate inner ear is exposed to powerful light source and second is Continuous suctioning of the blood and perilymph in the vestibule. The incidence of post-operative tinnitus also depends on the duration of surgery. In our study for initial few cases average time duration was 45-90 min after that it was between 35-45min. Anomalies of the ossicular were reported in our study to be 1.1%. The patient had malformed incus. The titanium kurz piston was placed in between the handle of malleus and footplate of stapes. Wiet *et al.* reported about 1% incidence of incus malleus fixation and malformed or short long process of incus was reported in 14% of patients. We encountered facial nerve overhanging the oval window in 2 (6.6%) of patients perforator was used to make control hole in the posteroinferior quadrant to avoid injury to the facial nerve this was done meticulously, post operatively we did not had any complications related to facial nerve (table 3)

Results in this series are similar to findings in other studies in the literature, the main shortage in this study is the small number of patients further studies with larger sample sizes and longer follow-up periods to fully gauge the safety and effectiveness of this endoscopic technique. Every ENT surgeon must acquire good surgical skills for stapes surgery with microscope before stitching over for endoscopic stapedotomy otherwise he may have to face long learning curve

VI. Conclusion

Endoscopic minimal invasive surgery is particularly suitable for stapedial diseases. The telescope used provide good illumination, bird's eye view of middle ear structures, with minimal manipulation of chorda tympani nerve, without bony wall curettage surgery can be completed in most cases. The demerits are mainly single handed operation, lack of depth perception and has long learning curve.

This research paper was approved by Ethical Committee of Mount Zion Medical College, Ezamkulum, Addar Pathanamhitta (dist) Kerala-691556

-No Conflict of Interest

-No funding

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DEMOGRAPHIC STATISTICS (Table :1)

Overall		No of patients %
Age (years)	Range	18-60
	Mean±SD	36±12
sex	Male	12 (40%)
	Female	18 (60%)
Ear affected	Right	16 (53.33%)
	Left	14 (46.66%)
Follow up	Range in Months	2-12 22 (73%)

AUDIOMETRY Table :2

AUDIOMETRY	RANGE	NO OF PATIENTS
PRE OP ABG	25-35 dB	18 (60%)
	36-45 dB	12 (40%)
POST OP ABG	<10 dB	24 (80%)
	10-20 dB	5 (16.6%)
	>20 dB	1 (3.33%)

COMPLICATIONS (Table :3)

COMPLICATIONS	NUMBER OF PATIENTS (%)	
Intra operative	Tear in tympanic membrane	2 (6.6%)
	Perilymph gusher	1 (3.3%)
	Chorda nerve injury	1 (3.3%)
	vertigo	5 (16.6%)
Post operative	SND	1 (3.3%)
	Taste disturbance	3 (10%)
	tinnitus	2(6.66%)

Dr D. Sekhar Reddy. “Endoscopic stapedotomy: Surgical and audiologic outcome.” *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, 19(4), 2020, pp. 07-10.