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Research Article

Outcomes of Bone Cement Application in Endoscopic Stapedectomy

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Abstract

Background: Stapes surgery is a successful and safe treatment modality with high success and low complication rates in the management of otosclerosis. Stapes piston crimping to the long process of the incus is a crucial step. Glass ionomeric cement, a form of bone cement, is used for otological purpose e.g stapedectomy. **Objective:** The study aims to clarify the role of bone cement in primary stapedectomy with an assessment of the postoperative hearing state. **Methods:** A prospective randomized clinical study including patients with otosclerosis was conducted. The study population was divided into two equal groups. Group A had primary stapedectomy with bone cement bridging between the prosthesis and a long process of the incus while group B had the procedure with crimping of the prosthesis. **Results:** fivty patients were included in the study. A statistically significant improvement of the hearing state was present in both groups in all frequencies ($p < 0.05$). **Conclusion:** The use of Glass Ionomer Bone cement in primary stapedectomy may have a role in providing stability for the procedure.

Keywords: stapedectomy, Titanium prosthesis, Hearing loss, Conductive deafness, Bone cement

Introduction

Management of otosclerosis by stapedectomy is considered a successful option due to good results as regards hearing and less complication. [1]

Stapes piston fixation to the long process of the incus by crimping is an important step because a loose piston can cause bad hearing results and a higher incidence of piston displacement, also, excessive crimping might lead to the necrotic ischemia of the long process incus. [2]

In 2001, the United States Food and Drug Administration (USFDA) approved the application of glass ionomeric cement (GIC), for otological procedures. And so, it has been used in revision stapes surgery.[3]

Objective

The main objective of the current study is to assess the results of the application of bone cement in stapes surgery for otosclerosis as regards results, safety, and complication rate.

Patient and Methods

This study is a prospective comparative study involving 50 patients with otosclerosis, who fit the inclusion criteria and were selected from the outpatient clinic of otorhinolaryngology of Minia University Hospital, from January 2021 to June 2022.

This study was approved by the ethical committee in the faculty of medicine, at Minia University (approval No: 2:1/2021), with a recorded and informed approval obtained from the participants after a thorough explanation of the study and its motives.

Inclusion criteria:

- Normal otoscopic examination.
- Audiological examination of all patients with pure conductive hearing loss with absent acoustic reflex.

Exclusion criteria:

- Tympanic membrane perforation.
- Sensorineural hearing loss.
- Only hearing ear.
- Revision cases.
- Recent upper respiratory tract infec-tion and middle ear infection.
- Cases unfit for general anesthesia.

This study prospectively compared clinical outcomes in terms of the time of ope-ration, safety of bone cement application, complication rates if present, complete audiological evaluation at 3, 6, and 12 months postoperative, and compared results with fixation of prosthesis without bone cement. The titanium prosthetic device was fixed to the long process of incus (LPI) in the first group (Group A) with the help of bone cement, but in the second group (Group B) by crimping the titanium prosthesis without the use of bone cement. A total of 50 cases included in the present study divided into:

Group1 (Group A):

Twenty-five cases were included in this group.

Group2 (Group B):

Twenty-five cases were included in this group.

Method

Evaluation of the patients

1- Detailed history of ear, nose, and throat (ENT) was taken for each patient and otological symptoms).

2- Complete ENT examination: with detailed otoscopic examination and tuning fork tests.

B- I**nvestigation**:

- Laboratory investigations, electro-cardiogram (ECG), and internal medicine fitness.
- Full audiological assessment (Pure Tone and speech audiometry): with a selection of cases of conductive hearing loss.

Operative Technique:

- By using endoscopy Karl Storz (Germany) high-definition endoscopic system, with a 4-mm diameter, 18-cm length, 0-degree endoscope with camera image 1S full HD- Tower Karl Storz.
- All participants under general anesthesia, incision of the external auditory canal skin about 6-8 mm lateral to the annulus after local injection of epinephrine. The incision was then extended until the bone beneath was visible.
- Tympanomeatal flap was elevated.
- The chorda tympani were gently removed from its groove with its pre-sservation and anterior displacement.
- Assessment of joint and ossicular motion to confirm the patho-physiology of stapes fixation and also evaluation of facial nerve course and its normal variant if present. Figure (1)
- The UN traditional opposite staped-ectomy approach proposed by House et al., in 2002 was carried out by perforating the oval window and inserting the prosthesis with application to the long process of incus before the incudostapedial joint was split. By using this technique, the force of insertion is prevented from entering the oval window.
- An oval window's fenestration was carried out using a 0.8-mm perforator as shown in Figure (2).
- Immediately following the stapedo-tomy during the endoscopic surgery, dexamethasone was injected into the fenestra using a 21-gauge injector. The physician Serhat NAN et al., in 2021 utilized dexamethasone regularly. [4]

- **Application of prosthesis**

In group A, the incus- Titanium prosthesis junction was bridged with a drop of (GIC) created by mixing a liquid and sterile powder for 7 seconds, and then using the mixture for 1 to 3 minutes as illustrated in Figure 4. Controlling any bleeding around the ossicles is mandatory before applying GIC. To prevent unfavorable reactions with soft tissues or ossicular fixation, the surgeon must take care not to let GIC material touch the tympanomeatal flap or middle ear mucosa, the facial nerve, and the stapes footplate. The surgeon gives the GIC seven minutes to solidify after applying it. After the GIC hardens, it is mandatory to check the movement of ossicles to evaluate the success of this technique. Figure (3)

In group B, the titanium prosthesis was inserted by crimping, with this procedure being endoscopically recorded as illustrated in Figure 3.

- A single dose of intraoperative intravenous steroid, Elik et al., in 2018. [5]
- Using a sickle knife to split the stapedius tendon.
- Fracture of stapes superstructure with its removal.
- Repositioning of tympanomeatal flap.
- The outer ear tract was then packed with gel foam. Figure (4)

Results

The statistical package software IBM SPSS 28.0 (IBM; Armonk, New York, USA) was used to analyze the data. The Kolmogorov-Smirnov test was used to detect if the data were normal. Data were expressed as median, interquartile range (IQR) for non-parametric data, in addition to both number and percentage for categorized data.

Two independent groups were compared using the Mann-Whitney U test for non-parametric data, and the Wilcoxon test was employed to look for differences between two dependent variables within each group. Comparing categorical variables was carried out using the Chi-square test or Fisher's exact test. A p-value less than 0.05 is considered significant.

Males represented 30% of cases (15 cases) while females represented 70% (35 cases). There was no discernible distinction between the two groups. (P=0.27). The mean age in group (1) was (32.32±6.7) while it was (34.08±7.04) in group (2), there was no statistically significant difference between groups (P=0.37).

Table 1: shows the audiometric data at 500 Hz for preoperative and postoperative patients at three, six, and twelve months.

	500 Hz			
	Preoperative	**3m postoperative**	**6m postoperative**	**12m postoperative**
Air 500 Hz				
Titanium with bone cement(n=25)	65 (60-70)	28 (23-33)‡	23 (23-28)‡	28 (23-28)‡
Titanium without bone cement(n=25)	65 (60-75)	38 (33-41)‡	33 (33-38)‡	33 (28-38)‡
	p= 0.292	***p= <0.001****	***<0.001****	***p= <0.001****
Bone 500 Hz				
Titanium with bone cement (n=25)	20 (20-25)	20 (15-20)	20 (20-22)	20 (15-22)
Titanium without bone cement(n=25)	20 (20-25)	20 (15-20)	20 (10-25)	20 (15-20)
	p= 0.788	***p= 0.964***	***p= 0.516***	***P= 0.141***
ABG 500Hz				
Titanium with bone cement(n=25)	45 (40-50)	8 (6-8)‡	3 (3-8)‡	3 (3-8)‡
Titanium without bone cement(n=25)	45 (40-50)	16 (13-18)‡	13 (13-23)‡	13 (10-23)‡
	p= 0.369	***p= <0.001****	***p= <0.001****	***p= <0.001****

Table 2: shows the audiometric data at 1000 Hz before and after (three, six, and twelve months) surgery.

	1000 HZ			
	Preoperative	**3m postoperative**	**6m postoperative**	**12m postoperative**
Air 1000 Hz				
Titanium with bone cement(n=25)	60 (50-65)	30 (25-32)‡	25 (22-30)‡	25 (25-30)‡
Titanium without bone cement(n=25)	65 (61-70)	37 (35-47)‡	35 (33-41)‡	35 (31-38)‡
	p= 0.113	***P=<0.001****	***p= <0.001****	***p= <0.001****
Bone 1000 Hz				
Titanium with bone cement(n=25)	20 (15-25)	20 (15-25)	20 (15-25)	20 (15-20)
Titanium without bone cement(n=25)	25 (20-25)	20 (20-25)	20 (15-25)	20 (15-25)
	p= 0.206	***p= 0.495***	***p= 0.882***	***p= 0.48***
ABG 1000Hz				
Titanium with bone cement(n=25)	40 (35-45)	10 (5-10)‡	5 (5-10)‡	7 (5-10)‡
Titanium without bone cement(n=25)	42 (38-45)	17 (14-28)‡	15 (10-25)‡	15 (10-24)‡
	p= 0.308	***p= 0.001****	***p= <0.001****	***p= <0.001****

Table 3: Preoperative and postoperative (3, 6and 12 months after surgery) audiometric results at 2000 Hz

	2000 HZ			
	Preoperative	**3m postoperative**	**6m postoperative**	**12m postoperative**
Air 2000 Hz				
Titanium with bone cement(n=25)	55 (40-60)	30 (25-35)‡	30 (25-30)‡	30 (25-31)‡
Titanium without bone cement(n=25)	60 (50-63)	40 (35-41)‡	35 (33-38)‡	35 (35-41)‡
	p= 0.096	***<0.001****	***p= <0.001****	***p= <0.001****
Bone 2000 Hz				
Titanium with bone cement(n=25)	25 (20-25)	22 (20-25)	25 (20-25)	25 (20-25)
Titanium without bone cement(n=25)	25 (20-25)	22 (20-25)	25 (20-25)	25 (15-25)
	p= 0.889	***p= 0.905***	***p= 0.732***	***p= 0.826***
ABG 2000 Hz				
Titanium with bone cement(n=25)	30 (20-35)	10 (5-10)‡	5 (2-7)‡	5 (5-10)‡
Titanium without bone cement(n=25)	35 (25-40)	16 (14-20)‡	13 (10-16)‡	15 (10-16)‡
	p= 0.131	***p= <0.001****	***p= <0.001****	***= <0.001****

Table 4: Preoperative and postoperative (3, 12, and 6 months after surgery) audiometric results at 4000 Hz

	4000 HZ			
	Preoperative	3m postoperative	6m postoperative	12m postoperative
Air 4000 Hz				
Titanium with bone cement(n=25)	50 (45-60)	25 (20-30)‡	25 (20-30)‡	25 (20-27)‡
Titanium without bone cement(n=25)	55 (45-65)	35 (30-40)‡	40 (35-45)‡	36 (30-45)‡
	p= 0.218	***p= <0.001****	***p= <0.001****	***p= <0.001****
Bone 4000 Hz				
Titanium with bone cement(n=25)	20 (20-25)	20 (15-25)	20 (15-25)	20 (20-25)
Titanium without bone cement(n=25)	25 (20-25)	23 (20-25)	23 (20-25)	25 (20-25)
	p= 0.184	***p= 0.287***	***p= 0.641***	***p= 0.157***
ABG 4000 Hz				
Titanium with bone cement(n=25)	30 (25-40)	5 (0-10)‡	1 (0-5)‡	5 (0-5)‡
Titanium without bone cement(n=25)	30 (25-40)	12 (10-15)‡	15 (10-20)‡	13 (5-20)‡
	p= 0.63	***p= <0.001****	***p= <0.001****	***p= <0.001****

Table 5: Preoperative and postoperative (3, 6and 12 months after surgery) average audiometric results

	Average			
	Preoperative	3m postoperative	6m postoperative	12m postoperative
Average Air				
Titanium with bone cement(n=25)	56.3 (52.5-60)	28.3 (23.3-30.8)‡	26.5 (24.5-27.5)‡	27 (24.5-28.3)‡
Titanium without bone cement(n=25)	60.8 (55.3-65)	36.5 (33.8-41.3)‡	35.8 (33.5-39.5)‡	35.8 (32-40.5)‡
	p= 0.071	***p= <0.001****	***p= <0.001****	***p= <0.001****
Average Bone				
Titanium with bone cement(n=25)	21.3 (20-22.5)	20 (18.8-21.8)	21.3 (18.8-23.8)	21.3 (18.8-22.5)
Titanium without bone cement(n=25)	23.8 (20-24.5)	21.3 (18.8-22.5)	20 (17.5-23.8)	21.3 (17.5-22.5)
	p= 0.2	***p= 0.623***	***p= 0.877***	***p= 0.832***
Average ABG				
Titanium with bone cement(n=25)	36.3 (31.3-40)	8.5 (2-10.8)‡	5 (3.3-6.8)‡	5.8 (3.3-8.3)‡
Titanium without bone cement(n=25)	39 (33.3-42.5)	15.8 (14-21.3)‡	14.3 (12-19.8)‡	14.3 (9.8-20.8)‡
	p= 0.193	***p= <0.001****	***p= <0.001****	***p= <0.001****

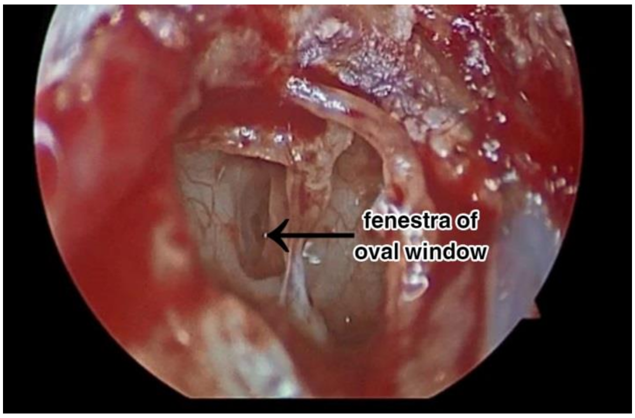

Fig. (1): Fenestration of the oval window by hand-held perforator

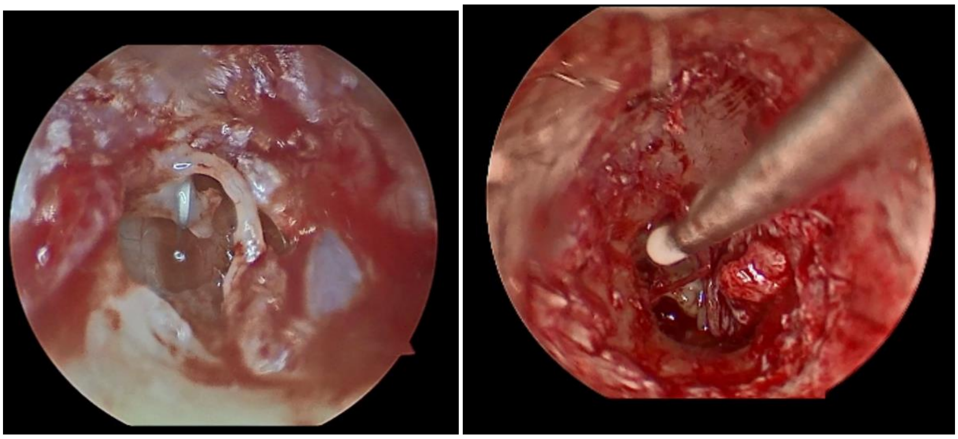

Fig. (2): Fixation of titanium prosthesis with bone cement in Group (A)

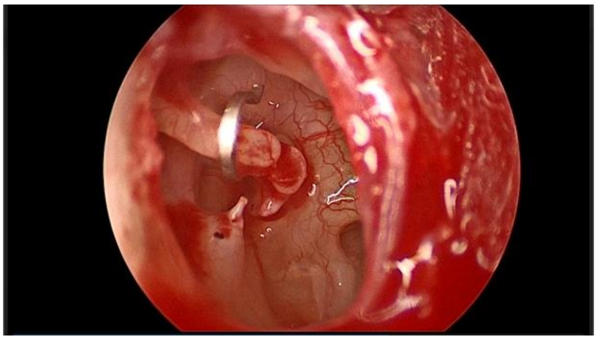

Fig. (3): Insertion of titanium prosthesis and its Fixation by crimping in Group (B)

The median operation time was higher among group (A) than group (B), the distinction was statistically considerable. Total operation time is the period between the application of the endoscope and its removal including the application of the prosthesis and its fixation with bone cement time for bone cement preparation (mixing and insertion)and time of its hardening after application, so it is higher in group A.

Results of Pure tone audiometry (PTA) of Air conduction (AC) at 500 HZ revealed that the threshold of hearing was significantly better among group (A) than group (B), Between the two groups, the distinction was statistically considerable at 3,6, 12 months postoperatively ($P<0.001$. No noticeable difference existed between the groups, for bone conduction (BC) at 500 HZ. At 3, 6, and 12 months following surgery, group (B) members had significantly greater Air bone gap (ABG) 500 HZ values than group (A). Hearing is better in group (A) with bone cement than in group (B) by crimping. **Table (1)**

Results of audiometry at 1000 HZ revealed that the threshold of hearing was significantly better among group (A) than group (B) at 3,6, and 12 months postoperatively. No noticeable difference existed between the groups. For bone conduction at 1000 HZ. Air bone gape 1000 HZ was higher among group (B) than group (A) at 3, 6, and 12 months after surgery, the distinction was statistically notable. p= <0.001. **Table (2)**

Regarding results of audiometry at 2000 HZ, the threshold of the hearing was significantly higher (so hearing was worse) among group (B) than group (A), and the distinction was statistically notable between the two groups at 3, 6, 12 months postoperatively (P<0.001). Regarding bone conduction at 2000 HZ, there was no statistically significant difference between groups. As regards ABG 2000 HZ, it was significantly higher among group (B) than group (A) at 3, 6, and 12 months postoperatively. Better hearing in group (A) with bone cement than in group (B) by crimping. **Table (3)**

Results of audiometry at 4000 HZ revealed that the threshold of hearing was significantly better in group (A) than in group (B) at 3, 6, and 12 months postoperatively. Concerning bone conduction at 4000 HZ, there was no notable discrepancy among the two groups. Air bone gape 4000 HZ was higher among group (B) than group (A) at three, six, and twelve months after surgery, the difference was statistically significant p= <0.001. **Table (4)**

Average air conduction was lower (better hearing) among group (A) than group (B) at 3, 6, and 12 months postoperatively, the difference was statistically significant p= <0.001. Regarding average bone conduction, there was no statistically significant difference between groups. The average Air bone gap was higher among group (B) than group (A) at 3, 6, and 12 months postoperatively, the difference was statistically significant p=<0.001. **Table (5)**

Concerning complications, 1 patient in Group A and 2 in Group B required resection of the chorda tympani nerve during the procedure. Decrease and loss of taste sensation were the symptoms reported by the patients post-operatively and their symptoms ameliorated within 6 months. Vertigo and vomiting occurred in 15 (60%) of the patients in group A and 15 (60%) of the patients in group B, respectively. Ten (group A) and eleven (group B) patients also experienced vomiting. They were managed by intravenous fluid, corticosteroids, anti-vertiginous, and antiemetic drugs. All patients improved after 2 days. One patient in group A with residual hearing loss in the early follow-up from residual tympanic membrane perforation and two patients in group B with residual hearing loss one of them with sensorineural hearing loss and the other one with CHL in the long-term follow-up may need revision surgery. Also, no facialpalsy and no intraoperatve gusher.

The success rate in group A with bone cement is 96% higher than group B without bone cement which is 92% (p-value =0.38).

Discussion

GICs have been utilized in ear procedures since the 1990s. They are utilized to fill the gap between ossicles. Glass ionomer cements offer physiological outcomes that are comparable to the way the natural ossicular chain functions.[6]

In otosclerosis surgery, glass ionomer cement is used to stabilize various prostheses, in addition to repairing the ossicular chain[7], numerous writers assert that GIC reduces the frequency of recurrent surgery by fixing the prosthesis and halting degradation of the incus' protracted process. After surgery for patients with otosclerosis, persistent hearing loss was found to be prosthesis slippage and incus necrosis. These issues stem from

implanting the prosthesis on top of the LPI.[8]
In the current study, bone cement was used for fixation of the prosthesis in one group and compared with crimping in the other group.

Goebel and Jacob proposed the use of bone cement in primary stapedotomies in 2005. Their research is more thorough than other studies that suggested that using bone cement in difficult primary stapedotomy situations might improve hearing.[10]. In a 2017 study, Elzayat compared the efficacy of crimping Teflon prostheses and bone cementing in primary stapedotomy. Group A needed to complete the stapedotomy for crimping the incus-prosthesis junction and group B for glass ionomer bone cementing without crimping. All patients were operated on by two senior surgeons utilizing a Teflon piston prosthesis under a microscope while all patients were using a general anesthetic. An audiological evaluation was recorded six months after surgery. Regarding time of operation, the mean time needed to complete the stapedotomy in group A was 37.4±4.26 minutes, whereas the mean time needed to complete the procedure in group B was 39.7±1.49 minutes between the two groups under study, there was no discernible difference in operation data. 2 patients in group A need resection of the chorda tympani nerve. One patient in group B had a tear in the tympanic membrane during the elevation of tympanomeatal flap and tragal cartilage perichondrial graft was used for repair this tear. All patients showed complete healing during the post-operative follow-up. Both AC and ABG were improved in the two studied groups. The postoperative average residual air-bone gap and hearing gain were statistically significant in group B ($p< 0.05$) compared with group A. In the current study, 50 patients from two equal groups underwent primary stapedectomy by a single surgeon using an endoscope. Group A is fixed with bone cement and group B is fixed by crimping. The study compared the effectiveness of the two fixation methods, the operative success, and the operative time which in group A was55±6 minutes and in group B was v45±7 minutes there was a significant difference. Need for cutting of the short chorda tympani, three patients with chorda tympani affection—1 in group A and 2 in group B—complained of taste disorder and improved after a six-month follow-up.

It has been observed that stapedotomy results in varying degrees of gap closing in primary stapedotomy with the late-onset audiological outcome and audiovestibular complication[12]. It is widely agreed upon that a reduction of the discrepancy to below 20 dB would indicate a favorable surgical outcome[13].In the current study, the average air-bone gap in group A was 36.3 (31.3-40) dB before surgery, and it decreased to 8.5 (2-10.8) dB at 3 months, 5 (3.3-6.8) at 6 months, and 5.8 (3.3-8.3) at 12 months. The average air-bone gap in group B was 39 (33.3-42.5) dB before surgery, but it was only 15.8 (14-21.3) after 3 months, 14.3 (12-19.8) after 6 months, and 14.3 (9.8-20.8) after 12 months. The postoperative air-bone gap was significantly different between the two groups (p 0.05). In this case, the use of bone cement to attach the prosthesis to the LPI is useful. In the present research the prosthesis was attached to the LPI with bone cement, and rotated as one unit during palpation, it allowed for more realistic sound transmission. This is the most likely explanation for the excellent air-bone gap closing seen in the bone cement group, with average gains of 7 dB at 1000 Hz.

In a study by Sioshansi et al., in 2021, 46 cases with otosclerosis underwent stapedotomy with bone cement fixation: 21 were primary cases and 25 were revision cases. The average follow-up was 17 months. ABG improved on average from 27 dB to 9 dB (P.0001), and the mean AC PTA decreased from 56 dB preoperatively to 34 dB following surgery. Neither primary stapes surgery nor revision stapes surgery significantly differed in postoperative ABG (6 dB vs. 10 dB, $P=0.07$). With longer follow-up time (mean 44 months, neither the BC PTA nor the word recognition scores significantly changed. According to Sioshansi et al., in

2021, three patients underwent additional revisions, while one patient experienced sensorineural hearing loss, but in the current study, twenty-five otosclerosis patients underwent staped-ectomy with bone cement fixation and had an average follow-up of 12 months. All of the patients' procedures were primary instances; there were no revision cases. Before surgery, the average AC PTA was 56, 3 dB and 27 dBPostoperatively (P.0001), the ABG improved on average from 36, 3 dB preoperatively to 5, 8 dB post-operative (P.0001), and both variables were significant.

Hosoya et al., in a 2023, retrospective analysis of eight cases of endoscopic transcanal stapes surgery using hydro-xyapatite prosthesis. ABGs following surgery were generally within 10 dB, follow-up for 12 months following surgery. No postoperative sensorineural hearing loss was noted. One patient with intraoperative injury is the chorda tympani. In 50% of individuals, post-operative temporary vertigo and transient taste disturbance were noted.[14]

The average postoperative ABGs in the current study's (50 cases of endoscopic transcanal stapes surgery employing piston-type titanium prosthesis) were all under 10dB. Residual tympanic membrane perforation was observed in 4% of cases in group A leading to persistent hearing loss in 4% of cases in group A. Residual hearing loss in 8% in group B one of them sensorineural hearing loss and the other one CHL in the long term follow up and may need to revision surgery, no intraoperative gusher nor facial nerve palsy were observed.

Dexamethasone administration to the fenestra during surgery by SerhatİNAN et al., in 2021, decreased the severity of dizziness and the frequency of antiemetic drug use early after the operation while there is no effect on the hearing thresholds and dizziness in the long-term period.[4]

Çelik Ç et al., in 2018, perioperative corticosteroids may help prevent sensori-neural hearing loss post-stapedectomy. 106 Patients were involved in this study for primary stapedotomy and were divided in two group. Group 1 (n=56: intra-operative use of intravenous (i.v.) steroids and Group 2 (n=50: no intraoperative steroid usage). The follow-up period was between 3 and 40 months. The hearing outcome between the two groups was similar. Average BC following surgery at 500, 1000, and 2000Hz were all statistically significantly higher for all cases ($p < 0.05$). At 4000Hz, no such statistically significant improvement ($p > 0.05$). Looking at the level of improvement, this was highest for bony conduction 2000Hz ($p < 0.001$)[5]. In the current study 50 cases with pure conductive hearing loss were operated on under general anesthesia, routine administration of i.v dexa intraoperative for all patients who underwent primary stapedotomy with a follow-up 12 months post-operative, bone conduction at 500, 1000, 2000, 4000HZ, there was no statistically significant difference between two groups

BianconiL, et al., in 2020, operated 150 ears by endoscopic stapes surgery using piston-type titanium ABG<10 db (78, 7%), ABG<20db (92, 7%).[15]

In the current study, 50 ears were operated by endoscopic stapes surgery using piston-type titanium. ABG5.8 inTitanium with bone cement, ABG14.3Titanium without bone cement after 12 months.

Due to increased efficacy in illuminating the middle ear, endoscopic stapedotomy has gained in popularity during the last two decades. The bone canal wall or chorda tympani nerve has been better identified. It is now widely recognized as a first-line treatment for otosclerosis due to its status as a low-risk, cost-effective alternative for patients experiencing progressive hearing loss.[16]

Sixty patients participated in the study conducted by Mostafa M. et al., in 2021. A total of two equal groups made up the study population. Primary stapedotomy with Teflon prosthesis crimping was performed in Group A, and bone cement in Group B. The hearing outcome was one month after surgery. The stability of the prosthesis over the long term was determined by the 6-month postoperative audiogram. A notable improvement in hearing status across all frequencies (p <0.05) but the group B had a greater closure of the postoperative air-bone gap at 2000 Hz compared to group A. All patients underwent follow-up one year after surgery. 2 cases (10%) in Group A and 3 cases (15%) in Group B had vertigo and vomiting as a result of the problems that this investigation revealed. They were treated with intravenous hydration, corti-costeroids, antivertigo, and anti-emetics. All cases improved after 2 days. One patient in group A and two in group B experienced postoperative dysgeusia. On the month's follow-up, this dysgeusia improved in all patients. Additionally, no occurrences of facial palsy or tympanic membrane perforation were reported [17]. The same concept of bone cement was applied in the current research; however, a piston titanium prosthesis was used instead. Group A titanium with bone cement and Group B titanium without bone cement were the two equal groups of 50 patients that were used in the study. Following up on the hearing outcome at 3, 6, and 12 months after surgery. Vertigo and nausea were both experienced by 15 patients in Group A and 15 patients in Group B, respectively. They were treated with intravenous hydration, cortico-steroids, antivertigo, and antiemetics. After a couple of days, all patients got better.

Conclusion:

In primary stapedotomy, the use of GIC may help to fix the prosthesis and reduce the persistent post-operative conductive hearing loss in otosclerosis patients.

- No conflict of interest.

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