Case Reports

Stapedectomy in tympanosclerosis, hearing results

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ABSTRACT

تهدف هذه الدراسة إلى تقييم نتائج استخدام إزالة الركاب لعلاج تصلب الطبل المسبب لثبات الصفيحة القدمية للركاب، وذلك بمراجعة حالات تصلب الطبل للنافذة البيضاوية للذين أجريت لهم عمليات. تمت إزالة الركاب لعلاج تصلب الطبل المسبب لثبات الصفيحة القدمية للركاب لثمانية مرضى. تحقق إغلاق الفجوة العظمية الهوائية (ABG) في غضون 10 دسبل dB في 25% من الحالات، و تقل عن 20 دسبل dB في 87.5% من الحالات. كان متوسط الفجوة العظمية الهوائية (ABG) قبل العملية 31.09 دسبل dB، وأصبحت الفجوة العظمية الهوائية (ABG) بعد العملية 13.28 دسبل dB. في 62.5% من الحالات، كان هنالك تحسن كبير في عتبات توصيل الهواء بعد (أكثر من أو يساوي 20 دسبل dB). لم يلاحظ وجود ضعف حسي عصبي في هذه السلسلة. وكان متوسط عتبة التوصيل العظمي (BC) قبل العملية 23.43 دسبل dB و بعد العملية 16.25 دسبل dB. متوسط المتابعة من 6.5 أشهر.

The aim of the present study was to evaluate the results of using stapedectomy to treat tympanosclerosis fixation of the footplate. A retrospective review of tympanosclerosis of the oval window with stapes fixation, after undergoing surgery. Eight patients underwent stapedectomy for tympanosclerotic stapes. Postoperative (post-op) air-bone gap (ABG) closure to within 10 dB was achieved in 25% of cases. An ABG of less than 20 dB was obtained in 87.5% of cases. The mean preoperative (pre-op) ABGs were 31.09 dB, and post-op ABGs were 13.28 dB. Significant post-op improvement of air conduction thresholds (more than, or equal to 20 dB) was found in 62.5% of cases. No significant sensorineural hearing loss was seen in this series with a mean pre-op bone-conduction threshold (BC) of 23.43 dB and a mean post-op BC threshold of 16.25 dB. The mean follow-up period was 6.5 months.

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When tympanosclerosis involves the tympanic membrane (TM) and/or the malleus and incus, treatment is usually straightforward and uncomplicated. When the stapes is involved, therapy is more controversial and may be more difficult.[1] As stapedectomy requires the opening of the inner ear, the middle ear should be clean and dry, and the TM should be intact. The management of stapes fixation resulting from tympanosclerosis remains controversial.[2] Whereas some ear surgeons consider tympanosclerosis a possible contraindication to ossiculoplasty in cases of stapes fixation,[3] others[1] believe that significant benefit can be achieved by surgery. The aim of this study was to report the hearing results in surgically treated cases of stapes fixation due to tympanosclerosis in King Abdulaziz University Hospital in Riyadh, Kingdom of Saudi Arabia.

Cases Report. A retrospective chart review of patients treated by stapes surgery for tympanosclerosis at King Abdulaziz University Hospital, Riyadh, Kingdom of Saudi Arabia, from September 2005 to February 2007 was carried out. The preoperative (pre-op) and postoperative (post-op) pure-tone air and bone-conduction (BC) thresholds at 500, 1000, 2000, and 4000 Hz were used to calculate the pure-tone averages. Air and BC threshold from the same test were used to calculate the air-bone gap (ABG). The number of patients studied was 8: 6 males and 2 females. Their age ranged from 18-46 years (mean 29 years). All patients underwent 2 stages of surgery. Seven patients had previous tympanoplasty to repair a tympanic membrane (TM) defect. One patient had canal-wall-down mastoidectomy, and mastoid oblitration. The TM was intact, and the middle ear mucosa was healthy in all patients during the second stage of surgery (stapedectomy). The surgical technique varied according to the extent of the tympanoscleosis. Five cases were labeled as type IV tympanosclerosis (fixation of the stapes and malleus-incus complex) and 3 cases as type III tympanosclerosis (involving the stapes only). In 5 cases of type IV tympanosclerosis, stapedectomy was performed in combination with removal of the fixed incus and malleus head. In 4 cases, the stapes

superstructure was impeded in tympanosclerosis and the oval window was obliterated. En bloc removal of the tympanosclerotic plaque together with the stapes superstructure was performed as advised by Austin[4] and Tos[5]. Piece-meal removal of the tympanosclerotic plaques was avoided to minimize the risk of cochlear damage. After fenestration was made in the footplate using angled picks, complete removal of stapes footplate was performed in 4 patients. In 3 cases, large fenestra with partial removal of the footplate was performed. Stapedotomy was performed in one case, with the prosthesis placed between the handle of the malleus and oval window. A Robinson hydroxylapatite oval window to malleus prosthesis was used in 4 patients, and Wehre's single notch incus-stapes replacement prosthesis (made of a hydroxylapatite) was used in one patient. Two cases of type III tympanoscleosis have stapedectomy, and one has stapedotomy. Restoration of the sound-conducting mechanism was carried out between the oval window and the long process of incus by a 0.3 mm diameter Teflon piston prosthesis. We used 4-frequency pure-tone averages for bone and air thresholds (0.5, 1, 2, and 4kHz). An ABG were calculated. The follow-up ranged between 4-10 months with the mean follow-up period being 6.5 months. Postoperative ABG closure to within 10 dB was achieved in 2 cases. An ABG of less than 20 dB was obtained in 6 cases (**Table 1**). Significant post-op improvement of air conduction thresholds equal or more than 20 dB was found in 7 cases. No significant sensorineural hearing loss was seen in this series, and a mean BC threshold preoperatively of 23.43 db and mean BC threshold postoperatively of 16.25 db was recorded (**Table 2**).

Tables - Preoperative and postoperative air-bone gap (ABG).

Patient	1	2	3	4	5	6	7	8
Preop ABG	24	16	27.5	46	41	39	27.5	27.5
Postop ABG	12.5	0	12.5	14	15	26	9	17.5

Preop - pre operative, Postop- post operative, ABG - air-bone gap, dbB - decibels

Table 2 - Preoperative and postoperative bone conduction.

Patients	Pre-Op	Post-Op
1	25	15
2	30	8
3	35	30
4	30	16
5	7	14
6	22	16
7	20	16
8	19	11

db - decibels

Discussion. The tympanosclerosis is used to describe a sclerotic or a hyaline degeneration of the fibrous and elastic fibers in the lamina propria of the TM and middle ear mucosa. It appears to be an end-product of recurrent acute or chronic ear infection, as well as occurring following otitis media with effusion (OME). In 1869, von Troltsch first described tympanosclerosis as a stiffness of the fibrous tissue of the deepest layers of the middle ear mucosa that may affix the stapes in the oval window niche and/or the malleus and incus in the region of the attic (cited in Tos et al).[5] Gibb in 1976,[6] divided tympanoscleosis macroscopically into 2 types according to its texture. Type one is soft, creamy, rubbery, and of cartilaginous texture, and peels like an onion. Type 2 is hard white, firmly adherent, and fractures during attempts at removal. Wielinga et al,[3] classified tympanosclerosis according to its location, where type I is involvement of the perforated or intact TM. It has an incidence of 24-51% in chronic suppurative otitis media (CSOM) and 0-15% in OME. Mostly, it is of no clinical significance in terms of hearing loss. Type II is an attic fixation of the malleus-incus complex with mobile stapes. Type III is a mobile malleus-incus complex associated with stapes footplate fixation. Type IV is a fixation of both the stapes footplate and the malleus-incus complex. The types II-IV share common features. Their incidence is 7-32% in CSOM and is usually associated with a large central perforation (86-100%). They are mostly present in ears with long duration of infection. Tympanic perforation is present in up to 100% of cases with tympanosclerosis.[7] We believe that surgery should always be staged, and stapedectomy is performed with an intact ear drum, which is a belief of many surgeons.[2] Therefore, the stapedotomy should always be performed at least one year later, although some authors claim good results from a one-stage procedure.[5] Whereas some famous otologists, example Austin,[4] Sheehy and House,[8] and Tos et al,[5] favor surgical procedures, Smyth[9] has considered tympanosclerosis "the least amenable of the diseases of the middle ear, which we attempt to treat surgically." The same opinion is shared by Schuknecht et al.[10] If we exclude bone anchored hearing aid (BAHA), there are 2 main surgical procedures used to help patients with stapes fixation due to tympanosclerotic. First, there is the removal of plaques to release the fixed stapes (mobilization). The major advantage of mobilization is completion of the entire operation in one stage with the assumption that tympanosclerosis does not normally recur after complete removal.[8,11] However, according to several authors, there is greater risk of sensorineural hearing loss after mobilization.[9] The second option is

stapedectomy/stapedotomy, which is the technique of choice for several otologists.[2,12,13] However, some authors have shown that the result of surgery in patients with stapes fixation caused by tympanosclerosis is poorer than the outcomes of stapedectomy for otosclerotic fixation.[12] Although otosclerosis is not common in Saudi Arabia, many cases of CSOM have stapes fixation due to tympanosclerosis. Asiri et al,[14] reviewed 775 cases of CSOM in Saudi Arabia, and found the incidence of tympanosclerosis to be 11.6%, with 30% of these having fixation of the ossicles including the stapes footplate. In our series, good closure of ABG was achieved in most cases, which is similar to that in other series.[2,13,15] Hence, in our own practice, we prefer stapedotomy or stapedectomy to manage stapes fixation due to tympanosclerotic with an interposition graft and an appropriate prosthesis. This small series demonstrates that safe and successful stapedectomy is possible in cases with tympanosclerotic fixation of the stapes.

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Ethical Consent

All manuscripts reporting the results of experimental investigations involving human subjects should include a statement confirming that informed consent was obtained from each subject or subject's guardian, after receiving approval of the experimental protocol by a local human ethics committee, or institutional review board. When reporting experiments on animals, authors should indicate whether the institutional and national guide for the care and use of laboratory animals was followed.