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Stapedectomy and variations of the facial nerve

Otosclerosis is diagnosed in about 1% of the population. This is the disease with still unknown etiology and changing pattern (8). The main symptoms of otosclerosis are conductive hearing loss and tinnitus. Hearing loss can usually be corrected by surgery and excellent hearing results were reported previously (9). Stapedectomy or stapedotomy are carried out in patients with otosclerosis. In a proportion of cases tinnitus decreases or disappears after surgery (10). Stapedectomy is a very effective and safe procedure. However, certain anatomical findings in the middle ear may predispose to serious difficulties and complications. The main risk of the operation are sensorineural hearing loss and facial nerve palsy. Facial nerve palsy is reported in less than 1% of the operations (5). This complication is a very devastating event both for the patient and the surgeon.

The aim of the study was to analyze the incidence of anatomical variations and abnormalities of the facial nerve found during stapedectomy. Specific management in the case of anomalous course of the facial nerve was also described.

MATERIAL AND METHODS

A retrospective analysis of clinical records of 316 stapedectomies was carried out in search for facial nerve anomalies. Concomitant abnormalities found during the operation were also recorded. The group consisted of 232 females and 84 males. The mean age was 40.1 and it ranged from 11 to 65 years. All the operations were performed by one surgeon (Gołąbek). Local anesthesia was used in all cases. Endomeatal approach was used in 118 patients and endoaural approach in the rest cases. Three different sequences of surgical steps in the middle ear were used in the group (4). In the first group classical stapedectomy was performed: 1) removal of stapes superstructure, 2) making a hole in the footplate, 3) placing the prosthesis on the incus. In the second group the hole in the footplate was made before removal of stapes arch. In the third group: 1) the hole in the footplate, 2) placing the prosthesis on the incus, 3) removal of stapes arch, were performed.

In most cases a one-millimeter opening was performed using a manual perforator. The CO₂-laser was used in last 15 cases to make the hole in the stapes footplate, to evaporate the stapedia tendon and finally to weaken the posterior crus of the stapes. In all the procedures a 0.6 mm Teflon-piston prosthesis was used.

RESULTS

In 25 (7.9%) of 316 patients the facial nerve had an abnormal course. There were 16 women and 19 men in the group with facial nerve anomalies. The mean age was 41 ± 9.6 and it ranged from 18 to 56 years. Twenty patients exhibited partial and two total overhang of the nerve over the oval window. In two of them the facial nerve was dehiscent in the tympanic segment and in three patients an obliterative type of the disease was also noted. In 15 patients with a narrow oval window niche due to prominent facial nerve the sequence of steps in the middle ear had to be changed, and the opening in the footplate was done after removing the stapes arch. In two cases the prominent and dehiscent facial nerve overlapped nearly the hole footplate. The nerve was slightly elevated and the opening in the stapes footplate was performed in the lower part of the footplate. This allowed for the insertion of the Teflon piston prosthesis. The function of the facial nerve was normal in both cases. The facial nerve dehiscence without the protrusion was found in two more patients. Another individual demonstrated otosclerotic bone over the facial nerve.

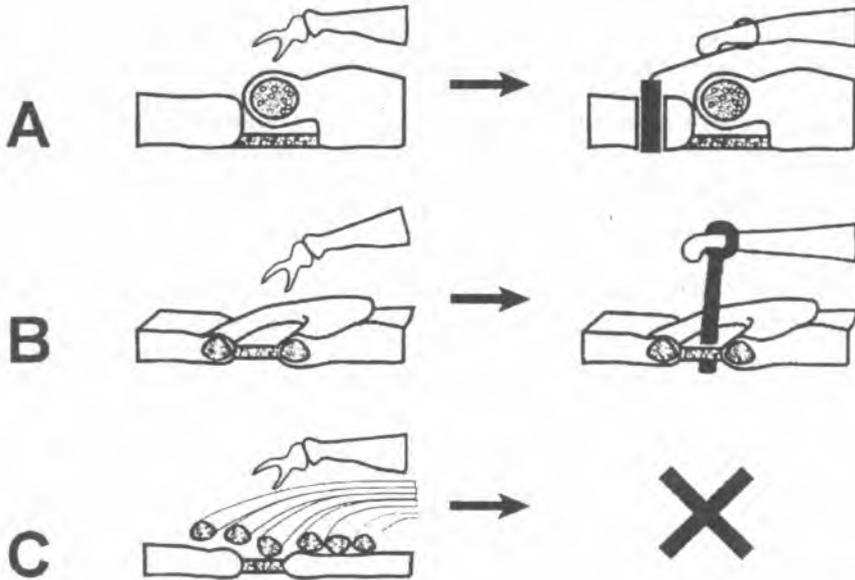


Fig. 1. The facial nerve overhang and the use of the Teflon-wire piston during stapedectomy (A), duplicated facial nerve with the piston inserted between the branches (B), the facial nerve is spread over the stapes completely obscuring footplate (C)

In one case a bifurcation of the facial nerve was found. Two branches of the nerve were almost covering the oval window in the stapes in between (Fig. 1 B). The hole was made in the footplate between the branches of the duplicated nerve, then the prosthesis was placed. The patient developed slight facial weakness after the surgery (grade III in House-Brackmann scale). The hearing improved, and the postoperative air-bone gap was 15 dB on the evaluation 4 months after surgery. The function of the facial nerve returned to normal within 5 months (grade I in House-Brackmann scale). In the same patient the second ear was operated on several

years before. Facial nerve overhang and an obliterative type of the disease were found during the first operation.

Three other patients from the group with facial nerve anomalies had operations performed on both ears. In two cases there was no facial nerve anomaly in the other ear. One patient had similar nerve overhang in both ears and concomitant obliteration of the oval window niche in one ear. In one individual facial nerve overhang was accompanied by stapes abnormality. The stapes superstructure formed a single columella connecting long process of the incus with stapes footplate.

DISCUSSION

Anomalies of the course of the facial nerve may be a non-expected finding during stapedectomy. Welding et al. (11) described four patients with facial nerve abnormalities. Three of them were directed to the authors with facial nerve injury after stapedectomy. Total overlap of the footplate by the nerve was found during re-exploration of those ears. Ballester et al. (1) reported partial overhang of the facial nerve in 32 (5.3%) and total overhang in 8 (1.3%) of 595 stapedotomies. Suggested management of total overlap of the footplate in otosclerosis is to drill an opening in the promontory. The use of the Teflon-wire prosthesis is helpful because the prosthesis can be bent Fig. 1 A (1, 2). In the case of partial prolapse of the nerve it is sometimes possible to make a stapedotomy and insert the prosthesis very close to the promontory. This was the procedure we used in our patients. Fisch (3) suggested gentle elevation of the prominent nerve to create more space for the prosthesis.

Blaser et al. (2) found duplication of the facial nerve in one case in a series of 548 stapedectomies. When a duplicated nerve is found at the operation, the only way to complete the reconstruction of the ossicular chain is to insert the prosthesis between the branches of the nerve. The cases in our series show that the presence of facial nerve abnormality in one ear does not necessarily mean that the nerve has an abnormal course in the other ear as well. However, the group with facial nerve abnormalities and bilateral operation is too small to draw any conclusions. The facial nerve can also completely obscure the stapes footplate. In such a situation no prosthesis should be inserted. The operation has to be terminated without performing stapedotomy (Fig. 1 C).

The use of laser systems in stapes surgery facilitates performing the opening in the stapes footplate and dividing the posterior crus. However, certain lasers like KTP-laser can create a thermal effect and indirectly injure the nerve (6). Total overhang of the facial nerve can make the use of the laser impossible. The opening in the promontory has to be done with a microdrill or with a manual perforator.

The high resolution computed tomography used preoperatively could show facial nerve abnormality (7). Patients with anomalous course of the nerve could be directed to more experienced centers.

CONCLUSION

Anomalies of the course of the facial nerve can be found in about 8% of stapedectomies and they require specific management. The knowledge of the possible abnormalities and relevant procedures is crucial for safe and successful stapedectomy.

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SUMMARY

The aim of the study was to analyze the incidence of anatomical variations and abnormalities of the facial nerve found during stapedectomy. Specific management in the case of an anomalous course of the facial nerve was also described. A retrospective analysis of clinical records of 316 stapedectomies was carried out in search for facial nerve anomalies. In 25 (7.9%) patients the facial nerve had an abnormal course. Twenty patients exhibited partial and two total overhang of the nerve over the oval window. In two of them the facial nerve was dehiscent in the tympanic segment and in three patients an obliterative type of the disease was also noted. The facial nerve dehiscence without the protrusion was found in two more patients. Another individual demonstrated otosclerotic bone over the facial nerve. In one case a duplicated facial nerve was found. Two branches of the nerve were almost covering the oval window (Fig.1B). The piston was placed in the footplate between the branches of the duplicated nerve. The patient developed slight facial weakness (grade III in H-B scale) after the surgery. The function of the facial nerve returned to normal within 5 months. Anomalies of the course of the facial nerve can be found in about 8% of stapedectomies and they require specific management. The knowledge of the possible abnormalities and relevant procedures is crucial for safe and successful stapedectomy.

Nietypowy przebieg nerwu twarzowego podczas stapedektomii

Oceniano 316 stapedektomii pod względem występowania nietypowego przebiegu nerwu twarzowego, utrudniającego wykonanie zabiegu. Nieprawidłowe ułożenie nerwu zauważono podczas 25 (7,9%) operacji. U 20 chorych stwierdzono nawis nerwu, częściowo zasłaniający niszę okienka owalnego, w tym u dwu chorych nerw twarzowy był odsłonięty w odcinku

bębenkowym. U dwu chorych nisza okienka była prawie całkowicie zasłonięta. Obserwowano również odsłonięcie nerwu twarzowego bez nawisu oraz obfite masy otosklerotyczne na kanale nerwu twarzowego. U jednego chorego nerw twarzowy był rozdwojony i obejmował strzemiączko swoimi odnogami. Wykonano otwór w podstawie pomiędzy odnogami i umieszczono w nim protezę, uzyskując dobry wynik słuchowy. Chory miał częściowe porażenie nerwu twarzowego bezpośrednio po zabiegu. Niedowład ustąpił całkowicie po 5 miesiącach. Nieprawidłowy przebieg nerwu twarzowego występuje w 8% operacji. Znajomość możliwego przebiegu nerwu twarzowego i postępowania w tych nieprawidłowościach jest konieczna, aby wykonać stapedektomię bezpiecznie.