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The Suprameatal Approach in Cochlear Implant Surgery: Our Experience with 80 Patients

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Key Words
Cochlear implant, new technique · Cochlear implant, surgical approach

Abstract
The suprameatal approach (SMA) was first performed in 1999. It was developed for cochlear implantation as an alternative to the classic technique of transmastoid posterior tympanotomy approach. In the course of SMA the middle ear is exposed from the external auditory canal and the electrodes are inserted into the cochlea through a suprameatal tunnel bypassing the mastoid cavity. The goal of developing the SMA was to simplify the surgical technique, shorten the duration of surgery, enable wide exposure of the middle ear during the procedure, and avoid possible damage to the facial nerve and chorda tympani. We report here the results of 80 patients who were operated on using the SMA technique.

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Introduction

The classic surgical technique for cochlear implantation was first performed by House [1] in 1961, and until now this technique has not undergone much change. Mastoidectomy and posterior tympanotomy are the main steps in this approach. Posterior tympanotomy is a relatively easy procedure to perform, however it may harbor some potential complications, including facial nerve palsy [2–4].

Only a few alternatives to this classic approach have been described. Colletti et al. [5] described an approach via the middle cranial fossa, Kiratzidis [6] used a tunnel drilled anterior to the mastoid area, and Hausler [unpubl. data] used an open groove in the external auditory canal, which he filled with cement.

The SMA was developed in 1999, a pilot of 15 cases were first described in 2000 [7]. We describe an alternative approach to the classic transmastoid-posterior tympanotomy technique [7]. With the SMA approach the middle ear is exposed from the external auditory canal and electrodes are inserted into the cochlea through a suprameatal tunnel bypassing the mastoid cavity.

Materials and Methods

Eighty patients (50 males, 30 females) underwent surgery using the SMA technique. These patients included 61 children between the ages of 11 months and 16 years, and 19 adults between the ages of 17 and 76 years. The implants used were 47 Nucleus 24, 16 Med-El, 12 Nucleus Contour, and 5 Clarion CII. The patients were followed up after surgery for periods ranging from 2 to 40 months (mean 15.7).

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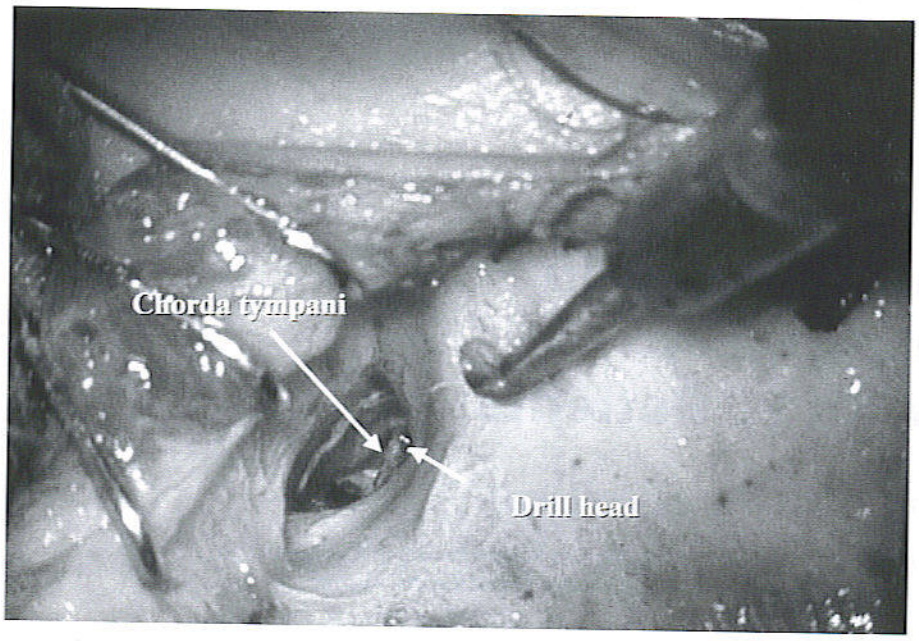

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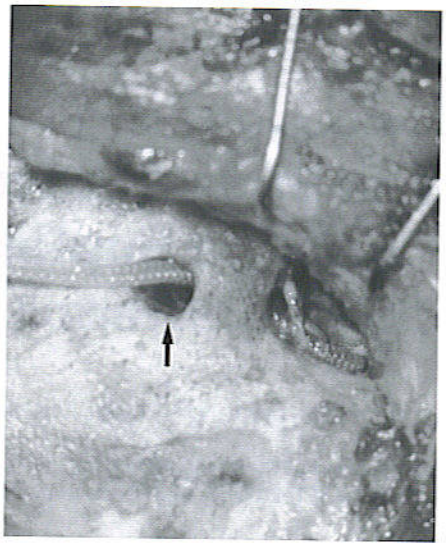

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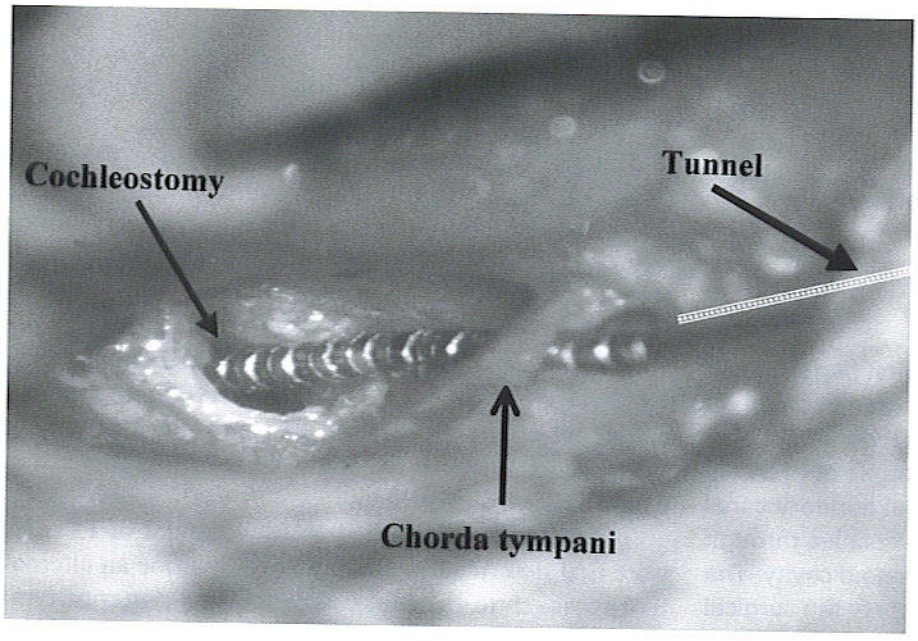

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Fig. 1. Drilling of the tunnel in the suprameatal area. The position of the drill head is seen posterior and lateral to the chorda tympani.

Fig. 2. The introduction of the electrode into the cochlea following anterior displacement of the tympano-meatal flap. The electrodes are inserted through the lateral opening of the tunnel (black arrow) and are gently passed medial to the chorda tympani into the cochleostomy.

Fig. 3. Zooming in, the position of the electrodes is seen medial to the chorda tympani and in the cochleostomy.

A retroauricular small 'hook' skin incision is followed by a large anteriorly or superiorly based periosteal flap which is raised, and a posterior pouch is created for the placement of the body of the implant. An anchor-well is drilled in the parietal bone and a tympano-meatal flap is elevated, as done for middle ear surgery, and wide exposure of the middle ear is thus achieved. A 1–2 mm long groove is drilled in the wall of the middle ear posterior superior and lateral to the chorda tympani, until the body of the incus becomes visible. The groove is located superior to the region of bone curettage performed during stapedectomy. The position of the cochleostomy site is determined antero-inferior to the oval window and drilling is stopped when the membrane of the scala tympani becomes visible. An imaginary straight line is drawn between the cochleostomy, the groove and the suprameatal region. The external location of drilling is marked, the angle of drilling is determined, and drilling is performed in the direction of the groove. The incus body, which is lateral to the facial nerve, protects the facial nerve from injury. Drilling is stopped when the drill head is seen in the groove posterior superior to the chorda tympani and lateral to the body of the incus (fig. 1). The dura of the middle cranial fossa is exposed in order to prevent injury. Once the tunnel is drilled the membrane of the scale tympani is opened by using a small hook and the electrode is inserted through the tunnel into the cochleostomy (fig. 2, 3). Small pieces of temporalis muscle are used for sealing the cochleostomy and fixing the electrode within

the EAC groove. The body of the implant is pushed into the posterior pouch and the ball electrode underneath the temporalis muscle. The subperiosteal flap is used to cover the electrode array. The tympano-meatal flap is put back in place and the surgical wound is closed.

Results

No major complications related to surgery were seen in this group of patients; no facial injury, no electrode misplacement and no electrode protrusion into the external auditory canal were seen during the follow-up period. In 1 patient, perforation of the tympanic membrane still exists 6 months after surgery. This patient suffered from recurrent acute otitis media before the implantation.

Discussion

The facial recess is bordered posteriorly by the vertical segment of the facial nerve and anteriorly by the chorda tympani. It was found to develop fully to a mean width of 4.11 mm at the age of 2 years [8]. In another paper it describes the range between 2.4 and 5.7 mm [9]. In some cases with narrow recess the chorda tympani nerve must be sacrificed during surgery.

Drilling through the facial recess during posterior tympanotomy endangers the facial nerve and the chorda tympani. Despite the fact that the rate of facial nerve injury has decreased in recent years, it may still occur [2–4]. The significance of chorda tympani injury in cochlear implant surgery has not been amply investigated.

The groove and the suprameatal tunnel in the SMA technique are located at a safe enough distance to allow avoidance of injury to both the facial nerve and chorda tympani. The elevation of the tympano-meatal flap provides wide exposure of the middle ear cavity as seen in tympanoplasty surgery. The cochleostomy may thus be performed with better visibility and control, with a nearly unlimited exposure of the promontory, oval window, round window and ossicles. Improved visibility of the cochleostomy drilling site increases the ability of careful cochleostomy drilling and may help in better preservation of hearing rests.

The exclusion of mastoidectomy in the SMA method shortens duration of surgery to about 1 h and improves the aesthetic results with no retroauricular bony defects.

In summary, the SMA technique has been proven to be an advantageous alternative procedure for cochlear implantation.

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