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# Suprameatal approach: new surgical approach for cochlear implantation

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**Abstract**

The conventional technique for cochlear implantation is via a mastoidectomy and posterior tympanotomy. An alternative approach for cochlear implantation is hereto described.

The middle ear is entered through a suprameatal approach (SMA) bypassing the mastoid cavity. This surgical approach shortens the duration of the procedure to approximately one hour. The introduction of the cochlear implant electrode array involves drilling in the suprameatal region and the osseous portion of the external auditory canal at a safe distance from the anatomical position of the facial nerve. This prevents possible injury by direct trauma or drill overheating of the chorda tympani or facial nerves.

We report 15 consecutive patients who were operated on using the SMA technique. No complications were encountered as a result of this surgical technique but further experience may be necessary.

**Key words: Cochlear Implantation**

## Introduction

The classical surgical technique for cochlear implantation was described by Clark *et al.* in 1979.[1] Until now this technique has not changed much. The main steps in this approach include a 'C' or 'J'-shaped skin incision followed by mastoidectomy, posterior tympanotomy and cochleostomy. Posterior tympanotomy, first described by Janen in 1957[2] as a means of approaching the middle ear, has been enthusiastically adopted by cochlear implant surgeons because it provides good access to the round window and promontory. Posterior tympanotomy is a relatively easy procedure to perform, but may harbour some potential complications including facial nerve palsy.[3–5]

We describe an alternative approach to the classic transmastoid-posterior tympanotomy technique. This approach entails entering the middle ear via a suprameatal route bypassing the mastoid.

## Materials and methods

### *Subjects*

Fifteen patients, including 10 males and five females were operated on using the SMA technique. This series included 13 children between 20 months and 11 years of age and two adults 38 and 49 years old. In all patients, the Nucleus 24 implant was used. The patients were followed-up two to nine months after surgery (mean = 5.7 months).

### *Surgical technique*

An upright J-shaped skin incision with the shorter limb extending posteriorly is followed by elevation of a skin flap. A large anterior periosteal flap is raised and a posterior pouch is created for the placement of the ICS (imlantable cochlear stimulator) package. A well is drilled for the ICS package anchor. The posterior wall of the external auditory canal (EAC) skin is incised 5–7 mm lateral to the annulus. A six o'clock incision is made on the meatal skin and the tympano-meatal flap is elevated thus entering the middle-ear cavity. This procedure is identical to the retro-auricular tympanotomy performed in middle-ear surgery. A groove is then drilled posterior to the chorda tympani (the EAC groove). This groove is located superiorly to the region of bone curettage perfrmed during stapedectomy. An oblique tunnel is created in the suprameatal region (the suprameatal tunnel) connecting to the lateral end of the EAC groove. In order to avoid injury to the middle fossa dura, drilling is initiated by careful exploration of the dural position in the suprameatal region. Once the middle fossa dura has been localized, an oblique tunnel extending away from the dura in the infero-medial direction is created. The cochleostomy is drilled in the

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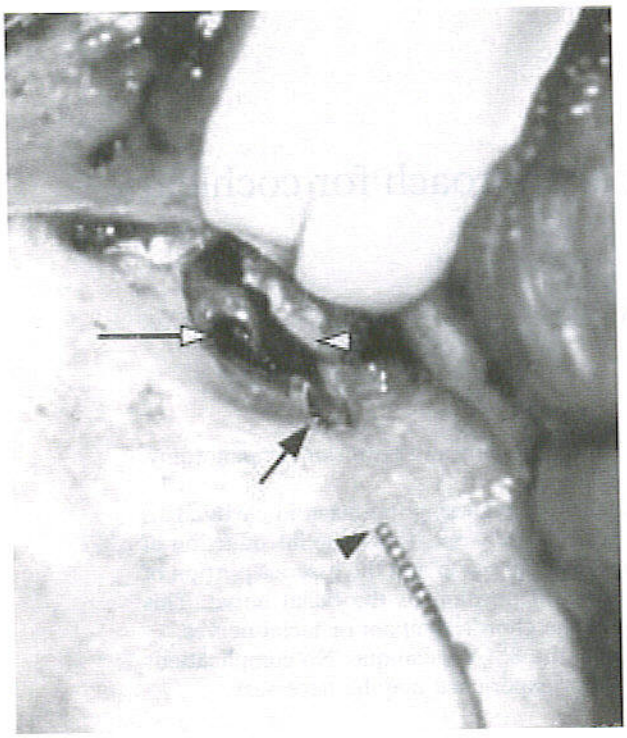

FIG. 1

The introduction of the electrode into the cochlea: following anterior displacement of the tympano-meatal flap (small white arrow), the electrodes are inserted through the lateral opening of the tunnel (black arrow head) and are gently passed within the groove (long black arrow) medial to the chorda tympani into the cochleostomy (long white arrow). Note the linearity of the insertion path.

promontory antero-inferior to the stapes and thus an imaginary line is created between the suprameatal tunnel, the EAC groove, the space underneath the chorda tympani between the malleal manubrium and the long process of the incus, and the cochleostomy. The electrode is passed through this imaginary line into the cochleostomy (Figure 1). Small pieces of temporalis muscle are used for sealing the cochleostomy and fixing the electrode within the EAC groove and the suprameatal tunnel. The ICS package 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 tympanomeatal flap is placed back and the surgical wound is closed.

## Results

No complications were seen in this group of patients; no facial nerve injury, no flap breakdown and no mastoiditis. There were neither perforations of the tympanic membrane nor protrusions of the electrode into the external auditory canal during the follow-up period. No case of electrode misplacement was seen among patients in this series. Hearing results have not been completely evaluated yet.

## Discussion

The facial recess fully matures to a mean width of 4.11 mm at the edge of two years.[6] In some cases, a much narrower recess may be seen and the chorda tympani nerve must then be sacrificed during surgery. In one patient described by Singh, a canal wall down procedure resulted in facial nerve palsy.[7]

The rate of facial nerve injury has decreased in recent years but may still be incurred. A questionnaire sent to 152 U.S. cochlear implant surgeons revealed a transient post-operative facial palsy in 1.7 per cent of patients.[4] The rate of temporary facial palsy in Hanover and Melbourne was two per cent.[5] Evidently, the risk of facial nerve palsy due to drilling the facial recess during posterior tympanotomy, even if being relatively low, is an unavoidable occasional occurrence.

Few alternative approaches to posterior tympanotomy have been described in the literature. Infection and electrode extrusion through the skin of the EAC led to the abandonment of the endomeatal approach and replacement with posterior tympanotomy.[8–10] Colletti *et al.*[11] described an approach via the middle fossa and Singh[7] used the canal wall down technique in cases of congenital anomalies.

The facial recess is bordered posteriorly by the vertical segment of the facial nerve and anteriorly by the chorda tympani. Drilling through the facial recess during posterior tympanotomy endangers the facial nerve and the chorda tympani. Despite the fact that published cases of facial nerve palsy following cochlear implantation surgery are temporary and not permanent, it may still be discomforting for both the patient and surgeon. The significance of chorda tympani injury in cochlear implant surgery has not been amply investigated. The EAC 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 tympanomeatal flap provides complete exposure of the middle-ear cavity as seen in tympanoplasty surgery. The cochleostomy may thus be created under better vision and control with a nearly unlimited exposure of the promontory, oval window, round window and ossicles. The cochleostomy in this approach may be performed more anteriorly on the promontory than in the classic technique and as a result the electrode may reach the more apical part of the cochlea. This may influence the audiometric results. The hearing results of this group of patients, however, have not yet been evaluated. The exclusion of mastoidectomy in the SMA method shortens the duration of the procedure to about one hour and improves the aesthetic results with no retro-auricular bony defects.

In summary, this new technique has been proven to be a quick and safe procedure for cochlear implantation. It has not been followed by any complications thus far, but it is prudent to recognize that further experience with this technique is needed.

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