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Subdural haematoma: a complication of cochlear implantation

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Abstract
Cochlear implants have transformed the treatment of sensorineural hearing loss. They have few major complications. The authors describe the case of a man fitted with a cochlear implant who suffered a post-operative subdural haematoma. The haematoma is thought to have been caused by bleeding from emissary veins opened by the drill passages used to anchor the sutures for the receiver/stimulator. The authors have abandoned tie down sutures in cochlear implants, preferring an appropriately deep well with squared-off rims, which would secure the implant in place. They have had no further complications of this nature.

Key words: Cochlear implants; Haematoma, Subdural; Postoperative Complications

Case Report

A 59-year-old man underwent cochlear implantation of his left ear. He had suffered sudden onset bilateral profound sensorineural hearing loss after a general anaesthetic for herniorrhaphy 20 years earlier.

The implant used was a Nucleus® 24 channel cochlear implant and the procedure was performed in accordance with that described in the surgeon's guide supplied with the implant; a post-auricular incision, cortical mastoidectomy, posterior tympanotomy, and cochleostomy. Having created the well for the receiver/stimulator, tie down holes were created using a 2 mm diamond paste burr drill. The package was secured in position with 3-0 Ethilon® ties inserted through these holes. The electrode was inserted through the cochleostomy and, after checking the neurophysiology, the wound was closed (Figure 1).

Within hours of the procedure, the patient complained of numbness and paraesthesiae along the lateral border of the right leg, with weakness of dorsiflexion at the ankle. The remainder of the lower limb had normal power and sensation. Foot pulses and capillary refill were normal. A diagnosis of lateral popliteal nerve palsy from pressure over the nerve whilst on the operating table was suggested as a cause for these symptoms.

By the next day, the altered sensation was less marked, but the motor weakness remained. A neurosurgeon examined the patient and concluded that a lesion at the spinal level or higher was responsible. However, a myelogram performed showed no abnormality; magnetic resonance imaging (MRI) of the spine was not possible due to the cochlear implant. The patient was discharged with a foot drop splint and an out-patient appointment with the neurosurgeon. A week later, the patient was re-admitted to the neurosurgical ward with a two-day history of fluctuating dysphasia. A computerized tomography (CT) scan of the head revealed a minor degree of midline shift caused by a thin left-sided subdural haematoma. A repeat scan nine days later showed this to have increased in size, with a more noticeable midline shift (Figures 2(a) and 2(b)).

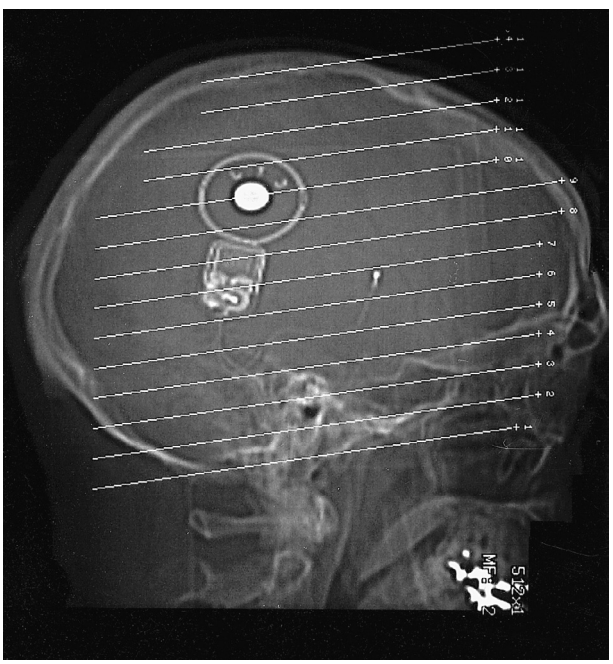

Fig. 1
Lateral 'scannogram' showing position of receiver/stimulator.

The patient underwent drainage of the haematoma via a left frontal burr hole. This was performed under local

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FIG. 2(A)
Axial CT scan demonstrating subdural haematoma.

FIG. 2(B)
Midline shift of the brain caused by the subdural haematoma.

anaesthetic as he was not keen to have a general anaesthetic in view of the complications he had suffered before.

The patient subsequently made a full recovery. He had a good audiological result with open set discrimination of speech and was able to use a mobile phone.

- **A case of subdural haematoma following cochlear implantation is presented**
- **The cause was thought to be bleeding from emissary veins**
- **The paper discusses a modification in implantation technique to overcome this problem**

Discussion

Drilling of tie-down holes is described in the Nucleus® Surgeon's Guide,[1] and also in the Medel® Surgical Manual,[2] both of which are supplied with their respective implants. This is recommended in order to immobilize the receiver/stimulator implant package, allowing it to be securely held in position with ties.[3] The holes should be created such that they do not penetrate the inner table of calvarial bone.

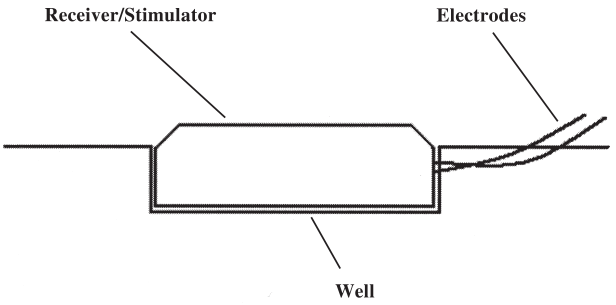

FIG. 3
Diagrammatic representation showing how implant should sit within bony well; note the square edges to the recess, obviating the need for tie-down sutures.

Problems with receiver migration have been reported in the past. Webb *et al*. reported a rate of 0.2 per cent in their review.[4] Djalilian *et al*. described two cases in their series where wound infection led to erosion of the ties and movement of the receiver under the scalp flap.[3] They proceeded to remedy this by two methods: firstly, by using a titanium mesh held to the skull by screws to secure the receiver/stimulator in place, and secondly, using a Gore-Tex® patch, also screwed to the skull.

Another technique that has also been tried involves the use of ionomeric bone cement. Ramsden *et al*. have used this polymaleinate glass ionomer to stabilize the receiver/stimulator in the bony recess.[5]

Having searched through *PubMed*, *Ovid*, and *Proquest* databases, this was found to be the first report of a subdural haematoma being caused during cochlear implant insertion. There has been one other description of a subdural haematoma caused by a bone-anchored device attached to the skull. This was the insertion of a skull-mounted percutaneous pedestal, for the delivery of power for a left ventricular assist device. The device was screwed to the calvarium. This case was complicated by the fact that the patient was anticoagulated with warfarin. The patient subsequently died.[6]

In the present case, the authors feel that the cause of the subdural haematoma is likely to have been injury to an emissary vein whilst creating the 'rat bite' holes in the calvarium, or from passing the suture needle through them. There was some bleeding through these holes initially, and haemostasis was achieved using bone wax. They suspect that the bleeding, however, continued internally, and led to the formation of the haematoma.

The methods described by Djalilian *et al*. still require drilling and application of screws to the calvarium. This has the potential of injuring diploic vessels, with the possibility of leading to a similar complication to the present case. The use of cement may cause a foreign body reaction and potentially lead to rejection of the implant.

The authors advocate the creation of a deep well for seating the implant, with appropriately 'squared off' rims (Figure 3) which would prevent the migration of the receiver/stimulator without the need for further devices. Furthermore, this would lend itself to fewer 'foreign' bodies within the surgical site, and therefore, less chance of infection.

The authors' unit has performed 140 cochlear implants since this case. They have not used anchoring sutures in any of these, and have not had any further complications of this kind. Furthermore, none of their patients have suffered receiver migration or extrusion.

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