Case Report

Transient brain injury from penetration of a halo pin

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This case report describes a patient who had a halo device for traction applied to obtain correction of scoliotic deformity between a two-stage operative procedure. The patient developed a neurological deficit suggestive of brain injury following retorquing of a halo pin. This was confirmed by an MRI scan of the brain. The patient made a full recovery of the neurological deficit following replacement of the pin.

Keywords: halo device; cerebral complications; paediatric spine; scoliosis

Introduction

The halo fixation device was developed in 1959 by Perry and Nickel¹, and has been the most common means of immobilisation of the cervical spine since its introduction. Although initially described as a means of applying traction and immobilisation, the indications for its use include the treatment of spinal injuries, pathological lesions of the spine and spinal deformities. Pin site infection and loosening have been recognised as the most frequent complications of halo usage. We report the case of a 12 year old child who developed a transient neurological deficit secondary to the intracranial penetration of a halo pin.

Case report

A 12 year old boy was being followed up after initial surgery for idiopathic scoliosis. Because of the progression of the curve, a two-stage procedure was planned. Following removal of the sublaminar wires inserted at the initial surgery, a carbon fibre halo was applied with an aim to achieve some degree of correction with traction before the second stage procedure.

Six hours after retorquing of the pins, the patient complained of headache, and bad asymmetry of his face and weakness of his left hand grip. Neurological examination revealed an upper motor neurone lesion affecting the left half of his face, and weakness of the muscles of the left hand. He was drowsy, afebrile and the other cranial nerves were intact. There was normal function of the lower limbs with flexor plantar reflexes.

With the clinical suspicion of intracranial penetration of a halo pin in the temporo-parietal region of the brain on the right side, an MRI scan of the brain was performed. This revealed an artefact related to the halo pin in the right temporal region. There was

evidence of cerebral edema and hyperechogenicity in the temporo-parietal region on the right side. There was no displacement of the midline structures, but effacement of the posterior horn of the right lateral ventricle was evident (Figures 1 and 2).

The penetrating pin was replaced more posteriorly. There was no leakage of CSF through the pin site, and the scalp was sutured. The patient made a complete neurological recovery 24 h after the replacement of the pin.

Discussion

The reported complications with the use of a halo fixation device include pin loosening, pin site infection, pin penetration, dysphagia, pin scars, pin discomfort

Figure 1 MRI of the brain (Axial T2 weighted image)

Figure 2 MRI of the brain (Coronal T2 weighted image) showing artefact related to the halo pin in the right temporal region (→). There is hyperechogenicity of the underlying motor cortex with effacement of the posterior horn of the right lateral ventricle

and loss of reduction or progression of the spinal deformity.²⁻⁴ Brain abscess secondary to application of halo device has also been reported.⁵⁻⁷ Penetration of the inner table at the pin sites is considered to be responsible for the development of an abscess in most cases.

Various authors have reported penetration of the skull by a halo pin^{2-4,8} but brain injury associated with it has only been reported once in the English literature⁹. Not much has been written about halo usage in children. Koptis and Steingass and Baum *et al* reported one case each with halo pin penetration in children.^{10,11} None of these was complicated by brain injury. It is thought that this complication is common because of the relative softness of the cranial wall in skeletally immature patients.

The halo pins are designed with a sharp point and a broad shoulder to avoid penetration of the skull. In cadaver skulls, the halo pins applied with six inch-pound application torque were seen to partially penetrate the outer aspect of the skull. Thus there is a solid margin to allow safe retightening.¹² A study by Rizzolo *et al* reported the effect of insertion torque on halo pin complications. Pin loosening was found in 20% and 26% and infection in 7% and 13% in the 6 inch-pounds and 8 inch-pounds groups respectively. The authors recommend that the halo pins be inserted with 6 inch-pounds of pressure to minimise the risk of penetration of skull.¹³

Based on their study of the osteology of the skull, Garfin *et al* have recommended ideal sites for placement of halo pins.¹² This is to avoid complica-

tions such as pin penetration of the skull and problems associated with penetration of the temporalis muscle.

Dorfmueller and Hollerhage reported a case of a patient with rheumatoid arthritis after atlantoaxial stabilisation and halo external fixator immobilisation. The patient presented with global aphasia and an impaired consciousness from a cerebral haemorrhagic contusion after an accidental fall.⁹

In the case reported here, the clinical features of drowsiness, asymmetry of face, the weak left hand grip and absence of aphasia raised the suspicion of intracranial penetration of the posterior halo pin on the right side. This correlates well with the representation of the various parts of the body in the motor cortex. The body is represented upside down with the face lying lowest followed by the hand, arm, trunk and leg.

In addition to highlighting a rare complication, this case illustrates the usefulness of the carbon fibre type of halo in patients who are likely to need a subsequent MRI scan. The MRI scan is helpful in diagnosing complications such as brain injury and brain abscess which may arise from cranial penetration of a halo pin.

With the increasing use of the halo device, attention to details in pin application, maintenance and proper pin-site care is stressed to minimise the number of complications.

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