

## *Personal view*

# Management of children with head injuries in district general hospitals

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Trauma is the major cause of death in children aged 1–14 years. A head injury may occur in isolation, but it is often just one component of a multiple injury. In these circumstances it is the head injury that is most likely to cause a fatal outcome.<sup>1</sup>

In the United Kingdom primary treatment of all patients with head injuries is traditionally carried out at district general hospitals with referral to neurosurgical units only in special circumstances. The reasons for this include the relative paucity of neurosurgical cover, the often isolated nature of the neurosurgical units, and the small percentage of patients with head injuries who require operations. The dangers of such a system for both adult and paediatric patients are obvious: it is non-neurosurgeons who make the primary decisions about neurosurgical referral, and neurosurgical junior staff are not unknown for their zeal in preserving their specialist beds for aneurysms and meningiomas, for example, especially when many of the injuries referred to them may not need specialist care. Much of the responsibility for this system must lie with the neurosurgeons, and it is only within the past few years that they have produced their own guidelines for the care of adults with head injuries.<sup>2</sup>

It is convenient to consider the management of children with head injuries in a district general hospital under the following headings: diagnosis, investigations, admission policy, treatment, referral to a neurosurgical unit, and follow up at the district general hospital.

### **Diagnosis**

The diagnosis of head injury, particularly in infancy, is overshadowed by the question of non-accidental injury. The problem has two aspects: is the child with neurosurgical problems suffering from a head injury at all and if so how has it been caused?<sup>3</sup> Brisk shaking of a young child will create damage that ranges from cerebral irritation (presumably due to

blood over the surface of the brain) to cerebral oedema with or without subdural effusions. In these circumstances the intracranial pressure may be raised with fullness of the fontanelle and an increased head circumference, splaying of cranial sutures, and papilloedema and fundal haemorrhages. Chronic bilateral subdural effusions with raised intracranial pressure in a child under 1 year of age are almost always due to non-accidental injury, although there may be little external evidence of damage to the head. Even in older children non-accidental injury should always be suspected when the circumstances surrounding the trauma do not ring true.

### **Investigations**

Any child in whom an injury to the head is suspected should have a skull *x*-ray picture taken. Although this policy is sometimes derided by radiologists, from a statistical point of view a skull fracture (or splayed sutures) is a definite indication of the presence of an intracranial haematoma,<sup>5,6</sup> although its predictive power is not as great as in adults.<sup>7</sup> Where facilities for computed tomography are available any child presenting with a combination of a skull fracture and a disorder of consciousness lasting more than five hours after the injury should be scanned, particularly if the level of consciousness is low. A further indication is in the diagnosis of non-accidental injury. Blood over the cerebral hemispheres and along the falx in an infant with a story indicating a possibility of non-accidental injury is usually diagnostic,<sup>8</sup> and computed tomography has an important part to play in providing circumstantial evidence for the diagnosis.

### **Admission policy**

Admissions fall into two groups: those patients who obviously require hospital treatment because of the

extent of their injuries and those who might be well enough to return home but in whom there is sufficient risk of complications for them to be kept under observation until the danger is over. Children suspected of having suffered non-accidental injury come into the first category and should always be admitted.

From the toddler age group upwards (and this is effectively from the time of suture closure) the indications for admission and for observation are the same. The incidence of raised intracranial pressure with or without an actual haematoma is highest among those whose skull *x*-ray pictures show a fracture and those whose level of consciousness had not returned completely to normal before they were seen in the casualty department. Children in either group should be admitted for observation for 24 hours. Obviously the time after the injury that the patient is seen in the casualty department will vary. Should a child seen within one hour who is still drowsy at that time but completely well two hours later be observed for the same time as a child seen three hours after the injury who is already fully recovered, regardless of the amount of time for which they were unwell? There is some evidence to suggest that any child who is the slightest bit unwell should be observed in hospital until five hours have elapsed from the time of injury.<sup>5</sup> If at that time they are perfectly fit and their skull *x*-ray pictures have shown no abnormality they could be allowed to return home providing responsible supervision is available. Children who remain unwell after five hours would then go through the full 24 hours of observation.

In infancy circumstances are a little different. It is in this age group that the highest incidence of intracranial haematoma occurs due to the presence of subdural collections.<sup>9</sup> Obviously an open anterior fontanelle allows some assessment of the intracranial pressure to be made. The incidence of non-accidental injury in this age group is also highest; therefore, although an assessment of consciousness cannot be carried out in the same way as for an older child, the same period of precautionary observation should be recommended. If the child appears at all unwell (and this includes a suspicion of raised intracranial pressure) when five hours have elapsed from the time of the injury then admission for observation should be mandatory. A skull fracture is also an indication for admission. A coma scoring and outcome scale for head injury in infants and toddlers has been suggested by Raimondi and Hirschauer.<sup>9</sup>

Observation in hospital is useless unless the nursing and medical staff are carefully instructed in the tests to be used and the action to be taken should

the results change. The reason, apart from the obvious economic one, for trying to reduce the number of patients admitted to hospital for observation is to ensure that only those most likely to suffer a complication are admitted, and therefore the observations should be carried out in a more alert and suspicious fashion. Who should have responsibility for both the medical care and the observation of the child admitted after a head injury? There is no doubt that all such children should be in paediatric wards, and it is my view that the primary responsibility for them is best taken by paediatricians. I cannot see the point of the duty general surgical or orthopaedic team having to provide this extra care among all their other duties, and their experience in assessing sick children is likely to be limited.

### Treatment

Many children with head injuries show great irritability, but sedation may interfere with adequate monitoring of the vital signs and level of consciousness. Extreme irritability particularly in an infant may, however, warrant the judicious use of small doses of phenobarbitone.

Epileptic attacks in the first few hours after an acute head injury are common in children. Although they point to the possibility of the development of late post-traumatic epilepsy, these earlier seizures are likely to be indicative of a poor overall outcome only in children under 12 months old.<sup>9</sup> In older children they may occur after quite trivial accidents and in the absence of other neurological signs do not affect the statistical chances that the patient is harbouring an intracranial haematoma.

It is difficult to say when raised intracranial pressure ceases to be a normal part of a head injury and becomes a complication. There is no doubt that any child in whom raised intracranial pressure is suspected should have computed tomography. When this is not possible locally urgent referral to a neurosurgical centre should be sought. In infants the most likely site for an intracranial collection is the subdural space, and many paediatricians would recommend needle exploration in the first instance to aspirate any fluid.

Some children respond to even a comparatively trivial head injury by a delayed deterioration of consciousness without the formation of haematomas.<sup>10</sup> The aetiology of this strange condition is unknown but is thought to be associated with diffuse brain swelling associated with a generalised hyperaemia of the brain. It is best treated (as is the diffuse brain swelling of childhood that may follow a more severe injury) by intubation and hyperventila-

tion, together with other methods of reducing intracranial pressure such as the administration of mannitol. Many paediatric units, whether in hospitals containing a neurosurgical department or not, are already accustomed to monitoring intracranial pressure as part of the management of encephalopathies and Reye's syndrome, and this facility has rationalised the measures for reducing intracranial pressure in children with head injuries.

#### **Referral to a neurosurgical unit**

There are two categories of patient who require referral. The first comprises those whose primary injury has been sufficiently severe to make the paediatricians at the district general hospital reluctant to undertake their management; the number who fall into this category will depend on the local availability of computed tomography. A paediatrician faced with a sick child and no computed tomography is more likely to ask for neurosurgical help than one who knows from his own scans that he or she is not overlooking an intracranial haematoma. Although neurosurgical units may not be able to take all the patients that paediatricians wish merely for primary care and observation, there is no excuse for failing to discuss such a patient with the regional centre. Unfortunately, as mentioned above, the service provided for paediatric patients by a neurosurgical unit may be worse from the paediatric point of view than the one the child is leaving in the district general hospital. This is another reason why paediatricians may wish to keep such children under their own management rather than transfer them to a unit where they may be looked after by non-paediatricians in the corner of an adult ward. When the neurosurgical unit is within a large hospital the responsibility for the child should be shared between the two disciplines. Where neurosurgical units are isolated from any form of paediatric cover then referrals are likely to be fewer because the care they can offer is not as good.

The other category of referral to the neurosurgical unit comprises those children in whom complications have occurred during the period of observation. A deteriorating level of consciousness, changes in pupillary responses, and abnormalities of respiration or other signs of a rise in intracranial pressure even when this cannot be assessed by palpation of a fontanelle should always lead to urgent referral. If deterioration is rapid mannitol should immediately be given intravenously. The child's respiratory state at such times is always precarious, and serious consideration should be given to intubation and ventilation before an ambulance journey. If there is

any doubt an anaesthetist should accompany the child. Once a decision to refer has been made it is best not to delay matters while trying to organise computed tomography locally when this has previously not been done. The neurosurgical unit is more likely to be able to arrange the scan at short notice because of the number of emergency scans it is accustomed to doing.

Is there any place for emergency surgery at a district general hospital? In my opinion there is no substitute for the prediction and then early recognition of complications followed by a prompt transfer to neurosurgeons. The problems posed by a patient with a severe head injury in the casualty department have recently been well described in an editorial that applies equally well to children and ends with these words: 'The essence of managing this type of emergency is not to panic but rather to consider and correct all extracranial abnormalities. The aim should be to present the neurosurgeon with a damaged but well oxygenated and well perfused brain. This will give the patient the greatest chance of recovery.'<sup>11</sup>

#### **Follow up at the district general hospital**

A child with a head injury, particularly if old enough to be at school, may show a distressing but characteristic pattern of psychomotor problems because of the injury, and the paediatrician is undoubtedly the best person to supervise further management. Although individual symptoms and signs may appear vague, there is a well recognised constellation of reduced attention span and short term memory, irritability, emotional lability, and impairment of judgment that may follow any period of concussion. All these can interfere with the child's schooling and produce family interactions that add to the psychological difficulties, and yet they may not at first be recognised as being directly related to the child's disabilities. The paediatricians at the district general hospital may not have been directly concerned in any neurosurgical procedures, but with their understanding of the family background they are undoubtedly the best people to guide the patient and his or her family through these under recognised problems.<sup>12</sup>

What changes should be recommended in order to improve the care of children with head injuries in the United Kingdom? In district general hospitals children with head injuries should be admitted only to units that have adequate paediatric staff. Such a hospital should have the facility for computed tomography in order to reduce the number of children who are referred to neurosurgical units for care alone. Speedier organisation of transport from

hospital to hospital for emergencies is also required, and the regional neurosurgical units themselves need modifying. Although at present there seems no possibility of funding specialist paediatric neurosurgeons, no regional centre should be without one neurosurgeon who is prepared to take particular responsibility for paediatric cases. In addition, neurosurgical units receiving children with head injuries should have paediatric wards and paediatric cover in the same hospital for their admission and care.

The problems posed by children with head injuries, particularly those who are very young, are difficult and carry heavy emotional overtones. Only by altering or adapting existing facilities in the ways described above will these young patients be able to receive the standards of care that they need.

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