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CURRENT TOPIC

Minor head injury

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Head injury is one of the more common reasons for children to attend for urgent medical care, whether to accident and emergency departments or their general practitioner. Often these attendances are accompanied by a high degree of anxiety, both by the parents or guardians with the child and the doctors and nurses providing medical care. In the UK most of these children will receive their initial care and attention in accident and emergency departments from relatively junior members of medical staff, often working in difficult situations. This has led to the development of guidelines for the safe management of children presenting with head injury to accident and emergency departments.[1 2] There is, however, scepticism in some quarters about the extent to which these guidelines are used.[3]

In addition, publications on head injury are confusing with, on occasion, diametrically opposed methods of management being advocated. The purpose of this review is to highlight the problem of minor head injury in children and to further discuss some of the issues affecting patient management.

Aetiology

Most children receive a head injury as a result of a fall.[4 5] Most of these occur while the child is running on a level surface or when the child falls from a short height. Only a minority of all head injuries due to falls occur from a fall of more than 3 m.[6] With regard to morbidity and mortality, those children who fall from a height of greater than 5 m are most at risk.[7] Falls from windows account for the most significant morbidity and virtually all mortality.[8]

Although road accidents account for only 2% of all attendances at accident and emergency departments, they account for 55% of all fatalities.[9] Most of these deaths will be the result of a head injury.[10] More worryingly, 73% of these deaths will occur before any form of medical help can be given.[11] There is evidence that preventive measures such as wearing cycle helmets,[12 13] using seat belts to restrain children in moving vehicles,[14] and better education of pedestrians[15] will reduce the incidence of head injury.

In-line skating has recently emerged as a significant cause of injury in children and head injuries feature prominently in these.[16]

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Epidemiology

The reported incidence of head injury in children under 14 years of age in Scotland in 1985 was estimated at 4011/100 000. This figure is an increase of 30% compared with a study conducted over 10 years earlier.[17 18] In keeping with most reports of accidents in childhood there is a significant male predominance.[19] Approximately 45% of all children presenting to accident and emergency departments with a head injury are less than 5 years of age.[18] It is difficult to determine whether this predominance in the under 5 age group is a reflection of the actual incidence of the problem or a reflection of the anxiety that parents feel about this age group.

In a recent self report study of adolescents the incidence of head injury has been reported as 15.8% in 11 year old children and 13.5% in 13 year olds. In each group 5.0 and 7.8%, respectively, reported being concussed.[20] In these and other studies most children with head injury had no significant sequelae. In general, the incidence of acute sequelae in children is much less than that in adults.[21] Consequently, most head injuries in children can be considered to be minor.

Clinical features

When presented with a child with head injury it is important for doctors to determine whether there is any evidence that a brain or other intracranial injury is present or is likely to have occurred.

The mechanism of injury is important in determining the probability of the presence or absence of significant head injury. As detailed earlier, road traffic accidents and falls from a height are associated with significant morbidity and mortality. Similarly, being hit by a solid object with a high velocity, particularly golf clubs and stones, must be taken seriously. The large amount of energy imparted over a small area considerably increases the chance of skull fracture and underlying local brain injury. Often these fractures are depressed. Similarly, potential penetrating injuries, such as those sustained if a child is hit with a dart, are easy to underestimate. Although the external evidence of injury can often be minimal in these situations, the potential for underlying intracranial problems is high.

Historical features associated with brain injury include loss of consciousness, amnesia, neurological deficit—for example, transient cortical blindness or paresis—and seizure activity. In particular, significant brain injury is associated with prolonged loss of consciousness (more than five minutes)[21] and this is probably the single most important indicator. By extrapolation, therefore, children who have either no, or only transient, loss of consciousness can be considered to have a minor head injury.

The problem arises, however, in younger children and infants in whom it is almost impossible to determine loss of consciousness by history. In this situation other characteristics of the child after the head injury are most important. Indicators of brain injury in infants and small children include apnoea, pallor, and failure to cry immediately. It is not uncommon for parents to inform medical staff that they had to stimulate the child and perform basic life support manoeuvres. This indicates that the child has sustained a significant brain injury and should therefore be taken seriously. Non-accidental injury must be excluded in these children.

Other symptoms with which children present after head injury include headaches, lassitude, nausea, and vomiting. These are probably all indicators of minor to moderate brain injury. At this early stage, as the child is usually awake and does not have a significant alteration in their level of consciousness, it is unlikely that these are associated with an increased intracranial pressure. These symptoms usually abate within five hours without any major intervention. Simple analgesia—for example, paracetamol 15–20 mg/kg given once rectally or orally—will help headaches. In a small number of children vomiting will be persistent and these children may need to be admitted for rehydration treatment.

As with other presenting disorders it is important to inquire about other medical problems. Bleeding disorders, diabetes, and previous intracranial problems—for example, shunt surgery—are all associated with occult or delayed problems and children with these disorders should not be classed as having minor head injury.

The most important part of the examination is the assessment of the level of consciousness. Several scales exist, none of which is ideal for young children.[22–24] On presentation it is sufficient to determine whether the child is normal, has an altered sensorium, or is in a coma. Only those in whom the level of consciousness is normal can be said to have a minor head injury.

Wounds and abrasions around the head and scalp are difficult to examine properly in uncooperative small children and indeed palpation may actually increase the child's discomfort. The exception to this is the massive haematoma which can occasionally accompany fractures to the parietal or occipital bones. These haematomas usually present two to three days after the injury, often detected when the child or parent is brushing the child's hair. A large boggy swelling will be palpable and radiographs will invariably show a linear fracture to the affected bone.

Blood or cerebrospinal fluid from the child's ears or nose, periorbital bruising, or retromastoid haematoma (Battle's sign) are indicators of basal skull fracture. These are not minor head injuries.

Investigation after head injury

Few topics in accident and emergency medicine have created as much debate as the role of skull radiography in the management of head injured children. Two broad camps exist: those who believe that skull radiographs have a vital part to play and those who do not. Recommendations published initially for adults, but subsequently validated for children in 1990,[21] indicate that skull radiography in a British context has a major part to play in the determination of the severity of the injury.

Crucial to this debate is whether or not the child has evidence of a brain injury. If a brain injury has occurred (or there is circumstantial evidence that it has occurred), then the child is at risk of developing further intracranial injury. This risk is further increased if the child has either a persisting altered level of consciousness, evidence of a skull fracture (either clinical or radiological), or both. Consequently, all children with a history of loss of consciousness, basal skull fracture, or both, require skull radiography. Children under 1 year deserve special mention. They are difficult to assess clinically and the history may be unclear. In addition, they are at risk from non-accidental injury. These children should probably undergo skull radiography.[25]

Additional factors in the history which indicate skull radiography include falls from a height and focal high velocity injury—for example, 'hit by a golf club'. In many places these children will undergo computed tomography as the sole imaging modality. The benefits of this are that details of both cranial and intracranial pathology will be obtained. The yield, however, is low, with only about 20% of children undergoing computed tomography having abnormalities.[26] Thirty per cent of these abnormalities would be visible on plain skull radiographs (for example depressed fracture or pneumacephaly) and 11% would be apparent clinically (for example basal skull fracture). In all, only a small proportion (about 5%) will have neurosurgical intervention. This low yield is gained at the expense of a considerable increase in radiation exposure.[27] Younger children will also need sedation for the procedure.

If a skull fracture is present clinically or radiologically the child can no longer be considered to have a minor head injury and should be admitted to hospital. It has been suggested that these children should undergo computed tomography[21]; however, the need for all of these children to be scanned has been challenged.[28] In this report only those children with a skull fracture on a radiograph and an altered level of consciousness had a significant incidence of intracranial injury. This is further supported by Sainsbury and Sibert, who suggested that all significant injury will manifest within five hours of the injury.[29]

Discharge arrangements

Children may be safely discharged from the accident and emergency department after a minor head injury as long as their level of consciousness is normal and there is no clinical or radiological evidence of skull fracture. Children may be allowed home with a responsible adult who should be given written instructions about how to care for them and when to bring them back if there are any further concerns. Children should not be allowed home if there is concern about the mechanism of injury—for example, potential child abuse—if social circumstances are poor—for example, if the parents are known alcoholics or drug abusers—or if it is anticipated that there will be difficulties returning for medical care if any problems arise. In some situations children with probable minor head injury can be difficult to assess due to the presence of physical or pre-existing neurological abnormalities. If there is any doubt then these children should be admitted for a period of observation until experienced carers are happy that their behaviour is normal. If there is any further doubt about these children they should probably undergo computed tomography. If, for any reason, the child needs to be admitted, then this should ideally be to an area adjacent to accident and emergency under the supervision of clinical staff competent in the care of children.[29 30]

Follow up arrangements

It is probably in this area that the management of minor head injury is most deficient. Work by Casey *et al* showed that a small number of children (7%) with minor head injury will develop behavioural problems for varying lengths of time after the initial presentation.[31] It should be borne in mind that these were carefully selected and had no evidence of brain injury on presentation—that is, true minor head injury. Whether these are manifestations of undetected brain injury or some pre-existing brain pathology is difficult to determine. It has been shown that children with behavioural problems after head injury are no more likely to have had behavioural problems before the head injury than other children.[32] Despite this, there is no doubt that a small number of children will represent over time after discharge following minor head injury, with diverse symptoms including headaches, nausea, loss of concentration, and 'not being quite right'. These vague symptoms are easy to dismiss. Experience in adults has suggested that this may be associated with a need to seek compensation, but this is unlikely to be a factor in children. It is possible that parental anxiety may be transmitted to the child and that better counselling of parents may be necessary. Casey *et al* have tried this approach and found it not to be very helpful.[33]

The increasing availability and use of magnetic resonance imaging will no doubt throw more light on this complex area. A study concluded that magnetic resonance imaging may show evidence of diffuse axonal injury not visible on computed tomography and postulates a link with post concussional syndrome.[34] It is possible that with the greater availability of magnetic resonance imaging more light will be shed on post concussional states in the future.

Summary

Head injury is common in children, although the incidence of brain injury is much lower. Most children who sustain an injury to the head will only have a minor injury. Careful history, examination, and judicious use of radiology will identify those children at risk of brain injury. Children with no significant risk of brain injury may be safely discharged home to the care of responsible adults. Further work is needed to address sequelae after minor head injury.

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Hunch theory

It's not only Hollywood detectives who have hunches; most, if not all, experienced clinicians must be familiar with the situation in which they feel sure that a certain course of action is the right one but are unable to explain why. Much as we may strive towards evidence-based medicine clinical intuition can not be ignored. Now research neuropsychologists in Iowa (Antoine Bechara and colleagues, *Science* 1997;**275**: 1293-5) have given scientific respectability to the concept of valid but non-rational decision making.

Their experimental subjects were six patients with bilateral damage to the ventromedial prefrontal cortex (all known to to be poor at real life decision making) and 10 normal controls. They were each given some fake money and asked to choose cards from four piles, A, B, C, and D which told them whether they had won or lost money. Cards from piles A and B gave higher rewards but much larger losses than those from piles C and D so that in the long run repeatedly choosing A or B cards would result in a loss, and C or D a gain. Skin conductance responses (SCRs) were used as a measure of anxiety and the subjects were asked to explain the game after 20 cards and after each subsequent 10 cards up to 100 choices.

After experiencing a few losses in piles A or B normal subjects began to show SCRs before choosing cards from those piles but at that stage they could not explain what was happening. By about card 50 they were able to express a feeling that piles A and B were riskier and by card 80 many could explain why they were riskier (conceptual stage). Seven of the 10 normal subjects and three of the six with prefrontal damage reached the conceptual stage but the normal subjects who did not reach that stage nevertheless learned to choose well whereas the brain damaged patients continued to choose badly even after they were able to reason which piles were risky.

Situations requiring decisions probably activate neural systems holding subconscious information based on previous emotional responses to similar situations and decisions. Non-conscious signals, partly autonomic, then motivate decision making before conscious reasoning becomes effective.

'Playing a hunch' is probably an essential part of human decision making, allowing correct decisions to be made more rapidly than is possible by reasoning.

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