ORIGINAL ARTICLE

A prospective survey of patients with presumed accidental ear injury presenting to a paediatric accident and emergency department

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Objectives: To assess the characteristics of assumed accidental ear injury in children.

Methods: A prospective survey of 111 children presenting with accidental external or internal ear injuries to a paediatric accident and emergency department.

Results: The majority of patients were male (73%). Right and left sided injuries were equally common (51% right, non-bilateral). Presentation with accidental ear injury was very rare in children under the age of 1 year ($n=1$). Most patients were self referred (98%), and presented within six hours of injury (84%). The mechanism of injury was variable, but cotton bud induced injury was common (7%). The most common injuries were lacerations of the pinna, in 63 patients (56%). Fourteen per cent had blood in the external canal. Only three patients required admission.

Conclusions: Lacerations are the commonest form of accidental ear injury. Ear injuries that are bilateral and in children less than 1 year of age are rare and may suggest non-accidental injury. Cotton bud induced injury is common and preventable.

In a paediatric accident and emergency department, a large number of children present with non-accidental injury. Some of these children have ear injuries. Clearly, to differentiate accidental from non-accidental injury it is necessary to understand the whole range of presentation of accidental injury, and the histories that are consistent with these injuries. Several studies have reported the characteristics of non-accidental ear injury in children.^{1–10} However, the characteristics of presumed accidental ear injury in children are poorly documented. The aim of this prospective study was to document the characteristics of children presenting with presumed accidental ear injury.

METHODS

All children (age under 16 years) presenting to the accident and emergency department at the Sheffield Children's Hospital with a history of accidental external or internal ear injuries over a 30 month period were included in the study. Patients with penetrating injury resulting from insertion of an object into the ear canal were included. Patients presenting with a retained foreign bodies in the ear were excluded. The patients included in this study were identified by medical staff, and a study form was completed for each patient by a senior house officer, registrar or staff grade doctor in the accident and emergency department. The study form included details of the exact time of injury, the reported activity at the time of injury, exact mechanism of injury, and past history of trauma and burns. Clinical details were documented, including the presence of retinal haemorrhages, oral, nasal, and other injuries. Details of investigation and management were recorded. The presumption of accidental injury depended on the consistency of history and injury. Computer coded patient records were checked at the end of the study period to ensure no patients were omitted. A small number of patients presenting with severe multiple injuries including an ear injury may have been missed.

RESULTS

Altogether 111 patients fulfilled the study criteria (average of 3.7 per month). The majority were boys (73%). A majority of

patients were between 1 and 7 years old (55%), and only one patient was less than 1 year old (fig 1). The injuries were almost equally distributed on both sides (51% right side, 49% left side). There were no bilateral injuries. Almost all patients (84%) presented within six hours of the reported injury. Some 48% of injuries occurred in the home; 33% occurred outside (in the garden, park or street); and 8% occurred at school. Two injuries occurred in the Sheffield Children's Hospital itself.

The reported activity being undertaken by the child immediately before injury was walking ($n=9$), running ($n=14$), climbing ($n=8$), sitting ($n=8$), cycling ($n=4$), and other activities in 20. One child was injured while asleep (when a pinboard fell off the wall onto his head). In 50 cases (45%) the accompanying adult was unable to say what activity the child was engaged in at the time of injury.

The reported mechanism of injury (fig 2) was usually a fall (58%). Fifteen children (13.5%) were injured by a blow by an object, for example a ball, golf club or guitar. Six children fell against coffee tables. Three children were bitten by dogs. Fifteen injuries were self inflicted penetrating injuries. The majority of these ($n=8$) were from insertion of a cotton bud. Other objects inserted included pencils, match sticks, and wires. Six children reported that they had been injured by other children.

Most injuries were isolated to the ear, and only 13 (12%) patients had other injuries. The most common ear injuries were lacerations in 63 patients (57%). Sixteen patients had bruising of the pinna, none of which was discrete bruising of the rim. Fifteen children had abrasions of the pinna, and eight children had haematomas of the pinna. Of the patients with haematomas of the pinna, six were reportedly attributable to a fall, and two resulting from blows from a brick and golf club respectively. Sixteen patients had blood in their external canal. Some patients had more than one type of injury to the same ear. Five of the eight patients with cotton bud insertion and three of the seven patients with insertion of other objects had blood in the external canal. Tympanic perforation and haemotympanum were not visualised in any patient at the initial visit, although it was not always possible to exclude these because of the presence of blood in the canal. No children had

Figure 1 Age distribution of patients presenting with presumed accidental ear injury.

Figure 2 Mechanism of injury of patients presenting with presumed accidental ear injury.

retinal haemorrhages, and a CSF leak was not documented in any cases.

Skull radiographs were performed in 10% of patients, and all were normal.

Sixty five per cent of lacerations were treated with steristrip, and 11% were sutured in the accident and emergency department. Two patients were admitted and sutured under anaesthetic by plastic surgeons. Antibiotics were prescribed to 10% of the patients. Twenty were referred to the ear, nose, and throat surgeons for review, and two were noted to have perforated tympanic membranes, which were not visible at initial presentation because of blood in the external canal. Twenty five patients were referred to the audiologists for review. Of the 19 who attended, five were found to have hearing loss, which was no longer present at a further audiology appointment. The patients with transient hearing loss

included two children with otitis media, two with blood in the external canal, and one with a perforated tympanic membrane.

The one child aged under 1 year old, was seen at the age of 10 months with unexplained bleeding from his ear. He had unexplained grazing of his meatal opening, pinna and chin, and a longstanding nappy rash. He was seen on several occasions in the accident and emergency department. Before the ear injury, he presented at 6 and 12 months old with head injuries, the second of which occurred when his father hit his mother. After the ear injury he presented with two falls and an unexplained scald. A case conference was held, and he was taken into foster care.

DISCUSSION

Ear injuries are not frequently encountered in childhood accidents.¹¹ The incidence in this study was 3.7 cases per month (0.16% of all attendances in this period).

The distribution of injuries differed from that reported in studies of presumed non-accidental ear injury. Ear injuries in this study were distributed almost equally between right and left ears. No patients presented with bilateral ear injuries. In contrast, several studies documenting non-accidental ear injuries describe bilateral involvement in many cases.^{1 2 4 7} Furthermore, unilateral non-accidental ear injury is predominantly left sided, resulting from blows by a right handed person.³ Feldman⁷ described four children with a distinctive rim of petechial bruising along the top of the pinna of the ear thought to be attributable to crimping associated with non-accidental injury. Three of these children had bilateral ear bruising. No patients in our study presented with this pattern of bruising.

The age distribution of children presenting with accidental ear injuries is also of importance. Only one child in our survey was less than 1 year of age. This child subsequently presented with multiple other injuries consistent with possible non-accidental injury, raising the possibility that the earlier ear injury could have been non-accidental. Robertson *et al*¹² also found that head and facial injuries were rarely attributable to accidental injury before 9 months of age.

Fifteen children had penetrating injuries, half as a result of cotton bud insertion by the child. In all these children this was the first such injury. Although such injury may be caused unintentionally on a single occasion, repeated incidents may indicate abuse.²

A combination of unilateral ear bruising, haemorrhagic retinopathy, and radiological evidence of ipsilateral subdural haematoma with cerebral swelling has been described as pathognomonic of non-accidental injury (Tin ear syndrome).¹⁰ These findings were not observed in any patient in this study.

Eight children had haematomas of the pinna distributed almost equally between the right and left sides. It has previously been suggested that haematomas of the pinna are almost always associated with non-accidental injury.⁴ It has been suggested that the protective effect of the triangle created by the shoulder, skull and base of the neck reduces injury to the ear after a fall.¹³ On the basis of our study, we feel that haematomas are consistent with accidental injury in many cases.

It is important to decide whether injuries in a particular child are consistent with the child's age, level of activity, and the provided explanation for the injury. It is also important to be aware of the normal range of accidental injuries. Accidental ear injuries under the age of 1 year are rare, as is bilateral ear involvement. Accidental injuries are equally distributed between the left and right ears. In contrast with previous reports a haematoma of the pinna is commonly observed in accidental ear injury and should not be regarded as pathognomonic of abuse. Likewise, although isolated ear injuries might raise suspicion of non-accidental injury, the absence of other injuries cannot be regarded as pathognomonic. Cotton bud injuries are common and preventable.

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Contributors

PB initiated the study, edited the final manuscript and acts as guarantor. BS designed the protocol with assistance from PB, collected and analysed the data and wrote the initial draft of the manuscript. Funding: none.

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