MEDICAL PRACTICE

Contemporary Themes

Mistakes in diagnosing non-accidental injury: 10 years' experience

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Abstract

Fifty children who were referred to the child abuse team in Leeds over the 10 years 1976-86 with suspected non-accidental injury were found to have conditions which mimicked non-accidental injury. These included impetigo (nine children) and blue spots (five children). Five children who presented with multiple bruising had haemostatic disorders. Eight children had disorders of the bone. Five children had been previously abused physically. Four showed evidence of neglect. One had evidence of non-accidental injury as well as the condition mimicking abuse.

It is emphasised that when child abuse is suspected a sensitive and thorough assessment should be carried out by a paediatrician who is experienced in this.

Introduction

Both the public and doctors are now aware of the many different manifestations of child abuse, and this has resulted in an increase in the number of children being referred for suspected abuse. No one would doubt the importance of recognising non-accidental injury, but a mistaken diagnosis can cause much distress.[1,2]

One problem is being able to distinguish accidental from non-accidental injury. Several studies have compared the patterns of accidental and non-accidental bruising, fractures, and burns.[3-6] Another problem is being able to distinguish non-accidental injury from diseases that either produce similar signs or predispose to actual injury, and many case reports have been published, including some on rare or serious diseases.[2,7-9] Some reports describe unusual folk medicine practices.[1,10-12] A few illustrate commoner medical conditions that may be mistaken for child abuse.[13-15]

We report on 10 years' experience with children who were referred to the child abuse team in Leeds with diseases or congenital abnormalities or had suffered unusual injuries that mimicked non-accidental injury. The children were all seen by one of three paediatricians (one consultant and two senior registrars or lecturers in child health who are now consultant community paediatricians) who had a special interest and training in dealing with child abuse. The team also included social workers and a clinical psychologist. Cases were discussed and difficulties in diagnosis resolved by cross referral and obtaining second opinions both within and outside the team.

The children

During 1976-86, 50 children were referred with suspected abuse, and an experienced paediatrician made an alternative diagnosis of the cause of the symptoms and signs. There were 18 girls (aged 2 weeks to 10 years; average age 2 years) and 32 boys (aged 1 month to 15 years; average age 3 years 8 months). All were examined after referral by at least one paediatrician with experience in managing child abuse. Children who had bruises from accidental injury or fractures after trauma of uncertain cause were excluded from this study.

In addition to these 50 children 2578 cases of child abuse were referred between 1976 and 1986: 666 children with suspected sexual abuse and 1912 children with suspected physical abuse. The referrals came from a wide range of medical, nursing, and non-medical agencies. In 1976, 38 children had a diagnosis of abuse, and in 1986 this number had risen to 767.

Results

Of the 50 children, 23 had bruises or lesions resembling bruises, 18 had lesions resembling burns or scalds, eight had actual or apparent bony injury, and one had alopecia areata (table). They all came from poor communities in Leeds. One third (17) of the children were already known to the social services department: five had been previously abused, two were educationally

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subnormal, four had mothers with known psychiatric problems, two had mothers on probation orders, and four came from families that were known to cope poorly with their children. There were signs of neglect in four children and accidental injuries in four others.

Diagnoses of children referred as possible cases of non-accidental injury

Diagnosis	No
Presenting as "bruising" (n=23)	
Blue spots	5
Capillary haemangioma	3
Prominent facial veins	1
Idiopathic thrombocytopenic purpura	3
Haemophilia	1
Haemorrhagic disease of newborn	1
Eczema	2
Erythema nodosum	1
Allergic periorbital swelling	1
Subconjunctival haemorrhage secondary to pertussis	1
Ink, paint, or dye on face	2
Vietnamese folk medicine (*cao gio*)	1
Dental treatment (bruised face)	1
Presenting as "scalds" or "burns" (n=18)	
Impetigo (seven resembled cigarette burns)	9
Dermatitis of napkin area	3
Chilblain	2
Fixed drug eruption	1
Mechanical abrasion	2
Concentrated vinegar burn	1
Presenting as "bony injury" (n=8)	
Clavicle injured at birth	1
Old cephalhaematoma	1
Osteoporosis (neuromuscular disorder)	1
Caffey's disease	1
Congenital hydrocephalus	1
Normal skull variant	1
Scoliosis	1
Osteomyelitis	1
Other	
Alopecia areata	1

The correct diagnosis was usually made without delay by the first paediatrician consulted. There was, however, delay for more than a day in 10 cases, of which seven were unusual (hydrocephalus, osteoporosis, Caffey's disease, fixed drug eruption, vinegar burn, and two cases of idiopathic thrombocytopenic purpura).

The commonest mistake was to confuse impetigo with burns, usually "cigarette burns." These presented as repeated lesions in children who were known to the social services department. (Three of the children had been victims of previous abuse, and the mother of the fourth was subject to a probation order.) Non-accidental injury was suspected in the absence of a "compatible history" or frank "denial" of any burn and sometimes "inappropriate lack of concern." The diagnostic features that distinguished impetigo from cigarette burns in our patients included the appearance of crops of irregular, superficial crusted erosions on the face, arms, and legs of the child and its siblings that healed promptly without scarring when treated with oral antibiotics.

Three children who were referred with "scalds" had severe ammoniacal "nappy" rashes. In each case the rash extended anteriorly up the trunk and down one or both legs. One of these children was certainly severely neglected and undernourished. The other two appeared to be adequately cared for.

A 13 month old boy had lesions that resembled scalds around both ankles (see fig 2). His mother's explanation of accidental contact with vinegar seemed inadequate until a sample of the vinegar was tested and found to be commercial acetic acid of pH 1·5 that his grandfather used, after diluting, on a "pie and pea" stall in the market.

Failure to identify blue spots correctly occurred in five children (see fig 4). One child was of mixed racial origin and was accompanied only by his mother, who was white. The child was described as "caucasian," and the possibility of normal pigmentation was not considered by the first doctor. Blue spots can also occur in "pure" caucasians.

In three children flat "stork-mark" capillary haemangiomas in the hairline were misidentified as bruises, and the children were referred as possible cases of non-accidental injury. There was usually a worrying story to accompany the "injury," such as the case of one 8 month old child who was said to have been "dropped" by her 3 year old sibling.

Two Asian children were referred with pigmentary changes of widespread severe eczema. Dye or paint on the face was deceptive in two other children, one of whom was admitted to hospital because of the "bruising" observed.

Five children were referred with genuine bruising that appeared to be excessive. Haemophilia A was diagnosed for the first time in a 3 year old Asian child who presented with multiple bruises of differing ages over his arms, legs, and face. Three children presented with widespread bruising that suggested excessive trauma until petechiae subsequently appeared and a low peripheral blood platelet count led to the correct diagnosis of idiopathic thrombocytopenic purpura (see fig 5).

Two cases of traumatic bruising are included. A thriving 10 year old Vietnamese girl was referred by a school nurse with multiple fresh bruises on her back, shoulders, and chest caused by her mother pinching her skin as part of a Vietnamese folk medicine treatment for a cold. A 4 year old boy with facial swelling over his right jaw was suspected of having been abused when his stepfather said he had fallen off a wall. It was discovered later that he had had dental treatment for an abscess four days before he presented.

Of eight children who were referred with a query of bony injury, only two had fractures confirmed on *x* ray examinations. In a 1 month old infant with a fractured clavicle there was radiological evidence of healing and the history of a difficult birth. A 5 month old infant had an old calcified cephalhaematoma that was mistaken for a postnatal injury. There was no underlying fracture.

Multiple fractures were present in an 18 month old child who had osteoporosis secondary to a neuromuscular disorder. Non-accidental injury was suspected as the single mother of three children denied that she was having any difficulty and refused help in coping with her physically handicapped daughter. There were, however, no other signs of injury to suggest abuse.

Abuse was suspected in a 9 month old girl who was referred with irritability and a bulging fontanelle because the parents were frequently fighting. There were no signs of injury and the head circumference was normal. Meningitis was excluded and hydrocephalus discovered on neurological computed tomography.

One child had a particularly prominent parietal eminence that was initially worrying as his mother admitted that she "might have bumped him." It was, however, normal on radiological examination and no other signs of non-accidental injury were present. Another child was referred by relatives because of prominent ribs on one side of his chest and the possibility that his psychiatrically ill mother had injured him. The rib prominence was due to a minor thoracic scoliosis. A child thought to have an injured elbow was shown to have osteomyelitis that responded to treatment with antibiotics.

Multiple fractures were suspected in a child with Caffey's disease who presented with painful soft tissue swelling over both shins and the left jaw bone. A skeletal survey showed the "onion skin" periosteal reaction at the sites of tissue swelling, as is found in this disorder.

Discussion

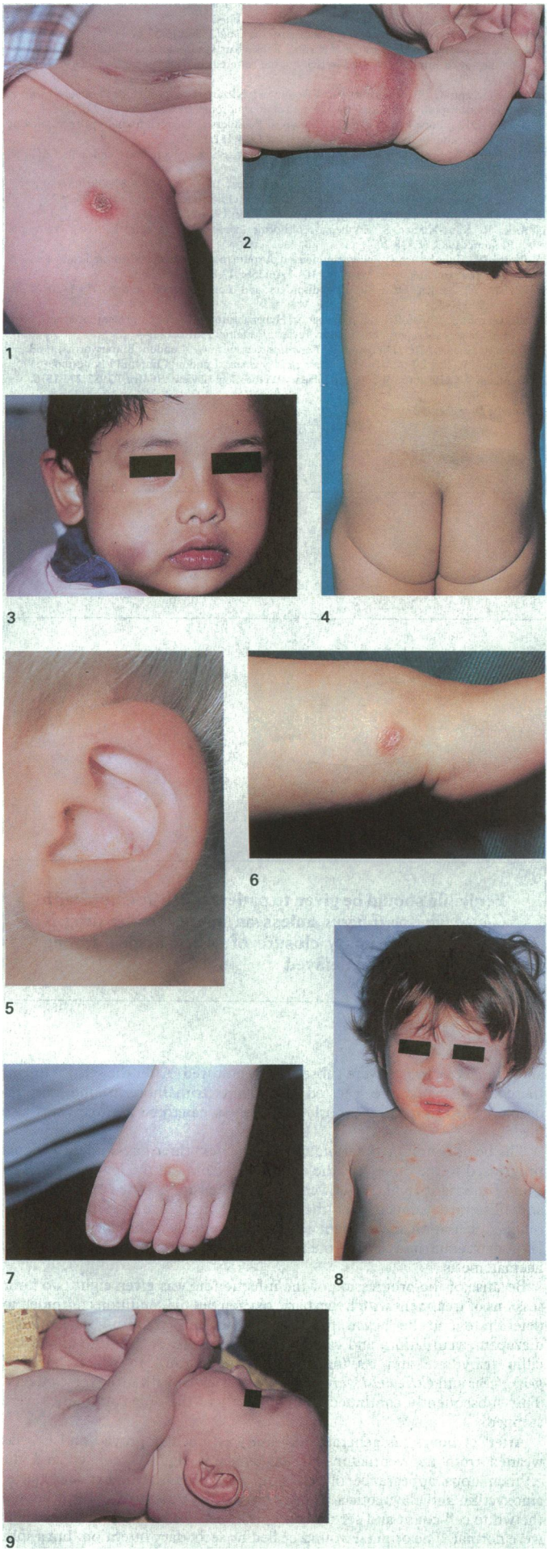
Theoretically, there are many conditions that can mimic non-accidental injury either by producing lesions that resemble burns, bruises, or bone injury or by predisposing the child to such injuries. Fortunately, relatively few children with such conditions were referred to the child abuse team, and the correct diagnosis was usually obtained quickly.

The findings of this study show that common complaints were frequently referred as non-accidental injury, particularly if they occurred in families which were thought at risk of child abuse or neglect. When parents deny causing an injury when there is a lesion resembling an injury it suggests abuse to the doctor.

The commonest mistake was suspecting cigarette burns on children who had impetigo. Genuine cigarette burns are not common: only three affected children were seen in the nine years 1977-85 in this centre.[6] Such burns have been described, however, in refugee children in South East Asia as a form of folk medicine.[11]

Ammoniacal napkin dermatitis may resemble scalding, but the lesions tend to be more extensive and form a different pattern from a deliberate scald on the bottom.[6] Mechanical grazes may look like burns, but here they occurred in children who were much older than those usually subjected to non-accidental burns.

A surprising assortment of common skin conditions may be interpreted as bruising, usually by lay referral agents. Blue spots are easily misidentified as bruises, particularly in children of mixed racial or caucasian origin, in whom the normal occurrence of this pigmentation may not be considered. Extensive such "bruises" have occasionally wrongly been attributed to severe abuse in a child dying from unknown causes.[2] If there is any doubt about the cause of an area of skin pigmentation a follow up examination of the child will soon show the progressive colour changes of the genuine bruise.



In a recent study haemostatic disorders were found in eight of 50 cases of suspected non-accidental injury, and the authors of the report emphasised the importance of carrying out blood coagulation tests to exclude such disorders.[16] The important pointer to the diagnosis in our single case of haemophilia was the history of easy bruising and bleeding. The commonly measured prothrombin ratio is normal in haemophilia; it is the partial thromboplastin time which is prolonged and should therefore be included in the routine clotting screens.

A peripheral blood platelet count and measurement of the bleeding time should also be carried out to exclude quantitative and qualitative disorders of platelets.[16] In the children with thrombocytopenia accidental trauma causing severe bruising arose before the typical petechiae appeared, hence the referral as "non-accidental injury." Inherited platelet dysfunction is rare, but dysfunction induced by drugs—for example, aspirin or penicillin—is well known and should be excluded.

Vasculitic lesions, commonly poststreptococcal or drug induced, may produce widespread "bruises."[17] Our patient had lesions on the legs only. The facial tissue swellings that sometimes appear in Schönlein-Henoch purpura have been mistaken for signs of abuse.[15]

The Vietnamese lay practice of "coin rubbing," or *cao gio*, has been described and dramatic bruising may result.[10] Other severe folk practices include burning and "cupping."[11,12] Although the intention of such treatment is to help the child, it should be seen as a culturally sanctioned form of child abuse and other strategies suggested to the parents.

Bone fractures are almost always due solely to trauma, whether accidental or non-accidental, and the main problem is eliciting the true story of the trauma. Some unusual cases of bone disease that have presented as suspected child abuse have been described.[7,8,18,19] Over an entire decade in Leeds only one child who was referred for suspected abuse had multiple fractures due to a genuine bone disease (osteoporosis). The unlikely event of missing copper deficiency in normal infants with multiple fractures was discussed in a recent editorial.[20] Caffey's disease is an uncommon disorder of bone growth that produces signs that might easily be mistaken for non-accidental injury but that can be excluded by expert radiological examination.[18,19]

The diagnosis of child abuse is never simple and requires general experience in paediatrics as well as a knowledge of the usual injuries seen in abuse. Failure to detect abuse may mean failure to protect the child. Diagnosing abuse when there is none is distressing and may lead to increased anxiety, even suicide, as well as the wrong treatment.[1,2] Fortunately, it was recognised relatively early that the children described here had not been abused, and none were removed from their parents' care nor were legal proceedings taken against parents.

FIG 1—Three year old boy with lesions. Referred by family doctor with suspected cigarette burns. Irregular crusted lesions characteristic of impetigo are present on thigh and lower abdomen. 2—Thirteen month old boy (see text). Burns from "vinegar," which was really glacial acetic acid with a pH of 1·6. The discoloured band represents tight trouser leg elastic which seemed to hold the caustic liquid against the child's leg. The story sounded too ridiculous to be true, and the admitting doctor questioned abuse. 3—Jaw line bruise in 3 year old Asian child referred by the accident and emergency department for suspected abuse. Bruise had mass and was a haematoma: diagnosis was haemophilia A. 4—Mongolian blue spots in girl aged 3, sister of 11 month old girl who was non-accidentally burnt by mother. Child was of mixed racial parentage. 5—Petechial bruising in ear lobe, which is a common site for non-accidental injury, in a 4 year old boy who was referred after multiple bruises to head and trunk were seen during visit to ophthalmologist's clinic. Clotting screen and bone marrow examination confirmed a diagnosis of idiopathic thrombocytopenic purpura. The site of bruising in ear is not the usual pattern in child abuse. 6—True cigarette burn on wrist of young child: pale central area, cratered with smooth outline. 7—Unusual circular lesion, referred as cigarette burn, in a 2 year old with signs of gross physical neglect and failure to thrive. This child and younger sibling showed cold, swollen blue hands and feet, and there were similar but smaller lesions in the sibling. Lesion is likely to be a small area of skin necrosis as seen in cold injury. 8—Henoch-Schönlein syndrome mimicking abuse in a preschool child, age unknown. 9—Baby aged 5 months referred, with blue lesion, from special nursery with staff who were experienced in work with child abuse. Lesion had appeared to mother and staff de novo. Two older siblings were in care after non-accidental injury was admitted. Lesion was unchanged one week after presentation. Diagnosis was cavernous haemangioma. Many such lesions appear and enlarge after birth.

Most referrals were made by a third person, such as a school nurse or child minder, rather than by the parents, which may have caused anxiety in some cases. This is the price to be paid for greater public awareness and vigilance over child abuse, which makes it essential to have easy, rapid access to a specialist with experience and training in managing such children. More research and training are needed so that non-accidental injury can be diagnosed with more precision.

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Lesson of the Week

Gas gangrene: a cautionary tale

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The principles of preventing and treating gas gangrene are well known but are often forgotten because the disease is uncommon in civilians.[1] As the incidence, morbidity, and mortality of gas gangrene after injury may be reduced by appropriate management[2] awareness of this life threatening disease is important.

Penicillin should be given to patients with infection with *Clostridium perfringens* unless an allergy to the drug is proved, and primary closure of soiled or penetrating wounds should be delayed

Case report

A previously well 6 year old boy presented with a laceration to his right knee after a fall. On examination he had a deep wound over the anterolateral portion of the knee, through which the joint capsule was visible. Radiographic examination showed air within the joint (figure). Exploration of the wound showed considerable soiling with a small laceration of the capsule and a haemarthrosis. The haematoma was evacuated, the capsule repaired, and the wound cleaned extensively. The skin was sutured and the leg placed into a split cylinder of plaster of Paris. The boy had previously developed a rash and facial swelling when given amoxycillin, which had subsided after the drug was withdrawn, and erythromycin was therefore given prophylactically.

Three days later he developed a fever and his right leg became oedematous. The white cell count was raised (32×10^9/l with a predominance of neutrophils), but cultures of blood did not yield any growth. When the wound was re-explored pus was found, from which *Clostridium perfringens* and *Citrobacter freundi* were subsequently cultured. After the sensitivities of these organisms had been tested cefuroxime, trimethoprim, and metronidazole were given intravenously; equine gas gangrene antitoxin was also given.

The boy's condition deteriorated over the next three days and the oedema progressed to the other leg, the abdominal wall, and the lower chest. The skin of the right thigh and lower abdomen became mottled and indurated and blisters developed over the thigh and the dorsum of the foot. He retained sensation in his right leg and movement of his toes and ankle. Hyponatraemia and hypoproteinaemia developed, and he had a small haematemesis.

Because of the progression of the infection he was given eight two hour sessions of treatment with hyperbaric oxygen but his condition continued to deteriorate and he began to have convulsions, requiring intravenous diazepam, ventilation, and cardiovascular support. A test dose of amoxycillin trihydrate and clavulanic acid (Augmentin), to which both *Cl perfringens* and *C freundii* were sensitive, was given with no adverse effects. This subsequently continued at high dose and the other antibiotics were stopped.

After 24 hours his general condition was much improved and he was weaned from the ventilator. His oedema was slightly reduced and the erythematous appearance of the skin was diminished. Ten days after amoxycillin and clavulanic acid were started the oedema had resolved and the white cell count and serum concentrations of electrolytes and proteins were normal. The original wound healed by secondary intention, but a split

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