

Bruising in children

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The words bruise, contusion and ecchymosis are synonymous. A bruise is an escape of blood into the skin or subcutaneous tissue, or both, following the rupture of blood vessels, usually capillaries, by the application of blunt force. There may be associated swelling, in which case the injury may be referred to as a haematoma.

The appearances of the bruise may be influenced by:

1. The severity of the blunt force.
2. The vascularity of the underlying tissues.
3. Diseases which affect the connective tissues or the ability of the blood to clot.
4. If the skin is loose at the site of injury, as for example around the eye or genitalia, bruising will occur more easily.
5. If there is excess subcutaneous fat, bruising will also occur more easily. Conversely, if the skin is strongly supported and muscle tone is good, bruising may be minimal (for example as on the abdominal wall of boxers).
6. Age. Infants and old people tend to bruise more easily.
7. Sex. Women are said to bruise more easily than men.
8. Colour of the skin. Bruising shows more easily the paler the skin.

The extent of a bruise may increase considerably after the injury which caused it, due to continued extravasa-

tion of blood and tracking between tissue planes. 'Gravity shifting' of the blood may result in a bruise appearing in a place remote from the point of injury. Bruises do not blanch on pressure but may vary in colour, depending on their age. Bruising can be confused with paint or pen marks, dye from clothes, a Mongolian blue spot, a capillary haemangioma and periorbital swelling as a result of allergy or infection.

In dark-skinned children, bruises may also be confused with café-au-lait spots. If there is any doubt that a lesion is a bruise, serial examination will decide the matter.

Petechiae are tiny blood spots in the skin, each about the size of a pinhead. They are of fairly regular size and circular in shape and are usually red or purple at initial presentation. They classically arise in idiopathic thrombocytopenic purpura, meningococcal infection and leukaemia, all as a result of reduced platelet count or abnormal clotting, but petechiae may also arise in children with normal clotting and platelet counts as a result of trauma. Examples are the petechial bruising which occurs as a result of a suction bite (a 'love bite' on the soft tissues of the neck), petechial bruising which may affect the pinna of the ear when it is squeezed or slapped, and petechial bruising on the cheek or around the orbit as a result of a slap mark to the face.

Accidental bruising in normal children

Many children when examined carefully have some evidence of minor trauma consistent with normal activity.¹ Robertson et al 1982² sought recent minor traumatic lesions in 400 children attending routine child health and school clinics over a 10-month-period. All visible bruises, abrasions and lacerations resulting from injuries received during the preceding 2

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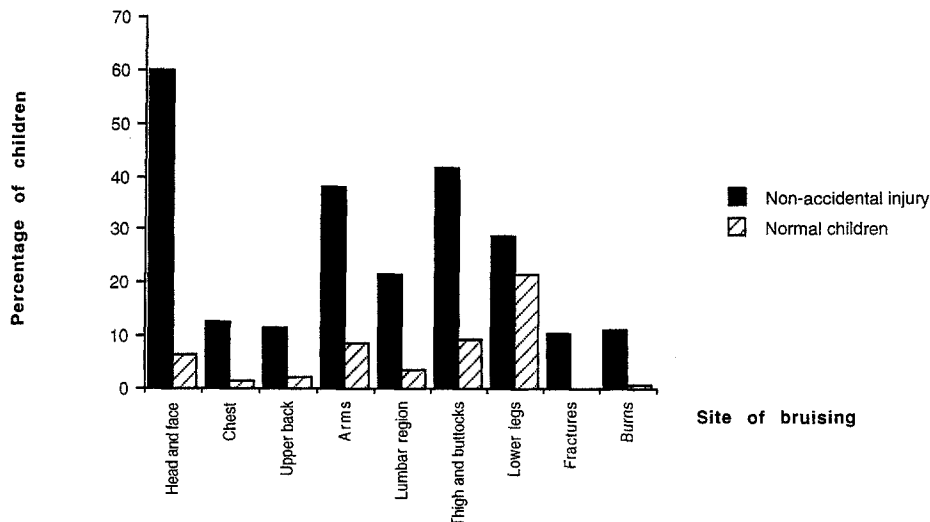


Fig. 1 — The distribution of bruises in accidental and non-accidental injury (Robertson et al, 1982).

weeks were recorded. The children were aged 2 weeks to 11 years. Of these 400 children, 37% had a detectable lesion, due to recent minor trauma at the time of examination, and bruises were the most common form of injury, often accompanied by minor abrasions or lacerations. The commonest sites of bruising were the lower legs (21.5%), thigh and buttock (9.25%) and arms (8.5%). In contrast, bruises to the head and face were found in only 6.5%, bruises to the lumbar region in 3.75%, bruises to the upper back in 2% and bruises to the chest in 1.5%. These data are shown in Figure 1 for comparison with the pattern in non-accidental injury. There were some differences in the pattern with different age groups. Injuries to the lower leg were uncommon before the age of 18 months. Head and facial injuries were commonest in the toddler age group, presumably as a result of falls. Accidental bruising to the lumbar region was uncommon before the age of 6 years but affected about 1 in 6 children thereafter. Only 2 out of 60 children aged between 2 weeks and 2 months had bruising. Most accidental bruising occurs over bony prominences and hence accidental bruising over the abdomen, chest and back was uncommon in all age groups. Only 2 out of the 400 children had injuries to the genitalia.

Data on absolute number of bruises in accidentally injured children are hard to find. Hobbs et al 1993³ suggest that up to 12 bruises may be seen in non-abused children.

Patterns of bruising in disease

In diseases such as Henoch-Schönlein purpura, idiopathic thrombocytopenic purpura or an inherited but as yet undiagnosed coagulopathy, the child may appear well but have unexplained bruising. Clues to the diagnosis of coagulopathy may be obtained from the family history or a history of excessive or

prolonged bleeding after previous circumcision, tooth extraction or minor injury. If the injuries are severe and particularly if they are likely to lead to legal action, it would be a wise precaution to undertake a clotting screen. A platelet count, thrombin time, prothrombin time and partial thromboplastin time will exclude most haematological disorders, although mild von Willebrand's disease may be missed. Both O'Hare and Eden 1984 and Wheeler and Hobbs 1988^{4,5} report series in which children presenting with bruising had clotting tests done which revealed that 15–20% had abnormal investigations, although this may be an over-estimate. The vast majority of children with bruising thought to be non-accidental have an entirely normal clotting screen and, if any minor abnormalities are found, the first action should be to repeat the clotting screen.

Patients with Ehlers-Danlos syndrome, pseudo-xanthoma elasticum and Marfan's syndrome have abnormal elastic tissue. Both Ehlers-Danlos and Marfan's have been associated with platelet dysfunction and there is a lifelong tendency to excessive bruising.

There is a collagen abnormality in osteogenesis imperfecta but there should be no difficulty in distinguishing this condition from non-accidental injury.⁶ Scurvy is now extremely uncommon in the UK but may present with bleeding, bruising and radiological periosteal reaction.

Bruising in non-accidental injury

This article will deal only with physical abuse. Bruising may be seen as one of the signs associated with sexual abuse^{3,7} but there is not scope to deal with this here.

There are very few physical findings which are pathognomonic of non-accidental injury. However, there are a number of features of bruising which are more common in non-accidental injury than in genuine

accidents and these may be used to reach a 'balance of probability' assessment. All pre-pubertal children should be undressed completely for the examination. When parents or legal guardians present a child to be seen by a doctor, there is implied consent that the doctor will examine as much of the child as he or she feels necessary. There is therefore no obligation to seek consent to undress a child even if the examination is for suspected non-accidental injury. However, if an older child specifically refused to undress, there would be little to be gained by trying to pursue this forcibly and a court order does not allow a doctor to proceed against the informed wishes of a child who does not consent. Under an emergency protection order, parental presence or consent is not necessary to examine a child. Children between the ages of 16 and 18 years are now considered to have the same capacity as an adult to consent to an examination or treatment. A child under the age of 16 is able to consent, or refuse to consent, provided he or she is sufficiently mature and intelligent to be able to understand what is involved (the concept of 'Gillick competent'). The assessment of competence is left as a matter for the doctor to decide.⁸

When the child is undressed, there may be evidence of poor hygiene, dirty clothing, dirty nappy, nappy rash or failure to thrive. In addition to looking for bruises, scratches are common in abused children and there may be traumatic alopecia. The child's height, weight and head circumference should be plotted on a centile chart. However, the main clue to child abuse on physical examination is that there are multiple injuries in time and space. Multiple injuries are rare in children, outside the lower leg area, unless they are involved in a major trauma such as a motor vehicle accident.

Number of bruises

Bruises are present in 90% of physically abused children and often the bruises are multiple in number, particularly in the most severe type of physical abuse, although some children may be seen with a single or first injury (e.g. a slap mark to the face).

Age of bruises

The literature regarding the ageing of bruising is confusing. Forensic textbooks which cite the colour

changes which a bruise undergoes with time do not appear to be based on research in children and there is no general consensus on the duration of each stage of colour, nor even any agreement on the exact sequence of colour changes (Table 1).^{3,9-13} Nevertheless, although ageing of soft tissue injuries is an inexact science, it may be very obvious that certain injuries are of very different ages.

Sites of non-accidental bruising

The common sites are shown in Figure 1. Robertson et al found 84 children in whom non-accidental injury was proven or suspected. A similar incidence of bruising affecting the lower legs was found for the abused group as for normal children but bruising at all other sites was commoner in children thought to have sustained non-accidental injury. Head and facial injuries were particularly common at all ages in the children suspected of non-accidental injury. Injuries to the head and face area are commoner in non-accidental injury because the bruising is caused by blows to the head, slaps to the face and fingermarks around the cheeks due to force feeding. In particular, bruises on the external ear are extremely unusual following genuine accidents as are bruises to the lateral side of the lower jaw. Black eyes can occur in normal schoolchildren but two black eyes, or several black eyes over a period of time, should raise suspicion. Two black eyes can occur simultaneously if the forehead hits a hard surface and blood then tracks down into both periorbital regions.

Bruises on the buttocks and outer thighs may be related to punishment, whereas injuries to the inner thigh or genital area should suggest a more detailed search for other evidence of sexual abuse.

Particular patterns of bruising in non-accidental injury

There are a few injuries which are particularly suggestive of non-accidental bruising. Multiple bruises, approximately 1 cm in diameter, which may be found on the cheeks, chest, back, arms or thighs, may be due to fingertip bruises inflicted by an adult either by poking the child or by a very tight grip. There are no truly genuine accidental injuries which can give multiple 1 cm circular bruises on different surfaces of the body. Suction bruising ('love bites') are always inflicted by an

Table 1—Ageing of bruises. Various published schemes to aid ageing of bruising (see bibliography for full references)

	Adelson (1974)	Rentoule (1973)	Camps (1976)	Polson (1984)	Spitz (1980)
Initial colour	Red/blue	violet	red	red, black	blue/red
1-3 days	blue/brown	dark blue	purple, black	purple, black	dark purple
1 week	yellow/green	green	green	green	green/yellow
8-10 days		yellow	yellow		brown
2 weeks		normal	normal	yellow	normal

adult and may suggest a sexual element to the abuse. Toddlers certainly do bite one another but they do not inflict petechial haemorrhages associated with suction. Linear bruising on the buttocks, thighs or lower back suggest beating with a cane or a strap, whereas four or five linear marks close together on the side of the cheek or a buttock may represent an adult handprint from a slap mark. There will often be lines of petechial haemorrhage along the fingermarks of the hand slap. If the adult was wearing a ring at the time, this may leave a tell-tale sign. Scratchmarks may occur on the nose, cheek, ears, limbs or abdomen and a nip may give rise to a pair of bruises, facing one another, or on the pinna of the ear, petechial haemorrhages. Odd bruising may arise when a child is struck through the clothing and then the pattern of the weave may appear on the child's skin. If the child has been beaten on a number of occasions, or some time ago, the typical linear or parallel pattern may be lost and beating with a slipper or a shoe may simply lead to large areas of bruising over the buttocks which do not conform to any simple shape. Likewise, kicks delivered to the abdomen, chest or lower limbs rarely reflect the shape of a shoe. Some typical non-accidental injuries are shown in Figures 2 and 3.



Fig. 2 — Fingertip bruising to the trunk.

The role of the paediatrician

Immediate action

The approach to dealing with non-accidental injury has been reviewed elsewhere.^{14,15} The importance of accurate documentation of injuries cannot be



Fig. 3 — Linear marks on the buttocks from punishment.

overestimated and casualty departments should provide a body chart (analogous to that used for burns) to allow even the least artistically-inclined practitioner to record the injuries. This should be a contemporaneous record of the site, dimensions and colour of each injury rather than vague hatching and shading. It is also common when cases come to court for there to be several diagrams, none of which agree. Few casualty departments offer a 24-h photographic service and so these diagrams may be extremely important in subsequent legal action. If photographs are to be taken, it is usual to ask permission of the parents (and the child where appropriate). Ultra-violet photography may also demonstrate bruises which are not clearly visible to the naked eye, or to look for evidence of older injuries or scar formation.¹⁶

Giving evidence in court

A number of questions are commonly asked of the paediatrician giving evidence in court in relation to non-accidental bruising. For many of these there are no data available but there are some commonsense approaches to answering these questions.

1. How long would it have taken for the bruise to appear? Redness and swelling may arise almost immediately but discolouration due to extravasation of blood may not appear for some hours or until the next day. Table 1 shows the difficulty of ageing bruising but the presence of other associated features (for example, tenderness, swelling, associated excoriation or abrasions) may

suggest that the injury is fairly recent. It is wise for the paediatrician to confine himself to saying that some bruises appear older than others, rather than to be dogmatic on exact ageing. One study which looked at attempts to age bruises from photo-graphic evidence suggested this was much less precise than forensic textbooks implied.¹⁷

2. How much force would have been required to cause the bruise? This is impossible to answer but a useful phrase is to say that 'excessive force must have been used' and to perhaps amplify this by saying that such bruising would not have arisen during the normal care of a child, the normal dressing of a child or during normal play. Some of the explanations which parents frequently offer for non-accidental bruising are:

- 'It happened while I was dressing the child'
- 'The child fell out of bed or off the sofa'
- 'A friend or sibling did it'
- 'It happened during rough and tumble play with an adult'
- 'He bruises easily'

These are rarely tenable. All parents will have experienced the difficulty of dressing an unco-operative toddler and perhaps have been surprised at the amount of force required in wrestling their own child into a babygro. However, they will also have observed that bruising very rarely occurs during this daily undertaking. There have been a number of reviews of the injuries when children fall from heights of up to 3 feet, both in the home and hospital, and these have all reached the same conclusion that serious or severe injury is unlikely from falls of this magnitude. Scalp or facial haematoma occur in 20%, lacerations to the facial area in 10% but in two thirds of such children there is only minor bruising or no observable injury.¹⁸

3. Would the bruising have been painful? The answer to this must be yes. However, in a young pre-verbal child it is possible that the other, non-abusing, parent would not have been aware that the child had been bruised because the child may simply cry or be grizzly and this is non-specific. However, if the child has been undressed, changed or bathed since the incident, the parents would be expected to have noticed bruising.
4. The paediatric witness may be asked to speculate in court on possible mechanisms. Parents rarely

tell us exactly how they have injured their child and, even when they do so, they no doubt give a sanitised version.¹⁹ The most important thing to emphasise to the court is not a hypothesis about how each individual injury occurred but to stress the importance of the pattern as a whole, ie. the number, distribution and shape of the bruises.

Conclusion

Bruising may occur as a result of a bleeding diathesis or more commonly due to trauma, which may be accidental or non-accidental. If there is a single injury, distinction between accidental and non-accidental bruising may be difficult but, if the injuries are multiple, the number of injuries, their site, their age and their shape may all help in formulating an opinion about whether the bruising is non-accidental.

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