

# Physical abuse: more certainty now?

Geoff Debele

## Abstract

There is now a strong evidence base for the characteristics of inflicted injury. Professionals within the multidisciplinary team and the courts are increasingly relying on other features such as the child's presentation to help determine whether child maltreatment has occurred. These features are somewhat subjective in nature, with little or no evidence to assist the clinician, particularly where there is uncertainty surrounding the possibility of child maltreatment.

This paper will examine further evidence on the physical signs of child maltreatment, focussing on primary research on bruising, sentinel injuries, occult rib fractures and conditions that mimic physical injury such as the resurgence in the use of cupping as a remedy for childhood illness. It will also examine emerging evidence on a child's presentation, including history, response to injury and time to seek medical attention.

If uncertainty surrounding the causation of an injury remains following advice and peer review, this must be acknowledged and stated unequivocally.

**Keywords** child abuse; ecchymosis; fractures; traditional medicine

## Introduction

The diagnosis of inflicted injury remains one of the most difficult challenges in clinical paediatrics. Despite increasing evidence on the characteristics of inflicted injuries in comparison to non-inflicted injuries, particularly with respect to bruising, skeletal fractures, burns and head injuries, so-called 'grey cases' and uncertainty in diagnosis abound.

In a previous article, I discussed 'grey cases' where 'diagnostic uncertainty' can lead to circumspection and indecision. I focussed primarily on isolated bruising in a premobile infant, occult rib fractures and the incidental finding of a cephalohaematoma in an otherwise normal infant.

In order to increase diagnostic certainty, many Emergency Departments utilize a screening instrument that is universally applied to all children presenting with an injury. These include questions on the consistency of the history given for the injury, time to seek medical attention and the appropriateness of the interaction between the child and carers. Although their use has increased the detection of suspected intentional injury, data on

confirmation of such injury was typically absent. The truthfulness or falsehood of the history given for an injury, what constitutes an unnecessary delay in seeking medical attention for an injury, a child's response to an injury and child/carer interaction remain subjective.

In this update, I will examine new evidence on the patterns of bruising in pre-school children, the importance of recognising so-called sentinel injuries in the prevention of serious or fatal injury, defining the cause of occult rib fractures and cutaneous and non-cutaneous conditions that might be mistaken for inflicted injury, including the recent upsurge in 'cupping' as a traditional folk remedy. I will also examine the emerging evidence base for other factors used to estimate the likelihood of inflicted injury such as the explanation given for the injury, the child's expected response to injury and perceived delay in seeking medical attention, factors that are being relied on more and more by professionals, welfare agencies and the courts to determine whether an injury is inflicted or accidental.

## Patterns of bruising

In an important contribution to the literature, Kemp et al. have followed up their systematic review of patterns of bruising in childhood with a large, prospective longitudinal study of children (less than 6 years) that confirms a strong relationship between the presence, number and location of bruises at different stages of a child's development. Parents, recruited from well-baby clinics, hospital outpatients and local mother and baby groups, reported any bruising in 38 different locations on their child's body, weekly, for up to 12 weeks, recording them on a body chart. In all, 3523 bruises were recorded from 2570 data collections from 328 children (mean age 19 months). The prevalence of bruising in the first collection for each child was 5.3% in pre-mobile, 55.8% in early mobile (crawling or cruising) and 87.5% for walking children.

The premobile infants were subdivided into those who were not yet able to roll over and those able to roll over. Twelve bruises were recorded in 9 of 405 collections (2.2%, 95% CI 1.2%–4.2%) in children unable to roll, compared with 75 bruises in 59 of 605 collections (9.8%, 95% CI 7.6%–12.4%) for those who were able to roll. The mean number (SD) of bruises per collection was 0.09 (0.35).

## Location

The most common sites were below the knees, 'facial-T' (forehead, nose, upper and lower lip, chin) and head (the area within the hairline). The ears, neck, genitalia and hands were rarely bruised (less than 1% of collections) in any developmental group. Buttocks and front trunk were rare sites (less than 0.2%) in premobile and early mobile children; when bruising to the front trunk occurred, it was predominantly over bony prominences in walking children.

Thus, any premobile infant presenting with multiple bruises and any child presenting with bruising in locations other than 'facial-T', head or below knees, particularly on the ear, neck, buttocks and genitalia should arouse suspicion of possible inflicted injury. While commentators have drawn attention to methodological flaws in this study such as the use of self-reported data from a selected population, flaws acknowledged

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by the authors, these data do provide an invaluable baseline for the assessment of bruises in children.

### Isolated bruise

However, the study has also produced a relatively unexpected finding; that isolated bruising *does* occur in premobile infants. For example, two bruises to the cheek were noted from multiple collections in premobile infants and two bruises to the ear in collections from early mobile infants. The cause, when reported, of some of the bruises included bumping into mother's tooth, falling asleep on a dummy, banging themselves with a fist or rattle, and a toy being dropped on one infant. The authors state that 'the probability of abuse in this population was low'; each collection was scrutinised and explanations given for the bruises, where available, were compatible with the bruise sustained. 'In a few cases where bruise pattern was deemed unusual, they were independently reviewed by a child protection team and abuse was excluded'. One commentator concluded, 'so it is true that almost any injury can, albeit very rarely, occur accidentally at any developmental stage or at any site'.

### Sentinel injuries

Where does that leave the discussion on so-called sentinel injury? A sentinel injury has been defined as a visible injury that may, or may not be recognised as concerning but, if not acted upon appropriately, gives rise to serious or fatal inflicted injury, often within weeks. Sheets et al. undertook a single-centre, retrospective analysis of 401 infants less than 12 months-of-age investigated for suspected abuse. Physical abuse was found with 'reasonable diagnostic certainty' in 200 infants by the hospital child protection team. Fifty-five (27.5%) had a sentinel injury; *bruising* occurred in 80%, *intraoral injury* in 11% and fracture in 7%. In the 100 infants where there was 'intermediate concern' for abuse, 8 (8%) had a sentinel injury, predominantly bruising. No sentinel injuries were found in the remaining 101 infants investigated and found not to have been abused. The authors were conscious of the potential for circular reasoning in this study but found that no cases were classified as definite abuse based on the findings of a sentinel injury.

In 23 of the 55 definite abuse infants with sentinel injury, the parents apparently made health professionals aware of the injury yet in only 10 cases were abuse suspected. In some cases, the injury was noted as a finding on examination and considered to be accidental, self-inflicted or a condition unrelated to injury. This was also found in smaller cases series and case reports.

In the 44 definitely abused infants with sentinel bruising, there were 66 bruises in various locations (forehead, face, ear, extremity and trunk), similar to the locations of everyday bruises found in Kemp's study, although *bruising to the trunk and ears*, rare in Kemp's study, occurred *more commonly as sentinel injuries* in Sheet's study.

### Likelihood of inflicted injury

Any bruise in premobile infants raises the suspicion of physical abuse. What is the likelihood of such abuse in children presenting with putative sentinel injuries such as bruising? Lindberg et al. carried out a large, retrospective analysis of children seen in ED, observation or inpatient setting in 18 US tertiary centres from

2004 to 2011. They identified putative sentinel injuries in 0.7% of all visits among 30,355 children less than 24 months-of-age, the majority having one injury identified. Their candidate injuries included bruising, burns, oropharyngeal injuries, isolated skull fracture, extremity fracture, genital injury and subconjunctival haemorrhage, all of which were cited as sentinel injuries from previous case series and reports.

Rates of abuse for each sentinel injury varied between centres due to variations in coding assignment for abuse and in testing for occult injury (for example, by skeletal survey). For bruising, the *rates for abuse in infants aged less than 6 months*, ranged from 1.1 to 21.3% (mean 8.35), for burns, 0–6.95 (mean 3.5%) and for oropharyngeal injury 0–41.7% (mean 17.0%). Rates of abuse for infants aged less than 12 months with an isolated skull fracture were 0.3–11.8% (mean 4.3%). Despite the study's several limitations, including the possibility of circularity, rates for abuse for sentinel injuries in infants less than 12 months were relatively high.

### Negative evaluation

Thus, a sentinel injury such as an isolated bruise or oropharyngeal injury, particularly in a premobile infant requires investigation for possible inflicted injury. The medical investigation such as a full skeletal survey is to detect occult injuries rather than to exclude an inflicted injury; a child abuse evaluation that does not show injuries beyond the sentinel injury is different from, say, a negative sepsis evaluation.

When faced with such uncertainty and in the absence of a 'diagnostic gold standard' it is often helpful to ask, 'Are there factors present in the child's presentation with an injury, such as the plausibility of the history, a child's expected response to an injury or perceived delay in seeking medical attention for an injury that might be important in estimating the likelihood of inflicted injury?' The reliability and accuracy of these factors in helping to distinguish an inflicted from an accidental injury have yet to be established and there is a dearth of comparative studies of children with inflicted and accidental injury that explore them in detail. Yet they are used by professionals and the courts to inform decisions on whether an injury is inflicted or accidental.

### History

Chaiyachati et al. studied 134 consecutive cases of children presenting with bruising, head injury or fracture that were subject to investigation for suspected abuse by the Child Protection Paediatric (CAP) team in a single-centre. They compared 23 so-called 'grey cases', where the team found diagnostic uncertainty, with 48 cases of 'definite abuse' and 63 'definite accident' cases with respect to history of the incident, delay in seeking medical attention, the child's past medical history and the family's social history.

### "Found" injuries

There is no data on substantiation of abuse or accident from assessment or follow up, making it difficult to determine the contribution of circularity to their data. Elements in the history common to both grey and abuse cases were the frequency of "found" injuries, i.e. injury was incidentally noticed without any history of trauma (e.g. a scalp swelling noted while bathing an

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