

# From bruises to brain injury: The physician's role in the assessment of inflicted traumatic head injury



Michelle GK Ward MD, Child and Youth Protection Program; W James King MD, Division of Pediatric Medicine; Susan Bennett MB, Child and Youth Protection Program, Department of Paediatrics, Children's Hospital of Eastern Ontario, Ottawa, Ontario

A four-month-old boy, born at term without complications, presents for his well-baby appointment with his mother. He is developmentally normal and has a negative review of systems, except that he is described as 'colicky'. His height, weight and head circumference are slightly above the 50th percentile. On examination, two small brown-yellow bruises on the right arm superior to the antecubital fossa are noted. The mother reports that she hadn't noticed the bruises before, but she believes they may correspond to the location where the baby is typically held during his bath. The physician requests that the mother return if more bruises develop.

Two weeks later, the mother presents with the baby to the emergency department because of vomiting with each feed for 24 h without diarrhea. The baby is afebrile, well hydrated and has a normal examination. A diagnosis of viral gastroenteritis is made, and the physician recommends monitoring the baby's hydration status.

One week later, the baby returns to the emergency department accompanied by paramedics. The parents report that following a feed, he turned blue and went limp. On examination, the baby is irritable and has two small bruises over the left knee. On further history, there is no known trauma and no personal or family history of bleeding disorders. A computed tomography (CT) scan of the head is requested because of the apneic episode, previous vomiting and concerns for possible trauma. The CT scan shows subdural and subarachnoid hemorrhages. The baby is admitted to hospital for further evaluation.

The complete blood count, international normalized ratio, partial thromboplastin time and screening blood work are normal. An ophthalmologist's examination shows multiple hemorrhages bilaterally in different layers of the retina. A skeletal survey is positive for metaphyseal fractures at both distal femora and the left proximal tibia. In a nonmobile infant without a history of trauma, the latter is considered to be a possible cause for these injuries. Child welfare authorities are notified of these results as being highly concerning for inflicted injury, and a joint investigation with the police is initiated.

## LEARNING POINTS

A CPSP study on head injury secondary to suspected child maltreatment, completed in 2008, reported 220 cases over a three-year period (1), representing an annual incidence rate of 14.1 per

100,000 infants younger than one year of age. The CPSP study also found that:

- 38% of cases presented at least once before recognition.

Inflicted traumatic head injury is often undetected at first presentation. In a review of hospitalized cases of abusive head injuries, 31% of cases were 'missed', and these cases had an average of 2.8 physician visits before recognition. The 'missed' cases were more likely to be younger, Caucasian, living with both parents and less symptomatic (2).

- 25% of cases had lethargy, irritability and/or vomiting as their only symptoms.

Infants with traumatic head injury may not show signs of head injury or have nonspecific symptoms only. Of the CPSP cases, 75% had clear signs or symptoms with decreased level of consciousness, seizures, respiratory difficulty, apnea and/or a soft tissue injury of the head.

- 39% of cases exhibited bruising at the time of presentation for medical care.

Bruises are very uncommon in nonmobile infants (<1%) (3). Any unexplained bruise in a premobile child should lead clinicians to consider inflicted injury and/or a coagulation disorder as a possible cause. Bruising may be the only external sign of inflicted injury, even when more serious internal injuries are present. In this case, the initial bruising may be considered to be a sentinel event, and the recognition of trauma at the first presentation may have prevented further injury.

The physician's role in assessing possible inflicted injuries in infants should include the following actions:

- Evaluate signs and symptoms and treat clinically.
- Inform child welfare authorities when there is a concern or suspicion that injuries relate to maltreatment.
- Evaluate for other injuries or consult an expert in child maltreatment.

Injuries of the brain, skull, eyes, bones, skin, mouth and abdomen can be associated with inflicted head trauma (85% of CPSP cases underwent skeletal surveys and 39% had at least one skeletal fracture; furthermore, 90% of cases with a subdural hemorrhage underwent an ophthalmology examination and 50% had retinal hemorrhages). CT scanning is recommended for acute assessment

Correspondence: Canadian Paediatric Surveillance Program, 2305 St Laurent Boulevard, Ottawa, Ontario K1G 4J8.

Telephone 613-526-9397 ext 239, fax 613-526-3332, e-mail cpsp@cps.ca

Accepted for publication June 19, 2013

of infants who are being evaluated for traumatic head injury (94.9% of CPSP cases underwent head CT) (4).

- Consider the differential diagnosis for each apparent injury and evaluate for mimics, medical etiologies and medical predispositions.

When bleeding or bruising is present, a coagulation work-up is recommended (70% of CPSP cases with intracranial hemorrhage underwent coagulation screening). When fractures are present, a bone health work-up is recommended (34% of CPSP cases with a fracture underwent metabolic bone work-up).

- Document the history and findings in an objective and descriptive manner. Line diagrams and/or photo documentation of visible injuries are recommended.

The source of information should be documented, eg, “The following history was provided by the mother...” Skin findings should be described by size, shape and colour, such as “Three red-purple parallel linear bruises on the right knee measuring 3.0 cm × 0.1 cm with sparing between each line” as opposed to “hand print”.

- Provide an opinion and/or consult an expert in child maltreatment to provide an opinion on the interpretation of findings for child welfare authorities. The diagnosis should be objective and descriptive. In this case, the diagnoses are traumatic head injury, retinal hemorrhages and metaphyseal fractures. The summary should include an explanation of possible mechanisms (birth, accidental or inflicted trauma), timing of injuries and interpretation of symptoms in relation to the injuries. These factors should be related to the relevant medical literature.

- Consult and collaborate with other relevant specialty services such as neurosurgery, hematology and ophthalmology. The Canadian Medical Protective Association can be consulted for medico-legal advice.
- Recommend appropriate medical, developmental and mental health follow-up.
- Consider whether other children may also need evaluation (siblings or daycare contacts) and whether psychosocial supports can or should be offered to the caregivers.
- Counsel new parents and all caregivers on normal infant crying, ways to soothe a crying infant and the dangers of shaking a young child (5,6).

## REFERENCES

1. Bennett S, Ward M, Moreau K, et al. Head injury secondary to suspected child maltreatment: Results of a prospective Canadian national surveillance program. *Child Abuse Negl* 2011;35:930-6.
2. Jenny C, Hymel KP, Ritzen A, et al. Analysis of missed cases of abusive head trauma. *Pediatrics* 1999;282:621-6.
3. Maguire S, Mann MK, Sibert J, et al. Are there patterns of bruising in childhood which are diagnostic or suggestive of abuse? A systematic review. *Arch Dis Child* 2005;90:182-6.
4. American Academy of Pediatrics, Section on Radiology. Diagnostic imaging of child abuse. *Pediatrics* 2009;123:1430-5.
5. Barr RG, Rivara FP, Barr M, et al. Effectiveness of educational materials designed to change knowledge and behaviors regarding crying and shaken-baby syndrome in mothers of newborns: A randomized, controlled trial. *Pediatrics* 2009;123:972-80.
6. Dias MS, Smith K, DeGuehery K, et al. Preventing abusive head trauma among infants and young children: A hospital-based parent education program. *Pediatrics* 2005;115:e470-7.

---

The original study, ‘Head injury secondary to suspected child maltreatment (abuse or neglect)’, was conducted from 2005 to 2008 by the following investigators and research team: Susan Bennett MB ChB, Tammy Clifford PhD, Gilles Fortin MD, W James King MD, Morag Mackay MSc, Katherine Moreau PhD, Amy Plint MD and Michelle Ward MD. Further information on the study is available at [www.cpsp.cps.ca/surveillance/study-etude/head-injury-secondary-to-suspected-child-maltreatment-abuse-or-neglect](http://www.cpsp.cps.ca/surveillance/study-etude/head-injury-secondary-to-suspected-child-maltreatment-abuse-or-neglect).

---

*The Canadian Paediatric Surveillance Program (CPSP) is a joint project of the Canadian Paediatric Society and the Public Health Agency of Canada, which undertakes the surveillance of rare diseases and conditions in children and youth. For more information, visit our website at [www.cpsp.cps.ca](http://www.cpsp.cps.ca)*