



ADVANCING HEALTH EDUCATION & RESEARCH

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AVA Research Review

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Review Title: Bruising in young infants is a “red flag” for child physical abuse and a chance for tertiary prevention.

Reviewer: Rachel Gilgoff MD, Center for Child Protection, UCSF Benioff Children's Hospital Oakland

Article: Nancy S. Harper, MD, Kenneth W. Feldman, MD, Naomi F. Sugar, MD, James D. Anderst, MD, MSCI, and Daniel M. Lindberg, MD. Additional Injuries in Young Infants with Concern for Abuse and Apparently Isolated Bruises. *J Pediatr* 2014;165:383-8

Article Summary: Brief Overview:

Bruising is rare in infants younger than six months of age; “those who don't bruise rarely bruise.” (1) Thus, bruising in pre-mobile infants without a history of accidental trauma is a “red flag” for possible child physical abuse.

Yet, infants with bruising are not routinely screened for further injuries or bleeding disorders, and cases of child physical abuse are missed. In a recent study of infants less than 12 months of age diagnosed with definite abuse, 22% had previous bruising reported by at least one parent. (2) In another study of missed cases of abusive head trauma, 37% of the missed cases had facial and scalp injuries that were not used as indicators of possible abuse. (3)

The authors of this study posit that a standardized, routine evaluation for all infants less than six months of age with bruising would increase the detection of child physical abuse and prevent further abuse. A routine evaluation would also decrease the variability in child abuse assessments, which may be unjustly influenced by social risk factors such as race and socioeconomic status.

Several studies have shown that a significant number of victims of serious child abuse have a history of prior, “sentinel” bruising. (2) However, there is no study, prior to this one, that evaluates the prevalence of significant additional injury in infants that present with isolated bruising.

Methods:

This study was a secondary analysis of the Examining Siblings To Recognize Abuse (ExSTRA) data set. The original EXSTRA study was a prospective, multi-center study by 20 child abuse teams that evaluated children suspected of being abuse (index patients) and children who were in contact with the same suspected perpetrator.

The present study first identified 980/2890 (34%) index patients less than six months of age, of which 254/980 (26%) had bruising. The authors conducted an independent blinded review of these cases, and identified 219 infants with isolated bruising. After discussion among the three leading authors, 146 subjects were ultimately included in the study. Isolated bruising was defined as presenting with bruising in the absence of any other concerning physical exam findings or a history of physical assault.

Study Aims/Hypotheses:

In a select study population of children of suspected physical abuse and their siblings, this study aimed to evaluate how often child abuse physicians ordered further diagnostic testing for infants less than six months of age with isolated bruising, and to determine how often these tests uncovered additional serious injury or bleeding disorders.

Relevant Findings:

When evaluated by a child abuse team, 93.8% of the subjects received a skeletal survey, 91% neuroimaging, 63% hepatic transaminases, 10.3% abdominal CT, and 70.5% bleeding labs. Ultimately, these tests identified additional injuries in 50% (73/146) of the subjects.

Of note, however, only 86% (63/73) of the cases with additional findings were reported to Child Protective Services suggesting that some of the additional injuries were not suspicious for child physical abuse. Also, 93% (63/73) of the cases with no additional findings were reported to CPS suggesting that isolated bruising alone was considered suspicious for child physical abuse in the vast majority of these cases.

Neuroimaging:

Head CT and/or Brain MRI identified new injuries in 27.4% (40/133) of cases. Some of the injuries found included skull fractures (20), subdural hematoma (18), subarachnoid hemorrhage (17), cerebral contusion (7) and cerebral edema (2). The majority, 90%, of cases with findings on neuro-imaging had facial or scalp bruising.

Skeletal Survey and Dedicated Films:

Analysis of the subjects revealed that 42.5% (62/146) had fractures identified and 58% (36/62) had multiple fractures. Skeletal surveys identified new fractures in 23% (34/137) of the subjects that received a survey. Dedicated films and neuroimaging identified the other fractures. However, not a single fracture was identified by bruising over the site of the injury.

Abdominal Injury:

Hepatic transaminases were elevated (greater than 80 IU/L) in 14 of 92 patients tested. Abdominal CT identified four liver lacerations and/or contusions.

Bleeding Disorders:

No bleeding disorders were identified in this study. However, for most cases the bleeding work-up consisted of only PT/INR, PTT and

platelets. Fewer than 20% of the infants tested had additional studies such as fibrinogen, thrombin time, vonWillebrand antigen, factor levels, or platelet-function analysis.

Author's Conclusions:

This study supports related research that bruising in young, pre-mobile infants is concerning for child physical abuse and is associated with a high risk for additional injuries including abusive head trauma, fractures and liver injury. Routine diagnostic testing, including a skeletal survey, head CT or brain MRI, and hepatic transaminases on all infants younger than six months of age with isolated bruising, could identify a significant number of additional injuries and prevent future abuse. The authors also note the recommendation that children with an AST or ALT greater than 80 should receive an abdominal CT to further evaluate for hepatic injury.

Potential Limitations:

A notable selection bias exists, given that the infants in this study were all referred to a child abuse specialist. Therefore, the bruising had already been deemed somewhat suspicious for child physical abuse before any additional testing had been

ordered. Second, since the authors did not provide the denominator (all children with bruises vs. only children with bruises who also had a child protection team evaluation), prevalence estimates will be again limited by this bias and caution should be made in ascribing these prevalences to the general population of children with bruising. Additionally, the number and location of bruises did not seem to predict which infants would have additional injuries supporting the need for all infants younger than six months of age with bruising to get additional diagnostic testing.

The authors' first, independent, blinded assessment to determine which cases should be included in the study yielded 219 subjects. However, when the three authors reviewed the 219 cases, consensus determined that 146 subjects would be included in the study. The article does not discuss the characteristics of the 73 subjects that were cut from the initial list, so it is unclear if these cases could have changed the findings.

Unfortunately, this study did not include ethnicity or socioeconomic status data on their subjects. The authors surmised that routine diagnostic testing of all infants with bruising

would decrease variability in child abuse assessments and prevent racial or economic profiling. They also reported that the presence or absence of additional injuries did not predict the perceived likelihood of abuse nor the decision to report to CPS. However, they did not evaluate whether race or socioeconomic status could have affected perceived likelihood of abuse or reporting to CPS in this cohort.

While no bleeding disorders were identified, fewer than 3% of patients in this study received the full set of bleeding labs suggested by the more current published guidelines. Future studies with a larger sample size will be needed to evaluate the benefits of more rigorous testing for bleeding disorders.

Subjects who did not receive additional testing were counted as having no additional findings. Therefore, the true prevalence of additional injuries in this cohort could have been higher if all subjects received a skeletal survey, head CT, hepatic transaminases and/or abdominal CT.

Reviewer's Comments:

This study provides additional evidence that bruising in young infants is a "red flag"

for child physical abuse, and offers compelling data to support the authors' call for the implementation of clinical guidelines for routine diagnostic testing of all infants younger than six months of age with bruising.

Since this study involves infants with some pre-study suspicion of child physical abuse, the question arises whether the study recommendations for routine testing are applicable to the general pediatrician's office. However, the authors make some interesting points to suggest that routine skeletal surveys and head CTs should be more universally used in young infants with bruising. The authors note that in contrast to their finding that 50% of infants with isolated bruising had additional serious injuries, only 5.6% of infants with isolated skull fractures in the ExSTRA study had additional serious findings. This suggests that infant bruising is a greater red flag for child physical abuse than infant skull fractures. The authors also note that no infant in this study had a single fracture identified by isolated bruising overlying the site of injury. Skeletal surveys and head CTs can identify injuries that cannot be found by simply focusing on the location of bruising. The authors note that, while infants with face and

head bruising were more likely to have findings on head CT or MRI, 10% of infants with bruising elsewhere on their bodies also had findings on head CT. It is also interesting that the number and location of bruising did not predict the presence of additional findings. This study finds that even a single bruise in a young infant is associated with a high risk for additional injury. While the authors recommend more routine neuro-imaging, the risk-benefit of radiation exposure with CT scan (vs. MRI) in the context of children with isolated bruises has not been adequately studied.

Overall, this study reinforces the idea that bruising in babies is concerning and should be thoroughly evaluated as an indicator of possible child physical abuse. Finally, this study is a reminder that recognizing the significance of bruising in pre-mobile infants can prevent further more serious abuse.

References:

1. Sugar NF, Taylor JA, Feldman KW, and the Puget Sound Pediatric Research Network. Bruises in Infants and Toddlers: Those Who Don't Cruise Rarely Bruise. *Arch Pediatr Adolesc Med.* 1999;153(4):399-403.

2. Sheets LK, Leach ME, Koszewski IJ, Lessmeier AM, Nugent M, Simpson P. Sentinel injuries in infants evaluated for child physical abuse. *Pediatrics.* 2013;131:701-7.

3. Jenny C, Hymel KP, Ritzen A, Reinert SE, Hay TC. Analysis of Missed Cases of Abusive Head Trauma. *JAMA.* 1999;281(7):621-626.