Ten "must read" articles on physical child abuse

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Child abuse is a common problem worldwide, and affects all ages, both sexes and all races. The presentation of child abuse cases is extremely variable, and early and subtle cases are easily missed. There is a growing body of literature on the subject of child maltreatment; healthcare providers caring for young children need to familiarize themselves with this literature to aid them in the identification, evaluation, and management of these challenging patients. This article reviews ten key publications on the subject of physical child abuse.

Key words: Review article, Child, Physical abuse.

Introduction

Child abuse is a common and significant problem worldwide. Early, sometimes subtle presentations are easily missed or misdiagnosed, resulting in repeated and often escalating injury. All healthcare providers who care for children need to be aware of the spectrum of signs and symptoms in children with injuries resulting from child abuse. Familiarity with the literature on this important subject can provide objective data to help with the identification, evaluation, management, and decision making critical to caring for abused patients. While it would be impossible to include the entire child abuse literature in a single review, this article reviews ten publications, according to author's selection which have helped to sculpt the landscape of child abuse literature.

Bruising

1. Sugar NF, Taylor JA, Feldman KW. Bruises in Infants and Toddlers: Those who cruise rarely bruise. Arch Pediatr Adolesc Med. 1999;153:399-403

Description: This was a prospective evaluation of infants and toddlers presenting for well-child care at community primary care offices. A total of 973 children aged 1 day to 35 months were evaluated in the study. 20.9% of the patients had bruising on examination. Only 2/366 (0.6%) of patients under 6 months of age had a single bruise, and only 6/107(5.6%) of those 6 to 8 months of age had any bruising. The percentage of patients with bruising increased significantly after 9 months of age, so that nearly ½ of the patients had bruises by 18 months and the majority of patients over 24 months of age had bruises.

Key Point: Pre-ambulatory patients (prior to cruising) rarely have even a single bruise. Any patient who is not yet cruising with any bruising should be carefully examined and evaluated for causes of abnormal bruising, including child abuse and bleeding disorders.

2. Stephenson T, Bialas Y. Estimation of the age of bruising. Arch Dis Child 1996; 74:53-55.

Description: Fifty cases of known accidental bruising of varying ages (range 1 to 14 days) were photographed and reviewed by a blinded reviewer to describe the colors observed and estimate the age of the bruising based upon accepted schemes. The estimated age of bruising was correct in only 54% of cases. Red color was seen in bruises aged 1 through 7 days, yellow color was seen in bruises aged 2 through 12 days, green color was seen in bruises aged 3 through 14 days and all other colors were seen in bruises of any age.

Key Point: Aging of bruises is inexact, and evaluation of colors of bruises from photographs adds additional difficulty. The color change of bruises as they age is imprecise, and probably should not be used to attempt to time injuries precisely.

Head Injury

3. Jenny C, Hymel KP, Ritzen A, Reinert SE, Hay TC. Analysis of missed cases of abusive head trauma. JAMA 1999; 281:621-626.

Description: This landmark study evaluated cases of known abusive head trauma to determine the frequency with which this diagnosis had been missed in prior evaluations. Fifty four of 173 (31.2%) abused children with head injuries had been evaluated by at least one physician after the time of their initial head injury. The diagnosis was most frequently missed in those patients who were very young, Caucasian, from intact/two-parent families, and those who presented with vague complaints such as vomiting or irritability. The most common misdiagnoses for these patients included gastroenteritis or influenza, accidental head injury, and "rule out sepsis". Five of the 54 missed cases (9.3%) died as a result of their injuries, and the authors felt that four of these five deaths would have been preventable if abuse had been recognized earlier.

Key Point: Infants with abusive head trauma often present with vague and nonspecific symptoms such as vomiting and irritability, and are more likely than older abuse victims to have the diagnosis missed. Physician bias may lead to increased recognition of child abuse in patients who are minorities and those from single-parent homes. If the diagnosis of abuse is missed, repeat injury is common and fatal injuries may result.

4. Duhaime AC, Alario AJ, and Lewander WJ, et al. Head injury in very young children: mechanisms, injury types and ophthalmologic findings in 100 hospitalized patients younger than 2 years of age. Pediatrics 1992; 90:179-185.

Description: The authors prospectively evaluated 100 children less than 2 years of age admitted to the hospital for a head injury. They applied a "biomechanical profile" to evaluate fully the circumstances of the injury incident, performed a detailed physical examination, radiological examination, and fundoscopic examination. Families were interviewed regarding the injury event. 24% of

patients were classified as victims of abuse; of these patients, 8 presented with a history of a fall less than 4 feet, 2 with admitted assault, and 14 with no history of injury. 54% of abused patients, as compared to 33% of patients with accidental injuries, had intracranial hemorrhage. Retinal hemorrhages were found in 10 patients; 9 of these were victims of abuse. The only patient with retinal hemorrhages resulting from an accidental injury was a passenger in a high speed motor vehicle crash who died as a result of their injuries.

Key point: Child abuse is a common cause of severe head injury in young children, and these patients have a significantly higher rate of intracranial hemorrhage, retinal hemorrhage, and death. While retinal hemorrhages do occasionally occur from accidental trauma, this is rare and typically associated with massive trauma.

Fractures

5. Leventhal JM, Thomas SA, Rosenfield NS, Markowitz RI. Fracutes in young children: distinguishing child abuse from unintentional injuries. Is J Dis Child 1993; 147:87-92.

Description: This retrospective case series evaluated 215 children less than 3 years of age with 253 fractures over a 4 year period. The cases were rated as questionable, likely, definite abuse or accident after independent review by 2 clinicians, 2 radiologists, and then a consensus of the clinicians and radiologists reviewing each case together. They classified 24.2% of fractures in this series as abuse, 8.4% as unknown, and 67.4% as unintentional. All rib fractures (12) in the study were classified as being the result of abuse. Of extremity fractures, 82% of those in children less than 1 year of age were felt to be due to abuse; 83% of those children with long bone fractures due to abuse had at least 1 additional fracture. The authors found that cases with no history of trauma, a minor history with a significant fracture, a midshaft or metaphyseal humerus fracture, or a fracture under 1 year of age, were more likely to be the result of child abuse. Skeletal surveys were performed in 38% of patients and revealed additional fractures in 31% of cases.

Key point: Fractures occurring in children under 1 year of age should be carefully evaluated for the possibility of abuse. Additionally, in cases where there is either no history of trauma or only a minor trauma history, abuse should be considered. Skeletal surveys should be performed in any case of a fracture under 3 years of age where child abuse is being considered.

6. Cadzow SP, Armstrong KL. Rib fractures in infants: Red Alert. The clinical features, investigations and child protection outcomes. J Paediatr Child Health 2000;36: 322-326.

Description: This study was a retrospective review of all cases of rib fractures in children under 2 years of age over a 5-year period. Eighteen total infants were identified, with a total of 101 fractured ribs. Child abuse was the etiology of the rib fractures in 15 of the 18 cases (83%). The average age of the patients with abuse-related rib fractures was 16 weeks, as compared to 52 weeks in those with accidental rib fractures. Of the 3 patients with rib fractures not due to abuse, two were run over by cars and the third was a patient with end stage liver failure and osteopenia. Four of the eighteen abuse cases had rib fractures identified incidentally during evaluation for an unrelated indication, and four were identified during evaluation of possible abuse due to other injuries/concerns. A presenting history of trauma was present in only five of the fifteen abuse cases, four of which presented with a history of a fall from a height of less than 3 feet.

Key point: Rib fractures are uncommon injuries in infants and young children. In the absence of significant bone disease or mas-

sive trauma, rib fractures in this age group are highly suggestive of abuse.

Miscellaneous

7. Tarantino CA, Dowd MD, Murdock TC. Short vertical falls in infants. Pediatric Emergency Care 1999; 15:5-8.

Description: The authors performed a retrospective review of infants 10 months of age and younger presenting with a history of a short vertical fall (four feet or less). 167 patients were evaluated for a short fall over a 3 year period. These included falls from beds (55%), couches (16%), or other objects (10%), or being dropped from a caregiver's arms (20%). The majority (85%) of patients had minor or no injuries. Twelve patients had a skull fracture, and 2 patients had an intracranial hemorrhage. Both patients with intracranial hemorrhage were later determined to be victims of child abuse. Patients with significant injuries were significantly more likely to have been dropped by a caregiver, while 84% of those who rolled off of a couch, bed or other object had no injury or minor injuries.

Key point: Short vertical falls are unlikely to result in intracranial or other serious injuries, and consideration of abuse should occur in these cases.

8. Coant PN, Kornberg AE, Brody AS, Edwards-Holmes K. Markers for occult liver injury in cases of physical abuse in children. Pediatrics 1992; 89:274-278.

Description: This prospective study looked at the use of laboratory markers for abdominal trauma in patients being evaluated for possible child abuse. Forty-nine patients ranging from 1 month to 11 years of age with no signs of abdominal injury were evaluated. Levels of liver transaminases, lactate dehydrogenase, and amylase were performed, along with a urinalysis. Four patients had elevated transaminase levels and one also had an elevated amylase level; these four patients then had abdominal Computed Tomography performed. Three of these four patients had liver lacerations on CT.

Key point: Occult abdominal trauma in victims of abuse may be detected through the use of serum transaminase and amylase levels. Suspected abuse cases should have screening levels drawn and abdominal CT should be performed in those cases with elevated levels.

Imaging

9. Sane SM, Kleinman PK, Cohen RA, et al. Diagnostic imaging of child abuse. Statement from the Section of Radiology, American Academy of Pediatrics. Pediatrics 2000; 105:1345-1348.

Description/Key points: This policy statement provides proposed guidelines for imaging in cases of suspected abuse. Skeletal survey is mandatory in all cases of suspected child abuse under 2 years of age, and should be considered on an individual basis in older children. This should include AP views of all extremity segments (humeri, forearms, hands, femurs, lower legs and feet), 2 views of the skull and thorax, an AP view of the pelvis, and lateral views of the lumbar and cervical spine. A single-shot "babygram" is *NOT* acceptable screening for abuse-related fractures. The authors recommend the use of radionuclide bone scans on selected cases over 1 year of age; bone scan is more sensitive than plain films for rib fractures and periosteal elevation, but is more expensive than plain radiography and often requires sedation. Repeat skeletal survey 2 weeks after the initial injury increases the diagnostic yield of plain radiography without the additional cost and sedation required for bone scan. Computed Tomography of the head (without contrast) is recommended in all cases of abuse with suspected or known head injuries. Magnetic Resonance Imaging of the brain should be considered 5 to 7 days

after the initial injury to fully delineate the intracranial injuries. Computed Tomography (with intravenous contrast) of the abdomen or chest should be performed in those patients with signs, symptoms, or laboratory abnormalities suggesting abdominal or thoracic injuries.

10. Zimmerman S, Makoroff K, Care M, Thomas A, Shapiro R. Utility of follow-up skeletal surveys in suspected child physical abuse evaluations. Child Abuse and Neglect 2005; 29:1075-1083.

Description: The authors performed a prospective evaluation of 48 patients with suspected abuse-related injuries. Additional information was yielded in 22/48 (46%) patients, including 3 patients in whom the outcome of the case (abuse or non-abuse) was changed (6%). A total of 27 previously undetected fractures were identified on repeat imaging performed an average of 21 days after the initial evaluation. The additional fractures included 18 rib fractures, 4 scapular fractures, 1 tibial metaphyseal fracture, 1 femur metaphyseal fracture, 1 tibial fracture, 1 clavicular fracture, and 1 fibular fracture.

Key point: Repeat skeletal survey, performed 2-3 weeks after the initial survey, can add critical information to the evaluation of a suspected child abuse case. Additional fractures, particularly rib and metaphyseal fractures, can be identified, while questionable findings on the initial survey can be clarified.

Conclusion

This article lists and summarizes ten articles on child abuse which have provided major contributions to the field of pediatrics and the recognition and evaluation of suspected non-accidental trauma. All pediatric medical care providers should be familiar with these articles and incorporate the recommendations into their practice. Failure to recognize, completely evaluate and appropriately manage, or properly report child abuse is likely to result in repeat injury to the child and their siblings.