

CHILDREN AND FAMILY RESEARCH CENTER

Bruises Literature Review

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Executive Summary

Bruises are commonly found on children who have been abused and can be an important indicator of child abuse (Atwal, Ruddy, Carter and Green, 1998; Galleno & Oppenheim, 1982; McMahon, Grossman, Gaffney, & Stanitski, 1995). It is vital that medical and child welfare professional are able to distinguish bruises caused by ordinary accidents from non-accidental bruises caused in child maltreatment. While empirical research in this area is incomplete, there are several studies that provide information on topics related to bruises. These can be categorized into three areas: prevalence of bruising among children, non-accidental versus accidental bruises, and aging of bruises.

Prevalence Of Bruising Among Children

- Bruises are a strong indication of child abuse and are often present in cases of child maltreatment ((Atwal, Ruddy, Carter & Green, 1998; Galleno & Oppenheim, 1982; McMahon, Grossman, Gaffney, & Stanitski, 1995; Worlock, Stower, & Barbor, 1986).
- Soft tissue injuries were found on 92% of 341 abused children and only 37% of a group of 400 children who had not been abused (McMahon et al., 1995; Worlock et al., 1986).

Non-Accidental Versus Accidental Bruises

- Bruising is directly correlated with developmental stage (Carpenter, 1998; Labbe & Caouette, 2001; McMahon, Grossman, Gaffney, & Stanisk, 1995; Mortimer & Freeman, 1983; Sugar, Taylor, & Feldman, 1999).

- Bruises are uncommon in normal infants and crawlers and become common among cruisers and walkers (Carpenter, 1998; Sugar, Taylor, & Feldman, 1999).
- Facial bruising is rare in infancy (Mortimer and Freeman, 1983).
 - 49% of soft tissue injuries on abused infants and 38% of soft tissue injuries on abused toddlers involved the head or face (McMahon et al., 1995).
- It is not common for children to be bruised on the head and face (Robertson, Barbor, & Hill, 1982; Sugar, Taylor, & Feldman, 1999). However, among abused children, there are frequent injuries to the head and face (Atwal, Ruddy, Carter & Green, 1998; De Fonseca, Feigal, & Benseal, 1992; McMahon, Grossman, Gaffney, & Stanitski, 1995).
- Cultural practices may be identified as child abuse (Du, 1980; Kornberg, 1992).
- Skin disorders may be incorrectly diagnosed as child abuse (Johnson & Coury, 1988; Makris, 2001; Richardson, 1994; Singleton, 1986).

Aging of Bruises

- Although aging of bruises is important for identifying patterns of abuse, there is disagreement as to whether the age of a bruise can be accurately determined (Langlois & Gresham, 1991; Stephenson & Bialas, 1996).
 - There is broad agreement that bruises go through an evolution in color but there are variations in the timing and colors (Langlois & Gresham, 1991; Smith & Fiddes, 1955; Stephenson & Bialas, 1996).

- Skin complexion effects the identification of bruising (Gordon, Shapiro, & Berson, 1988).

Introduction

Bruises can be a strong indication of abuse. Medical professionals play an important role in the identification of child abuse. Along with medical professionals, caseworkers often face several investigative dilemmas in identifying child abuse. Studies indicate that many structured assessment procedures do not adequately address risks to children associated with bruises (Atwal, Ruddy, & Green, 1998; Carpenter, 1998; Langlois & Gresham, 1991; Sugar, Taylor, & Feldmen, 1999). Collaboration with medical professionals through the investigation process is essential for child welfare workers. This collaboration requires child welfare workers to have a base level knowledge regarding bruises.

Search Strategy

The following sources were used to locate relevant literature about bruises: PsychInfo, Social Work Abstracts, MEDLINE, Child Welfare and Adoption, Social Science Abstracts, and ERIC. Combinations of the following terminologies, “bruises,” “child abuse,” “physical abuse,” and “assessment”, were used to identify appropriate studies. To be included in this review, a study must have: (a) been published in psychological, medical, sociological, and/or social work journal, (b) been an empirical evaluation of the association between accidental bruises and non-accidental bruises, (c) been an empirical evaluation of aging bruises, or (d) been a review of professional and accrediting organization standards. The National Clearinghouse on Child Abuse and Neglect, American Humane Association, American Academic of Pediatrics, American Medical Association, and American Pediatric Society were also reviewed to locate pertinent information.

Results

A number of reports are available indicating prevalence and incidence of non-accidental bruises. However, there is a paucity of empirical literature concerning how to distinguish non-accidental from accidental bruises. Many criteria have been suggested but few of these factors have ever been researched. Findings are organized into three sections: (a) prevalence of bruising among abused children; (b) criteria used to determine non-accidental from accidental bruises; and (c) aging of bruises.

Prevalence of Bruises Among Abused Children

Many studies found that a bruise is a strong indication of abuse (Atwal, Rutty, Carter & Green, 1998; Galleno & Oppenheim, 1982; McMahon, Grossman, Gaffney, & Stanitski, 1995). McMahon, Grossman, Gaffney, and Stanitski (1995) reviewed the hospital records of 371 children who were suspected of having been physically abused at Children's Hospital of Pittsburgh between January 1987 and July 1990 to determine specific features that might be used to distinguish injuries resulting from abuse compared to accidental injuries. Soft-tissue injuries were found in 341 (92%) of these children. Bruises were most common, accounting for 555 (62%) of 892 soft-tissue injuries and very few had a suspicious pattern. Galleno and Oppenheim (1982) reported soft-tissue injuries in 82% of children who had been abused, and in 61% of the children, they were the only injuries. Worlock, Stower, and Barbor (1986) found soft-tissue injuries in 25 (71%) of 35 abused children. Soft-tissue injuries are less common after accidents, but they still were found in 148 (37%) of 400 children who had not been abused.

Atwal, Rutty, Carter and Green (1998) also studied 24 cases of fatal non-accidental head injury in children to establish the prevalence, distribution and pathological associations of external bruising. Twenty-four cases of fatal non-accidental head injury in children were

retrieved from the archival records of the Department of Forensic Pathology, University of Sheffield from 1990 to 1996. All of the children were younger than 5 years of age and had sustained fatal intracranial injuries attributed to child abuse. External bruises were classified as new or old according to their color at the time of autopsy. Seventy-one percent of children had at least one external bruise.

Determining Non-Accidental From Accidental Bruises

Children's developmental stage, aging of bruises, and location of bruises were found as strong indicators of determining non-accidental bruises. Other considerations such as culture/ethnicity and skin disorders were also frequently discussed.

Children's developmental stage. Bruising is directly correlated with developmental stage (Carpenter, 1998; Labbe & Caouette, 2001; McMahon, Grossman, Gaffney, & Stanisk, 1995; Mortimer & Freeman, 1983; Sugar, Taylor, & Feldman, 1999). Studies showed that bruises are rare in normal infants and precruisers (crawlers) and become common among cruisers (walking with support) and walkers. This requires practitioners to give attention to a baby's level of development when considering whether a bruise is accidental.

Younger children are at higher risk of severe injury (Carpenter, 1998). Carpenter (1998) examined 177 babies aged 6-12 months for bruises. The site, size, shape, and color of bruises were recorded on a skin map, and the parent's explanation noted. Data collection included the baby's age, mobility and weight, demographic details, and health visitor concerns. Twenty-two babies had bruises, giving a prevalence rate of 12%. There were a total of 32 bruises; 15 babies had one bruise. All bruises were found on the front of the body and were located over bony prominences. Twenty-five of the bruises were on the face and head, and seven were on the shin.

The babies with bruises on the shin were mobile. There was a highly significant increase in bruises with increased in mobility.

Several studies support Carpernter's findings (Labbe, & Caouette, 2001; McMahon, Grossman, Gaffney, & Stanitski, 1995; Mortimer & Freeman, 1983; and Sugar, Taylor, & Feldman, 1999). Mortimer and Freeman (1983) examined 620 babies who were attending either a local authority health clinic or a hospital follow-up clinic to assess the incidence of facial and other bruises in a random sample of babies 12 months or younger. Bruises were seen on 6 babies only. This study shows that facial bruising is rare in infancy.

Labbe and Caouette (2001) investigated recent skin injuries in normal children. The participants in the study were children and adolescents seen successively for a reason other than trauma over a period of one year. Two thousand and forty examinations were done on 1,467 youngsters from 0 to 17 years of age. The majority of children 9 months and older (76.6%) had at least 1 recent skin injury, without a significant difference between the sexes. Seventeen percent of the total sample of children had at least five injuries, whereas 4% had 10 or more. Skin injuries were rare in the 0- to 8-month group (11.4%); they did not vary with the season, and they were mainly on the head and the face. Their injuries were mostly scratches and bruises and were found in only 1.2% of this group.

McMahon et al. (1995) and Sugar et al. (1999) also found that the patterns of injury were age-specific. McMahon et al. (1995) evaluated 44 babies who were 9 months old or less. On average, these babies had only one soft-tissue injury; thirty soft-tissue injuries involved the head or face, and seven (16%) babies had a burn. Babies in this age group were the most severely injured: 2 babies (5%) died, and 20 (45%) had a fracture.

The 61 children who were 10 months to 2 years old had an average of two soft-tissue injuries; fifty-four soft-tissue injuries involved the head or face, and 9 (15%) children had a burn (McMahon et. al., 1995). Fractures were found in eight (13%) children. Two hundred and sixty-six children who were 3 years old or more had an average of three soft tissue injuries; 165 involved the head or face, and only 6 children (2%) in this group had a fracture.

Sugar, Taylor, and Feldman (1999) used a cross-sectional design to conduct an investigation to determine the frequency and location of bruises in normal infants and toddlers and the relationship of age and developmental stage to bruising. Children younger than 36 months attending “well-baby” appointments with their primary care pediatrician were recruited. Any medical condition that causes bruises as well as known or suspected abuse was recorded. Bruises were found in 203 (20.9%) of 973 children who had no known medical cause of bruising and where abuse was not suspected. Less than 1% of children under 6 months, and less than 2% of children under 9 months, had any bruises. Children who are walking are more likely to bruise. Bruises were found in only 2% of non-walkers, in 18% of cruisers (walking with support), and in 52% of children who were walking.

Location. Location can be a helpful indicator in determining accidental or non-accidental causes of bruising. Although studies differ on some findings, there is a general consensus that children who are not abused are rarely bruised on the head and face, whereas victims of abuse are frequently abused in this location.

Robertson, Barbor, and Hull (1982) found injuries to the head and face in only 26 (7%) of 400 children who had not been abused, with the peak prevalence (one of six) in toddlers. Instead, soft-tissue injuries were usually on the lower extremities of buttocks (123 children) and the upper extremities (34 children). On the contrary, Roberson et al. and Sugar, Taylor, and Feldman

(1999) found no bruises on the hands or buttocks and only one child with a bruise on the foot. They found that the most frequent site of bruises was over the anterior tibia and knee. Bruises on the forehead and upper leg were common among walkers, but bruises on the face and trunk were rare, and bruises on the hands and buttocks were not observed at any age.

De Fonseca, Feigal, and Bensel (1992), McMahon, Grossman, Gaffney, and Stanitski (1995), and Atwal, Ruttly, Carter and Green (1998) found some consensus about locations of bruises among abused children. De Fonseca et al. found frequent injuries to the head and face in children who are victims of abuse. Three hundred and eighty-five (75.5%) of 511 physically abused children had injuries to the head, face, neck, or mouth. McMahon et al. (1995) found that among 105 abused infants and toddlers, 49% of the soft tissue injuries in infants and 38% of the soft tissue injuries in toddlers involved the head or face. Atwal et al. (1998) found that the face was shown to be the most common site of bruising, followed by the forehead and buttocks. Limb, chest and abdominal bruising were found to be uncommon.

Culture / ethnicity. Cultural practices that are unfamiliar to North Americans may at first be suspected as child abuse. For example, coin rolling that is a custom intended to treat fever, headache, and chills is very popular among South Asians (Du, 1980; Kornberg, 1992). Similarly, a ritual called cupping, where a cup or glass is heated and placed on multiple locations on the child's skin for treating pain, is popular among Russians and Eastern Europeans (Kornberg, 1992).

Skin disorders. Differential diagnosis of inflicted bruises is broad and should be fully considered before arriving at the diagnosis of abuse. For example, Mongolian spots are collections of melanocytes in the skin producing a bluish discoloration of the skin, usually

located towards the base of the spine. Mongolian spots are present at birth in over 80% of black children and less than 10% of Caucasian children (Richardson, 1994).

The medical literature has several case reports of dermatologic conditions that were first thought to be child abuse and, subsequently, were diagnosed as underlying illness or accidental trauma (Johnson & Coury, 1988; Makris, 2001; Richardson, 1994; Singleton, 1986). It is difficult to distinguish accidental injury from diseases and other conditions that produce similar signs. This underscores the need to routinely screen children with unusual or extensive bruises for bleeding disorders before initiating an abuse report.

Aging of Bruises

Aging of bruises can be important in a child protection investigation because it can allow medical personnel or child welfare workers to establish patterns of abuse. It would be helpful to determine if the injuries came from a one-time incident, or if injuries are occurring over time. However, there is disagreement as to whether the age of a bruise can be determined accurately. Despite early development of charts used for comparing the visible color of a bruises in forensic textbook, the charts (see Appendix) are not based on empirical research (Langlois & Gresham, 1991; Schwartz & Ricci, 1996; Stephenson, 1997; Stephenson & Bialas, 1996). In addition, research that has been conducted on human bruising is based on color photographs rather than direct inspection of the bruises.

Color. Color changes are the most frequently used criteria to identify the aging of bruises. Various forensic resources portray significant variation in conclusions regarding colors of aged bruises (see Appendix). There is broad agreement that bruises go through an evolution in color, initially appearing red, violet, or black (blue), and that successive colors include brown, green, and yellow.

Two important empirical studies were identified. Langlois and Gresham (1991) and Stephenson and Bialas (1996) attempted to determine how accurately the age of a bruise could be estimated by looking at its color. Langlois and Gresham (1991) analyzed 369 photographs taken from an emergency room. The authors concluded the following:

1. A bruise with any yellow must be older than 18 hours;
2. Red, blue, and purple or black may occur anytime from 1 hour of bruising to resolution;
3. Red has no bearing on the age of the bruise because red is present in bruises no matter what their age; and
4. Bruises of identical age and cause on the same person may not appear as the same color and may not change at the same rate.

Stephenson and Bialas (1996) also conducted research to document the sequence of color changes in photographs taken following accidental bruising in children. Using the same equipment throughout, a medical photographer captured 50 photos of accidental bruises in 23 children. The age of the bruise was known in all cases. A single observer, blind to the true age of the injury, reviewed the photographs and described the colors present in the bruise. Red coloration was seen in 15 out of 37 bruises that were less than one week old. Yellow coloration was seen in 10 out of 42 bruises over one day old.

Skin complexion. According to Gordon, Shapiro and Berson (1988), light-complexioned children may seem to bruise from relatively minor impacts, whereas bruises on dark-complexioned children may be masked by their skin color.

Depth. Smith and Fiddes (1955) estimated that yellow generally appears in 7 to 10 days but may appear in 3 days if the bruise is superficial. Langlois and Gresham (1991) also note that

yellow develops quicker in superficial bruises. This suggests that if a child has been bruised deeply and superficially at the same time in nearby locations, the bruises may be different colors and may seem to have occurred at different times.

Conclusion

Bruises are common manifestations of child abuse (Atwal, Ruddy, Carter and Green, 1998; Galleno & Oppenheim, 1982; McMahon, Grossman, Gaffney, & Stanitski, 1995). Bruises are commonly found on abused children and are seldom found on non-abused children.

A child's developmental stage, aging of bruises, and location of bruises were found as a strong indication of determining non-accidental bruises. However, it is also important to keep in mind that a differential diagnosis is important to rule out other causes of injury, such as skin disorders or acceptable cultural practices.

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APPENDIX

Different Authors Opinions on the Time Sequence of Color Changes in Bruises

	Adelson ¹	Rentoule & Smith ²	Camps ³	Polson and Gee ⁴	Spitz & Fisher ⁵	Wilson ⁶
Initial Color	Red/Blue	Violet	Red	Red, Black	Blue/Red	Red
1-3 days	Blue/Brown	Dark blue	Purple, Black	Purple, Black	Dark Purple	Blue, Purple
1 week	Yellow/Green	Green	Green	Green	Green/Yellow	Green, Yellow
8-10 days		Yellow	Yellow		Brown	Yellow, Brown
2 weeks		Normal	Normal	Yellow	Normal	Cleared.

¹ Adelson L. (1974). *The Pathology of Homicide*. Springfield: Charles C Thomas.

² Rentoule E., & Smith, H. (1973). *Glaister's medical Jurisprudence and Toxicology*. Edinburgh:Churchill Livingston.

³ Camps F. E. (1976). *Gradwohl's legal medicine*. Bristol: John Wright and Son.

⁴ Polson, C. J., & Gee, D. J. (1984). *The essentials of forensic medicine*. Oxford: Pergamon Press.

⁵ Spitz, W. U., & Fisher, R. S. (1980). *Medicolegal investigation of death*. Springfield: Charles C Thomas.

⁶ Wilson, E. F. (1977). Estimation of the age of cutaneous contusions in child abuse. *Pediatrics*, 60, 750-752.