Can you age bruises accurately in children: a systematic review

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CRD summary
This review investigated the accuracy of clinical assessment in estimating the age of bruising in children. The authors concluded that current evidence does not support the use of clinical assessment to determine bruise age. The review was methodologically sound and the extensive search only identified limited evidence. Hence, the authors' conclusion is likely to be reliable.

Authors' objectives
To assess whether it is possible, in clinical practice, to determine the age of bruising in children.

Searching
ASSIA (1987 to 2004), CareData (1980 to 2004), MEDLINE (1951 to 2004), ChildData (1958 to 2004), CINAHL (1982 to 2004), EMBASE (1980 to 2004), ISI Proceedings (1990 to 2004), PsycINFO (1987 to 2004), the Science Citation Index (1981 to 2004), SIGLE (1980 to 2004), the Social Sciences Citation Index (1981 to 2004) and TRIP; the search strategy was reported in full in the online publication. See Web Address at end of abstract. No language restrictions were applied. The electronic search was supplemented by an examination of the references in review articles and textbooks.

Study selection
Study designs of evaluations included in the review
No inclusion criteria were specified for the study design. Reviews, expert opinion, post-mortem studies and single case reports were excluded.

Specific interventions included in the review
Studies that used clinical assessment to assess the age of bruising in children were eligible for inclusion. The included studies assessed colour, tenderness, swelling and abrasions, either directly or from photographic evidence. One study used a standardised colour chart. Where reported, assessors included emergency paediatricians, other physicians and trainees.

Reference standard test against which the new test was compared
No inclusion criteria were specified for the reference standard of diagnosis. Prior knowledge of the exact age of the injury served as the reference standard, where estimates of accuracy were reported.

Participants included in the review
Studies assessing children (younger than 18 years) with bruising, or studies where data for children could be extracted separately, were eligible for inclusion.

Outcomes assessed in the review
No inclusion criteria were specified in relation to the outcome measures. The included studies reported inter-observer variability for the assessment of bruising characteristics, or the observed relationship between colour and age of bruise.

How were decisions on the relevance of primary studies made?
The authors did not state how the papers were selected for the review, or how many reviewers performed the selection.

Assessment of study quality
The validity of the included studies was assessed, based on the following: whether the exact age of injury was known; whether intra- or inter-observer variability was assessed; whether the observers were blind to the time of injury;
whether abuse and pre-disposing medical causes for bruising were excluded; and whether the study population was representative. Full critical appraisal of the included studies was reported in the online publication. See Web Address at end of abstract.

Two reviewers, from a panel of 15 reviewers all with child protection expertise, independently assessed validity. Standardised critical appraisal forms were used. Any disagreements were resolved by consultation with the full panel, or by conduct of a third independent review.

**Data extraction**

Two reviewers, from a panel of 15 reviewers all with child protection expertise, independently extracted the data. Any disagreements were resolved by consultation with the full panel, or by conduct of a third independent review. Data were extracted on inter-observer variation, accuracy of age estimation, and the relationship between colour and age of bruise.

**Methods of synthesis**

How were the studies combined?
The studies were combined in a narrative.

How were differences between studies investigated?
Differences between the studies and deficiencies in the available data were discussed in the text.

**Results of the review**

Three studies were included in the review: two studies with a total of 73 children and 86 bruises, and one study of 32 bruises in an unspecified number of babies.

Relationship between colour and age of bruise.

One study of 50 children, recruited from a children's hospital emergency department (with children excluded when abuse was suspected or there was an underlying medical condition), reported an association between colour and bruise age (P<0.001): red/blue and purple colours were more commonly seen in bruises less than 48 hours old, and yellow, brown and green colours in bruises over 7 days old. However, red/blue and purple colours were also seen in 4 of 13 bruises over 7 days old, while yellow/brown or green colours were also seen in 9 of 39 bruises less than 48 hours old.

In a second photographic study (36 bruises in 23 white children in an orthopaedic ward), a single observer reported that blue, brown, grey and purple colours were not discriminatory, red colours occurred only in injuries 1 week old or less, yellow occurred only after the first day, and green was seen in 9 of 32 bruises more than 2 days old.

The third study (32 bruises), conducted in babies attending a health visitor clinic, found that yellow colours appeared only in bruises over 48 hours old.

Accuracy and inter-observer variability.

The authors of the emergency department study reported that inter-observer reliability for the assessment of bruising age, colour, tenderness, swelling, or abrasions was poor (kappa -0.03), and that there was poor (40%) overall accuracy in determining the exact age of bruises to within 24 hours. Accuracy was improved (76.2%) for broad categorisation (fresh, 48 hours or less; intermediate, 48 hours to 7 days; old, more than 7 days) by emergency physicians (n=16); the accuracy of trainees (n=39) was lower (52.7%).

The photographic study, using a single observer, produced a correct classification of fresh, intermediate or old bruises (using the same classification system as the emergency department study) in 24 of 44 cases.

**Authors' conclusions**

The age of bruising cannot be accurately estimated using clinical assessment, either directly or using photographs. The
practice of using bruise colour to estimate age is unreliable and should be avoided in child protection proceedings.

**CRD commentary**
This was a generally well-conducted review that addressed a clearly stated research question using appropriately defined inclusion criteria. A thorough search of the literature was reported, which included attempts to identify unpublished studies and applied no language restrictions. Appropriate critical appraisal of the included studies was conducted and was reported, in full, online. The authors incorporated measures to minimise the introduction of error and bias into their review methodology and these were clearly reported. Given the minimal and varied data available, the choice of a narrative synthesis was appropriate, and was clearly and concisely presented. The authors' conclusion, that the evidence does not currently support the estimation of bruise age based on clinical assessment, follows from the data presented.

**Implications of the review for practice and research**
Practice: The authors stated that clinical assessment of the age of bruises in children is inaccurate and should not be used in child protection cases.

Research: The authors suggested that assessments of standardised measurements of colour (e.g. digital imaging techniques, spectrophotometry and ultraviolet photography) may be useful. If such methods could be used to develop an accurate calibration of bruise colour, large-scale validation studies would be required. These should include children of different age and skin colour.

**Funding**

**Bibliographic details**

**PubMedID**
15665179

**DOI**
10.1136/adc.2003.044073

**Original Paper URL**
http://adc.bmj.com/cgi/content/full/90/2/187

**Indexing Status**
Subject indexing assigned by NLM

**MeSH**
Adolescent; Child; Child, Preschool; Color; Contusions /pathology; Humans; Infant; Photography; Reproducibility of Results; Skin /pathology; Time Factors

**AccessionNumber**
12005005629

**Date bibliographic record published**
31/12/2006

**Date abstract record published**
31/12/2006
**Record Status**

This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.