Which radiological investigations should be performed to identify fractures in suspected child abuse?


CRD summary
This review concluded that diagnostic imaging of the skeleton should be mandatory where abuse is suspected in children under 2 years old; bone scintigraphy or skeletal surveys alone is insufficient. Additional oblique views, the conduct of skeletal surveys and bone scintigraphy, or repeat skeletal surveys improve diagnostic yield. The paucity of good-quality evidence and limitations of the review mean that the conclusions may be unreliable.

Authors' objectives
To determine which radiological investigations should be performed to identify fractures in suspected child abuse, and which children should be investigated.

Searching
MEDLINE, EMBASE, CareData, SIGLE, the Science Citation Index, CINAHL, ASSIA, ISI Proceedings, ChildData and TRIP were searched from inception to October 2005 without any language restrictions; the search terms were reported. Literature from 1947 to 1950 was handsearched.

Study selection

Specific interventions included in the review
Studies of radiological investigations were eligible for inclusion. The review primarily assessed the comparative yield of skeletal surveys (SS) and bone scintigraphy (BS).

Reference standard test against which the new test was compared
There were no inclusion criteria relating to the reference standards. Details of the reference standards used in the included studies were not reported.

Participants included in the review
Studies of children (under 18 years) suspected of being victims of abuse were eligible for inclusion. Studies with older participants where the results for those under 18 years of age could not be separated were excluded. Details of the populations in the included studies were not reported.

Outcomes assessed in the review
Studies with insufficient details on the diagnostic yield were excluded. The main outcomes reported in the review were the diagnostic yield (not defined by the authors) and sensitivity.

How were decisions on the relevance of primary studies made?
Three reviewers assessed the relevance of primary studies for inclusion; any disagreements were resolved by consensus

Assessment of study quality
Three reviewers assessed study quality; any disagreements were resolved by consensus. Quality was stated as being assessed according to NHS CRD guidelines, but further details and results were not reported.
Data extraction
The authors did not state how the data were extracted for the review, or how many reviewers performed the data extraction.

Methods of synthesis
How were the studies combined?
The results were combined in a narrative, grouped by intervention.

How were differences between studies investigated?
Differences between the studies were discussed in the text. The authors stated that between-study heterogeneity precluded pooling.

Results of the review
Thirty-four studies met the inclusion criteria (n not reported).

Diagnostic yield and sensitivity of BS and SS.
Five studies reported that BS was more sensitive than SS, and 2 studies that SS was more sensitive than BS.
Fourteen studies reported that either BS or SS alone was inadequate to identify all fractures.
One study reported that SS identified metaphyseal and skull fractures significantly better than BS.
Two studies that used follow-up radiograph noted false-positive findings with BS.
Across 8 studies: BS predominantly missed skull, metaphyseal and epiphyseal fractures, but identified associated soft tissue injury; SS missed rib fractures, perosteal injury and rear fractures of the foot or pelvis. Details of false negatives from the included studies were tabulated.

Repeat SS.
Two studies reported an increased yield with repeat SS; additional injuries identified were metaphyseal, rib, scapula, and vertebral fractures.

Accuracy of different SS views.
One randomised controlled trial showed that the addition of two oblique views to a four-view assessment increased sensitivity by 17% (95% confidence interval: 2, 36, \( p=0.18 \)) and specificity by 7% (95% confidence interval: 2, 13, \( p=0.004 \)).
Improved diagnosis has been reported for additional views and close inspection of radiographs of the pelvis (5 studies), hands and feet (3 studies), and spine (4 studies).

Authors’ conclusions
Diagnostic imaging of the skeleton should be mandatory where abuse is suspected in children under 2 years old; BS or SS alone is insufficient to identify all fractures. The addition of oblique views to SS, the conduct of both SS and BS, BS plus skull radiography and coned views of metaphyses and epiphyses, or repeat SS, may improve diagnostic yield.

CRD commentary
The review question was clear only in terms of the intervention and participants. Several relevant sources were searched, and attempts to reduce language and publication bias were made. The study selection and quality assessment processes were conducted in duplicate to reduce the potential for error and bias; however, it was unclear whether the
same measures were taken during the data extraction process. The decision to combine studies in a narrative seemed appropriate, but there were insufficient study details to adequately assess the degree of heterogeneity between studies. Study quality was assessed but the results were not presented. Details of the reference standards used in the included studies were not provided.

Although the authors stated which technique was more or less sensitive/specific, or reported the proportional increase in sensitivity/specificity of one technique over another, the actual sensitivities were generally not reported. It was therefore unclear as to the diagnostic accuracy of the tests. Given the paucity of good-quality evidence, the conclusions drawn seem overly strong. However, the authors acknowledged that these need subjecting to a prospective evaluation.

**Implications of the review for practice and research**

Practice: The authors stated that in children under 2 years old where physical abuse is suspected, diagnostic imaging of the skeleton should be mandatory and that BS or SS alone is insufficient to identify all fractures. They further stated that SS that includes oblique views, the conduct of both SS and BS, repeat SS, skull radiography added to BS and coned views of metaphyses and epiphyses, may improve diagnostic yield.

Research: The authors suggested prospective studies to validate guidelines for radiological investigations.

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