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Oblique chest views as a routine part of skeletal surveys performed for possible physical abuse—Is this practice worthwhile?

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Abstract

Objective: To evaluate the utility of oblique chest views in the diagnosis of rib fractures when used as a routine part of the skeletal survey performed for possible physical abuse.
Methods: Oblique chest views have been part of the routine skeletal survey protocol at Primary Children's Medical Center since October 2002. Dictated radiology reports since that time were reviewed, and all cases with rib fractures documented were chosen for study. For each chosen case two pediatric radiologists identified and recorded rib fractures using only the PA and lateral chest radiographs (standard two-view chest series) from the skeletal survey for each case. In a separate session they identified and recorded rib fractures using the PA, lateral, right oblique, and left oblique radiographs (four-view chest series) from the skeletal survey for each case. The results were compared.
Results: Twenty-two cases with rib fractures were identified. Interpretation of the four-view chest series was different than interpretation of the two-view chest series in 12 of the 22 cases (54%). Overall, the four-view chest series differed significantly in the number of rib fractures diagnosed compared with the two-view chest series ($p = .02$, Wilcoxon matched-pairs signed-rank test) adding 19 rib fractures and excluding 6 rib fractures.
Conclusions: The results indicate that use of the four-view chest series adds information to that obtained from the two-view chest series and increases the accuracy of diagnosing rib fractures in cases of possible physical abuse. Addition of oblique chest views to the routine protocol for skeletal surveys performed for possible physical abuse is recommended.

Keywords: Rib fractures; Child abuse; Oblique chest views; Skeletal survey

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Introduction

Rib fractures are relatively common among abusive fractures in infants (Akbarnia, Torg, Kirkpatrick, & Sussman, 1974; Belfer, Klein, & Orr, 2001; Loder & Bookout, 1991; Merten, Radkowski, & Leonidas, 1983), and may be more common than suspected based on routine radiographic evaluation (Kleinman, Marks, Richmond, & Blackbourne, 1995; Kleinman, Marks, Nimkin, Rayder, & Kessler, 1996). Acute rib fractures are especially difficult to visualize radiographically (Kleinman, Marks, Adams, & Blackbourne, 1988; Kleinman, Marks, Spevak, & Richmond, 1992; Zimmerman, Makoroff, Care, Thomas, & Shapiro, 2005). After exclusion of preexisting bone disease or significant accidental trauma, such as high-speed motor vehicle accidents, rib fractures are quite specific for abuse, particularly in infants (Bulloch et al., 2000; Cadzow & Armstrong, 2000; Feldman & Brewer, 1984; Garcia, Gotschall, Eichelberger, & Bowman, 1990; Williams & Connolly, 2004). In some cases even one rib fracture may sway the diagnosis in regard to abuse: thus, there is a need for thorough, accurate documentation of rib fractures to aid in the accurate diagnosis of child abuse. Detailed radiographic documentation of fractures, including rib fractures, may influence the investigation and legal outcome of child abuse cases, as well (Kleinman, Blackbourne, Marks, Karellas, & Bellanger, 1989).Bulloch, Schubert, Brophy, Johnson, Reed, & Shapiro, 2000

Oblique chest views are thought to help in diagnosing rib fractures, and several child abuse resources indicate that oblique views should be used selectively in skeletal surveys (Cooperman & Merten, 2001; Kleinman, 1998). Specifically, recommendations from the American College of Radiology and the American Academy of Pediatrics state that oblique views of the chest should be used as supplements to the frontal and lateral views when deemed necessary by the radiologist (American College of Radiology, 2001; Sane et al., 2000).

One previous study examined the utility of oblique chest views used routinely in skeletal surveys (Ingram, Connell, Hay, Strain, & Mackenzie, 2000). This study found that the oblique views increased the accuracy of radiologists in diagnosing rib fractures, but included only 14 cases. Our study was undertaken to examine this issue with a larger number of cases. We hypothesized that interpretation of oblique chest views in concert with the standard skeletal survey chest views would add information to interpretation of the standard chest views alone.

Methods

The University of Utah Health Sciences Center Institutional Review Board approved this retrospective study and a consent waiver was granted. The study period was from October 2002 (when our institution added oblique views of the chest to the protocol for skeletal surveys) through October 2005. To identify cases we reviewed the child protection team database for possible physical abuse consults that had skeletal surveys performed and interpreted at Primary Children's Medical Center. The dictated radiology reports of these cases were reviewed and those with documented rib fractures were selected for further study.

All skeletal surveys were performed using computed radiography cassettes (Fuji medical). Chest radiographs were obtained using bone detail technique. Oblique views were performed at approximately 30 degrees of obliquity with the patient in the supine oblique position. Images were reviewed on a PACS system (Agfa medical).