G92 Magnetic Resonance Microscopy as an Adjunct in The Evaluation of Infant Rib Fractures

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The purpose of this presentation is to explore the use of magnetic resonance microscopy in the evaluation of infant rib fractures, and to compare the findings with traditional anterior-posterior radiography, axial radiography, and histologic evaluation.

Following the second infant death in a family, the autopsy findings in the first infant death were reviewed at the request of the Naval Criminal Investigative Service (NCIS). Original autopsy radiographs from the first infant revealed multiple healing fractures that had previously been overlooked. Exhumation was recommended, and permission for exhumation ultimately granted. Re-interview of the mother, coordinated with the timing of the exhumation, prompted a confession as to how the children were killed.

The body of the first infant was exhumed, and healing posterior rib fractures were resected *en bloc* with the adjacent vertebral body and contralateral normal rib. Axial radiographs of each vertebra-rib pair were obtained. Magnetic resonance microscopy (MRM) was performed on each sample. Specimens were whole-mounted and cut in the axial plane for histology.

MRM provides microanatomic images of both hard and soft tissue. Images were acquired on a Bruker-Biospec system operating at 7 Tesla (300 MHz for ^{1}H). The 3-D images were acquired with a fast spin echo imaging sequence. The datasets were processed for visualization using the AVS/Express development environment, and 3-D images were rendered using a direct composite algorithm.

The ability to view and rotate the fractures in 3-D space allowed visualization of fracture morphology in ways unobtainable by standard radiography or histology. Fracture dimensions, the fracture line, the uninjured bony cortex, and the trabecular bony architecture were readily discernable by MRM. Histologic examination provided details of various aspects of bony healing that were not readily visible by MRM.

While MRM is currently an expensive imaging modality, limited to a few institutions and restricted to specimens of small size, it has great potential as an adjunct in the evaluation of healing fractures. With continued advances in technology and computing power, MRM will likely become widely available as an adjunct to, or perhaps a replacement for, histologic examination of some specimen types.

Infant, Magnetic Resonance Microscopy, Fracture