



D72 To Toss Film or Not to Toss Film? That is the Question in Radiography of Occult Fractures in Infants

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After attending this presentation, attendees will have a deeper understanding of key radiographic and technology-related considerations for the imaging of subtle pathology in infants using an animal model, also learning about the most and least appropriate approaches to such radiographic examinations.

This presentation will impact the forensic science community by reviewing traditional approaches to postmortem forensic imaging in infants while suggesting and validating alternate radiographic approaches in such cases.

The value of radiography in forensics is beyond question. However, employing radiography to document occult fractures in infants, less than one year old, can be challenging. In order to clearly visualize these subtle fractures, three factors must be taken into consideration; the focal spot size of the X-ray tube, the kilovoltage peak or kVp selected, and the image receptor.

The present study compared three imaging systems; a standard radiographic unit currently available in clinical settings, a dedicated mammographic unit that was no longer clinically compliant, and an X-ray cabinet unit. The largest focal spot, 0.6 x 1.2mm, was found in general radiography unit and the smallest, 0.1mm, with the cabinet X-ray system. The mammography unit had two focal spot sizes: 0.4mm for non-magnification imaging and 0.1 – 0.2mm when the magnification mode was selected. All images were recorded with either a digital, computed radiography or CR system and on X-ray film specifically intended for mammography. With film as the recording media, 30 – 40kVp was chosen to produce a high-contrast image. The kVp selection of 60 for the CR system was based on the manufacturer's guidelines for the minimum required to stimulate the receptor crystals within the imaging plate. However, in order for a more complete comparison, CR images were also taken at 40kV. The objective of the study was to determine which imaging system demonstrated a transverse fracture on the right third rib of a preserved fetal pig that had a crown-rump measurement of 29cm. A Visual Grading Analysis (VGA) methodology was employed to evaluate a total of 12 images and all images were reviewed by a radiologist, a radiologist assistant, and a senior radiographer, and compared to a reference image.

The image which scored best in terms of ability to resolve the fracture and related anatomy was acquired using the X-ray cabinet system at 35kVp and recorded on mammography film with a mean Image Quality Score (IQS) of 8.67. This was closely followed by the image acquired at 60kVp using the same combination of mammography film and the X-ray cabinet system (mean IQS = 7.33). However, the image obtained on film with the mammography unit set at 30kVp in the magnification mode clearly demonstrated the fracture despite a lower mean IQS of 1.67. The system receiving the lowest mean IQS was the general radiographic unit combined with mammography film at 60kVp (mean IQS = -9.33) and 40 kVp (mean IQS = -10.0). Combining the general radiographic unit with CR at 60kVp resulted in a mean IQS of 3.33. Unexpectedly, the same system taken at 40kVp produced an image with similar performance (mean IQS = 5.0) to those acquired on film (mean IQS = 4.33). The manufacturer's recommendation for the higher kVp setting was intended to minimize the dose to the patient. However, in forensic imaging patient dose is not a consideration.

In conclusion, depending on the radiographic equipment that might be available, technical factors can be adjusted to demonstrate occult fractures.

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