AbstractID: 3935 Title: Effects of exposure and structural background on the detection of computer-simulated nodules in digital chest phantom images: 2-AFC study

Purpose: To investigate how the exposure level and structural background affect the detection of computer-simulated nodules in digital chest phantom images.

Materials and Methods: Images of an anthropomorphic chest phantom were acquired with an a-Si/CsI flat-panel based digital radiography system at 120 kVp and a tube current ranging from 0.25 to 32 mAs. The source-to-image distance (SID) was increased and the x-ray beam filtered to further reduce the exposure levels. 1-cm diameter computer-simulated nodules with a contrast ratio of 2.68% were computer generated at various locations of the chest images. Two-alternate forced choice (2-AFC) experiments were performed to measure the ratio of correct observations as a function of the exposure level for various structural backgrounds present. For each exposure level and location, 30 pairs of 512x512 images were generated and displayed in pairs on a review workstation for reading. The ratio of correct observations versus exposure levels were computed from the reading scores for various locations. The plots along with the exposures corresponding to 90% accuracy were used to study the effects of structural backgrounds.

Result:
For all regions, the accuracy generally increases from 0.5 to 1.0 with the exposure. However, the threshold exposure for 90% accuracy varies with the location. In the abdomen region, the ratio of correct observations reaches 90% at a higher exposure level (~ 0.4 mAs). In the lung region, the ratio reaches 90% at a much lower exposure level (~ 0.0625 mAs). The difference in the threshold exposures may be due to the heavier attenuation in the abdomen region. Complexity of structural backgrounds may affect the threshold exposure and the level and consistency of the ratios measured.

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