

The effectiveness of bismuth breast shielding with protocol optimization in CT scans of the thorax

ABSTRACT

Background: Numerous techniques had been proposed to reduce radiation exposure in computed tomography (CT) including the use of radiation shielding. Objective: This study aims to evaluate efficacy of using a bismuth breast shield and optimized scanning parameter to reduce breast absorbed doses from CT thorax examination. Methods: Five protocols comprising the standard CT thorax clinical protocol (CP1) and four modified protocols (CP2 to CP5) were applied in anthropomorphic phantom scans. The phantom was configured as a female by placing a breast component on the chest. The breast component was divided into four quadrants, where 2 thermoluminescence dosimeters (TLD-100) were inserted into each quadrant to measure the absorbed dose. The bismuth shield was placed over the breast component during CP4 and CP5 scans. Results: The pattern of absorbed doses in each breast and quadrant were approximately the same for all protocols, where the 4th quadrant > 3rd quadrant > 2nd quadrant > 1st quadrant. The mean absorbed dose value in CP3 was reduced to almost 34% of CP1's mean absorbed dose. It was reduced even lower to 15% of CP1's mean absorbed dose when the breast shield was used in CP5. Conclusion: This study showed that CT radiation exposure on the breast could be reduced by using a bismuth shield and low tube potential protocol without compromising the image quality.

Keyword: Computed tomography; Bismuth shielding; Organ equivalent dose; Scan protocols; Tube potential; Breast