Purpose: To characterize the contrast improvement of simulated tumors in an anthropomorphic phantom using Dual Energy (DE) subtraction with a clinical on-board imager (OBI) at oblique angles.

Methods: An Alderson lung/chest anthropomorphic phantom with simulated tumors in the thoracic cavity was imaged using a sequential DE imaging methodology. High (120kVp) and low (60kVp) planar images were obtained in pairs every 100° in a full (360°) rotation using the OBI (Varian Medical Systems, Palo Alto, CA). Optimal mAs settings for DE component images were determined by varying the x-ray exposure time, while maintaining a constant tube current. DE images were created to best suppress the bone overlaying the simulated tumors. Tumor visibility in DE images was quantified using the Contrast-to-Noise Ratio (CNR). The ratio of the CNR from the DE image relative to a single image (standard protocol) was evaluated as a function of gantry angle.

Results: CNR was improved with DE imaging by an average ratio of 1.66 over all gantry angles. The greatest improvement occurred at gantry angles where the tumor was obstructed by the ribs alone. More modest improvements were observed where the tumor overlapped other soft tissue structures (such as the heart) or the dense spine, on a given projection.

Conclusions: This study illustrates the feasibility of performing DE imaging at oblique gantry angles using a clinical on-board imaging system. Incorporating DE imaging into clinical practice may allow for verification of tumor position at oblique gantry angles, and may facilitate the development of markerless motion tracking techniques.

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