AbstractID: 6693 Title: Evaluation of respiration-correlated digital tomosynthesis in the thorax and abdomen for soft tissue visualization and patient positioning

Purpose: To find optimal parameters for digital tomosynthesis (DTS) image reconstruction, to evaluate ability of respiration correlated DTS to reduce blur caused by respiratory motion, and to assess DTS imaging for soft tissue localization and patient positioning.

Methods and Materials: Image acquisition for DTS used a gantry-mounted kV on-board imaging system (Varian Medical Systems). We did not acquire DTS separately, but instead simulated DTS acquisition by using projection images acquired for CBCT. DTS reconstruction consisted of backprojection followed by a deblurring operation removing out-of-plane objects. For tumors subject to respiratory motion we selected projection images according to an external respiratory monitor signal (Real-time Position Management System, Varian Medical Systems). Reconstruction and registration of DTS images used vender research software.

Results: Optimal DTS quality is achieved with a 6-9 cm long deblurring volume in the direction perpendicular to the image and 20-30° reconstruction arc lengths. Image blur increases with longer arc lengths, while for shorter arcs out of plane objects become more pronounced. RC DTS reconstruction from disjoint arcs containing 2-3 respiratory cycles is feasible, yields images with less motion blur, and allows visualization of tumor movement. Generally, DTS was capable to visualize lung tumors, bronchi, liver, kidneys and abdominal lymph nodes. Estimated 3D registration error of DTS to reference DTS generated from the plan CT DRRs was 3 mm, relative to cone-beam CT as a standard. Registration of RC DTS of lung tumors was possible to within 2 mm.

Conclusions: DTS is capable of soft tissue visualization and patient positioning, including tumors subject to respiratory motion. With several advantages over full rotation CBCT scan, such as much shorter acquisition time, smaller dose and relaxed clearance requirement, DTS can become an efficient imaging modality for image-guided radiotherapy.

Conflict of interest: Research sponsored by NCI Grant P01-CA59017 and Varian Medical Systems.