AbstractID: 7476 Title: 3-D target localization at the end of expiration prior to respiration-gated radiotherapy treatment

Objective
Many tumors in lung and liver can not be visualized with 2-D on-board kV imaging. For these patients receiving gated-treatment, currently there is no tool to assess 3-D target position at the end of expiration before gated-treatment. The study explores the feasibility of using (a) free breathing CBCT, and (b) phase-selective reconstruction of "gated" CBCT to determine 3-D target position at the end of expiration.
Methods
A motor controlled moving phantom was used to simulate longitudinal target motion of 2.0 cm at breathing rate of 2-4 sec/cycle. Images of static phantom as well as moving phantom were acquired on simulation CT and CBCT. Target position in gated CT images was compared to that of free breathing CBCT. The start of CBCT beam-on at initial gantry angle was synchronized with respiratory motion recorded using a commercial respiratory gating system.
Results
Static target position in CBCT agrees with gated CT (except for 2 sec/cycle motion as found before). The moving target position in CBCT were similar for motion rates of 2-4 sec/cycle and their ITV volumes are dependent on image threshold. The target position at the end of expiration could be off ≥1.0 cm if defined by full-width-half-maximum (FWHM), and ~ 0.15 cm off if defined by FWTM. Target position in "gated" CBCT agree with gated CT at end of expiration, but image quality is dependant on sample number of gantry angle, in this phantom test, a minimum of 3 minute acquisition (3 sec/cycle motion) was required to avoid substantial alias artifacts.
Conclusion
Determination of 3-D target position at the end of expiration before gated treatment needs to be addressed. While clinical images are more complicated, free breathing CBCT or phase-selective reconstruction of CBCT can be helpful as a QA tool and deserve to be further explored.