AbstractID: 5577 Title: Implementing Quantitative Computed Tomography on Multi-Slice Scanners

Purpose:
Implementing Quantitative Computed Tomography (QCT) on Multi-Slice Computed Tomography (MSCT) scanners requires investigating the effects of axial vs. helical scan modes and protocol parameter variations on quantitative data. While previous work in this area focused on single-slice axial techniques, technological developments in Computed Tomography (CT) justify more complex assessment.

Method and Materials:
All scans were obtained using two phantoms designed for bone mineral (BM) densitometry: a reference phantom (three different density cores) and a QA torso phantom. Both phantoms have known properties and are required for long-term quantitative BM density assessment. The scan acquisition parameters that were varied included kV, mA, rotation speed, pitch, image thickness, detector configuration, reconstruction algorithm, table height, and tube temperature. To assess long-term scanner drift, the QA Torso phantom was scanned multiple times over three months on each of seven MSCT scanners (five GE Lightspeed-16s, one GE Lightspeed Qx/i, and one GE Lightspeed-Plus). The daily variability of the individual MSCT scanners and scanner-to-scanner variability was determined by coefficient of variation (mean/variance) from the QA Torso phantom data sets over time. All data were collected and analyzed in Hounsfield Units (HU) to provide insight about variations upstream of the actual BM density analysis through commercial software.

Results:
This study found no significant difference ($p > 0.05$) in mean HU between phantom images obtained using axial and helical scan mode, or when varying most of the other scan acquisition parameters. However, varying kV and reconstruction algorithm did result in significant ($p<0.0001$) quantitative shifts. Preliminary data indicated daily variability of 0.8% - 1.9% and scanner-to-scanner variability of 1.4%.

Conclusion:
MSCT systems can be optimized for use in determining the BM density of a vertebral body, provided very careful control of scan acquisition protocol is observed.