AbstractID: 7495 Title: Single- and dual-energy CT calcium content calibration lines for lung nodules: Effects of patient body and lung nodule size

Purpose: To determine the concentration of Ca in lung nodules for a CAD technique, lung nodule calibration lines are being derived at locations throughout lung fields. A study was performed to investigate the effects of patient body and lung nodule size on derived calibration lines.

Method and Materials: Simulated spherical lung nodules of two concentrations (50 and 100mg/cc $CaCO_3$) were employed. Three different diameter nodules (4.8mm, 9.5mm, 16mm) were scanned in a simulated thorax section "A" representing the middle of the chest with large lung regions. The 4.8mm and 9.5mm nodules were also scanned in section "B" representing the upper chest with smaller lung regions. Fat-rings were added to the phantoms to simulate larger patients. Images were acquired on a GE-VCT scanner at 80, 120 and 140kVp. The RMS CT# displacements between the calibration lines for phantoms with and without fat-rings were compared.

Results: Body-size had a significant effect on the calibration lines for each single kVp technique. Mean RMS displacements for the 9.5mm nodules at 80, 120 and 140 kVp were 22+/-2, 19+/-3, and 18+/-2HU, respectively for phantom "A", and 19+/-2, 14+/-1, and 14+/-1HU for "B". Corresponding displacements for 80kVp-140kVp dual-energy were much less: 5+/-1HU ("A") and 6+/-2HU ("B"). Results similar to the 9.5mm were obtained for the 4.8 and 16mm nodules in phantom "A" However, in phantom "B", the 4.8mm dual-energy displacements (12+/-4 HU) were about as large as the single-energy. The phantom "B" study was repeated, and the dual-energy displacements for the 4.8mm nodules were slightly better (7+/- 4 HU) on one lung side but about as poor (10+/-7HU) on the other.

Conclusion: Dual-energy CT calibration of the calcium concentration of lung nodules is less sensitive to patient body size than single-energy calibration. However, the dual-energy approach may not compensate for patient body size for smaller nodules.