AbstractID: 14210 Title: Quantitative imaging of a gold nanoparticle contrast agent with dual-energy CT

Purpose: To investigate the feasibility of imaging a gold nanoparticle contrast agent with dual-energy CT for the detection of vulnerable plaques.

Method and Materials: A chest phantom of the thorax was simulated with mixtures of either calcium hydroxyaptatite and water, elemental gold and water, or calcium hydroxyaptatite, elemental gold and water. The range of calcium and gold concentrations were 50 mg/mL to 1000 mg/mL and 0.5 mg/mL to 3.0 mg/mL, respectively. Two cases were considered. The first case was ideal and assumed the volume of the mixture was conserved and there was no interaction between any of the constituent materials. The assumption of volume conservation was relaxed for the second case and the materials were allowed to mix as occurs physically. CT images were generated at monoenergetic beam energies of 50 keV and 80 keV. A non-linear dual energy decomposition algorithm was adapted from projection imaging for use in CT. The known densities of calcium hydroxyaptatite and gold were related to the measured low and high energy signals from CT with a nine parameter fit. Measured densities were then calculated from the resultant fit.

Results: For the ideal case, the mean percentage error in measured gold density was -0.25% and the mean percentage error in measured calcium hydroxyapatite density was -0.11%. For the physical case, the mean percentage error in measured gold density was -8.76% and the mean percentage error in measured calcium hydroxyapatite density was -3.82%.

Conclusion: The results of simulation studies suggest that the density of a gold contrast agent can be measured in both two material and three material mixtures. The use of a nonlinear decomposition algorithm allowed the density of a gold contrast agent in a physical mixture to be measured with a mean error of less than 10%.

Conflict of Interest (only if applicable):