

Purpose:

The feasibility of material decomposition in x-ray spectral computed tomography for detection of vulnerable plaque was investigated.

Methods:

Simulations were performed for imaging of iodine, gold, calcium, and lipid with a photon counting Cadmium-Zinc-Telluride detector. Iodine is used to image the arterial tree, while the gold nanoparticles are used to detect plaque vulnerability to rupture. The concentrations of calcium and lipid in a plaque have been identified to be indicators of plaque's vulnerability to rupture. The four-material decomposition was performed with the least square minimization technique, including prior calibration for each material. The measured concentrations using decomposition were compared to the known concentrations.

Results:

The results showed reliable identification of the materials of interest and good agreement in assessment of their concentrations. Measured lipid concentrations (L_m) were related to known lipid concentrations (L_k) as $L_m = 1.0319L_k - 0.0031\%$.

Conclusions:

Spectral CT in conjunction with the least square minimization technique can potentially be used for detection of vulnerable plaque.