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# Procedural Protocol for Dual Energy Computed Tomography (DECT) Inversion

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**Abstract :** The dual energy computed tomography (DECT) aims at noting the HU(V) values for the sample at two different voltages V=V1, V2 and thus obtain the electron densities (ρe) and effective atomic number (Zeff) of the substance. In the present paper, we aim to obtain a numerical algorithm by which (ρe, Zeff) can be obtained from the HU(100) and HU(140) data, where V=100, 140 kVp. The idea is to use this inversion method to characterize and distinguish between the lipid and fibrous coronary artery plaques.With the idea to develop the inversion algorithm for low Zeff materials, as is the case with non calcified coronary artery plaque, we prepare aqueous samples whose calculated values of (ρe, Zeff) lie in the range (2.65×1023≤ ρe≤ 3.64×1023 per cc ) and (6.80≤ Zeff ≤ 8.90). We fill the phantom with these known samples and experimentally determine HU(100) and HU(140) for the same pixels. Knowing that the HU(V) values are related to the attenuation coefficient of the system, we present an algorithm by which the (ρe, Zeff) is calibrated with respect to (HU(100), HU(140)). The calibration is done with a known set of 20 samples; its accuracy is checked with a different set of 23 known samples. We find that the calibration gives the ρe with an accuracy of ± 4% while Zeff is found within ±1% of the actual value, the confidence being 95%.In this inversion method (ρe, Zeff) of the scanned sample can be found by eliminating the effects of the CT machine and also by ensuring that the determination of the two unknowns (ρe, Zeff) does not interfere with each other. It is found that this algorithm can be used for prediction of chemical characteristic (ρe, Zeff) of unknown scanned materials with 95% confidence level, by inversion of the DECT data.

**Keywords :** chemical composition, dual-energy computed tomography, inversion algorithm
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