Materials and methods

Phantoms

An elliptical (30 cm × 40 cm × 16.5 cm) Multi-Energy CT phantom model 1472 (Sun Nuclear) was used to assess the contrast between the soft tissue insert and the inserts with blood-mimicking material plus iodine at 2.0 or at 4.0 mg/mL. These inserts (diameter 28.5 mm, placed in water equivalent as background material) were selected to take into account tissues representative of the anatomical structures found in an enhanced abdominal CT acquisition. The insert positions were the same for each CT acquisition on each DECT platform (Figure S1A).

A 20-cm diameter ACR QA phantom (Gammex 464) placed inside a body ring (26.4 cm × 33 cm × 20 cm) was used to perform the task-based image quality assessment. The Noise Power Spectrum (NPS) was computed in Module 3 (Figure S1B). This module consists of a uniform water-equivalent material with two very small tungsten beads of 0.11-mm diameter. The Task-based Transfer Function (TTF) was computed in Module 1 (Figure S1C). This module is composed of four inserts of 25-mm diameter each placed in a water equivalent as background material (HU between −7 and 7). An acrylic insert (HU between 110 and 135) was also used.

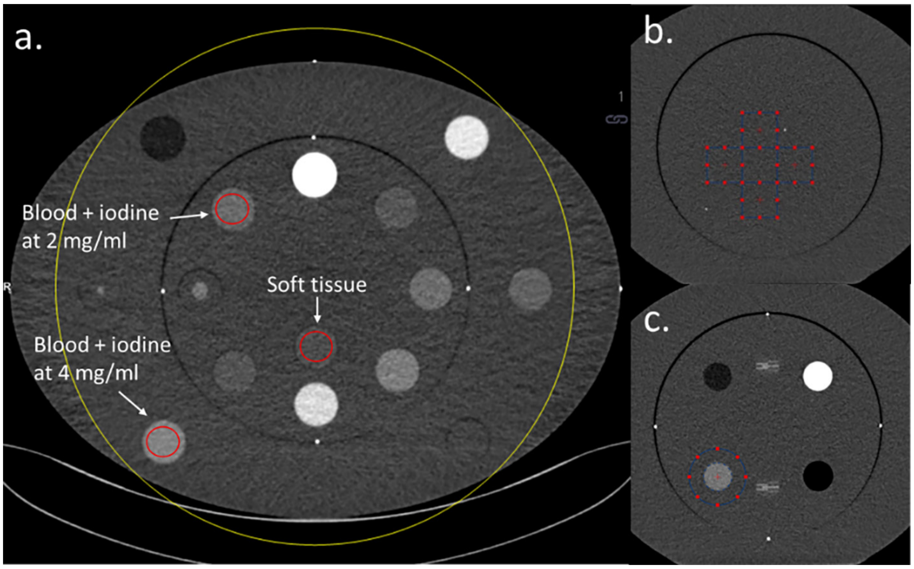

Figure S1 Images of the two phantoms used in this study. (A) Virtual monochromatic image at 70 keV of the multi-energy CT phantom with the positions of the soft tissue insert and inserts with blood-mimicking material plus iodine at 2.0 and 4.0 mg/mL used for the assessment of HU accuracy. (B) The four regions of interest (ROIs) of 64×64 pixels used for the noise power spectrum (NPS) assessment. (C) ROIs used to compute the task-based transfer function (TTF) placed on the acrylic insert.

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Calculation of theoretical CT numbers of Multi-energy inserts

For monoenergetic reconstructions, the attenuation values and the expected CT numbers can be derived for each of the inserts. The expected attenuation value for a compound at a given energy E, is represented by μ_C (E) and can be calculated using the using the following formula [1]:

$$\mu_C(E) = \rho_c \sum_i f_i \left(\frac{\mu}{\rho}\right)_i (E) \qquad [1]$$

where ρ_c represents the physical density of the compound, f_i represents the fraction by mass of each element, and $\left(\frac{\mu}{\rho}\right)_i (E)$ represents the mass-attenuation coefficient of each element at the given energy.

The CT number of each insert according to energy level was calculated using the following formula [2]:

$$HU(E) = \left(\frac{\mu_C(E) - \mu_{water}(E)}{\mu_{water}(E)}\right) \times 1000 \qquad [2]$$

where $\mu_{water}(E)$ represents the attenuation value of water and $\mu_C(E)$ represents the attenuation coefficient of a given insert.

Results

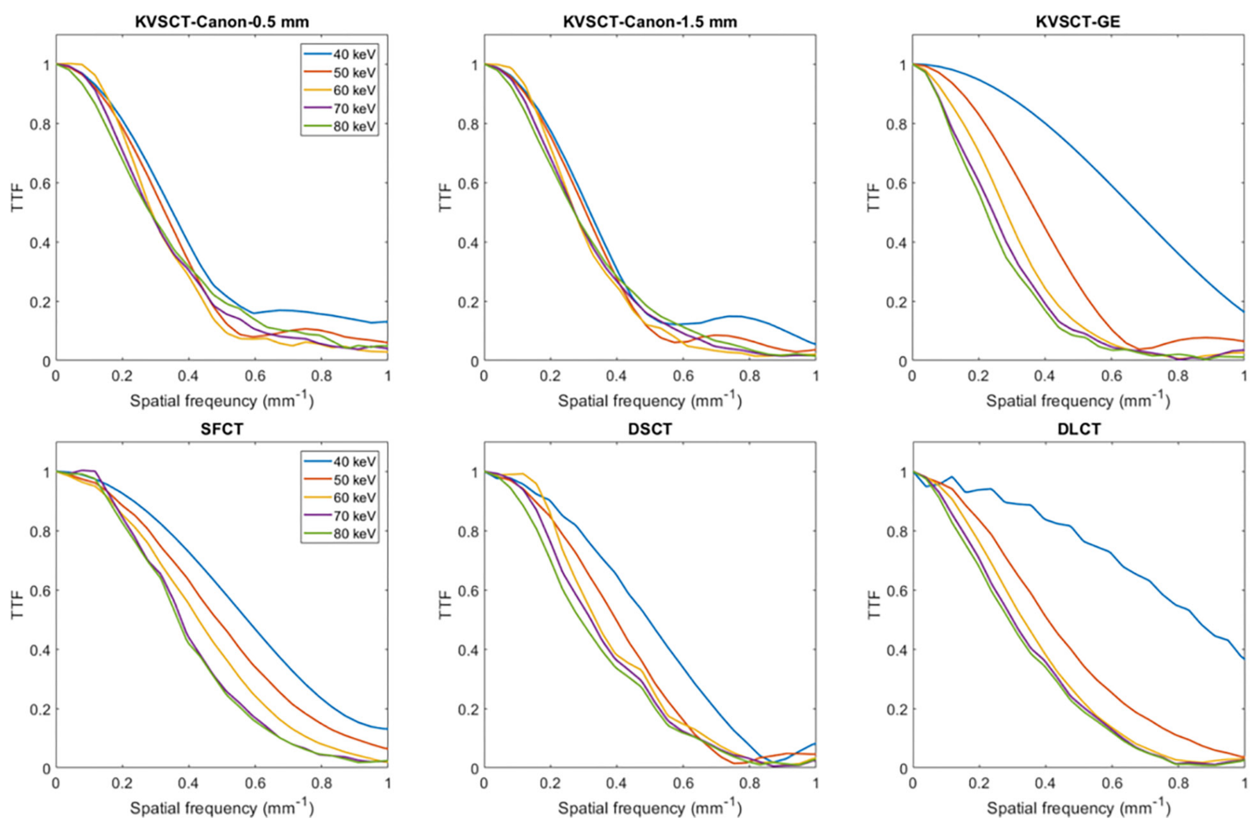

Figure S2 Task-based transfer function (TTF) curves of the acrylic insert obtained at different keVs for each dual-energy CT platform and both slice thicknesses for KVSCT-Canon. KVSCT-Canon, rapid kV switching CT; DLCT, dual-layer CT; DSCT, dual-source CT; KVSCT-GE, fast kV switching CT; SFCT, split filter CT.

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