The Role of Spectral Imaging in Renal Mass Characterization

Erik Paulson, M.D.
Duke University Medical Center
Incidental Renal Lesion

DDX: hyperdense cyst vs RCCA

“Recommend dual phase renal CT to r/o RCCA”

Another scan
More radiation
More contrast
Another charge
Contrast-enhanced Dual-Energy MDCT

-140 kVp Series-

Individualized Spectral-based Iodine Extraction

-80 kVp Series-

34 HU

66 HU

29 HU
Detection of Renal Lesion Enhancement with Dual-Energy Multidetector CT

Purpose:
To determine whether dual-energy multidetector CT enables detection of renal lesion enhancement by using calculated nonenhanced images with spectral-based extraction in a non–body weight–restricted patient population.

Materials and Methods:
Between January 2008 and December 2009, 139 patients were enrolled in this prospective HIPAA-compliant, insti-

Lesion attenuation measured on true and calculated non-contrast images. Enhancement compared.
Contrast-enhanced Dual-Energy MDCT

-140 kVp Series-

Individualized Spectral-based Iodine Extraction

34 HU

-80 kVp Series-

66 HU

Non-Enhancing Hyperdense Lesion

29 HU

33 HU

-120 kVp Series-
Comparison of lesion enhancement

- true
  - cyst
  - hyperdense cyst
  - angiomyolipoma
  - solid mass

- calculated
  - cyst
  - hyperdense cyst
  - angiomyolipoma
  - solid mass

Values:
- true: 1.1, 4.7, 18
- calculated: -0.5, 2.3, 13
- 60.3, 58.3
Promise?

- 60% RCCA’s are found incidentally
- Iodine subtraction technique allows detection of renal lesion enhancement without acquisition of true non-enhanced lesions
- May obviate need for non-enhanced scans
Problems?

- Accuracy (+/- 8-10 HU)
- Workflow
- Image quality
- Small lesions problematic
- Standard approach works
- Low dose non-enhanced scans efficacious
- Innovative recon techniques
  
  more
Applications Today??

- Routine DECT for body imaging
  - Confirm suspected hyperdense cysts without need for an additional scan
  - Confirm suspected solid masses without need for an additional scan
Thanks

Erik Paulson, M.D.
Duke University Medical Center
Figure 11. Renal cell carcinoma. (a) Axial contrast-enhanced nephrographic phase CT image shows an exophytic, hyperattenuating mass with attenuation of +59 HU arising from the interpolar portion of the right kidney. The differential diagnosis includes a hyperattenuating cyst and a solid neoplasm such as renal cell carcinoma or oncocytoma, which is unlikely. (b) True unenhanced axial CT image shows the mass with attenuation of +20 HU, a finding indicative of renal cell carcinoma. (c) Virtual unenhanced axial CT image generated with postprocessing techniques shows the mass with attenuation of -12 HU, a finding indicative of renal cell carcinoma. Note the margins of the field of view (dotted white line, arrow), which was 26 cm, of one of the detectors.

OBJECTIVE. The purpose of this study was to assess whether habitus and organ enhancement influence iodine subtraction and should be incorporated into spectral subtraction algorithms.

SUBJECTS AND METHODS. This study included 171 patients. In the unenhanced phase, MDCT was performed with single-energy acquisition (120 kVp, 250 mAs) and in the parenchymal phase with dual-energy acquisitions (80 kVp, 499 mAs; 140 kVp, 126 mAs). Habitus was determined by measuring trunk diameters and calculating circumference. Iodine subtraction was performed with input parameters individualized to muscle, fat, and blood ratio. Attenuation of the liver, pancreas, spleen, kidneys, and aorta was assessed in truly and
Contrast-Enhanced Dual-Energy MDCT

140-kVp Series

80-kVp Series

Individualized Spectral-Based Iodine Subtraction

Organ-Selective Attenuation Correction

Liver

Right Kidney

Pancreas & Aorta

Unenhanced MDCT
Bone can be differentiated from soft tissue because of the specific densities of the two materials!
Dx: Hyperdense cyst.
No further work-up.