MECT in Kidney and Adrenal

Ravi Kaza, MD

University of Michigan
Department of Radiology
Disclosures

• None
MECT in Kidney and Adrenal Imaging

- Renal mass characterization
- Urinary calculi characterization
- CT Urography
- Adrenal nodule characterization
Renal Mass Characterization

• Distinguish enhancing from non-enhancing renal masses with single phase of image acquisition
• Done by detecting iodine in enhancing renal masses
• Can eliminate the need for unenhanced imaging
• Permit the characterization of incidentally detected renal lesions
Renal Mass Characterization

• Virtual unenhanced images:
  - Enable measurement of Hounsfield units similar to true unenhanced images

• Iodine quantification:
  - Can be used to detect enhancement
    • > 2 mg/cc ≈ Enhancing
    • < 1 mg/cc ≈ Non-enhancing
Renal Mass Characterization

- Practical considerations:
  - Reduced conspicuity of calcification on VUE images
    - Due to material decomposition algorithms optimized at identifying iodine
    - Can mimic enhancement of septa
Renal Mass Characterization

- Practical considerations:
  - Variability of CT attenuation measurements
    - Between different dual-energy CT platforms
    - Between virtual and true unenhanced images


Renal Mass Characterization

• Practical considerations:
  - Differences in reported iodine density threshold
    • 0.5 mg/cc - 2 mg/cc
    • Could be due to difference in types of DECT, phase of examination and types of lesions evaluated in study
  - Sub centimeter lesions can be difficult to adequately characterize


Chad, et al., Evaluation of hyperdense renal lesions incidentally detected on single-phase post-contrast CT using dual-energy CT. BJR 2016
Urinary Calculi Characterization

• Knowledge of stone composition prior to stone extraction helps guide management
  - Uric acid: Medical management for dissolution
  - Struvite: Amenable for ESWL
  - Cystine, Calcium oxalate: PCNL

• HU measurements of single-energy CT have accuracy of 64-81% for calculi characterization
Urinary Calculi Characterization

• DECT: Analysis of change in stone attenuation at the two energies
  - Dual-source DECT
    • Dual-energy Index
  - Fast-kV switching DECT
    • Material basis pair images
    • Effective atomic number (Eff-Z)
Urinary Calculi Characterization

- Highly accurate in distinguishing uric acid from non uric acid calculi
- Improved sub classification of non-uric acid calculi as compared to SECT
Urinary Calculi Characterization

• Practical considerations:
  - Characterization needed only on first scan
  - Targeted repeat scan in region of calculus vs routine DECT for patient with calculus
Urinary Calculi Characterization

• Limitations:
  - Difficult to characterize calculi < 3-5 mm
    • Inability to obtain accurate attenuation values
  - Mixed calculi
    • Could be misclassified
  - Catheters adjacent to calculi
    • Could affect attenuation value
Adrenal nodule characterization

• Characterization of incidentally detected adrenal lesions
  - Measuring HU on the virtual unenhanced images
  - Eliminate the need for repeat scan