Clinical Use of Dual Energy CT Iodine Map for Renal Lesions

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Assessment of enhancement (presence of iodine) in a renal lesion

- Traditional approach to renal lesions:
  - Look for increased density (or not) from pre to post contrast images
  - Requires 2 scans
  - How much increase in HU?
Pseudo-enhancement

• The presence of iodine in the post contrast image affects the measured density of ANY lesion (probably due to beam hardening)
  – Research indicates 10 HU of increase is expected
  – Up to 20 HU or greater can occur (pseudo-enhancement)
Dual Energy CT

• Using two different energies allows for identification of specific materials
  – Iodine separation is clinically relevant
• Images showing iodine only are capable of being generated
  – No need for pre-post contrast images?
Iodine Separation

• Generation of high quality images requires good spectral separation of iodine
  – Dual Source CT can provide good separation
    • One tube at 80-90 kVp, other at 150 kVp
Iodine Map Images

• Iodine can be color coded
  – Red (like PET often is)

• Iodine “only” image overlays the traditional CT images
Benign Renal Cyst

• Despite the fact that the lesion measures greater than 20 HU on a single post contrast phase CT (26 HU), the iodine image shows no visible iodine present in the cyst

  – All renal neoplasm (RCC) should have iodine
  – Can feel more confidence in a benign diagnosis?
RCC (bilaterally)
Presence of iodine

• Red color visible in both renal lesions

  Indicates iodine (hence enhancement)

• ANY amount of red color indicated tumor
Artifact

• Note in prior case the “color” associated with the very dense biliary stent

  – Metallic or similar dense material may be confused for enhancement

    • Similar to PET/CT attenuation correction error
Artifact – Cholecystectomy clips
When else can it be useful?

• In cases with complex renal lesions
  – In cases with many renal lesions
    • Polycystic Renal and Von Hippel Lindau (VHL)
VHL patient
When can it be problematic?
Low level of enhancement

• Papillary RCC with low level enhancement
  – Especially difficult when homogeneous
• Need further defining for the lower limit of “signal” on Iodine images
  – Windowing optimization and improvements in quantification are still needed
What you might encounter in clinical routine
Another one
Size of lesion matter?

- Although size is a limiting factor in traditional CT dual phase imaging, it appears to be easier to visualize non-enhancing cysts on iodine images.
  - Defining the lower limit of size is still a point of ongoing research.
References


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