



Dual Energy CT – Gout and Renal Calculi

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Dual energy CT is a technique where a patient is scanned at two or more different energies, e.g. 120 keV and 70 keV. This allows us the ability to characterize specific materials based on the difference in behavior at different energy levels.

There are many applications of this technique. Two of them are discussed here.

Gout:

Gout is characterized by inflammatory response to the deposition of monosodium urate (MSU) crystals in the joints and soft tissue, which leads to acute or chronic arthropathy and gouty tophi formation. Diagnosis can be made on clinical and biochemical basis, however definite diagnosis requires microscopic demonstration of MSU crystals from the aspiration of the joint fluid, which is invasive and may also have false negative results.

Keeping the dual energy ratio at 1.36, the uric acid crystals lie below the line and are differently color-coded (green), whereas the calcium deposits lie above the line. Hence diagnosis of gout can be easily made, non-invasively (Figs. 1, 2).

With DECT it is also possible to quantify the overall tophus burden or volume of urate deposition without any user variability. This makes it an ideal tool for evaluating even a small change in tophus burden and can be used for follow-up to document response to treatment.

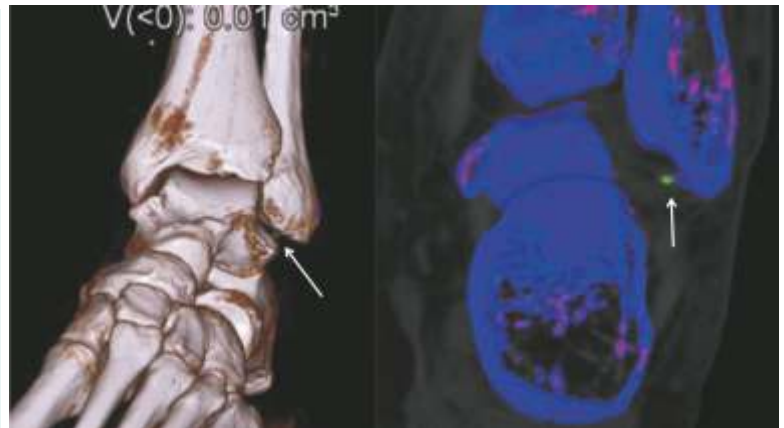


Fig. 1

Fig 1: A 33-years old man came with suspected gout and tibio-talar synovitis. The DECT shows crystal deposition, which appears as a focus of green (white arrow) medial to the lateral malleolus styloid. This is typical of gout.

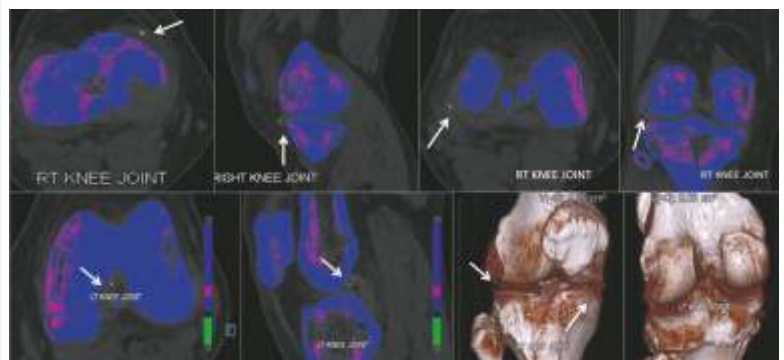
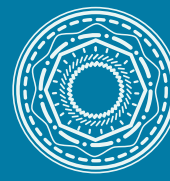


Fig. 2

Fig 2: A 45-years old man came with bilateral knee pain. MRI showed bilateral synovitis with low signal soft tissue on the right interpreted as possible infection. The DECT shows green-coded urate crystals on the right anterior the medial tibial plateau (white arrow) and adjacent to the lateral femoral condyle (white arrow). On the left, a green-coded crystal (arrow) is seen in the intercondylar notch.



At a glance:

- Dual energy CT (DECT) allows us to characterize some tissues and materials.

- In gout, the presence of monosodium urate crystals can be picked up using DECT
- DECT allows us to differentiate urate from non-urate crystals.

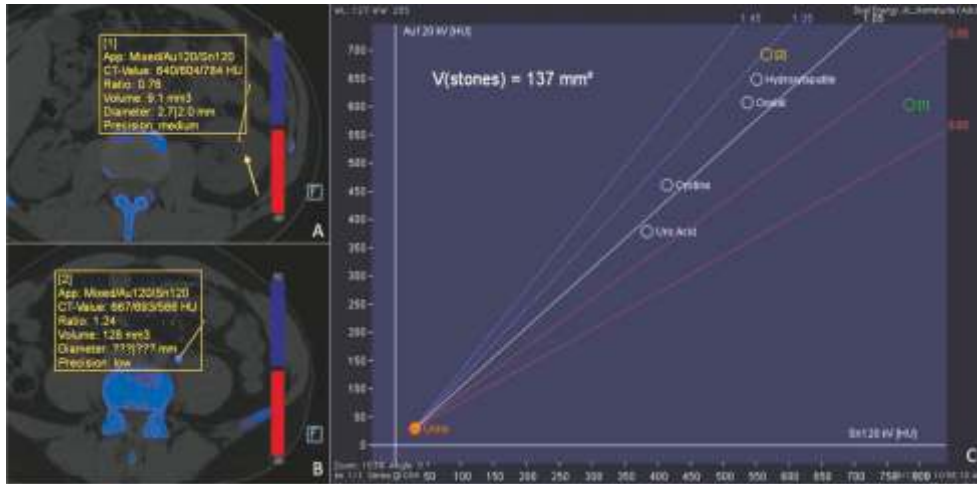


Fig. 3

Fig 3: This 60-years old man with left loin pain has two calculi, one in the left kidney and the other in the left ureter. The renal calculus is coded red and has a dual energy ratio of less than 1.05 (yellow arrow). The ureteric calculus has a high ratio (>1.05) and this represents a non-uric acid calculus likely hydroxyapatite.

Renal Calculi:

As different types of renal calculi are treated differently, knowledge about the composition of stones may guide decisions about their management and predict the effectiveness of therapy. For example, uric acid calculi can be managed medically with measures that facilitate dissolution, while the non-uric acid calculi need other forms of treatment such as ESWL or surgery.

Keeping the dual energy ratio at 1.05, the uric acid stones lie below the line and are colored red, whereas the non-uric acid stone lie above the line and are differently color-coded (blue).

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