The Use of Dual Energy CT In Lower Extremity Imaging: A Case Report

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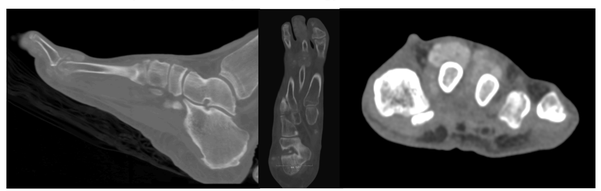
SECT vs. DECT

Conventional Single Energy Computed Tomography (SECT)

- Conventional computed tomography (CT) scans have long been the workhorse in the evaluation of lower extremity pathologies. (1)
- Conventional single energy CT (SECT) utilizes a single polychromatic X-ray beam emitted from a single source. This x-ray beam is then received by a single detector. (2)
- SECT beams typically range from 70 to 140 kVp. A standard of 120 kVp has been widely accepted. (2,3)
- CT images are generated by processing the amount of x-ray beam attenuation. Different materials in the body will attenuate differently.
- The degree that a material will attenuate the X-ray beam is dependent on tissue composition and photon energy level



(Figure 1) SECT revealing non-defined soft tissue mass

Dual Energy Computed Tomography (DECT)

- DECT utilizes two energy levels are used to generate images. 80 kVp and 140 kVp are commonly used x-ray beams. (2)
- Three DECT platforms are currently available. 1) Dual source DECT (DcDECT) 2) Single source DECT (SsDECT) 3) Indetector based spectral CT (4)
- All materials have unique attenuation profiles at different energy levels. DECT are able to utilize mathematical algorithms to examine and process tissues when exposed to both low and high energy polychromatic X-ray beams (2)
- Contrast-noise-ratio (CNR) is the single most important factor in allowing an interpreter to properly identify a lesion on CT (2)
- The lower energy levels of DECT allow for a better CNR resulting in higher likelihood of appropriately identifying lesions in the body. (4)

METHODOLOGY

A retrospective observational chart analysis was performed. Literature review of the topic of computed tomography use in the lower extremity was performed using pubmed and ovid. Keywords included but were not limited to computed tomography, SECT, and DECT

CASE

A case of a 71 year old male is presented. The patient has a past medical history of type 2 diabetes mellitus, kidney transplant, hypertension, hyperlipidemia, renal disease, gout, and myocardial infarction. The patient's chief complaint included pain in his left 2nd and 3rd toe. The pain was described as being localized over the metatarsophalangeal joints. There was no history of trauma.

Upon clinical examination, a 0.1 cm sinus was noted on the distal aspect of the 2nd toe with chalky white tophi expressed from the wound. No purulence or signs of infection was noted. The case was discussed with an in-house radiologist, and a DECT was obtained.

(Figure 2) DECT revealing clearly defined signal intensity indicative of gouty tophi

Upon review of the DECT (fig. 2), confirmation of gouty tophi was noted in the area of chief complaint. Upon confirmation of gout diagnosed, the patient was treated appropriately with colchicine. Subsequent alleviation of acute gouty attack was observed.

DISCUSSION

Single energy computed tomography (SECT) has long been utilized in the field of medicine to visualize and diagnose various pathologies. In the lower extremity, SECT have been useful in evaluating pathologies such as fractures. Although soft tissue masses may be visualized on SECT, the capability of differentiating these soft tissue masses have been limited. Dual energy computed tomography offers the possibility of further differentiating various pathologies found in the lower extremity. In our case, we have presented the use of DECT in the diagnosis of gout. K. Glazebrook et al has described DECT as a possible replacement of invasive joint aspirations in acute cases of gout (3). DECT has also been described as a sensitive, noninvasive, and reproducible method for identifying uric acid deposits. DECT do require equipment that may not be readily available at all institutions. With increased adoption of DECT into clinical practice, availability will continue to rise.

CONCLUSION

- Single energy computed tomography scans offer superior visualization of bony pathologies of the lower extremity.
- Although soft tissue masses may be visualized on SECT, differentiation between various masses can be limited.
- Dual energy computed tomography scans provide multiple voltages resulting in better contrast-noise-ratios that increase the likelihood of appropriately identifying lesions in the body.
- Imaging and diagnosing cases of gout, computed tomography has long been under utilized due to it's lack of sensitivity.
- DECT scans provide the capability of clearly visualizing urate crystals seen in cases of gout.

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