Dual Energy Gout Phantom Evaluation

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PURPOSE

The purpose of this study is to construct a gout phantom comprised of relevant materials that can be used for algorithm development for dual energy CT (DECT).

METHODS

1. A gelatin-based, gout phantom was created with uric acid (UA) gout inserts of 3 sizes (10,7,2 mm^3) and 5 concentrations (10-50% UA by mass).
2. Pseudogout, bone, and tendon were also included as these materials are sources of false positives (tendon and pseudogout) and false negatives (bone) in DECT gout assessment. Pseudogout can be confused with gout when only CT # is used but can be separated by material on DECT.
3. The phantom was scanned on a Revolution CT (GE Healthcare, Waukesha, WI) with gemstone spectral imaging (GSI) with: 80/140 kVp, 80mm collimation, 0.984 pitch, 335mA tube current, 0.8s rotation, and 0.625mm slice thickness.
4. Gout values in the phantom were compared with clinical gout values using empirically determined thresholds applied on Uric Acid(HAP) and HAP(Uric Acid) material images (1200 – 1378 mg/ml on Uric Acid(HAP) and -5-130 mg/ml on HAP(Uric Acid)).

Gout inserts in this dual energy gout phantom fell within clinically relevant density ranges and can be separated from pseudogout

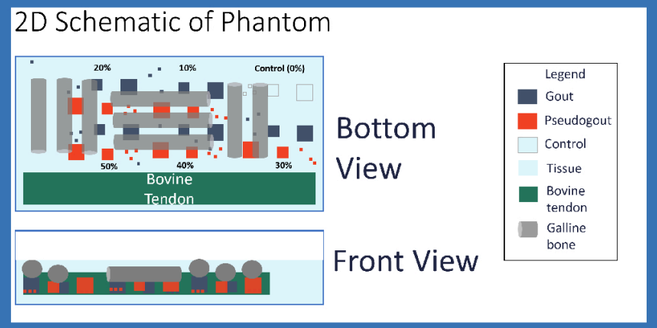


Figure 1



Figure 2

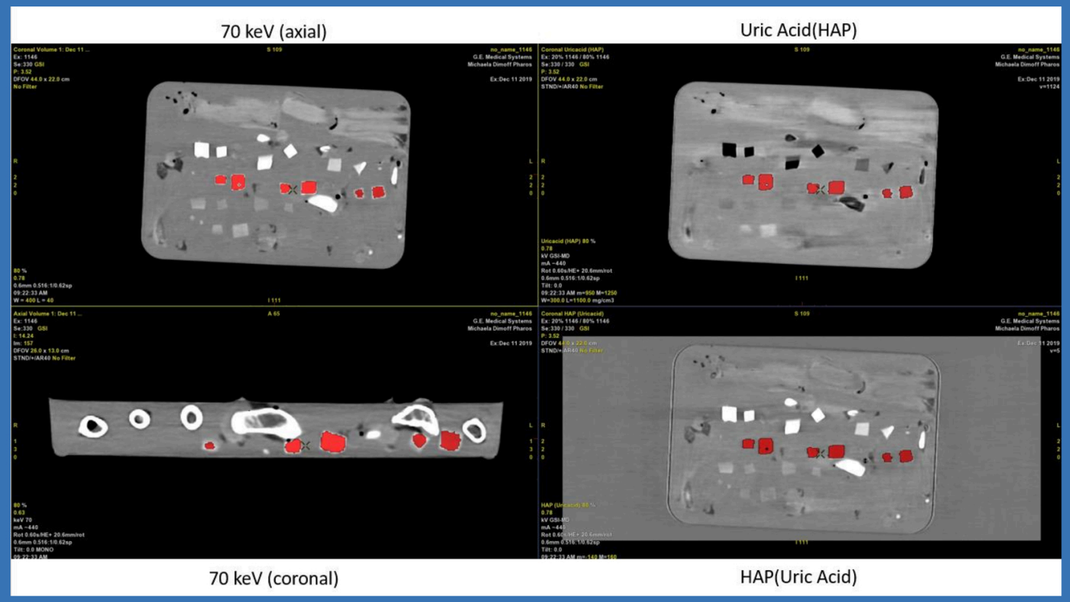


Figure 3

Results

Gout inserts in the phantom fell within clinically relevant ranges on dual energy CT material images whereas the pseudogout inserts were not within the thresholds.

FIGURE 1

2D schematics of a clinically relevant gout phantom. This phantom contains gout, pseudogout, bone and tendon materials.

FIGURE 2:

Bottom-up picture of the gout phantom.

FIGURE 3:

Dual energy CT image of the gout phantom with gout material color overlay. The gout was threshold using clinically-used material double thresholds on Uric Acid (HAP) and HAP (Uric Acid) images.