

Small-sized renal calculi – uric acid or non-uric acid?

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History

A 40-year-old male patient, suffering from intense right flank pain, came to the emergency department. He reported neither hematuria nor any other symptoms. A serum creatinine test revealed a normal level of 0.79 mg/dL. His medical history was unremarkable. Urolithiasis was suspected and a TwinBeam Dual Energy (TBDE) CT was performed for further assessment.

Diagnosis

TBDE CT images showed two small calculi with smooth surfaces in the right kidney, measuring 3.2 x 1.9 mm and 2.3 x 1.9 mm in size with a density of 950 HU and 607 HU. In the Dual Energy (DE) composition analysis, both calculi were color-coded blue and plotted in the non-uric acid area in the DE diagram. Due to the small size of the calculi, the decision was made to firstly manage the patient medically, considering the potential of spontaneous passing of the calculi. In follow-ups, the patient continued to do well with improved symptoms.

Comments

Urolithiasis is often a painful urinary disorder and one of the most common causes of visits to emergency departments. [1] It affects around 900,000 people per year in the USA,

resulting in annual medical costs of \$5.3 billion. [2] CT imaging can provide important information such as the location, size and surface structure of the calculi, as well as the extent of kidney involvement, to plan an optimal patient management. Moreover, the chemical composition of the calculi can be characterized in vivo using DECT, prior to treatment, to plan therapies and to prevent recurrences. [3]

A uric acid (UA) calculus, for example, can be treated non-invasively at an early stage with urinary alkalization. A small calculus can be spontaneously ejected without intervention. DECT is available with a single source CT scanner, a dual source CT scanner or a Photon-counting CT scanner. This case is performed using TBDE on a single source CT scanner, the SOMATOM go.Top. TBDE enables simultaneous acquisition of high and low kV datasets in a single scan. A dedicated DE application is then used to depict attenuation profiles of the calculi, allowing for the differentiation between UA and non-UA stones. The results are plotted in a DE diagram and the calculi are color-coded – red for UA and blue for non-UA. In this case, both calculi were visualized and, despite their very small size, could be characterized as non-UA by the postprocessing software,

owing to the motion-free image quality achieved. This made it possible to change the “Resolution” setting from 8 to 3 for an optimal assessment. DECT provides simple and reliable information for the physicians, enabling confident diagnoses and therapy planning for the patients. ●

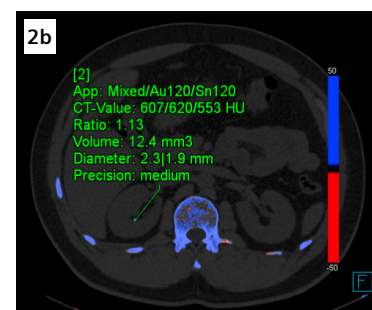
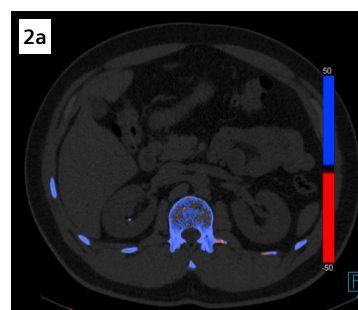
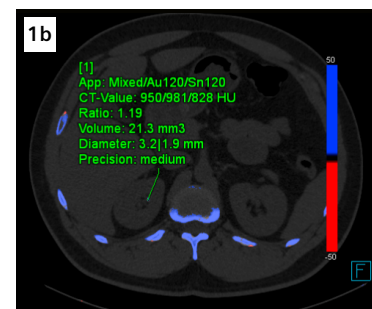
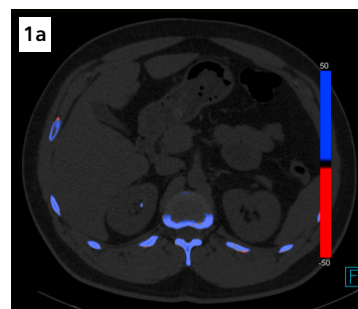
References

- [1] Chaytor RJ, Rajbabu K, Jones PA, McKnight L. Determining the composition of urinary tract calculi using stone-targeted dual-energy CT: evaluation of a low-dose scanning protocol in a clinical environment. *Br J Radiol* 2016; 89: 20160408.
- [2] Primak AN, Fletcher JG, Vrtiska TJ, Dzyubak OP, Lieske JC, Jackson ME, Williams JC Jr, McCollough CH. Noninvasive differentiation of uric acid versus non-uric acid kidney stones using dual-energy CT. *Acad Radiol*. 2007 Dec;14(12):1441-7. doi: 10.1016/j.acra.2007.09.016. PMID: 18035274; PMCID: PMC2743375.
- [3] Manglaviti et al. In Vivo Evaluation of the Chemical Composition of Urinary Stones Using Dual-Energy CT. *AJR* 2011; 197: W76–W83.

The statements by Siemens Healthineers' customers described herein are based on results that were achieved in the customer's unique setting. Because there is no "typical" hospital and many variables exist (e.g., hospital size, case mix, level of IT and/or automation adoption) there can be no guarantee that other customers will achieve the same results.

1 **2** TBDE axial images show two small calculi with smooth surfaces and color-coded blue in the right kidney. The measurement of each calculus is also shown.

3 Both calculi are plotted in the non-UA area in the DE diagram.



Examination Protocol

Scanner	SOMATOM go.Top
Scan area	Thorax/Abdomen
Scan mode	TwinBeam Dual Energy
Scan length	638 mm
Scan direction	Cranio-caudal
Scan time	18 s
Tube voltage	Au/Sn120 kV
Effective mAs	293 mAs
Dose modulation	CARE Dose4D
CTDI _{vol}	8.13 mGy
DLP	575 mGy*cm
Rotation time	0.33 s
Pitch	0.3
Slice collimation	64 x 0.6 mm
Slice width	1.5 mm
Reconstruction increment	1.0 mm
Reconstruction kernel	Qr40 S3 [SPP]

