

## Comparison of urinary stone composition using chemical analysis vs dual energy computerized tomography (DECT): A preliminary ex-vivo study

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**Introduction & Objectives:** The chemical composition of urinary stones is conventionally estimated through Hounsfield Units (HU) at CT. However, HUs are not univocal and different chemical compositions are possible. The aim of the study was to assess whether the DECT is adequate in characterizing stones composition.

**Materials & Methods:** From 2009 to 2017, we collected stone fragments from patients who underwent endourological stone removal. The fragments were analysed by infrared spectrometry (FT-IR, Fourier Transform Infrared Spectroscopy, Nicolet iS5) and examined with two different DECT devices: Aquilion ONE 320 slice (Toshiba Medical Systems Corporations; using 80-135 kV and 100-135 kV) and SOMATOM Definition 64 slice (Siemens Medical Solutions, using 80 and 140kV). The images were processed on colour-coded monitors and specific colours were assigned to the chemical compositions [uric acid, calcium-based composition and cystine]. The mixed calcium-based composition included fragments composed by: mixed CaOx mono-/di- hydrate, CaOx+calcium phosphate, CaOx monohydrate + ammonium urate, and carbonate apatite phosphate. Descriptive statistic was used to depict the findings.

**Results:** Overall, 62 stone fragments were collected from 46 patients. Chemical analysis showed the following fragments composition: 16 CaOx monohydrate (25.8 %), 24 mixed calcium-based composition (38.7 %), 14 cystine (22.6%) and 8 uric acid (12.9 %). Because the density was not measurable for fragments <2 mm, three fragments were excluded from further analysis. The median density was: 1026 HU (IQR: 866-1365) for CaOx monohydrate, 923 HU (IQR: 798-1403) for mixed calcium-based composition, 527 HU (IQR: 351-557) for UA and 679 HU (IQR: 632-797) for cystine. The detection of UA stone fragments was 100% accurate using SOMATOM Definition or Aquilion (at 80-135 kV or 100-135kV). A 100% accuracy was reported for Ca-based stone fragments using SOMATOM Definition or Aquilion at 80-135 kV. Using Aquilion at 100-135 kV, the accuracy for Ca-based stone fragments declined to 84.2%. Using Aquilion, the accuracy for cystine was 76.9% at 80-135 kV but it dropped to 7.7% at 100-135 kV.

**Conclusions:** Ex vivo, DECT can distinguish chemical compositions of stones fragments. Its accuracy is optimal for UA and calcium-based compositions but there is still room for improvement in detection of cystine stones. Clinical studies are certainly required to investigate the reliability of DECT in vivo (e.g. individualizing treatment).