Potential interest of dual-energy computed tomography in gout: focus on anatomical distribution and clinical association

Sir, Gout is a chronic inflammatory arthritis resulting from long-standing hyperuricaemia, and is characterized by monosodium urate (MSU) crystal deposits in joints and periarticular soft tissues [1]. Recently dual-energy CT (DECT) techniques have been introduced as a sensitive, non-invasive and reproducible imaging technique for detecting MSU deposits in clinical studies of gout patients [2–4]. The newly developed imaging modality, DECT, can provide more extensive information about the location of gouty MSU deposits and their association with clinical variables. The main goals of our study were to identify the anatomical distribution of urate crystals in affected foot and ankle joints and to define the relationships between MSU crystal deposits and clinical parameters in gout patients using DECT.

We consecutively enrolled a total of 101 gout patients (male, n = 96) who fulfilled the preliminary criteria for the classification of primary gout proposed by the ACR [5]. Patients with present symptoms or a previous history of gout in the ankles and feet were included in the study sample. The study was approved by the Institutional Review Board/Ethics Committee at the Catholic University of Daegu. Informed consent was obtained at the time of study enrolment. Seventeen arbitrary locations were defined to identify anatomical locations of urate crystal deposits in the foot and ankle (see Fig. 1A). The most clinically affected foot/ankle region was scanned in each patient. DECT scans were performed following Nicolaou et al. [3].

We identified 39 patients (38.6%) among a total of 101 gouty patients with urate crystal deposits in affected feet and ankles. Regardless of the volume or size of the deposited crystals, a total of 82 urate crystal deposits from 39 gouty patients with crystals were identified (Fig. 1B). The most frequent locations for urate crystal deposits were at the first MTP joint of the great toe (n = 18, 22.0%), around or at the junction of the ankle (n = 16, 19.5%), around the first IP joint (n = 12, 14.6%) and in the transverse tarsal joint (n = 12, 14.6%).

Among the total study sample (n = 101), the presence of urate crystals by DECT was increased in patients with higher triglyceride (95% CI 1.003, 1.015, \( P = 0.003 \)) and uric acid levels (95% CI 1.010, 1.449, \( P = 0.039 \)). Disease duration was a significant determinant for the number of urate crystal deposits after adjustment for age, sex and disease duration among the 39 patients with urate deposits by DECT (\( r = 0.552, P = 0.002 \)).

DECT has been used to investigate the composition of urinary stones, including the differentiation of uric acid from non-uric acid calculi. It was confirmed that DECT could discriminate uric acid calculi from calculi of other types with various composition, such as cysteine and struvite, both in vivo and in vitro [6]. The most useful application for musculoskeletal diseases is the identification of subclinical urate crystal deposits in gout.

The most prevalent individual joint affected by acute attacks of gout was the first MTP joint, followed by the ankle/foot in a previous clinical survey of 354 gout patients [7].

Fig. 1 Anatomical distribution of area with urate crystal deposits in ankle and foot joints.

(A) Seventeen individual anatomical locations within and around joints and soft tissues are assigned on the dorsum view of foot and ankle. (B) The number of urate crystal deposits is illustrated at each anatomical location.
the present study we also demonstrate that MSU crystals are most frequently detected in the first MTP joint, ankle, transverse tarsal joint and first IP joint, in that order. These findings are consistent with the results of a prior DECT study [2]. We have also demonstrated an association between MSU crystal deposits, serum uric acid and serum triglyceride levels, after adjusting for age and sex. Hypertriglyceridaemia has previously been found to be common in patients with gout [8]. Genetic and/or metabolic factors may contribute to this association. Another analysis of the 39 tophaceous patients in the present study also demonstrated that disease duration is a crucial variable affecting the number of MSU crystal deposits. Therefore these data suggest that disease duration is a relevant parameter affecting the number of MSU crystal deposits. Our study has notable limitations. The present study was designed in a retrospective manner. Also, we did not measure the actual volumes of urate crystal deposition due to a lack of automatic volumetric software for DECT.

In conclusion, this is the first study reporting the prevalence of urate crystal deposits in foot and ankle joints of gout patients, as identified by DECT scanning. Using DECT, we have confirmed that the first MTP joint is the most frequently involved joint in the foot. Interestingly, we demonstrated that serum uric acid and triglyceride levels significantly increase the risk of the presence of urate crystal deposits in gout. In addition, disease duration is closely related to the number of urate crystal deposits in tophaceous patients. DECT should be assessed to determine its potential role in determining the presence and extent of urate crystal deposits in a larger study population.

**Rheumatology key message**

- DECT is a useful imaging tool for urate crystal deposits in gout.

**Disclosure statement:** The authors have declared no conflicts of interest.

Seong-Kyu Kim1, Hwajeong Lee1, Ji Hun Kim1, Sung-Hoon Park1, Sang Kon Lee2 and Jung-Yoon Choe1

1Division of Rheumatology, Department of Internal Medicine, Arthritis & Autoimmunity Research Center, Catholic University of Daegu School of Medicine and 2Department of Radiology, Daegu Catholic University Medical Center, Daegu, Republic of Korea.

Accepted 26 September 2012

Correspondence to: Jung-Yoon Choe, Department of Internal Medicine, Catholic University of Daegu School of Medicine, 3056-6 Daemyung 4-Dong, Namgu, Daegu 705-718, Republic of Korea. E-mail: jychoe@cu.ac.kr

**References**


