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SAT0422 URATE VOLUME AND DISTRIBUTION BY DUAL ENERGY CT: CLINICAL AND RADIOLOGICAL CORRELATION IN GOUT PATIENTS

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Background: Dual-energy CT (DECT) has shown tremendous potential as a novel non-invasive method of urate detection in patients with gout.

Objectives: Our aim was to determine the concordance between urate volume and distribution measured on DECT with clinical presentation among patients with gout.

Methods: We conducted a retrospective descriptive study of patients with gout who were referred by a rheumatologist for gout DECT scans between January 2008 and February 2018. At our institution, routine DECT scans for gout consist of four sets of images with limbs scanned in pairs: the hands/wrists, elbows, knees and ankles/feet. We obtained volumetric measurements for all four anatomical regions, and assessed the concordance with clinical presentation as retrieved from patient electronic health record.

Results: A total of 182 patients were included in this study; 96 patients (80.2% male, age range: 27-90, mean age: 62) had urate deposits on DECT scans. Among urate-positive patients, the mean total volume of deposits was 2.45 cm³ (hands/wrists: 0.17 cm³, 7%; elbows: 0.62 cm³, 25%; knees: 0.70 cm³, 28%; ankles/feet: 0.96 cm³, 39%). The average number of urate-positive joints was 2.5, higher than that of clinically symptomatic joints (1.9). Discordance between DECT results and clinical symptoms were seen more often in elbows (46 urate-positive vs. 22 symptomatic) and knees (68 vs. 43), compared with hands/wrists (31 vs. 30) and ankles/feet (90 vs. 87). Only in 25 (26.0%) patients, the distribution of symptomatic joints fully matched the distribution of urate deposits. In 6 patients (6.3%), there was no overlap between these two distribution patterns.

Conclusion: On DECT scans, most urate deposits in gout patients occur in the ankles/feet, followed by knees, elbows, and hands/wrists. DECT scans can reveal urate deposit in asymptomatic joints, especially in elbows and knees. Assessing the concordance of urate distribution with clinical presentation in all limb joints in gout patients, our results can help understand the pathophysiology of urate deposition in gout, and guide the development of DECT protocols for the screening, assessment and follow-up management of gout patients.

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SAT0423 WHERE SHOULD WE EXAMINE FOR URIC ACID DEPOSITS? RESULTS FROM THE NOR-GOUT ULTRASOUND STUDY

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Background: Ultrasound (US) has received an increasing attention in detecting uric monosodium urate (MSU) deposits, and US is included in the ACR/EULAR classification criteria for gout. OMERACT has developed definitions for US elementary lesions in gout including double contour (DC) sign (deposits of crystals on the surface of cartilage), tophus (larger hypo-echoic aggregation of crystals, usually well delineated) and aggregates (small hyper-echoic deposits).

Objectives: The present objective was to explore by US the most frequent locations of MSU deposits.

Methods: Baseline data from a prospective observational study were used where patients with crystal-proven gout who presented after a recent gout flare were included (202 patients (mean (SD) age 56.6 (14.2) years, disease duration 8.0 (7.7) years, 94.1% men), all with insufficiently treated serum uric acid level (>360 µmol/L/>6 mg/dl). We performed an extensive assessment with US (GE E9 machine, grey scale 15MHz) for semi-quantitative scoring of MSU deposits (0=none, 1=possible/small, 2=moderate, 3=major) using OMERACT definitions for DC, tophi and aggregates. The following locations were examined bilaterally; radiocarpal, MCP 2 and MTP 1 joints, triceps and quadriceps insertions, patellar (proximal and distal) and Achilles tendons as well as distal femur (maximal flexed knee) and talar cartilage. Sum scores for each crystal deposit were calculated and correlations were performed by use of Spearman rho, comparisons by paired samples test, and frequencies of deposits were calculated as percentages.

Results: The baseline mean (SD) serum uric acid level was 494 (87) µmol/L. Table 1 shows uric acid deposits to be correlated with kidney function and disease duration. Table 2 includes frequencies with at least moderate US scores (≥2) in the different joint and tendon localisations and shows DC primarily to be found in MTP1, followed by talar and femoral cartilage. Tophi and aggregates were primarily found in MTP1, followed by distal patellar and triceps tendons. There were no major differences between right and left side. In 25 patients (12.5%) DC was seen on femoral or talar cartilage but with no deposits in the MTP1 joint.

Conclusion: Uric acid deposits were associated with reduced kidney function as well as disease duration. When gout is suspected the present study suggests US examinations of MTP1, distal patellar and triceps tendons as well as talar and femoral cartilage to be the most important sites to examine for presence of MSU deposits.

Table

	Disease duration	Uric acid $\mu\text{mol/L}$	Creatinine $\mu\text{mol/L}$	Creatinine $\mu\text{mol/L}$
Sum score DC	0.35**	0.30**	0.26**	-0.27**
Sum score tophi	0.27**	0.13	0.27**	-0.37**
Sum score aggregates	0.16*	0.05	0.22*	-0.36**
Sum score DC, tophi and aggregates	0.29**	0.16*	0.29**	-0.40**

Table 2. Percentages of patients with different forms of ultrasound detected uric acid deposits

	Double contour		Tophus		Aggregates	
	Right	Left	Right	Left	Right	Left
Wrist	1.5	0.5	7.0	8.5	6.0	7.0
MCP 2	2.0	1.0	5.0	2.5	4.0	3.0
Distal femur cartilage	16.9	16.9	NA	NA	NA	NA
Talar cartilage	15.4	16.9	NA	NA	NA	NA
MTP 1	36.0	35.8	44.0	45.5	51.5	50.3
Triceps	NA	NA	15.0	12.5	32.8	31.8
Quadriceps	NA	NA	5.5	8.0	10.1	15.9
Proximal patellar tendon	NA	NA	5.0	7.0	9.5	13.4
Distal patellar tendon	NA	NA	19.5	15.0	42.5	37.3
Achilles	NA	NA	9.5	8.0	12.1	6.0

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SAT0424 PHENOTYPE OF PATIENTS WITH EARLY ONSET GOUT

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Background: Gout is a frequent inflammatory arthritis in men after 45 years old. In this common (CG) form, gout is associated with comorbidities (CMs) including metabolic syndrome, hypertension, type 2 diabetes (T2D), obesity, chronic kidney disease and cardiovascular (CV) diseases. In contrast, very few data are available for early onset gout (EOG), defined as first flare before 30 years old.

Objectives: The aim of this study was to compare gout characteristics and CMs between EOG and CG.

Methods: We retrospectively included all gout patients (pts) with ineffective ULT who were referred to our department between 2014 and 2018, and who had at least one visit between 9 and 15 months after first visit. At baseline, ineffective ULT was defined by a serum urate level (SUL) above target ($> 360 \mu\text{mol/L}$). Demographic characteristics, gout history and CMs, treatments were systematically recorded.

Results: Among 213 pts, 39 (18.3%) had experienced a first gout flare before 30 years old. Pts and gout characteristics are summarized in table 1. Mean age of first flare in EOG was $24.8 (\pm 5.5)$ years. Familial history of gout was more frequent in EOG than in CG (60.6 vs 24.6%). First flare involved the 1st metatarsophalangeal joint in 70% of EOG pts. EOG pts had more severe gout than CG pts: longer disease duration ($p<0.0001$), more flares in the last 12 months ($p<0.0001$), more tophi ($p=0.005$) and higher febuxostat (FBX) dosage ($p=0.02$) to achieve SUL target.

Pts with CG had more CMs than EOG pts: CV diseases, hypertension, T2D, dyslipidemia and kidney transplantation. Non-alcoholic fatty liver disease was more frequent in EOG than CG (61.1 vs 24.1%).

At final visit, 62.8 and 67.9% of EOG and CG patients, respectively, achieved SUL target ($p=0.56$). Proportion of pts taken ULT was similar in both groups as well as proportion of pts treated with allopurinol or FBX.

Table 1. Patient characteristics between early onset and common gout

Variables	Early onset gout (N=39)	Common gout (N=174)	p
Age at inclusion (years), (mean $\pm$ SD)	40.2 (12.2)	62.2 (11.8)	<0.0001
Sex (male)	38 (97.4%)	145 (83.3%)	0.02
BMI (kg/m^2), (mean $\pm$ SD)	29.6 (5.8)	28.9 (4.9)	0.49
Family history (n,%)	20 (60.6%)	30 (24.6%)	<0.0001
Age at first flare (years), mean $\pm$ SD)	24.8 (6.2)	55.4 (12.6)	<0.0001
Disease duration (years) (mean $\pm$ SD)	15.4 (12.6)	6.9 (7.6)	<0.0001
Tophi (n,%)	24 (61.5%)	58 (36.9%)	0.005
Urate arthropathy (n,%)	21 (65.6%)	61 (49.6%)	0.11
Number of flares last 12 months (mean $\pm$ SD)	4.7 (2.9)	3.0 (2.82)	0.009
eGFR (ml/min/1.73), (mean $\pm$ SD)	91.7 (33.4)	63.4 (24.5)	<0.0001
Baseline SUL ($\mu\text{mol/l}$) (mean $\pm$ SD)	495.9 (147.4)	521.1 (109.1)	0.23
CV diseases (n,%)	0	21 (13.2%)	0.02
HT (n,%)	9 (23.7%)	107 (64.8%)	<0.0001
Type 2 diabetes (n,%)	3 (7.9%)	41 (25.3%)	0.02
NAFLD (n,%)	11(61.1%)	14 (24.1%)	0.003
Dyslipidemia (n,%)	13 (33.3%)	70 (45.5%)	0.17
Chronic kidney disease stage 3-5 (n, %)	8 (25.8%)	58 (40.6%)	0.12
Final SUL ($\mu\text{mol/l}$) (mean $\pm$ SD)	360.7 (135.5)	336.6 (109.9)	0.26
SUL at target ($<360 \mu\text{mol/l}$) (n,%)	22 (62.8%)	110 (67.9%)	0.56
ULT final (n,%)	36 (92.3%)	148 (92.5)	0.97

BMI : body mass index; eGFR : estimated glomerular filtration rate; NAFLD : non-alcoholic fatty liver disease; SUL : serum urate level; ULT : urate-lowering therapy

Conclusion: In conclusion, EOG is more severe and EOG pts have less CMs. Moreover, EOG has a higher inheritability trait than CG patients suggesting different pathological mechanisms.

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SAT0425 CLINICAL CHARACTERISTICS AND RISK FACTORS OF ULCERATION OVER TOPHI IN PATIENTS WITH GOUT

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Background: With increasing prevalence of gout world-wide, ulceration associated with tophaceous gout is becoming increasingly common in recent years. Investigation of the clinical characteristics and risk factors will allow us to better understand the fact of ulceration over tophi and improve the management for such challenge problem.

Objectives: To describe clinical characteristics of ulceration over tophi in patients with gout and determine risk factors associated with ulceration.

Methods: Patients presenting with tophi or ulceration(s) over tophi were prospectively recruited and their clinical characteristics were recorded. Comparison of clinical characteristics and risk factors for ulceration were analyzed between groups.

Results: A total of 105 patients were enrolled. 33 patients with ulcerations were older, with prolonged duration with gout and tophi, a higher rate of obesity, greater number of tophi, lower level of GFR, and higher level of serum creatinine, ESR and CRP. The mean duration of ulceration was 1.63 ± 2.32 months. The ulcerations mainly located in ankle (34.21%) and MTP (39.47%), with a mean size of 32.37×22.76 mm. The majority of ulcerations were categorized as stage I (42.4%) and stage II (51.5%). In univariate regression analysis, age, glucocorticoid abuse, gout duration, tophi duration, tophi number and GFR were associated with ulceration. In the multivariable model, significant differences were demonstrated in glucocorticoid abuse, tophi duration, tophi number.

Conclusion: Gout patients with ulceration(s) over tophi present several different aspects of clinical characteristics compared with those without ulceration. Glucocorticoid abuse, prolonged duration with tophi and greater number of tophi are risk factors for ulceration over tophi. Avoiding indiscriminate use of glucocorticoid needs to be emphasized, and prevention of tophi formation via initiate effective urate-lowering therapy is highly recommended in patients with gout.

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SAT0426

TOPHI, THE PREDICTIVE FACTOR OF ARTERIAL STIFFNESS IN PATIENTSWITH GOUT AND HYPERURICEMIA

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Background: Gout is the most common form of inflammatory arthritis and its prevalence is increasing in recent decades. Many studies have reported that gout and hyperuricemia are associated with an increase in

Figure 1. Multiple ulcerations over tophi in one patient

Table 1. Clinical parameters in gout patients with ulceration and without ulceration

*Variable	Total (n= 105)	Ulceration (n = 33)	Non-ulceration (n = 72)	P value
Age, years	54.2 ± 14.9	61.1 ± 16.0	51.1 ± 14.9	0.002
Male, n (%)	102 (97.1%)	32 (97.0%)	70 (97.2%)	0.943
BMI, kg/m ²	24.2 ± 3.6	23.7 ± 3.5	24.4 ± 3.7	0.335
Smoking history, n (%)	45 (42.9%)	17 (51.5%)	28 (38.9%)	0.225
History of alcohol intake, n (%)	33 (31.4%)	11 (15.3%)	22 (30.6%)	0.776
Diet control, n (%)	77 (73.3%)	23 (69.7%)	54 (75.0%)	0.568
Glucocorticoid abuse, n (%)	40 (38.1%)	22 (68.8%)	18 (25.0%)	< 0.001
Gout duration, years	10.9 ± 6.2	12.5 ± 7.9	10.2 ± 5.2	0.208
Tophi duration, years	4.4 ± 3.1	6.6 ± 3.7	3.4 ± 2.1	< 0.001
Tophi number, n	5.2 ± 4.1	7.6 ± 4.9	4.1 ± 3.1	0.003
Hypertension, n (%)	49 (46.7%)	17 (51.5%)	32 (44.4%)	0.500
Diabetes, n (%)	21 (20.0%)	11 (33.3%)	10 (13.9%)	0.021
Cardiovascular disease, n (%)	9 (8.6%)	4 (12.1%)	5 (6.9%)	0.614
Urinary calculus, n (%)	37 (35.2%)	12 (36.4%)	25 (34.7%)	0.870
Serum creatinine, μmol/L	109.1 ± 55.0	122.9 ± 62.1	102.7 ± 50.0	0.003
Serum uric acid, μmol/L	624.0 ± 130.7	650.6 ± 117.6	611.8 ± 135.3	0.159
ESR, mm/h	59.2 ± 39.4	79.9 ± 37.5	49.7 ± 36.7	< 0.001
CRP, mg/L	44.7 ± 47.1	53.8 ± 39.9	40.7 ± 49.8	0.005
GFR, ml/min/1.73 m ²	61.2 ± 30.0	51.1 ± 31.1	65.8 ± 28.6	0.001

n, number.

* refers to number of the patients.

Table 2. Ulceration characteristics in 33 patients with gout including 38 ulcerations

Variable	Results
Ulceration duration, month	1.63 ± 2.32
Ulceration location	
Ankle, n (%)	13 (34.21%)
MTP, n (%)	15 (39.47%)
Knee, n (%)	1 (2.63%)
MCP, n (%)	5 (13.16%)
PIP, n (%)	2 (5.26%)
Hip, n (%)	1 (2.63%)
Elbow, n (%)	1 (2.63%)
Ulceration size, mm	
Length	32.37 ± 16.10
Width	22.76 ± 15.28
Ulceration stage, n (%)	
I	14 (42.4%)
II	17 (51.5%)
III	2 (6.1%)
IV	0

n, number.

all-cause mortality and cardiovascular mortality. Increased arterial stiffness is an independent marker of cardiovascular diseases and risk predictors. Many studies have shown a significant correlation between uric acid levels and arterial stiffness. Augmentation Index (AI) is an indirect measure of arterial stiffness. Tophi is formed when gout is left untreated for a long time.

Objectives: The aim of this study is to determine whether the presence of tophi could predict an increase in arterial stiffness.

Methods: Between June 2017 and June 2018, augmentation index was measured using SphygmoCor for patients who visited Jeju National University Hospital in South Korea with gout or hyperuricemia. Medical records, laboratory and AI data were retrospectively analyzed.

Results: One hundred twenty two patients participated in the study and AI was measured. Most (96.7%) of the patients were male. At the time of the examination, 99 patients (81.1%) were treated with uric acid lowering agent and the mean duration of the disease was 6.9 years. When the patients were divided into two groups according to the presence or absence of Tophi, the average age (60.2 ± 11.6 vs 53.4 ± 13.2 , $p=0.023$) of the patients with Tophi was significantly higher, duration of disease (13.0 ± 6.5 vs 5.4 ± 5.4 , $p=0.000$) was longer and the AI (28.7 ± 7.8 vs 20.7 ± 10.4 , $p=0.001$) was higher. When multiple linear regression analysis was performed to exclude the effects of other variables (DM, HTN, hyperlipidemia, age, BMI, total cholesterol, creatinine), tophi was a predictor of high AI ($b = 5.478$; 95% CI, 0.343-10.613; $p=0.037$). Multiple logistic regression analysis was performed to determine the predictors of tophi. The duration of disease and AI @ 75 values were significantly predictive of the presence of tophi (Odds ratio 1.113; 95% CI, 1.024-1.209; $p=0.012$).

Conclusion: This study suggests that the presence of tophi is an independent predictor of increased arterial stiffness in patients with gout and hyperuricemia.

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