

The prevalence, subtypes and risk factors of hyperuricemia in lupus nephritis patients at chronic kidney disease stages 1-3



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Objectives: There is a high prevalence of HUA in the general population, while it's expected to be higher in lupus nephritis (LN) patients. The aim of this study is to investigate the prevalence, subtypes and risk factors of hyperuricemia (HUA) in LN patients at chronic kidney disease (CKD) stages 1-3.

Methods: From January 2011 to January 2016, a total of 177 LN patients were enrolled into this study. The demographic, clinical and laboratory characteristics of LN patients with and without HUA were collected. Based on fractional excretion of uric acid, HUA were divided into three subtypes. Spearman's correlation coefficient and multivariate logistic regression was used to estimate the correlative and independent risk factors of HUA.

Results: The prevalence of HUA in our cohort was 40.11%. There were more hypertension (56.3% vs 34.9%, $P=0.005$), higher levels of triglycerides (3.1 ± 1.6 vs 2.6 ± 1.7 mmol/l, $P=0.018$) and 24-hour proteinuria [2.7 (0.3, 5.3) vs 1.2 (0.2, 3.1) g $P=0.036$], lower estimated glomerular filtration rate (eGFR) (75.7 ± 25.0 vs 98.7 ± 28.5 mL/min/1.73 m², $P<0.001$) and C3 (48.4 ± 29.3 vs 60.3 ± 27.0 mg/dl, $P=0.006$) in LN patients with HUA than those without HUA. (Table 1, 2)

Serum uric acid (SUA) levels were positively correlated with triglycerides ($r=0.223$, $p=0.003$), 24-hour urinary albumin ($r=0.231$, $p=0.002$) and N-acetyl- β -D-glucosaminidase activity (NAG) activity ($r=0.329$, $p=0.001$), while negatively correlated with eGFR ($r=-0.411$, $p<0.001$), 24h urinary calcium ($r=-0.413$, $p<0.001$) and C3 ($r=-0.252$, $p=0.001$). Independent risk factors of HUA were CKD stages (OR=2.425, 95% CI=1.417-4.148, $p=0.001$) and triglycerides (OR=1.310, 95% CI=1.023-1.678, $p=0.032$). (Figure 1)

Table 1 Characteristics of LN patients with or without HUA

Characteristics	Overall (N=177)	HUA (N=71)	Non-HUA (N=106)	P value
Female (%)	149.0 (84.2)	56.0 (78.9)	93.0 (87.7)	0.117
Age (yr; median[range])	37.5 (26.0,49.0)	37.0 (26.0,49.0)	37.9 (26.0,50.0)	0.521
Course (mo; median[range])	50.6 (2.0,60.0)	53.6 (1.0,48.0)	48.6 (2.0,63.0)	0.690
Hypertension (%)	77.0 (43.5)	40.0 (56.3)	37.0 (34.9)	0.005
Hyperlipidemia (%)	71.0 (40.1)	30.0 (42.3)	41.0 (38.7)	0.635
Diabetes (%)	8.0 (4.5)	1.0 (1.4)	7.0 (6.6)	0.078
ACEI/ARB (%)	75.0 (42.4)	35.0 (49.3)	40.0 (38.1)	0.199
Body Mass Index (Kg/ m ² ; mean \pm SD)	22.9 \pm 3.8	23.4 \pm 3.4	22.6 \pm 4.0	0.071
SLE-DAI (median[range])	10.0 (8.0,13.5)	12.0 (9.0,16.0)	10.0 (6.0,13.0)	0.307
Crescents (%)	69.0 (48.9%)	36.0 (67.9%)	33.0 (37.5%)	0.053
Global sclerosis (%)	88.0 (62.4%)	38.0 (71.7%)	50.0 (56.8%)	0.055
Mesangial proliferation [M-S (%)	49.0 (34.8%)	20.0 (37.7%)	29.0 (33.0%)	0.345
Endothelial proliferation [M-S (%)	47.0 (33.3%)	22.0 (41.5%)	25.0 (28.4%)	0.079
Leukocyte infiltration [M-S (%)	26.0 (18.4%)	13.0 (24.5%)	13.0 (14.8%)	0.180
Tubular interstitial lesions [M-S (%)	103.0 (73.0%)	41.0 (77.4%)	62.0 (70.5%)	0.244
Small vascular lesions (%)	63.0 (44.7%)	25.0 (47.2%)	38.0 (43.2%)	0.387

Table 2 Characteristics of LN patients with or without HUA

Variable	Overall (N=177)	HUA (N=71)	Non-HUA (N=106)	P value
Blood glucose (mmol/l; mean \pm SD)	4.4 \pm 0.9	4.5 \pm 0.7	4.3 \pm 0.90	0.036
Hemoglobin (g/l; mean \pm SD)	110.1 \pm 20.4	106.2 \pm 19.5	112.8 \pm 20.6	0.04
Serum albumin (g/l; mean \pm SD)	25.9 \pm 8.6	24.2 \pm 8.5	27.0 \pm 8.5	0.045
Ser (μmol/l; median[range])	74.0 (60.0,99.0)	93.0 (71.0,125.0)	68.0 (53.8,80.0)	<0.001
SUA (μmol/l; mean \pm SD)	362.0 \pm 114.9	473.9 \pm 80.3	287.1 \pm 60.9	<0.001
Triglycerides (mmol/l; mean \pm SD)	2.8 \pm 1.7	3.1 \pm 1.6	2.6 \pm 1.7	0.006
Calcium (mmol/l; mean \pm SD)	2.0 \pm 0.2	2.0 \pm 0.2	2.1 \pm 0.2	0.032
Phosphorus (mmol/l; mean \pm SD)	1.3 \pm 0.3	1.4 \pm 0.3	1.3 \pm 0.3	0.003
PTH(pg/ml; median[range])	32.9 (21.2,53.8)	39.6 (23.4,77.1)	30.4 (19.8,46.5)	0.003
Anti-dsDNA(IU/ml; median[range])	310.5 (84.2,838.3)	426.3 (102.5,737.6)	273.0 (58.9,578.8)	<0.001
C3(mg/dl; mean \pm SD)	55.5 \pm 28.4	48.4 \pm 29.3	60.3 \pm 27.0	<0.001
Urine sediment [(RBC>3/HP)%]	98.0 (55.4)	48.0 (67.6)	50.0 (47.2)	0.007
24h urinary albumin (mg; median[range])	1522.0 (305.5,4417.5)	2676.0 (306.0,5341.0)	1233.0 (225.3,3099.5)	0.023
24h urinary α 1- microglobulin (mg/24h; median[range])	26.5 (12.4,55.4)	33.5 (16.3,70.9)	20.6 (11.7,41.3)	0.035
24h urinary calcium (mmol/24h; median[range])	1.0 (0.5,2.3)	0.6 (0.4, 1.0)	1.5 (0.8, 2.9)	<0.001
NAG activity (U/L; median[range])	15.1 (6.8,26.2)	21.4 (9.8,38.0)	13.2 (5.5,20.8)	<0.001
Urinary volume (mean \pm SD)	1.3 \pm 0.5	1.2 \pm 0.5	1.4 \pm 0.5	0.009
eGFR(mL/min/1.73 m ² ; mean \pm SD)	85.5 \pm 30.8	75.7 \pm 25.0	98.7 \pm 28.5	<0.001

Figure 1 Correlations of SUA with eGFR, 24h urinary calcium, C3, triglycerides, 24-hour urinary albumin and NAG activity

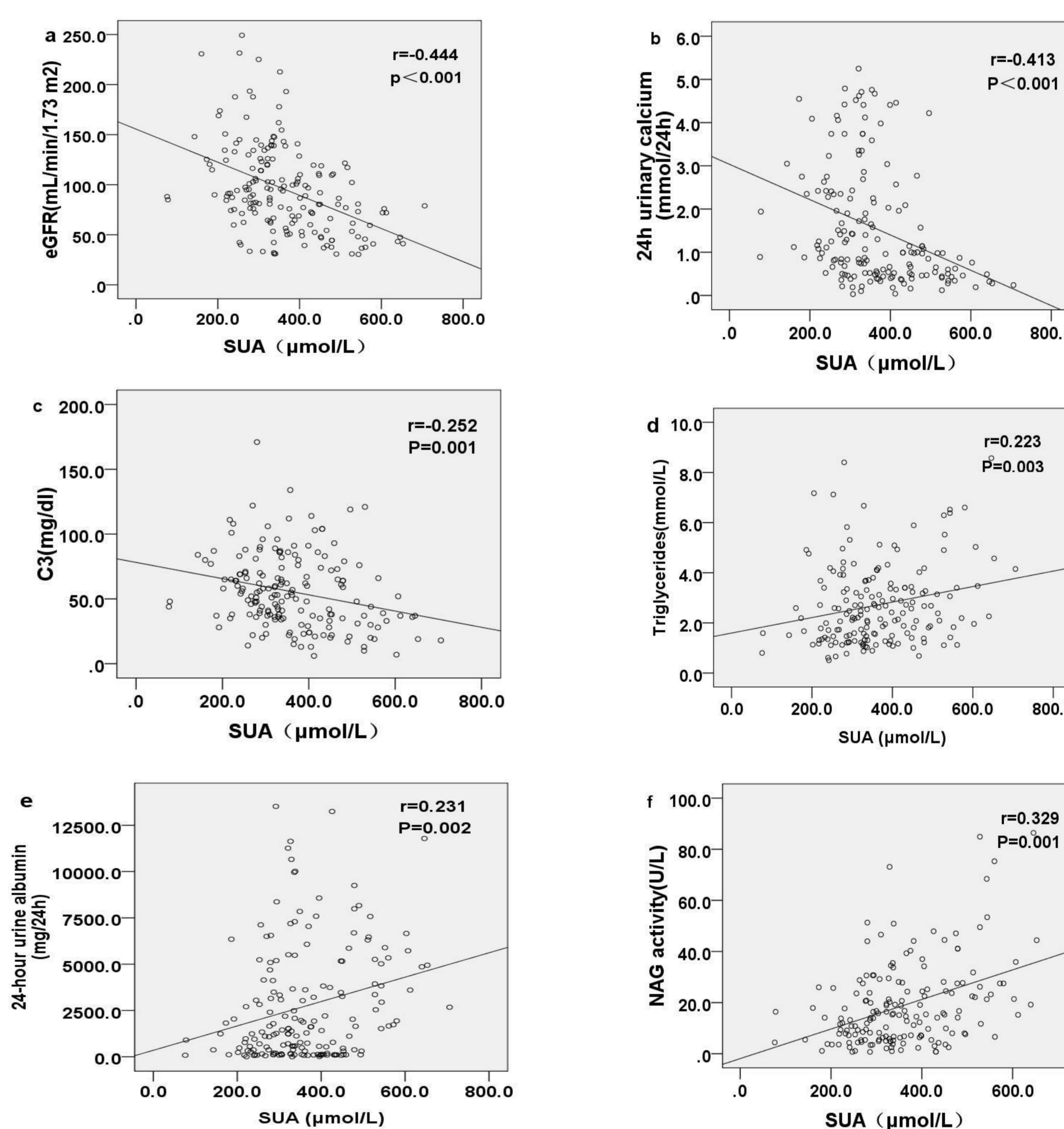
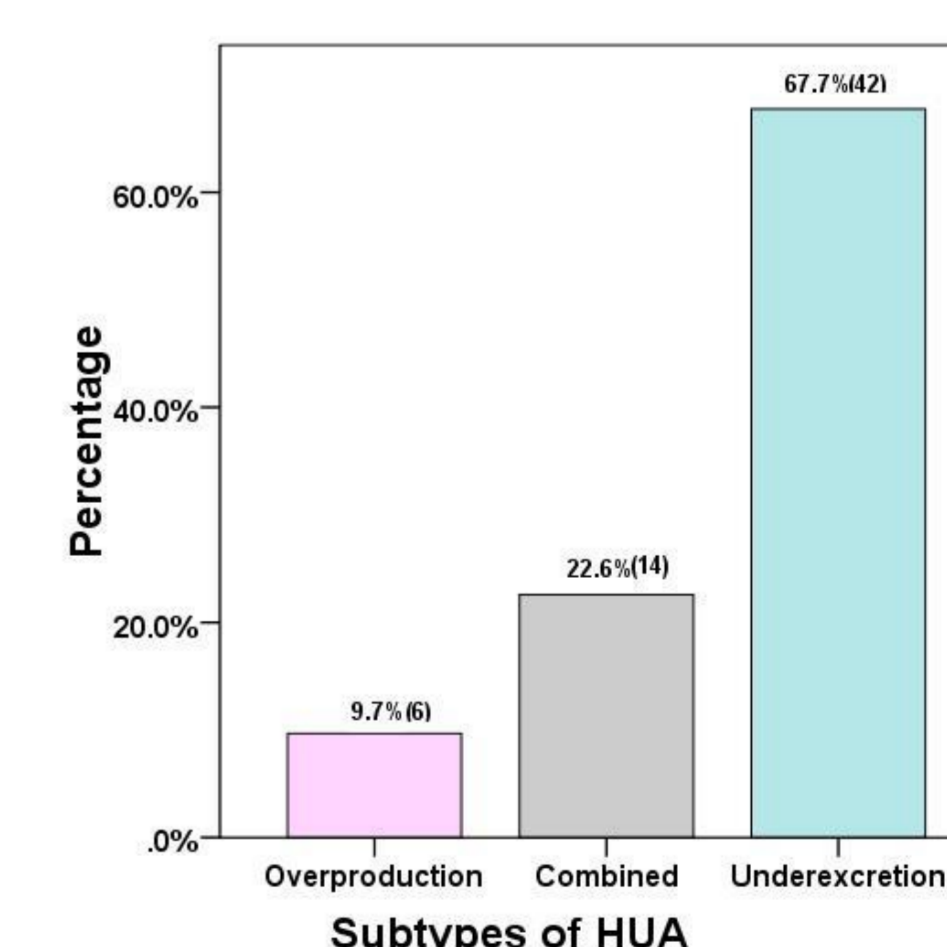


Figure 2 The subtypes of HUA in patients with LN at CKD stages 1-3

The underexcretion, overproduction and combined subtype of HUA were 67.7 %, 22.6% and 9.7%, respectively ($p<0.001$). (Figure 2)



Conclusion: There was a high prevalence of HUA and underexcretion of uric acid was the dominant subtype in LN patients at CKD stages 1-3. The occurrence of HUA in LN may be related to renal insufficiency, SLE disease activity and metabolic disorder.

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