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Metabolic Dysfunction-Associated Steatotic Liver Disease and the Risk of Urolithiasis: A Nationwide-Based Study

Youngmin Yoon¹, Soon Hyoung Kang², Byung Chul Shin¹, Hyun Lee Kim¹¹Department of Internal Medicine-Nephrology, Chosun University Hospital, Korea, Republic of²Department of Internal Medicine-Nephrology, Hanmaum medical center, Korea, Republic of

Objectives : This study aimed to investigate whether metabolic dysfunction-associated steatotic liver disease (MASLD) is associated with an increased risk of urolithiasis compared with individuals without steatotic liver disease (SLD) and those with cardiometabolic risk factors (CMRFs) alone.

Methods : We conducted a retrospective cohort study of 242,022 participants from the Korean National Health Insurance Service–National Health Screening Cohort. Participants were categorized into three groups: no SLD without CMRFs, no SLD with at least one CMRF, and MASLD. Urolithiasis incidence was identified using ICD-10 codes. Cox proportional hazards regression models were used to estimate hazard ratios (HRs) for urolithiasis, adjusting for demographic, metabolic, and lifestyle factors.

Results : During a median follow-up of 8.7 years, 8,907 participants (3.7%) developed urolithiasis. After multivariate adjustment, urolithiasis incidence was highest in the MASLD group (adjusted HR [aHR]. 1.45; 95% confidence interval [CI], 1.33–1.57; $P < 0.001$), followed by the no SLD with CMRFs group (aHR. 1.25; 95% CI, 1.15–1.36; $P < 0.001$), compared with the no SLD without CMRFs group. In addition, the number of CMRFs was a significant predictor of urolithiasis risk, with a stepwise increase in incidence observed with higher CMRF counts.

Conclusions : MASLD significantly increases the risk of urolithiasis, independent of CMRFs. Furthermore, the risk of urolithiasis rises progressively with the number of CMRFs. Our findings support the recognition of MASLD as a systemic metabolic condition with renal implications, highlighting the need for integrated management strategies that address both hepatic and metabolic health to prevent stone formation.

Figure 1.png

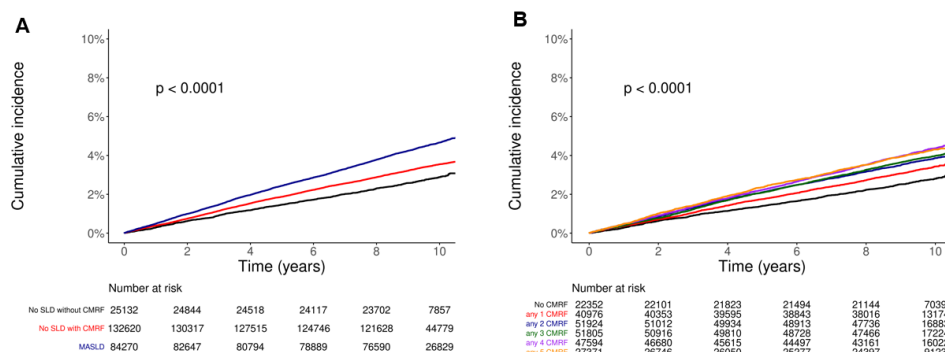




Figure 1.png

Table 1. Association between SLD and urolithiasis

Group	Number	Events	Follow-up duration (person-years)	Incidence rate (per 1000 person-years)	Crude HR (95% CIs, P-value)	Adjusted HR (95% CIs, P-value)
No SLD without CMRF	25132	692	236974	2.92	1 (Reference)	1 (Reference)
No SLD with CMRF	132620	4470	1237656	3.61	1.24 (1.14–1.34, p<0.001)	1.25 (1.15–1.36, p<0.001)
MASLD	84270	3745	780828	4.80	1.64 (1.51–1.78, p<0.001)	1.45 (1.33–1.57, p<0.001)
Male	123540					
No SLD without CMRF	12183	386	112721	3.42	1 (Reference)	1 (Reference)
No SLD with CMRF	55836	2317	505710	4.58	1.34 (1.20–1.49, p<0.001)	1.30 (1.16–1.45, p<0.001)
MASLD	55521	2781	506998	5.49	1.60 (1.44–1.78, p<0.001)	1.49 (1.34–1.66, p<0.001)
					P for interaction	0.232
Female	118482					
No SLD without CMRF	12949	306	124253	2.46	1 (Reference)	1 (Reference)
No SLD with CMRF	76784	2153	731946	2.94	1.20 (1.06–1.35, p=0.003)	1.22 (1.08–1.37, p=0.002)
MASLD	28749	964	273830	3.52	1.43 (1.26–1.63, p<0.001)	1.45 (1.27–1.66, p<0.001)
					P for interaction	0.352
Age ≥ 65	65584					
No SLD without CMRF	3737	105	33720	3.11	1 (Reference)	1 (Reference)
No SLD with CMRF	38323	1140	344148	3.31	1.06 (0.87–1.30, p=0.542)	1.05 (0.86–1.28, p=0.638)
MASLD	23524	858	212991	4.03	1.29 (1.06–1.59, p=0.013)	1.15 (0.94–1.41, p=0.181)
					P for interaction	0.136
Age < 65 years	176438					
No SLD without CMRF	21395	587	203254	2.89	1 (Reference)	1 (Reference)
No SLD with CMRF	94297	3330	893508	3.73	1.29 (1.18–1.41, p<0.001)	1.24 (1.14–1.36, p<0.001)
MASLD	60746	2887	567837	5.08	1.76 (1.61–1.92, p<0.001)	1.50 (1.37–1.64, p<0.001)
					P for interaction	0.029

*The model was adjusted for age, sex, income level, residence area, hyperparathyroidism, gout, inflammatory bowel disease, Charlson comorbidity index, hemoglobin level, glomerular filtration rate, smoking, and regular exercise status. SLD, steatotic liver disease; CMRF, cardiometabolic risk factor; MASLD, metabolic dysfunction-associated steatotic liver disease; HR, hazard ratio; CI, confidence interval.