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Predictive Factors for Kidney Stone Recurrence in Type 2 Diabetes Mellitus

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Introduction

The presence and severity of type 2 diabetes mellitus (DM) are associated with kidney stone disease. However, the factors related to stone recurrence in DM patients has not been established. This study determined the predictive factors for stone recurrence in DM patients.

Methods

- A cross-sectional analysis of stone recurrence was conducted from January 2013 to August 2019 by using our database of DM patients diagnosed with stone disease from 2002 to 2012.
- DM defines as FPG ≥ 126 mg/dl or HbA1c ≥ 6.5% or presence of DM in medical record.

Results

There were 1,617 type 2 DM patients with kidney stone disease, 373 (23%) had a stone recurrence. Of these patients, 40% had asymptomatic stones, 43% visited emergency department, and 45% required a surgical intervention. Median time to recurrence was 64 months.

We found that higher HbA1c, calcium oxalate and uric acid stone composition are risk factors for stone recurrence, whereas older age, insulin therapy, and higher urine pH are protective factors (Table 2).

Results

Table 1. Baseline characteristics by recurrent stone status

	Recurrent (n=373)	Non-recurrent (n=1244)	*P*-value
Age (y), median (Q1,Q3)	70 (63,78.5)	74 (66,82)	**<.001**
Gender (male)	240 (64.3)	774 (59.8)	.130
BMI (kg/m^2), median (Q1,Q3)	32.5 (28.5,38.3)	31.9 (28.3,36.6)	.071
Previous GFR (ml/min/1.73m^2), median (Q1,Q3)	102.8 (71.9,140.9)	93.0 (57.0,128.4)	**<.001**
Current GFR (ml/min/1.73m^2), median (Q1,Q3)	78.7 (51.0,114.7)	68.4 (48.0,140.1)	**.001**
CKD stages, n (%)			
Stage 1	146 (39.1)	419 (33.8)	.066
Stage 2	108 (29.0)	299 (24.1)	.069
Stage 3	93 (24.9)	386 (31.1)	**.026**
Stage 4	20 (5.4)	92 (7.4)	.210
Stage 5	6 (1.6)	44 (3.5)	.085
Insulin therapy, n (%)	49 (13.1)	258 (20.7)	**.001**
HbA1c (%), median (Q1,Q3)	7.1 (6.3,7.9)	6.8(6.2,7.7)	**.014**
Urine pH, mean±SD	5.7±0.7	5.8±0.8	**.001**
Stone composition, n (%)	(n=110)	(n=218)	
Calcium oxalate	80 (72.7)	162 (74.3)	.861
Uric acid	22 (20.0)	36 (16.5)	.530
Calcium phosphate	7 (6.4)	15 (6.9)	>.999
Struvite	1 (0.9)	5 (2.3)	.668
Follow-up period (y), median (Q1,Q3)	9 (7,11)	10 (8,12)	**<.001**

P-values are derived from Mann-Whitney *U* test or T-test for continuous variables, and Chi-square test or Fisher's exact test for categorical variables.

Table 2. Multivariable logistic regression models predicting stone recurrence in DM patients

	OR	95% CI	*P*-value
Age	0.973	0.961-0.985	**<.001**
Gender (male)	0.815	0.633-1.048	.111
BMI	1.012	0.994-1.030	.198
Current GFR	0.997	0.993-1.000	.064
Insulin therapy	0.564	0.399-0.798	**.001**
HbA1c	1.093	1.007-1.186	**.033**
Urine pH	0.799	0.674-0.947	**.010**
Stone composition			
Calcium oxalate	1.775	1.303-2.418	**<.001**
Uric acid	2.312	1.316-4.063	**.004**
Calcium phosphate	1.891	0.742-4.818	.182
Struvite	0.725	0.083-6.364	.771

OR (odds ratios) and 95%CI (confidence interval) for a 1-unit change in this factor. *P*-values are derived from binary logistic regression.

Conclusion

The stone composition and insulin therapy are strong predictors for stone recurrence in DM patients, while HbA1c and urine pH are modifiable factors. Thus, good glycemic control and urine alkalinization should be considered for recurrent stone prevention.