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The predictability of foamy urine to proteinuria; and its long-term observation

Woojin Jang, Jung Sun Oh, Dong Kyun Yoo, Hae Won Kim, Beom Kim, **Woojin Jang**
Department of Internal Medicine-Nephrology, Seoul Veterans Hospital, Korea, Republic of

Objectives: Foamy urine is well known as a representative sign of kidney disease. But the study about foamy urine and proteinuria is little and there was no longitudinal observation study about foamy urine. So we planned to inspect the foamy urine objectively and to observe the foamy urine to progress to proteinuria over time.

Methods: We checked the kidney function and urine tests every 3 months until 1 year. The grade of foamy urine was positive if the foam on the surface of the toilet bowl was more than 50% or negative if it was not. The proteinuria was defined when spot urine albumin-to-creatinine (UACR) was more than 30 mg/g and the subjects were classified as a non-proteinuria group or a proteinuria group. We compared the clinical, laboratory, and urinary tests between both groups at baseline. It was also compared that the change of proteinuria every 3 months until 1 year between two groups.

Results: Among the 96 subjects with foamy urine who came to nephrology clinic at Veterans Healthcare Service Medical Center, 79 (80.6%) were positive in foamy urine and 17 (17.4%) were negative in foamy urine and 23 (24%) were positive in proteinuria and 73 (76%) were negative in proteinuria. The sensitivity, specificity, positive and negative predictive values of foamy urine to proteinuria were 100%, 21.4%, 29.5%, and 100% respectively. There was no significant difference in kidney function, comorbidities, urine analysis, and 24-hour urine test. In non-proteinuria group, there was no significant increase in proteinuria over time. The change level of proteinuria had no significant difference ($P=0.365$) between non-proteinuria group and proteinuria group.

Conclusions: Our study evaluated the relation between foamy urine and proteinuria overtime for the first time. The finding showed that the foamy urine did not progress to proteinuria over 1 year.

Table 1. Baseline and urinary characteristics between non-proteinuria group and proteinuria group in subjects with proven foamy urine



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	Total (N=80)	Non-Proteinuria (N=55)	Proteinuria (N=25)	<i>P</i>
Age, years	69.5 ± 6.2	69.7 ± 5.0	69.0 ± 8.5	0.555
Male, N (%)	77 (98.7)	55 (100)	22 (95.7)	0.295
BMI, Kg/m ²	24.2 ± 2.8	23.4 ± 2.7	25.7 ± 2.2	0.001
SBP, mmHg	129.9 ± 13.5	129.7 ± 13.7	130.3 ± 13.3	0.578
DBP, mmHg	73.6 ± 8.2	74.0 ± 8.8	72.5 ± 6.6	0.776
Comorbidities				
BPH, N (%)	17 (21.8)	12 (21.8)	5 (21.7)	0.395
DM, N (%)	30 (38.5)	19 (34.5)	11 (47.8)	0.313
Hypertension, N (%)	58 (74.4)	38 (69.1)	20 (87.0)	0.155
BUN, mg/dL	16.1 ± 3.7	15.9 ± 3.6	16.4 ± 3.8	0.726
Creatinine, mg/dL	0.99 ± 0.20	1.00 ± 0.18	0.98 ± 0.24	0.576
eGFR, ml/min/1.73m ²	77.7 ± 13.0	77.2 ± 12.0	78.8 ± 15.5	0.755
HbA1C, %	6.2 ± 1.2	6.1 ± 1.2	6.3 ± 1.4	0.941
Dipstick proteinuria				0.002
None	64 (82.1)	51 (92.7)	14 (56.0)	
Trace	6 (7.7)	3 (5.5)	3 (12.0)	
≥ +	8 (10.3)	1 (1.8)	8 (33.3)	
Urine Specific Gravity	1.02 ± 0.02	1.02 ± 0.03	1.02 ± 0.01	0.768
Urine bilirubin	0.01 ± 0.11	0.00 ± 0.00	0.04 ± 0.21	0.122
Urine urobilinogen	0.31 ± 0.28	0.32 ± 0.29	0.30 ± 0.28	0.863
Spot Urine P/C ratio (g/g)	0.18 ± 0.61	0.07 ± 0.07	0.48 ± 1.09	0.000
Spot Urine ACR (mg/g)	200 ± 1073	8 ± 9	661 ± 1928	0.000
24-hour Urine Test				
Urinary sodium, mEq/day	171.0 ± 73.8	164.0 ± 69.5	187.7 ± 82.3	0.230
Urinary potassium, mEq/day	64.3 ± 24.6	63.1 ± 26.4	67.2 ± 19.7	0.414
Urinary calcium, mg/day	168.2 ± 99.9	166.2 ± 98.7	173.0 ± 104.9	0.763
Urinary phosphorus, g/day	0.712 ± 0.299	0.685 ± 0.314	0.777 ± 0.253	0.225
Urinary albumin, mg/day	116.3 ± 474.6	24.8 ± 63.9	235.2 ± 708.3	0.000
Urinary protein, mg/day	153.7 ± 510.2	62.5 ± 65.6	371.9 ± 910.9	0.000
Urinary creatinine, g/day	2.21 ± 8.64	2.6 ± 10.4	1.3 ± 0.3	0.502
Urinary uric acid, mg/day	462.0 ± 198.8	469.5 ± 175.8	482.7 ± 248.3	0.763
Urinary volume, ml/day	1817 ± 628	1836 ± 668	1772 ± 535	0.668
DPI, g/Kg/day	1.02 ± 0.42	0.983 ± 0.462	1.124 ± 0.300	0.378

Table 2. Difference in Urine Albumin-to-Cr ratio in non-proteinuria group over time

	Spot Urine ACR (mg/g)	<i>P</i>
0-3 Months	-7.5 ± 18.8	0.228
0-6 Months	-10.6 ± 23.7	0.058
0-9 Months	-17.2 ± 48.9	0.018
0-12 Months	-19.4 ± 53.4	0.054