

## INFLUENCE OF AMOUNT OF URINARY CALCIUM EXCRETION IN ADULTS ON URINARY SYMPTOMS INCLUDING NOCTURIA

### Hypothesis / aims of study

In pediatric urology, an excess excretion of urinary calcium (Ca) has been demonstrated to result in nocturia or decreased functional bladder capacity, and may be a cause of enuresis [1]. Additionally, adults with hypertension, which is a typical lifestyle-related disease and can be the cause of nocturia, are also known to have increased urinary Ca excretion. It has been reported that excess urinary Ca excretion causes a decrease in nocturnal antidiuretic hormone secretion as well as aquaporin-2 production in the renal collecting tubule, and thereby affects its urine concentrating ability [2]. Thus, excess urinary Ca excretion may have an effect on urinary symptoms including nocturia; however, no clinical studies have investigated the relationship between the amount of urinary Ca excretion and urinary symptoms, particularly in adults. We therefore conducted a study to clarify the relationship between various urinary symptoms including nocturia and the amount of urinary Ca excretion.

### Study design, materials and methods

We included patients aged 18 years or older who received treatment for the chief complaint of urinary symptoms, in a cross-sectional study to investigate the relationship between the amount of urinary Ca excretion and urinary symptoms.

The spot urine samples were collected, and the patients were divided into a group with normal urinary Ca excretion (normal group: N group) and a group with high urinary Ca excretion (hypercalciuria group: H group). The amount of urinary Ca excretion was corrected for urinary creatinine (Crea), and urinary Ca/Crea of 0.21 or more was defined as hypercalciuria.

The urinary symptoms were assessed with a frequency volume chart and the Core Lower Urinary Tract Symptom Score (CLSS), and the two groups were compared.

### Results

Data were analyzed for 317 patients (109 men), with a mean age of  $65.4 \pm 13.8$  years. The N group and H group comprised 208 (82 men) and 109 (27 men), respectively. The H group showed a significantly higher daytime frequency ( $7.2 \pm 2.3$  in the N group and  $8.0 \pm 2.5$  in the H group;  $P = 0.006$ ) and nighttime frequency ( $1.4 \pm 1.2$  in the N group and  $2.6 \pm 1.4$  in the H group;  $P < 0.001$ ) than the N group did. The mean single voided volume was lower in the H group than in the N group ( $304.8 \pm 65.4$  mL in the N group and  $218.7 \pm 62.5$  mL in the H group;  $P < 0.001$ ). The H group had a significantly greater nocturnal urine volume ( $412.8 \pm 206.2$  mL in the N group and  $640 \pm 242.1$  mL in the H group;  $P < 0.001$ ) and higher nocturnal polyuria index ( $19.7 \pm 7.0\%$  in the N group and  $27.6 \pm 7.7\%$  in the H group;  $P < 0.001$ ) than the N group did. The H group had higher CLSS scores than the N group did for parameters such as Q1 (daytime frequency), Q2 (nocturia), and Q3 (urgency) (Q1,  $P = 0.003$ ; Q2,  $P < 0.001$ ; Q3,  $P = 0.045$ ), with a worse quality of life (QOL) ( $P < 0.001$ ).

In addition, the urinary Ca/Crea was positively correlated with both nighttime frequency ( $r = 0.407$ ,  $P < 0.001$ ) and the nocturnal polyuria index ( $r = 0.488$ ,  $P < 0.001$ ).

Furthermore, the results of both univariate and multivariate analysis revealed that hypercalciuria was an independent risk factor for urination two or more times per night (odds ratio, 3.303; 95% confidence interval, 1.81–6.17;  $P < 0.001$ ).

Comparison of Core Lower Urinary Tract Symptom Score between the two groups

	N group	H group	P value
Q1. Daytime frequency	$0.7 \pm 0.8$	$1.0 \pm 0.9$	0.003
Q2. Nocturia	$1.3 \pm 0.9$	$2.0 \pm 0.9$	$< 0.001$
Q3. Urgency	$0.9 \pm 1.0$	$1.2 \pm 1.1$	0.045
Q4. Urge incontinence	$0.8 \pm 1.0$	$0.8 \pm 0.9$	0.678
Q5. Stress incontinence	$0.8 \pm 1.0$	$0.6 \pm 0.9$	0.099
Q6. Slow stream	$1.4 \pm 1.2$	$1.5 \pm 1.1$	0.821
Q7. Straining	$1.0 \pm 1.1$	$1.2 \pm 1.2$	0.146
Q8. Incomplete emptying	$0.9 \pm 1.1$	$1.1 \pm 1.1$	0.395
Q9. Bladder pain	$0.3 \pm 0.7$	$0.3 \pm 0.7$	0.824
Q10. Urethral pain	$0.2 \pm 0.6$	$0.3 \pm 0.6$	0.403
QOL index	$3.2 \pm 1.5$	$4.6 \pm 1.4$	$< 0.001$

## Nocturia and urinary symptom-related factors

	Univariate analysis			Multivariate analysis		
	OR	95% CI	P value	OR	95% CI	P value
Urinary Ca/ Crea: H group	5.50	3.20 – 9.46	< 0.001	3.30	1.81 – 6.17	< 0.001
Age	0.99	0.97 – 1.01	0.404	–	–	–
Gender: Male	1.01	0.63 – 1.61	0.968	–	–	–
Body Mass Index	1.04	0.97 – 1.10	0.278	–	–	–
Renal dysfunction: Presence	1.05	0.60 – 1.86	0.886	–	–	–
Hypertension: Presence	1.63	1.03 – 2.58	0.039	1.67	0.93 – 3.03	0.085
Diabetes mellitus: Presence	0.85	0.43 – 1.69	0.726	–	–	–
Hyperlipidemia: Presence	1.24	0.64 – 2.41	0.618	–	–	–

OR = odds ratio, CI = confidential interval

### Interpretation of results

Our study had limitations. The subjects were only those with urinary symptoms and the study was cross-sectional. However, even though the study population already had urinary symptoms, the amount of urinary Ca excretion was found to be associated with nocturia, nocturnal urine volume, and the nocturnal polyuria index. In addition, hypercalciuria itself was an independent risk factor for frequent nocturnal urination. These results seem to suggest that the control of hypercalciuria itself, through drug therapy or lifestyle modification, could lead to improvement in urinary symptoms.

### Concluding message

The study results suggest that hypercalciuria could affect the QOL.

### References

1. J Urol, 170:1670-1673, 2003
2. J Am Soc Nephrol 11:1173-1881, 2000

### Disclosures

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