

Original article

Quantification of the risk of urinary calcium stone formation in the urine collected at 2 times of the day in a group of children studied to rule out prelitiasis[☆]

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ABSTRACT

Background: Various genetic and environmental factors are involved in urolithiasis. The 2 most common metabolic abnormalities are the increase in urinary calcium and low urinary citrate excretion. The ratio calculated between the concentrations of both substances is a good risk marker for the formation of calcium stones.

Objectives: To determine whether the risk of urinary calcium stone formation changes throughout the day in the same patient.

Methods: We studied 56 children (23 V, 33 M) to check if they had prelitiasis. Calcium, citrate, and creatinine concentrations were determined in two urine samples collected one before dinner and the other in the morning. It was collected if they had ultrasound stones and if there was a history of urolithiasis in first and/or second degree relatives.

Results: In 25 patients (44.6%), renal ultrasound was positive for lithiasis (stones [$n=9$] and microlithiasis [$n=16$]). Forty of the 56 families (71.4%) had a history of urolithiasis. The percentage of abnormal urinary calcium (28.6%) concentrations and an abnormal calcium/citrate ratio (69.6%) was higher in the first urine of the day. The calcium/citrate ratio was the only studied parameter that was related to a family history of urolithiasis. There were no differences in urinary parameters between patients with and without ultrasound-confirmed kidney stones.

Conclusions: Urinary concentrations of calcium and the calcium/citrate ratio vary throughout the day. Urine produced at night has a higher risk of urinary calcium stone formation.

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Cuantificación del riesgo de formación de cálculos cálcicos en la orina correspondiente a 2 momentos del día en un grupo de niños estudiados para descartar prelitiasis

RESUMEN

Palabras clave:

Urolitiasis
Calcio
Citrato
Riesgo litógeno

Antecedentes: En la urolitiasis intervienen diversos factores genéticos y ambientales. Las 2 anomalías metabólicas más frecuentes son el incremento en la eliminación urinaria de calcio y la reducción en la de citrato. El cociente calculado entre las concentraciones de ambas sustancias es un buen marcador de riesgo de formación de cálculos cálcicos.

Objetivos: Determinar si el riesgo litógeno en la orina de un mismo paciente cambia a lo largo del día.

Métodos: Se estudiaron 56 niños (23 V, 33 M) para comprobar si eran portadores de prelitiasis. Se determinaron las concentraciones de calcio, citrato y creatinina en 2 muestras de orina recogidas, una, antes de cenar, y la otra, por la mañana, al levantarse. Se anotó si tenían cálculos ecográficos y si existían antecedentes de urolitiasis en los familiares de primer y/o segundo grado.

Resultados: En 25 pacientes (44,6%) la ecografía renal fue positiva para litiasis (cálculos [n=9] y microcálculos [n=16]). En 40 de las 56 familias (71,4%) existían antecedentes de urolitiasis. El porcentaje mayor de valores anormales de la concentración urinaria de calcio (28,6%) y del cociente calcio/citrato (69,6%) correspondió a la primera orina del día. Este último parámetro fue el único entre los estudiados que se relacionó con los antecedentes familiares de urolitiasis. No se comprobaron diferencias en los parámetros urinarios al comparar a los pacientes con presencia o ausencia de litiasis renal ecográfica.

Conclusiones: Las concentraciones urinarias de calcio y del cociente calcio/citrato se modifican a lo largo del día. Las orinas formadas durante la noche son más litógenas.

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Introduction

In 1939, Randall described that kidney stones present symptoms after a period of stone growth, so there is a period of variable duration that he called "symptomatic silence".¹ This period of time without symptoms is proper, although not exclusive, of the pediatric age and is known as prelitiasis period.²⁻⁴ Children on prelitiasis may show various symptoms such as macro or microscopic hematuria, urinary infection, incontinence and other voiding disorders, dysuria, emission of turbid urine or repetitive abdominal pain.^{3,4}

For years it has been known that the urine contains substances that favor or inhibit stone formation. The two metabolic abnormalities more frequently detected, both in the prelitiasis and lithiasic period are the increase in urinary calcium excretion and the reduction of citrate. Since 1964, it has been known that a urine calcium/citrate ratio greater than 0.33 mg/mg is a risk marker for calcium containing stones formation.⁵ This data has been subsequently confirmed in several articles.⁶⁻⁸

For the first time in the pediatric literature, we wanted to study if a group of children were on a situation of prelitiasis by analyzing changes in urine composition when collected at two different periods of the day.

Patients and methods

Transversal study in 56 children (23 M, 33 F) who were evaluated to determine if they were in a situation of prelitiasis. The patients attended at the Pediatric Nephrology outpatient clinic of the University Hospital of Nuestra Señora de Candelaria between January and November 2015. Average age was 10.1 ± 3.5 years (range: 3.5–18 years). None of them received medication. The clinical characteristics by which they were studied are shown in Table 1.

Data collection

Calcium, citrate and creatinine concentrations were determined in two urine samples, one collected before dinner, and the second one in the morning (first urine of the day). The presence of calculi or micro calculi detected by ultrasound was noted as well as the evidence of family history of urolithiasis in their first or second degree relatives.

Urinary tests and renal ultrasound

The urine collected at night was stored in a refrigerator. Both urine samples were homogenized, acidified and tempered to dissolve the presumably formed crystals. Creatinine was

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