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RESEARCH ARTICLE

Risk factors evaluation for urolithiasis among children☆

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KEYWORDS
Hypocitraturia;
Hypomagnesuria;
Hypercalciuria;
Pediatric urolithiasis;
Systemic metabolic acidosis;
Urolithiasis risk factors

Abstract
Background: The prevalence of pediatric urolithiasis varies from 0.01–0.03%. Urolithiasis may be caused by anatomical, metabolic and environmental factors. Recurrence varies between 16 to 67%, and it is frequently associated with metabolic abnormalities. The objective of the present work was the identification of risk factors that promote urolithiasis in a child population.
Methods: This study included 162 children with urolithiasis and normal renal function (mean age 7.5 years). Risk factors were investigated in two stages. In the first stage, 24-hour urine, and blood samples were analyzed to assess metabolic parameters and urinary tract infection. During the second stage, the effect of calcium restriction and a calcium load on renal Ca excretion were evaluated. Data were statistically analyzed.
Results: Urolithiasis was observed in 0.02% of children, 50% of them with family history of urinary stones. There were multiple risk factors for urolithiasis including hypocitraturia (70%), hypomagnesuria (42%), hypercalciuria (37%; in 11/102 was by intestinal hyperabsorption, in 13/102 was unclassified. Ca resorption or renal Ca leak were not detected). We also detected alkaline urine (21%), systemic metabolic acidosis (20%), urinary infections (16%), nephrocalcinosis with urolithiasis (11%), oliguria (8%), urinary tract anomalies, hyperuricosemia and hypermagnesemia (7% each one), hypercalcemia (6%), hyperoxaluria (2%) and hypercystinuria (0.61%).

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Conclusions: Hypocitraturia and hypomagnesuria were the most frequent risk factors associated with urolithiasis, followed by hypercalciuria. High PTH values were excluded. Children presented two or more risk factors for urolithiasis.

PALABRAS CLAVE
Hipocitraturia;
Hipomagnesuria;
Hipercalciuria;
Urolitiasis pediátrica;
Acidosis metabólica sistémica;
Factores de riesgo para urolitiasis

Evaluación de factores de riesgo para urolitiasis en niños

Resumen
Introducción: La prevalencia de urolitiasis pediátrica varía de 0.01–0.03%. Las causas de urolitiasis pueden ser anatómicas, metabólicas o ambientales. Las recurrencias varían entre 16 a 67%, y están frecuentemente asociadas con alteraciones metabólicas. El objetivo del presente trabajo fue la identificación de factores de riesgo que promueven la urolitiasis en una población infantil.
Métodos: Se incluyeron 162 niños con urolitiasis y función renal normal, cuya edad media fue de 7.5 años. Los factores de riesgo fueron investigados en dos etapas. En la primera, con la muestras de orina de 24 h y sangre, se investigaron parámetros metabólicos e infecciones del tracto urinario. En una segunda etapa se valoró la calciuria, previa restricción seguida de carga de Ca. Los hallazgos fueron analizados estadísticamente.
Resultados: Se presentó urolitiasis en el 0.02% de los niños con historia familiar en el 50%. Se observó hipocitraturia (70%); hipomagnesuria (42%); hipercalciuria (37%; en 11/102 fue por hiperabsorción intestinal; en 13/102 fue inclasificable; no se observó hipercalciuria por resorción o pérdida renal). También se observó orina alcalina (21%); acidosis metabólica sistémica (20%); infecciones urinarias (16%); nefrocalcinosis con urolitiasis (11%); oliguria (8%); anomalías urinarias congénitas, hiperuricosemia e hipermagnesemia (7% cada una); hipercalcemia (6%); hiperoxaluria (2%); e hipercistinuria (0.61%).
Conclusiones: La hipocitraturia e hipomagnesemia fueron los factores de riesgo con mayor frecuencia, seguidos de hipercalciuria. Se excluyeron los valores de hiperparatiroidismo. Los niños exhibieron dos o más factores de riesgo para el desarrollo de urolitiasis.

1. Introduction

Pediatric urinary stone disease occurs infrequently in developed countries. The incidence of hospital admission due to urinary stones varies from 0.01–0.03%.[1,2] However, in the United States, there has been an increase from 18.4 cases per 100,000 hospital admissions in 1999 to 57 cases per 100,000 in 2008, with an adjusted annual increase of 10.6% ($p > 0.001$). Thus, the incidence of urinary tract stone disease has increased significantly among adolescents since 1996 during a 25-year period.[3,4] Recurrence varies from 16 to 67% and is more frequently present in children with metabolic disorders.[5] The site of localization of the stone varies: 66% of stones are found in the renal parenchyma and the rest are located in the ureter, ureterovesical-junction and bladder.[6]

Factors that enhance stone formation include decreased levels of natural inhibitors of urinary tract stone formation, such as citrate, magnesium, osteopontin,[7] pyrophosphate (PP_i), calgranulin,[8] uromodulin,[9] urokinase,[10] Tamm-Horsfall glycoprotein and albumin.[11] In addition, concentrated urine is a risk factor as it favors an increase of salts, resulting in their precipitation.[12] Other factors include anatomical abnormalities of the urinary tract, metabolic disorders, urinary tract infections, environment and low urine volume.

Urinary tract stones are rarely asymptomatic. Common symptoms include abdominal pain, hematuria and dysuria. Urolithiasis (UL) is observed more frequently in children than in older patients[6]. A family history of urinary tract stones is present in 20–37% of children but it occurs at all ages.[13] Studies suggest that nephrolithiasis (NL) is inherited with a non-Mendelian transmission pattern with multiple genes.[14]

Some studies have described that renal stones are more frequent in males, but recent studies have mentioned that female children are at higher risk.[15] To this day, more than 28 pathogenic factors have been associated with the formation of urinary tract stones; this number is increasing and the frequency changing. Nevertheless, more studies for the evaluation of these factors in the pediatric population are needed. The purpose of this study was to determine the frequency of urinary tract stones and the pathogenic factors associated with their formation in patients from the Hospital Infantil de México Federico Gómez (HIMFG).