Anatomical alterations in patients with nephrolithiasis

Authors

Luis Alberto Batista Peres[1]

José Roberto Leonel Ferreira[2]

Ana Paula Kazue Beppu[3]

Everaldo Roberto de Araújo Junior[3]

Gustavo Vicenzi[3]

Ricardo Yukiharu Tsuge Yamamoto[3]

[1]Discipline of Nephrology of the Medical School of the Universidade Estadual do Oeste do Paraná (UNIOESTE), Cascavel, Paraná, Brazil
[2]Discipline of Imaging Diagnosis of the Medical School of the UNIOESTE, Cascavel, Paraná, Brazil
[3]Medical School of the UNIOESTE, Cascavel, Paraná, Brazil

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Corresponding author:
Luis Alberto Batista Peres
Rua São Paulo, 769
apt. 901- Centro
Cascavel – PR – Brasil
CEP: 85801-020
Fax: (45) 3327 3413
E-mail: peres@certto.com.br

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Abstract

Introduction: Nephrolithiasis is a multifactorial disease related to genetic disorders and environmental factors. Kidney stones are more common in adults and are associated with several metabolic and anatomical disorders. The major anatomical abnormalities, such as obstruction of the ureteropelvic junction, horseshoe kidney, complete or incomplete duplicated ureter, bifid pelvis, and medullary sponge kidney, are known to be responsible for stone formation. The objective of this study is to evaluate anatomical alterations in patients with nephrolithiasis in our region. **Methods:** Retrospective study on 1,378 patients with evidence of recent formation of kidney stones. Laboratory investigation and chemical analysis were performed when stones were available. Renal imaging techniques comprised at least renal ultrasound and excretory urography. **Results:** Of the 1,378 patients with nephrolithiasis cared for, only 367 (26.5%) (mean age, 36.8 ± 4.3 years) underwent anatomical investigation, of whom 198 (54.5%) were females. At least one anatomical alteration was found in 132 (36%) patients, the most common being renal cyst, completely or incompletely duplicated ureter, and obstruction of the ureteropelvic junction. **Conclusions:** Anatomical alterations were found in 36% of the investigated patients. Renal cyst, ureteral duplication, and obstruction of the ureteropelvic junction were the most frequently found anatomical alterations in the group.

Keywords: nephrolithiasis, anatomical alterations.

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Introduction

Nephrolithiasis is one of the most common diseases of the urinary tract, with an incidence ranging from 5% to 15% of the population for both sexes, and prevalence of 2% to 3% in the general population.[1] Several metabolic disorders, such as hypercalciuria, hypocitraturia, and hyperuricosuria, are associated with renal lithiasis.[2]

The following congenital or acquired anatomical alterations cause urinary stasis, predisposing to stone formation in the urinary tract: stenosis of the ureteropelvic junction; horseshoe kidney; vesical diverticula; medullary sponge kidney; caliceal cysts.[3]

This study aimed at describing anatomical alterations in a cohort of patients admitted for metabolic investigation of urinary lithiasis in the western region of the State of Paraná, Brazil.

Material and Methods

This study assessed the medical records of patients with recent evidence of lithiasis, who were referred to the Nephrology Outpatient Clinic of the Hospital Universitário do Oeste do Paraná for metabolic investigation by the outpatient clinic of Urology, from December 2001 to December 2008. The routine laboratory exams and the methodology applied have already been published.4 Data described in the imaging exams performed were recorded. The complete anatomical investigation comprised at least ultrasound of the urinary tract and excretory urography.

Data were stored in a Microsoft Excel database and were analyzed by use of descriptive statistics as follows: arithmetic mean; standard deviation; minimum and maximum values; and gross and percentage frequency. The anatomical alterations found are shown in Table 1.

Results

In the Nephrology Outpatient Clinic, 1378 patients with nephrolithiasis were cared for, 738 (53.4%) being of the female sex. Their ages ranged from 1 to 85 years (mean age, 37.5 ± 19.1 years). Complete investigation regarding the possibility of anatomical alterations was performed in 367 patients [198 (54.5%) females], whose age ranged from 1 to 77 years (mean age, 36.8 ± 4.3 years). Anatomical alteration was diagnosed in 132 (36%) patients, 72 (54.5%) being of the female sex, with ages ranging from 11 to 77 years (mean age, 41 ± 13.4 years). The total of anatomical alterations found was 134, the most common being as follows: renal cysts; pyeloureteral duplication; stenosis of the ureteropelvic junction; single kidney; atrophic kidney; medullary sponge kidney; and polycystic renal disease. Two patients had two alterations as follows: one had stenosis of the ureteropelvic junction and renal cyst, and the other had pyeloureteral duplication and renal cyst. Family history of nephrolithiasis was positive in 50% of the patients. Hypercalciuria was the most commonly associated metabolic disorder, diagnosed in 50% of all patients investigated for anatomical alterations. Regarding the chemical analysis of the stones, one was composed of pure uric acid, four were of calcium oxalate, and one, struvite. Table 1 shows the frequencies of the anatomical alterations found.

Discussion

This study assessed 1378 patients with nephrolithiasis, 367 of whom completed the investigation for anatomical alterations, among which the most common were renal cysts, pyeloureteral duplication, and stenosis of the pyeloureteral junction.

Metabolic and anatomical alterations are the two major etiopathogenic categories of nephrolithiasis. Metabolic alterations occur in 50% of the patients investigated.[5,6] Major anatomical alterations, such as obstruction of the ureteropelvic junction, horseshoe kidney, complete or incomplete ureteral duplication, medullary sponge kidney, and pelvic kidney, occur in up to 40% of the patients with nephrolithiasis.[7]

The imaging exams available for investigating anatomical alterations of the urinary tract are as follows: renal ultrasound; excretory urography; computed tomography; voiding urethrocystography; radioisotopic cystography; renal scintigraphy; and magnetic resonance imaging.[8] The ultrasound is the first method to be applied due to its low cost and lack of risks. Excretory urography assesses, in addition to bilateral function, the anatomy of the urinary tract, and can diagnose nephrolithiasis, obstructions, duplication and position anomalies; the use of iodine contrast medium, however, may be a risk for allergic reactions and nephrotoxicity.[9] Both exams were used routinely in this study to assess the anatomical alterations of the urinary tract in patients with nephrolithiasis.

Computed tomography assesses the anatomy of the urinary tract even in patients with renal dysfunction, and the possibility of tridimensional reconstruction provides further information. It may assess nephrolithiasis without using contrast medium and, unlike excretory urography, is not affected by the superposition of bone or intestine.[10] Voiding urethrocystography assesses the anatomy of the urinary bladder and urethra, and the presence of vesicoureteral reflux.[11] Radioisotopic cystography is used in the follow-up of vesicoureteral reflux. Renal scintigraphy provides information about the renal function and anatomy. Magnetic resonance imaging provides potential advantages in children and is a good method for assessing multiple congenital anomalies.[12] Those exams have not been routinely performed in our study.

The prevalence of kidney stones in patients with urinary tract malformations and renal cystic diseases is greater than in the general population, suggesting a causal association. Urinary stasis is the pathogenic explanation for nephrolithiasis associated with anatomical alterations, because of a delay in the elimination of crystals and an increase in the risk of urinary tract infection. Metabolic investigation should be performed for the specific diagnosis and clinical treatment of

Table 1 Anatomical alterations found in patients with lithiasis of the urinary tract

Anatomical alterations	Total	%
Renal cyst	43	31.9
Pyeloureteral duplication	25	18.5
Stenosis of the UPJ	15	11.2
Single kidney	10	7.5
Atrophic kidney	9	6.8
Medullary sponge kidney	6	4.4
Polycystic kidney disease	6	4.4
Pelvic kidney	4	3
Neurogenic urinary bladder	3	2.4
Nephroptosis	3	2.4
Horseshoe kidney	3	2.4
Renal malrotation	2	1.6
Caliceal clubbing	1	0.7
Ureteral dilatation	1	0.7
Stenosis of the distal ureter	1	0.7
Polycystic horseshoe kidney	1	0.7
Renal tumor	1	0.7
Total of alterations	134	100

UPJ: ureteropelvic junction.

the metabolic disorders, reducing the recurrence of urinary stones, even in individuals with anatomical alterations.[13]

The limitations of the present study comprise its retrospective character and performing only two imaging exams in the patients. However, most anatomical alterations reported in the literature may be assessed by use of both methods. Such imaging exams were performed for diagnosing and managing nephrolithiasis. The risk of exposure to radiation and radiological contrast medium should be considered.

In conclusion, renal cysts, pyeloureteral duplication, and stenosis of the ureteropelvic junction were the most frequently found anatomical alterations in patients with nephrolithiasis in our study.

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