

# Epidemiology of urolithiasis consultations in the Paraíba Valley

## *Epidemiologia dos atendimentos por urolitíase no Vale do Paraíba*

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### ABSTRACT

**Objective:** to know the epidemiological profile of patients with urolithiasis in the Paraíba Valley region, identifying its prevalence and spatial distribution. **Method:** we conducted a cross-sectional study, by residence location in the Paraíba Valley, on morbidity data due to urolithiasis obtained from the DATASUS, covering the period between 2010 and 2012. We aimed at identifying the general, male and female prevalence of urolithiasis, the distribution by age, type of visit, year season and spatial distribution. **Results:** there were 1,901 visits for urolithiasis in the 35 municipalities of the Paraíba Valley in the three years studied, 52.3% of them of female patients. Of the total, 70.1% of the visits were emergency ones. The feminine visits (67.2%) were mostly also urgent ( $p < 0.01$ ). The overall prevalence for urolithiasis was 31.7/100,000. Male prevalence was 30.7/100,000, and the female, 32.7/100,000 ( $p > 0.05$ ). The prevalence ratio was 0.9 men for every woman. The age group with the highest prevalence was between 30 and 39 years, with 23.1%. Warm seasons concentrated 51.6% of cases, while 48.8% occurred in the cold ones ( $p > 0.05$ ). **Conclusion:** women are more affected by urolithiasis than the male in the Paraíba Valley region, an unprecedented in the literature. There was no relationship between the year season and the disease. We identified municipalities where preventive actions of urinary lithogenesis are required.

**Keywords:** Urology. Urolithiasis. Epidemiology.

### INTRODUCTION

Urolithiasis is one of the most frequent diseases of the urinary tract in the world, displaying an increase in incidence and prevalence in all age groups and genders in the last decades, especially in industrialized countries<sup>1-3</sup>. It determines large costs for the health care systems in the world. In 2000, the estimated treatment cost of urolithiasis was more than two billion dollars in the United States<sup>4</sup>. In 2012, the Brazilian Unified Health System (SUS) has spent more than 32.5 million reais on hospital visits and admissions due to urolithiasis in Brazil<sup>5</sup>.

The epidemiological and lithogenic factors of urolithiasis involve ethnicity, gender, age, nutritional and dietary aspects, climate, occupation and physical activity, and it is known to be more common in diabetic, hypertensive and obese patients<sup>2,3,6</sup>. The peak incidence occurs between 20 and 50 years, decreasing after 70 years, being uncommon in children under ten years. Whites are three times more likely to develop urolithiasis than blacks, while Hispanics and Asians have intermediate risk. By mainly affecting people in the economically active group, it is a major cause

of absenteeism, affecting the patients' professional productivity. Studies suggest that the incidence of symptomatic urolithiasis increases during the summer, since the increase in temperature and exposure to sunlight are important risk factors for urinary lithogenesis, by favoring a greater risk of dehydration, resulting in increased urinary concentration and increased possibility of formation of urinary calculi and its clinical manifestations<sup>2,6-8</sup>.

Historically, urolithiasis has been two to three times more common in men than in women, reaching the men-woman ratio of 3-2<sup>2,6,7</sup>. However, alterations in food consumption patterns, fluid intake and obesity in men and women can cause changes in urolithiasis incidence and prevalence. In the United States the prevalence of urolithiasis is one in every 11 people, and the possibility of the male and female population develop urinary calculi during life is 12% and 6%, respectively<sup>6,9</sup>. Recent studies suggest that this epidemiological relationship between male and female is changing. An annual increase of women calls with complaints related to urolithiasis in emergency units was found, with decreasing male predominance in this disease. The incidence of urolithiasis in the United States,

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for example, is currently 1.3 men for every woman<sup>9-11</sup>. Currently there are no epidemiological studies on the profile of patients seen due to urolithiasis in Brazil.

Changes in the incidence and prevalence of urolithiasis may reflect underlying changes in the disease's risk factors. By identifying changes in its epidemiological pattern, new avenues for the prevention and better care for patients with this disease can be elucidated. This study aims to evaluate the epidemiological profile of the patients treated for urolithiasis in the Paraíba Valley region.

## **METHODS**

This is a cross-sectional study with urolithiasis morbidity data by residence location in the 35 municipalities of the Paraíba Valley region, State of São Paulo, in the period between 2010 and 2012. We obtained data from the National Health System DATASUS database. We excluded the coastal municipalities (Caraguatuba, Ubatuba, Ilhabela and São Sebastião) from the study because they are geographically separated from the others by the Serra do Mar (Sea Hills).

We considered the population living in the municipalities in the years 2010 to 2012, with the diagnoses N20 to N23 (kidney and ureter calculi, lower urinary tract calculi, urinary tract calculi in diseases classified elsewhere, unspecified renal colic) of the International Statistical Classification of Diseases and Related Health Problems, tenth revision (ICD-10)<sup>12</sup>.

We analyzed the data to identify the overall prevalence of symptomatic urolithiasis per 100,000 inhabitants, the prevalence by gender, the age group of patients treated, the type of care (elective or emergency), the season when hospitalizations occurred and the spatial distribution of urolithiasis visits by municipality in which the patient lived. The months considered representatives of the seasons summer (January, February and March), autumn (April, May and June), winter (July, August and September) and spring (October, November and December) are in agreement with data obtained at the Information Access Portal of the National Institute of Meteorology (INMET), for the three years.

We analyzed data using spatial statistics, being geo-referenced and analyzed by area to provide the Global Moran indices (I), with the TerraView software, provided by the National Institute for Space Research (INPE). The Global Moran index is a first order measure of spatial autocorrelation, which indicates the degree of spatial association in the set of information through the product relative to the average. After assembly of the thematic maps with the urolithiasis general, male and female prevalence, we evaluated the expected spatial distribution by Local Empirical Bayesian Method. This performs a softening of rates by municipality, assuming that the knowledge and uncertainties about the real risk value of an event in each area within a given region may be represented by a probability distribution<sup>13</sup>. With the achievement of the expected rates by the local empirical Bayes method, we then compared these with the actual prevalence rates found.

## **RESULTS**

During the study period, urolithiasis complaints were responsible for 1,901 calls from residents in the 35 municipalities of the Paraíba Valley, ranging from one to 562. Of these, 665 (35%) occurred in 2010, 612 (32.2%) in 2011 and 624 (32.8%) in 2012. The average was 54.3 attendances, with a standard deviation of 107.8. During the three years, 52.3% (995) of visits were from female patients. Of the 906 calls by male patients, 73.3% (664) were on an emergency basis. In females, of the 995 urolithiasis calls, 67.2% (668) were urgent ( $p < 0.01$ ).

The prevalence of symptomatic urolithiasis in Paraíba Valley, obtained indirectly by the number of visits resulting from this disease, was 31.7/100,000. Regarding gender, the prevalence was 30.7/100,000 in men and 32.7/100,000 in women ( $p > 0.05$ ). The relationship found between the male and female prevalence was 0.9 men for every woman affected with the disease. During the period, the age group with the highest number of patients was between 30 and 39 years, with 439 calls, equivalent to 23.1% of the total demand in the three years. Of the total demand due to urolithiasis, 45.1% occurred in patients aged between 30 and 49 years.

In the summer, there were 517 due to urolithiasis, corresponding to 27.2% of the total. In the fall, there were 460 (24.2%). In winter, the number of urolithiasis treatments was 461 (24.2%). Finally, in the spring, there were 463 (24.4%) calls. In the warm seasons (spring and summer) calls summed 51.6% (980) ( $p > 0.05$ ). The global Moran index (MI) and the  $p$ -value were  $I_M = 0.01$  ( $p = 0.43$ ) for urolithiasis calls per 100,000 inhabitants. Table 1 brings the general and by-gender prevalence of symptomatic urolithiasis of all 35 studied municipalities.

Applying the estimated Bayesian Local Empirical method, we found differences in the actual general prevalence from that expected. The  $I_M$  and its  $p$ -value were respectively 0.08 and 0.13. We computed the same estimate of the Bayesian Local Empirical method for the prevalence of symptomatic urolithiasis by gender. In men, the  $I_M$  was 0.17, and its  $p$ -value, 0.07. For females, the  $I_M$  was 0.11, and  $p = 0.1$ .

## DISCUSSION

This study on the epidemiology of urolithiasis has identified the profile of the distribution of the disease in Paraíba Valley and its prevalence by gender, age, type of service and the season with the most calls. Urolithiasis is historically more prevalent in men than in women. In a review of the specific aspects of male and female genders that are related to the genesis of urolithiasis, Seitz *et al.*<sup>3</sup> stressed that urinary osmolality in men is higher than in women. Furthermore, the antidiuretic response to vasopressin is different between genders, being greater in males, which can influence the urinary concentration and therefore result in a higher chance of urinary stone formation. For years urolithiasis researchers have realized the trend of change in its incidence and prevalence, especially by the gradual increase in the care of women, with consequent reduction of the relationship between male/female care<sup>3,11,14-17</sup>.

The prevalence of urolithiasis found in our region is different from all the other identified in similar studies. We found a prevalence in which the female gender is the majority, an unprecedented event. In

**Table 1.** Overall and by gender/100,000 prevalence of symptomatic urolithiasis in residents of the 35 municipalities of the São Paulo State Paraíba Valley between 2010 and 2012.

Variables	Overall	Male	Female
Aparecida	10.5	9.9	11.0
Arapeí	40.3	79.8	0
Areias	9.0	18.2	0
Bananal	13.0	19.7	6.4
Caçapava	10.9	12.6	9.3
Cachoeira Paulista	41.8	53.8	30.2
Campos do Jordão	43.0	31.2	54.3
Canas	15.0	14.8	15.2
Cruzeiro	47.4	46.1	48.7
Cunha	139.3	132.0	147.0
Guaratinguetá	51.8	55.3	48.5
Igaratá	45.1	73.4	15.4
Jacareí	34.5	38.8	30.3
Jambeiro	6.1	0	12.7
Lagoinha	27.6	26.9	28.3
Lavrinhas	35.2	20.0	50.6
Lorena	33.4	35.8	31.1
Monteiro Lobato	16.0	0	33.5
Natividade da Serra	40.1	28.8	52.4
Paraibuna	17.2	18.8	15.6
Pindamonhangaba	27.1	26.9	27.4
Piquete	9.5	4.9	13.8
Potim	16.8	14.9	19.3
Queluz	14.5	11.4	17.7
Redenção da Serra	34.5	16.6	54.2
Roseira	34.4	27.3	41.7
Santa Branca	12.1	0	24.1
Santo Antônio do Pinhal	20.5	10.2	31.0
São Bento do Sapucaí	76.4	75.9	76.9
São José do Barreiro	16.4	16.3	16.5
São José dos Campos	29.4	28.1	30.7
São Luíz do Paraitinga	60.9	62.7	59.1
Silveiras	11.4	11.3	11.6
Taubaté	27.3	22.5	31.9
Tremembé	22.5	9.1	37.5

**Source:** DATASUS.

Table 2, we compare the prevalence of urolithiasis between male and female found in several studies on its prevalence.

Regarding the type of call, it became clear that the most common call is the urgent one, given that, when symptomatic, urolithiasis usually presents with intense pain and signs that compromise quality of life<sup>6,18</sup>. Women were more prevalent, both in elective and in emergency care ( $p < 0.01$ ).

We found that 45.1% of patients treated during the study period were aged between 30 and 49 years, in agreement with the literature<sup>3,15</sup>. According to Trinchieri *et al.*<sup>19</sup>, the overall incidence of urolithiasis increases about 0.4% per year, 0.6% in males and 0.2% in females. According to their study, the annual increase in urolithiasis is probably a result of interaction between environmental factors such as dietary habits and lifestyle, particularly the increase in the consumption of animal protein.

When analyzing calls for urolithiasis by season, it became clear that most of the visits occurred in the summer, in which there is greater risk of dehydration due to the increased average temperature, which predisposes to increased urinary concentration and greater chance of urinary calculus formation. However, when comparing the attendances in the warm seasons (spring and summer) with the cold ones (fall and winter), there was no statistical significance ( $p > 0.05$ ). In a study on the influence of geographical variation in the prevalence of urolithiasis, Soucie *et al.*<sup>20</sup> concluded that the ambient temperature and the intensity of sunlight are important factors in the

genesis of urolithiasis. They observed that the risk of a person developing urinary calculi is almost twice higher in the residents of states nearby the equator, and therefore warmer and with higher incidence of sunlight, when compared with those closer to the north pole, with lower average temperatures and lower sunlight incidence.

The prevalence of symptomatic urolithiasis in Paraíba Valley in the three years studied was 31.7/100,000, fewer than the one found in Florida, in 2004, by Strobe *et al.*<sup>11</sup>, of 169.9/100,000. In the same study, the prevalence of symptomatic urolithiasis in males and females were, respectively, 105.5 and 64.4/100,000. In our study, the prevalence was 30.7/100,000 for males and 32.7/100,000 for females. No municipality in the studied region showed a higher overall prevalence than that found by Strobe *et al.*<sup>11</sup>, however the municipality of Cunha had a higher male prevalence than the one found in that study, and as the female prevalence, again Cunha and also São Bento do Sapucaí had a prevalence higher than that found in Florida (Table 1).

Upon spatial analysis, the municipalities with the highest prevalence of urolithiasis in the Paraíba Valley were evident. When considering both genders, there was a cluster of municipalities represented by São Luiz do Paraitinga, Cunha, Guaratinguetá, Campos do Jordão and São Bento do Sapucaí. For the prevalence in males, the predominant cluster of municipalities was formed by São Luiz do Paraitinga, Cunha and Guaratinguetá. For females, the municipalities belonging to the higher prevalence cluster were Redenção da Serra, Natividade

**Table 2.** Urolithiasis male/female prevalence ratio. Adapted from Seitz *et al.*<sup>3</sup>.

	Male/female prevalence ratio	
Daudon <i>et al.</i> <sup>14</sup>	2.3 (2001)	France
Knoll <i>et al.</i> <sup>15</sup>	2.4 (1977)	Germany
	2.7 (2006)	
Nowfar <i>et al.</i> <sup>16</sup>	1.6 (1998)	United States
	1.2 (2003)	
Lieske <i>et al.</i> <sup>17</sup>	3.1 (1970)	United States
	1.3 (2000)	
Our study	0.9 (2015)	Brazil

da Serra, Sao Luiz do Paraitinga, Cunha, Guaratinguetá, Campos do Jordao and São Bento do Sapucaí. These clusters represent municipalities where intervention is important for reducing urolithiasis incidence and prevalence. After evaluation of the municipalities by the Empirical Bayesian Local method, it was possible to see differences in the spatial distribution of the general, male and female symptomatic urolithiasis, which may mean an underreporting of urinary calculi cases or even bad filling of health services forms by staff, not respecting the patient's municipality of residence.

In conclusion, the epidemiological and spatial analysis of urolithiasis in the Paraíba Valley has identified that in the area in question, the women seem to be more affected than men are. We did not detect a relationship between the season and disease. It was possible to identify cities with the highest prevalence rates, where an intervention is required to reduce the occurrence of urolithiasis. For the epidemiological evaluation of urolithiasis in Brazil to be possible, further studies in other Brazilian regions are needed.

## R E S U M O

**Objetivo:** conhecer o perfil epidemiológico dos pacientes com urolitíase, na região do Vale do Paraíba, identificando sua prevalência e distribuição espacial. **Métodos:** estudo transversal com dados de morbidade por local de residência decorrente de urolitíase no Vale do Paraíba, relativos ao período compreendido entre 2010 e 2012, obtidos do DATASUS. Os dados foram analisados para identificar a prevalência geral, masculina e feminina da urolitíase, a distribuição por idade, tipo de atendimento, estação do ano e sua distribuição espacial. **Resultados:** ocorreram 1901 atendimentos por urolitíase nos 35 municípios do Vale do Paraíba nos três anos estudados, sendo 52,3% dos pacientes do sexo feminino. Do total, 70,1% dos atendimentos foram em caráter de urgência. Os atendimentos femininos, na sua maioria (67,2%), também foram de urgência ( $p < 0,01$ ). A prevalência geral encontrada para a urolitíase foi 31,7/100.000 habitantes. A prevalência masculina foi 30,7/100.000 e a feminina de 32,7/100.000 ( $p > 0,05$ ). A relação de prevalência encontrada foi 0,9 homens para cada mulher. A faixa etária com o maior número de pacientes atendidos foi entre 30 e 39 anos, com 23,1% do total. Nas estações quentes ocorreram 51,6% dos atendimentos, enquanto nas frias 48,8% ( $p > 0,05$ ). **Conclusões:** foi possível identificar que na região do Vale do Paraíba o sexo feminino é mais acometido pela urolitíase do que o masculino, fato inédito na literatura. Não se encontrou relação entre a estação do ano e a doença. Foram identificados municípios onde ações de prevenção da litogênese urinária são necessárias.

**Descritores:** Urologia. Urolitíase. Epidemiologia.

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