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Knowledge and attitudes of patients with nephrolithiasis: a cross-sectional study

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Abstract

Nephrolithiasis is a common urinary tract disease with an increasing prevalence, mainly due to the lack of control of modifiable risk factors. The aim of this study was to assess the level of knowledge about risk factors for nephrolithiasis and patients' attitudes. This is a cross-sectional, observational, descriptive, and analytical study based on a review of medical records and through an online survey of patients diagnosed with nephrolithiasis during follow-up at a private nephrology clinic in Joinville, Brazil. Gender, age, comorbidities, laboratory values, knowledge, and attitudes were evaluated. An explanatory multivariate model was proposed to assess the effect of knowledge and attitudes on risk factors for nephrolithiasis. Of the 129 participants, 44 (34%) were men, median age 42 years and median time to diagnosis 5 years. Hypertension was the most prevalent comorbidity in 26%. In 42% of patients, there was weight gain since the first consultation. Alone, excessive salt consumption (98%), low water intake (77%) and high protein consumption (67%) were the most identified risk factors. After adjusting for confounders, greater knowledge was not associated with weight gain (OR=0.94; 95% CI 0.73-1.22; p=0.661) or lower salt intake (OR=1.26; 95% CI 0.95-1.67; p=0.106). Greater knowledge was associated with greater daily fluid intake (OR=1.50; 95% CI 1.11-2.01; p=0.008). Although there is little knowledge of all nephrolithiasis risk factors, measures to increase awareness can contribute to preventive attitudes.

Keywords: Urolithiasis. Risk factors. Knowledge. Prevention.

INTRODUCTION

Nephrolithiasis is a common urinary tract disease, affecting about 19% of men and 9% of women until their seventh decade of life[1]. According to data from the North American population, the prevalence of nephrolithiasis may be increasing by around 8% in recent decades[1]. Part of this increase may be related to obesity[2], increased salt consumption[3], dietary patterns[4,5] and geographic conditions[6,7]. Although lifestyle changes can contribute to a reduction in the risk of nephrolithiasis[3], such knowledge and a real change in lifestyle can still be a major challenge among patients with nephrolithiasis.

A large study involving more than 28,000 North American adults found an increase in the prevalence of nephrolithiasis between 2007 and 2016, reaching around 10% between 2015 and 2016[8]. In Brazil, a study involving cities with more than 300 thousand people evaluated the number of hospitalizations related to nephroli-

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thiasis based on hospital information from the Ministry of Health (DATASUS) between 2010 and 2015[7]. There were about 12 thousand hospitalizations due to nephrolithiasis in the analyzed period, and the most prevalent age group was between 45 and 54 years old[7]. Another study carried out in 35 municipalities in Vale da Paraiba, also based on DATASUS data of patients treated in hospitals for nephrolithiasis[9], found a prevalence rate of nephrolithiasis of 31.7/100,000 people, with a prevalence ratio of 0.9 of men compared to women between 2010 and 2012[9]. Such epidemiological data in the Brazilian population demonstrate the important impact of this disease, albeit in a possibly underestimated way.

Advancing age, male gender, and genetic factors have been identified as non-modifiable risk factors for the occurrence of nephrolithiasis[8,10]. Among the main modifiable risk factors associated with the formation of kidney stones are dietary factors[11] - low fluid intake[12], high consumption of salt[13] or animal protein[14] - smoking[15], obesity[2], sedentary lifestyle[3], and low urinary output[16]. However, despite advances in invasive urological procedures for the treatment of nephrolithiasis[17], about 50% of patients will still have recurrence of the disease in 10 years, especially among overweight or obese patients[18]. This reinforces the need for prevention. However, both the guidance by health professionals and the knowledge of patients about risk factors and adoption of preventive practices has still been quite low, in studies carried out outside Brazil[19-23].

Considering the important prevalence of nephrolithiasis and, as far as our review was possible, the lack of studies in Brazil on the understanding of patients with this disease, the objective of this study was to evaluate aspects related to the understanding of nephrolithiasis and its association with preventive attitudes of the disease in patients being followed up in a specialized clinic.

METHODS

Design, Study Site, and Sampling

This is a cross-sectional, observational, descriptive, and analytical study of patients diagnosed with nephrolithiasis treated at a nephrology clinic in Joinville, Santa Catarina, based on an electronic questionnaire carried out between 05/07/2021 to 05/20/2021. All patients, over 18 years of age, diagnosed with nephrolithiasis and treated between 2010 and 2020 at that clinic were invited to answer an electronic questionnaire via Google Forms. All patients who agreed to participate signed an electronic informed consent form. The present study was approved by the Research Ethics Committee at the University of the Region of Joinville (CAAE 33719920.2.0000.5366).

Data collection

Sociodemographic aspects such as age, sex, and education level were evaluated. Data from the first visit to the clinic were also evaluated through medical record review, such as comorbidities, weight and height, laboratory results (calcium, uric acid, sodium, citrate, magnesium, and oxalate in 24-hour urine and creatinine, uric acid, glucose, calcium, serum TSH), and imaging results (ultrasound and/or abdominal tomography).

To assess patients' knowledge and attitudes about nephrolithiasis, a questionnaire was developed by the researchers themselves based on the main known risk factors and possible prevention attitudes, such as low salt consumption,

ingestion of more than 2 liters of fluids per day, and obesity control[24, 25].

Statistical analysis

Categorical variables are presented by frequency and percentage. Quantitative variables are presented by the median and interquartile range (25th and 75th percentiles). Differences between the distributions of categorical variables, when the sample was stratified by the median time of diagnosis and current weight status in relation to the first consultation, were evaluated by the chi-square test or Fisher's exact test and, for quantitative variables, by the Mann-Whitney test, after verifying that the distribution was not normal according to the Kolmogorov-Smirnov test. Each one of the correct answers to the ten questions designed to assess patients' knowledge related to risk factors for nephrolithiasis received one point and constituted the knowledge score (zero value: lack of knowledge; value 10: total knowledge). To assess the effect for each one-point increase in the knowledge score on protection for weight gain, for excessive salt consumption, and intake of more than 2 liters of water daily reported, a multivariate model was proposed by logistic regression considering the potential confounders (age, sex, BMI at first visit, time of diagnosis of nephrolithiasis) in an explanatory model. A p value <0.05 was assumed to be significant. SPSS version 23 software was used to conduct the analyses.

RESULTS

From the initial sample of 371 patients, contact was not possible for 53 (14%) and 189 (51%) did not respond to the electronic questionnaire. There was no statistical difference regarding the variables verified in the first consultation between respondents and non-respondents regarding age, BMI, sex, comorbidities, time of diagnosis, and number of stones. Of the 129 participants (41% response rate), 44 (34%) were men, median age 42 years old, with a median of 4.0 stones visualized through imaging, and a median time to diagnosis of 5 years. Hypertension was the most prevalent comorbidity reported (26%), and 54 (42%) patients had increased their weight since the first visit. Other sample characteristics are presented in Table 1.

Regarding the knowledge of risk factors (Table 1), excessive salt consumption was the most mentioned by the participants (98%), followed by ingesting less than 2 liters of water per day (77%), and consuming a lot of protein (67%). Urinating less than 2 liters per day and being male were the least recognized risk factors by participants (33% and 15%, respectively).

When the sample was stratified by the median time since diagnosis (less than or greater than 5 years, Table 2), individuals with a shorter time since diagnosis had a higher median BMI, both at the first and current consultations (26.9 vs. 24.3 ; p=0.007 and 26.4 vs. 24.1; p=0.008, respectively), and a trend towards a higher prevalence of men (42% vs. 25%; p=0.064) in relation to those with a longer time of diagnosis. There were no statistical differences in relation to the other variables, knowledge of factors or attitudes between the groups with longer or shorter time since diagnosis.

When the sample was stratified by the current weight situation in relation to the first consultation (decreased/unchanged or increased,

Table 3), individuals who increased weight in relation to patients who did not increase or remained with unchanged weight had a lower median BMI at the first consultation (24.3 vs. 26.3; p=0.039) and higher median of current BMI (26.9 vs. 24.5; p=0.022). Only one patient with increased weight had a diagnosis of hypothyroidism compared to 12 patients who had not gained weight (2% vs. 16%; p=0.019). In relation to the other variables, there was no significant difference. When assessing the questions regarding knowledge about risk factors for nephrolithiasis, attitudes, and knowledge score regarding weight change between the groups, there was no significant difference between individuals with weight gain compared to those who decreased or remained with the unchanged weight (Table 3).

The influence of the highest knowledge score on the risk for weight gain did not demonstrate a significant protective association, even after adjusting for age, time of diagnosis, BMI at first visit, hypothyroidism, and sex (OR=0.94; 95% CI 0.73-1.22; p=0.661). Regarding the attitudes pointed out by patients for the prevention of nephrolithiasis, the highest knowledge score also did not prove to be a protective factor for lower daily salt consumption after adjusting for the same variables (OR=1.26; 95% CI 0.95-1.67; p=0.106). In relation to fluid intake, the highest knowledge score was associated with a greater chance of ingesting more than 2 liters of water per day after adjustment for age, time of diagnosis, BMI at the first consultation, and sex (OR=1.50; 95% CI 1.11-2.01; p=0.008).

Table 1 – General Characteristics of the Sample (n=129). Joinville/2021.

Variables	Total Number or median	IQV %
Age years	42.2	38.1/54.6
Gender		
Female	85	65.9
Male	44	34.1
	25.3	22.2/28.1
Current BMI, kg/m^2	25.28	22.98-29.35
Diagnosis time, years	5.0	3.0/9.0
Number of stones	4.0	2.0/10.0
Change in weight reported since diagnosis		
Increased	54	41.9
decreased	35	27.1
Unchanged	40	31.0
Prior urological procedures, yes	49	38.0
Comorbidities		
Diabetes	13	10.1
Systemic Arterial Hypertension	33	25.6
Dyslipidemia	8	6.2
Thyroidopathy	13	10.1
Recognized as a risk factor for nephrolithiasis		
Obesity	74	57.4
Sedentary lifestyle	78	60.5
Smoking	46	35.7
Excess alcohol	51	39.5

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Variables	Total Number or median	IQV %
Age	49	38.0
Male	19	14.7
Excess salt	127	98.4
Excess protein	86	66.7
Drinks < 2 liters of water per day	99	76.7
Urinates < 2 liters per day	43	33.3
Attitudes for prevention		
Drinks > 2 liters of water per day	43	33.4
Controls salt intake	96	74.4
Exams		
Uric acid urine 24h (n=79)	613.0	465.0/742.0
24-hour urine calcium (=125)	187.0	134.0/269.0
24-hour urine magnesium (n=74)	70.0	49.5/113.5
24-hour urine citrate (n=108)	553.50	384.5/946.5
24-hour urine oxalate (n=74)	16.5	11.7/22.0
24-hour urine sodium (n=76)	161.0	132.0/208.2
Serum uric acid (n=93)	4.8	3.7/6.1
Serum calcium (n=99)	9.4	9.1/9.6
Serum creatinine (n=104)	0.8	0.7/1.0

IQV: Interquartile Variation

Table 2 – Comparison of Characteristics, Knowledge/Attitudes about Nephrolithiasis by the Median Time of Diagnosis (n=129). Joinville/2021.

	≤ 5 years		> 5 years		
Varables	**Frequency or Median**	**% IQV**	**Frequency or Median**	**% IQV**	**P value**
Age years	44.6	37.6-56.2	46.7	38.3-53.6	0.885
Male gender	29	42.0	15	25.0	0.064
BMI at first consultation, kg/m^2	26.9	23.3/29.7	24.3	21.6/26.0	0.007
Current BMI, kg/m^2	26.4	24.1-30.0	24.1	22.3-28.1	0.008
Change in weight reported since diagnosis					**0.709**
Increased	31	44.9	23	38.3	
Becreased	17	24.6	18	30.0	
Unchanged	21	30.4	19	31.7	
Number of stones in the US	4.0	2.0-10.0	3.0	2.0-10.0	0.568
Prior urological procedure, yes	24	34.8	25	41.7	0.534
Comorbidities					
Diabetes	9	13.0	4	6.7	0.364
Systemic Arterial Hypertension	17	24.6	16	26.7	0.951
Dyslipidemia	5	7.2	3	5.0	0.723
Hypothyroidism	6	8.7	7	11.7	0.790
Recognizes as a risk factor					
Obesity	40	58.0	34	56.7	1.000
Sedentary lifestyle	41	59.4	37	61.7	0.936

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Varables	≤ 5 years		> 5 years		
	Frequency or Median	% IQV	Frequency or Median	% IQV	P value
Smoking	21	30.4	25	41.7	0.253
Excess alcohol	28	40.6	23	38.3	0.936
Age	26	37.7	23	38.3	1.000
Male	12	17.4	7	11.7	0.505
Excess salt	68	98.6	59	98.3	1.000
Excess protein	49	71.0	37	61.7	0.349
Drinks < 2 liters of water per day	53	76.8	46	76.7	1.000
Urinates < 2 liters per day	23	33.3	20	33.3	1.000
Knowledge Score	4.0	3.0/6.5	5.0	3.0/6.7	0.764
Attitudes for prevention					
Drinks > 2 liters of water per day	22	31.89	21	35.0	0.851
Controls salt intake	50	72.5	46	76.7	0.731

US: Ultrasound
IQV: Interquartile Variation

Table 3 – Comparison of Characteristics and Knowledge/Attitudes about Nephrolithiasis by Current Weight Situation in relation to First Consultation (n=129). Joinville/2021.

Varables	Unchanged/Decreased Weight		Weight increased		
	Frequency or Median	% IQV	Frequency or Median	% IQV	P value
Age years	45.0	38.2/57.2	45.7	35.5/52.8	0.505
Male gender	26	34.7	18	33.3	1,000
BMI at first consultation, kg/m^2	26.3	24.0/30.1	24.3	21.8/27.8	0.039
Current BMI, kg/m^2	24.5	22.5/28.3	26.9	23.7/29.5	0.022
Number of stones in the US	4.0	2.0/10.0	4.0	2.0/10.0	0.736
Diagnosis time, years	5.0	3.0/7.0	5.0	3.0/9.0	0.511
Prior urological procedure, yes	28	37.3	21	38.9	1,000
Comorbidities					
Diabetes	7	9.3	6	11.1	0.973
Systemic Arterial Hypertension	16	21.3	17	31.5	0.272
Dyslipidemia	5	6.7	3	5.6	1,000
Hypothyroidism	12	16.0	1	1.9	0.019
Recognizes as a risk factor					
Obesity	46	61.3	28	51.9	0.371
Sedentary lifestyle	50	66.7	28	51.9	0.130
Smoking	27	36.0	19	35.2	1,000
Excess alcohol	43	57.3	35	64.8	0.500
Age	28	37.3	21	38.9	1,000
Male	10	13.3	9	16.7	0.783
Excess salt	73	97.3	54	100.0	0.509
Excess protein	51	68.0	35	64.8	0.850
Drinks < 2 liters of water per day	57	76.0	42	77.8	0.980
Urinates < 2 liters per day	25	33.5	18	33.3	1,000
Knowledge Score	5.0	3.0/7.0	4.0	3.0/6.0	0.467

to be continued...

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Varables	Unchanged/Decreased Weight		Weight increased		
	Frequency or Median	% IQV	Frequency or Median	% IQV	P value
Attitudes for prevention					
Drinks > 2 liters of water per day	26	34.7	17	31.5	0.850
Controls salt intake	60	80.0	36	66.7	0.132

US: Ultrasound
IQV: Interquartile Variation

DISCUSSION

The present study found that weight gain after the diagnosis of nephrolithiasis is one of the modifiable risk factors present in almost half of the analyzed sample, especially in those with a shorter time of diagnosis. Reduced salt consumption and increased daily liquid intake were the preventive measures most remembered by patients; however, when considering the total knowledge, the score is still low. Knowledge about risk factors and attitudes did not differ between those with a longer diagnosis or those who had increased weight. The highest knowledge score was only independently associated with a greater chance of a fluid intake greater than two liters.

Lifestyle changes and the effect of globalization, and changes in dietary pattern, may be increasingly increasing the prevalence of kidney stones in developing and developed countries[26]. A large study involving more than 28,000 US adults found an increase of the prevalence of nephrolithiasis between 2007 and 2016, being around 10% between 2015 and 2016[8]. The increase in the prevalence of obesity may be associated with increased formation of kidney stones[2] and changes in lifestyle for the prevention of nephrolithiasis has been a great challenge[3]. The present study observed that approximately half of the patients gained weight after diagnosis of nephrolithiasis.

Regarding the comorbidities found in the present study, systemic arterial hypertension was the most prevalent. The presence of systemic arterial hypertension has been associated with an increase of up to two times the chance of nephrolithiasis in relation to people without the disease[27]. This association may have influenced the greater recall of excess salt as a risk for nephrolithiasis in the studied sample, considering that salt care is a guideline to be observed in both diseases.

Although most patients evaluated in the present study recognized salt as a disease modifier, only two-thirds reported controlling dietary salt intake. Likewise, although nearly two-thirds of individuals recognized that drinking less than two liters of water a day could increase the risk of stone formation, only one-third of them drank more than two liters a day. Among other risk factors, smoking, sex, age, alcohol, and daily diuresis were not widely recognized in the influence of stone production in the sample studied. Although knowledge for some risk factors is quite common in the sample studied, general knowledge, when assessed by the total knowledge score, was low. This low perception of knowledge on the part of pa-

tients with nephrolithiasis has been reported in other studies[19,20]. Even among some health professionals, such knowledge is still below expectations[21]. The change in lifestyle habits that can have an impact on the reduction of formation of stones, as well as for other diseases, is something difficult for patients to adopt[14,15]. It was not possible to assess in the present study how much such risk factors are emphasized by the medical team in each consultation, demonstrating that this low knowledge of patients could be merely a recall bias. Another aspect found in the present study was the difference between the level of knowledge about the impact of high salt intake on stone formation and the attitude towards controlling this intake. Although there is knowledge about the risks of excess salt consumption, most patients who need to control their intake do not follow such guidance in their daily lives[28]. Although it was not possible to quantify the control of sodium intake prospectively, this factor points to the need for further evaluation of salt consumption and measures to strengthen the change in this habit.

The present study has limitations that need to be considered. First, it is a sample of patients with private health insurance for the most part and who may represent life habits and understanding of risk factors different from the general population without health insurance. Furthermore, because the methodology for participation was electronic, without more direct contact with the participant, it is not possible to rule out a selection bias in which patients who are more aware or concerned about the disease under investigation would be the ones who would be most interested in participating. to participate. Even so, in a sub-analysis we found no statistical difference between some relevant characteristics of the group that responded or not to the questionnaire.

Some hypotheses related to patients' knowledge of risk factors and their attitudes were raised with the present study that need to be further explored in future studies. The difficulty in controlling weight and salt consumption, even in a sample with systemic arterial hypertension, needs to be better understood in patients with nephrolithiasis. In addition, for studies that seek to focus on ways to improve patients' awareness of risk factors and monitor such changes, the present findings may contribute to the care of patients with nephrolithiasis.

CONCLUSION

It is concluded that the risk factors in general are not yet fully recognized by patients with nephrolithiasis in the sample studied. Although excess salt is a well-recognized risk factor, there are indications that this practice is not yet fully adopted by patients. Weight gain, among the modifiable factors, is a factor to be better addressed, especially in patients with a shorter time of diagnosis of nephrolithiasis. The increase in knowledge can impact on increased water intake, contributing to the prevention of nephrolithiasis.

Author statement CRediT

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