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**Irene Pinduli · Rodolfo Spivacow · Elisa del Valle
Susana Vidal · Armando L. Negri · Horacio Previgliano
Eduardo dos Ramos Farías · Jorge H. Andrade
Griselda M. Negri · Héctor J. Boffi-Boggero**

Prevalence of urolithiasis in the autonomous city of Buenos Aires, Argentina

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Abstract Urolithiasis is the third most common pathological disease afflicting the urinary tract, and usually occurs between the third and fourth decades of an individual's life. Epidemiological studies about this condition are lacking in our country. In 1998, we performed an epidemiological, cross-sectional study of the prevalence of urolithiasis in a sample of 1,086 subjects, which included men and women of all ages, selected from the general population of the city of Buenos Aires. The method used to gather basic information was an auto administered questionnaire about the present or past history of urolithiasis that was handled at the dwelling by a trained volunteer. We found a 3.96% lifetime prevalence of urolithiasis in the general population of Buenos Aires. The rate was slightly higher in men (4.35%) than in women (3.62%), with a male to female ratio of 1.19:1. No case of urolithiasis was found in subjects under the age of 20. In subjects over 19 years, the prevalence rate of the disease was 5.14%; 5.98% for men (CI 3.41–8.55%) and 4.49% for women (CI 2.61–6.37%). Prevalence increased with age, ranging from 2.75% in the 20–39 age group to 7.79% in those ≥60 years. The life time prevalence rate of urolithiasis observed in Buenos Aires is similar to that reported in a few other studies performed among males and females in the general population of USA and Europe. Prevalence of urolithiasis increases with age both in men and in women.

Keywords Urolithiasis · Life time prevalence · General population

Héctor J. Boffi-Boggero: Deceased

I. Pinduli · R. Spivacow · E. del Valle · S. Vidal · A. L. Negri
H. Previgliano · E. dos R. Farías
Board of Urolithiasis, Buenos Aires Nephrology Association,
Buenos Aires, Argentina

J. H. Andrade · G. M. Negri · H. J. Boffi-Boggero
Center for Epidemiological Research,
National Academy of Medicine of Buenos Aires,
Buenos Aires, Argentina

R. Spivacow (✉)
Instituto de Investigaciones Metabólicas,
Libertad 836, 1er piso, 1012 Buenos Aires, Argentina
E-mail: spiva@idim.com.ar
Tel.: +54-11-50319700
Fax: +54-11-50319703

Introduction

Urolithiasis is the third most common pathological disease afflicting the urinary tract [1], next to urinary infection and prostatic pathology. It usually occurs between the third and fourth decades of an individual's life, particularly in men [2]. Although new and effective therapeutic methods to treat nephrolithiasis have been introduced recently, this condition impacts on the economically active population and is characterized by high rate of recurrence and complications. Thus, knowledge of the prevalence of urolithiasis is of utmost importance when developing prevention programs.

A study performed in Northern California showed that out of 1,000 ambulatory examinations arising from any cause, 1.22% were attributed to urolithiasis [3]. In Rochester, Minnesota, a similar study showed that urolithiasis admissions ranged between 0.4 and 1.0 for every 1,000 hospital admissions [4].

Studies have demonstrated that prevalence rate varies considerably according to age [5, 6], race, geographic origin and socioeconomic condition of the study group [7, 8]. Most series [6, 9] agree that urolithiasis prevalence increases with age and is rare in children and adolescents [5, 10].

Few studies have been performed in the general population [5, 9, 11, 12], and two of them have reported an increase in the prevalence of urolithiasis in the recent years. Epidemiological studies performed in this group provide better knowledge of the distribution of this condition in the population, allowing an estimation of its impact on society and the instrumentation of better

prevention programs. Given the lack of studies on urolithiasis in Argentina, the aim of our work was to determine the prevalence of self-reported kidney stones in the general population of the autonomous city of Buenos Aires.

Materials and methods

We performed an epidemiological, cross-sectional study among the population of the autonomous city of Buenos Aires, in September 1998. The population herein studied consisted of men and women of all ages who were residents of Buenos Aires for at least 1 year.

A probabilistic domiciliary sample was designed with data provided by the *Instituto Nacional de Estadística y Censo, INDEC* (National Institute for Statistics and Census, INDEC) [13]. Data on sex of the population, number of dwellings per census radius and cartography per block were obtained. Conglomerate sampling was performed in two stages, with the dwelling as sampling unit and the subject as analysis unit.

Sample size was assessed using a prevalence of 8.5%, according to data previously found by our group in an exploratory analysis of urolithiasis frequency [14]. Assuming a 2% precision estimation and a 95% confidence level, 778 subjects were to be surveyed in order to obtain a simple random sampling. Using the two-stage sampling design and assuming that 20% of subjects would be missed due to lack of response (people's rejection to participate or people out of their dwelling), a final estimate of 1,300 subjects were to be contacted. The sampling unit was the dwelling and the rate of subjects per dwelling was 2.47 [13]. Consequently, some 547 dwellings were to be visited in order to contact 1,300 subjects.

Irregular settlements and shantytowns were excluded from the study for technical reasons. Socioeconomic stratification could not be performed, due to lack of updated information from the INDEC census.

Sampling was divided into two stages:

(a) The first stage included a randomized selection of 40 census radius, with a likelihood proportional to the number of dwellings. This allowed an adequate geographic distribution in the city.
(b) The second stage included the selection of dwellings in each census radius according to the general sampling fraction. For the selection of dwellings in the radius, a systematic random sampling was used right from the beginning.

Sampling design included up to three visits, which were done to obtain the necessary data.

The method used to gather basic information was a questionnaire. It was anonymously autoadministered and designed to recall present or past history of urolithiasis. It was distributed by a trained volunteer who visited the dwellings. In case of subjects below 15 years, a guardian was asked to answer the questions.

The questionnaire was divided into three sections: section 1: information about the dwelling; section 2: characteristics of the interviewee, his or her sex, date of birth and time of residence in the city and; section 3: information about the history of urolithiasis. The specific question was: Do you have or have you had a renal calculus? There were three types of responses: YES, NO, or I DON'T KNOW. In order to consider the presence of lithiasis, when the answer to the specific question was YES, the answer should be supported by at least one confirmatory data, as in the criterion used by Ljunghal and Hedstand [6]. The following confirmatory data were asked to reinforce the finding:

- If the stones were diagnosed by a physician
- If the stones were passed in the urine
- If the person had a sonography or radiography that showed the stones.

Thus, the possibility of false positives was restricted. Affirmative answers not supported by at least one confirmatory data were considered negative. The forms filled out with NO or I DON'T KNOW answers were considered negative for lithiasis.

In this study, the term *Prevalence* is used to refer to persons who have had one or more episodes of lithiasis. Then prevalence refers to the prevalence of a "history of the disease" and the prevalence rate is the proportion of persons in the population at some date who have such a history. There was no intention in this survey to study the epidemiology of risk factors, as nothing was asked about them in the questionnaire.

Data analysis

After checking both form completion and answer consistency, we proceeded to enter the data into an electronic database for further analysis using the SPSS statistical program.

Age was defined as the participant's age at the time of the interview. Patients over 80 years were not excluded from the analysis. Gender was confirmed by the interviewer's observation. Percent prevalence rates, their 95% confidence intervals [15] and relative risks were evaluated according to age and sex.

Results

A total of 1,350 subjects were found in the dwellings visited. Of them, 19.6% refused to participate mainly on safety or personal reasons. Of the 1,086 subjects herein included, 22 gave the answer "I DON'T KNOW" when asked about the current or past presence of urolithiasis. They were considered negative, although two of them have had gravel-colic syndrome and six have had renal colic. One of the subjects who did not know if he had lithiasis was under 20 years and the rest were classified among the other age groups.

Table 1 shows mean ages of study subjects and their confidence intervals according to gender and the reported presence of urolithiasis history. In this study, 46.5% of the population were men and 53.4% women. Median age of the whole population studied was 36.2 years, but the median for those with urolithiasis was 50.8 years, which means that half of the patients who reported the presence of this condition were older than 50 years. Mean age differed significantly ($P < 0.01$) between patients with positive or negative stone history, both for the whole population and for each sex. However, no statistically significant differences in age were found between sexes in each group (stone positive or stone negative patients). For those with a positive urolithiasis history, the man/woman ratio was 1:19.

The lifetime prevalence rate of urolithiasis history for both sexes was 3.96% (CI 2.80–5.12%, Table 2). All the subjects who had reported current or past presence of lithiasis had confirmed the diagnosis with a physician; 58.1% had seen the calculus either radiographically or sonographically, and 44.1% had passed calculus in the urine. The lifetime prevalence rate was 4.35% in men (CI 2.57–6.12%) which was slightly higher but not significantly different from the 3.62% seen in women (CI 2.10–5.14%).

In subjects over 19 years of age, disease prevalence rate was 5.14%: 5.98% for men (CI 3.41–8.55%) and 4.49% for women (CI 2.61–6.37%). This difference was not significant and the relative risk was 1.33. The prevalence rates vary from 0% in the younger group to 7.79% in the ≥60 age group, and increased gradually with age. Differences were not significant between sexes in the diverse age groups. The last age interval included 13 subjects over 80 years, one of whom had a positive urolithiasis history confirmed. No cases of current or past urolithiasis history were reported in subjects less than 20 years.

Discussion

As far as we know, this is the first epidemiological study of urolithiasis prevalence in Argentina. The lifetime prevalence of urolithiasis in the general population of Buenos Aires, the federal district of Argentina, was 3.96%, with a higher rate in males (4.35%) than in females (3.62%). However, this difference was not statistically significant.

The relative risk for males was 1.19 compared with females, which indicates that the probability of developing lithiasis is 19% higher in men. This is similar to the prevalence found by Serio 1.25 [9] and by Borghi 1.5 [5], but significantly lower than that reported at the Consensus Conference 4 [2]. In a previous series from our group we also found that the male female ratio was 1.4:1 and not very different from the one found in the present study [16]. We think that in western societies, lifestyle changes in females (working activity, type of diet fluid consumption etc.) have made them more prone to urolithiasis than before.

In subjects over 19 years, disease prevalence rate was 5.14%: 5.98% for men (CI 3.41–8.55%) and 4.49% for women (CI 2.61–6.37%). This difference was not significant and the relative risk was 1.33. The prevalence rate herein obtained compares very well with Borghi's [5] findings between 5.3 and 6.1% from Northern Italy. The rate did not differ significantly from the 5% found by Vahlensieck [10] in the group over 18 years, or from the 5.2% found in the US [11] in the 20–74 age group, in the period 1988–1994.

No marked differences were observed between the rate found by Soucie [17] in white men (8.9%, CPS II and 7.5%, NHANES II) and that reported in our study in the same population (6.9%). Similarly, Soucie [17] reported a rate of 3.4% (CPS II) and 4.1% (NHANES II) for the female population, compared with 5.46% found in our study.

The rate of 4.2% found by Robertson [18] in men ≥18 years compares very well with the 5.98% seen in our study in the same age and sex group. No case of urolithiasis was reported in subjects less than 20 years. Urinary stone disease is a relatively infrequent disease in children from developed countries. In different series of patients with renal lithiasis of all ages, prevalence in children varies from 2 to 2.7% [5, 10]. This could be the reason why other authors only studied subjects over 19 years [5, 9, 11, 12]. The fact that we did not find lithiasis among children and adolescents in this study does not mean that there are no cases in this age group. The confidence interval for both men and women in the 0–19 age interval was 0–1.89.

The prevalence of urolithiasis increases with age both in men and in women, which is consistent with the findings reported by other authors [6, 18]. Therefore, the difference in the mean and median age between those with stone history and those without it is worth mentioning.

The major limitation in our study is that our questionnaire did not take into consideration epidemi-

Table 1 Mean age and confidence intervals according to gender and the reported presence of urolithiasis history

Stone history	Males			Females			Total		
	n	$\bar{X}$	95% CI	*n*	$\bar{X}$	95% CI	*n*	$\bar{X}$	95% CI
Yes	22	51.7	45.6–57.7	21	53.0	45.1–60.9	43	52.3	47.6–57.1
No	484	34.5	32.7–36.2	559	38.0	36.4–39.6	1043	36.4	35.2–37.6
Total	506	35.1	33.4–36.8	580	38.5	36.9–40.1	1086	36.9	35.8–38.1

Table 2 Percent prevalence of urolithiasis history by gender and age group

Age group (years)	Sex				Total	
	Males		Females			
	Rate	95% CI	Rate	95% CI	Rate	95% CI
00–19[a]	0.00	0.00–3.37	0.00	0.00–4.13	0.00	0.0–1.89
20–39	3.14	0.43–5.85	2.45	0.33–4.57	2.75	1.07–4.43
40–59	8.00	3.66–12.34	5.33	1.94–8.72	6.58	3.86–9.30
≥60	8.47	1.37–15.57	7.37	2.12–12.62	7.79	3.56–12.02
Total	4.35	2.57–6.12	3.62	2.10–5.14	3.96	2.80–5.12

[a]Asymmetrical intervals were used [13]

ological risk factors such as diet, climate and other environmental factors (as work activity, socioeconomic condition, etc.). Because of this, we cannot use them to explain differences prevalent in other studies.

We think this simple study contributes to the knowledge of the prevalence of lithiasis in a crowded area in our country, as in the autonomous city of Buenos Aires. This epidemiological study gives us a better knowledge of the distribution of this condition in our population, allowing an estimation of its impact on society and the future instrumentation of better prevention programs.

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References

1. Smith LH (1989) The medical aspects of urolithiasis: an overview. J Urol 141:707
2. Consensus Conference (1988) Prevention and treatment of kidney stones. JAMA 260:977
3. Hiatt RA, Dales LG, Friedman GD, Hunkeler EM (1982) Frequency of urolithiasis in a prepaid medical care program. Am J Epidemiol 115:255
4. Johnson CM, Wilson DM, O'Fallon WM, Malek RS, Kurland LT (1979) Renal stone epidemiology: a 25-year study in Rochester, Minnesota. Kidney Int 16:624
5. Borghi L, Ferretti PP, Elia GF, Amato F, Melloni E, Trapassi MR, Novarini A (1990) Epidemiological study of urinary tract stones in a Northern Italian City. Br J Urol 65:231
6. Ljunhall S, Hedstrand H (1975) Epidemiology of renal stones in a middle-aged male population. Acta Med Scan 197:439
7. Andersen DA (1972) Environmental factors in the etiology of urolithiasis. In: Cifuentes DL, Rapado A, Hodgkinson A (eds) Urinary calculi. Karger, Basel, p 130
8. Pyrah LN (1979) Epidemiology of urolithiasis, in renal calculus. Springer, Berlin Heidelberg New York, p 3
9. Serio A, Fraioli A (1999) Epidemiology of nephrolithiasis. Nephron 81(suppl 1):26
10. Vahlensieck EW, Bach D, Hesse A (1982) Incidence, prevalence and mortality of urolithiasis in the german federal republic. Urol Res 10:161
11. Stamatelou KK, Francis ME, Jones CA, Nyberg LM, Curhan GC (2003) Time trends in reported prevalence of kidney stones in the United States: 1976–1994. Kidney Int 63:1817
12. Trinchieri A, Coppi F, Montanari E, Del Nero A, Zanetti G, Pisani E (2000) Increase in the prevalence of symptomatic upper urinary tract stones during de last ten years. Eur Urol 37:23–25
13. Instituto Nacional de Estadística y Censos (INDEC) (1991) Censo Nacional de Población y Vivienda. Buenos Aires, Argentina
14. Dos Ramos Farías E, Pinduli I, Man Z, Spivacow R, Toblli J, Vidal S, Licciardi L (1996) Consejo de Litiasis Renal (ANCBA). Sondeo de Prevalencia de la litiasis renal en la región metropolitana, República Argentina, 1995. Anales X Congreso Argentino de Nefrología, San Carlos de Bariloche, p 28
15. Fleiss JL (1981) Statistical methods for rates and proportions. Wiley, New York, p 14
16. del Valle E, Spivacow R, Zanchetta JR (1999) Metabolic abnormalities in 2,612 patients with nephrolithiasis. Medicina (Buenos Aires) 59:417–422
17. Soucie JM, Thon MJ, Coates RJ, McClellan W, Austin H (1994) Demographic and geographic variability of kidney stones in the United States. Kidney Int 46:893
18. Robertson WG, Peacock M, Baker M, Marshal DH, Pearlman B, Speed R, Sergeant V, Spith A (1984) Epidemiological studies on the prevalence of urinary stone disease in Leeds. In: Ryall RL et al (eds) Urinary stone. Churchill and Livingston, Melbourne, p 6