Prevalence of renal stones in Andalusian population: Results of PreLiRenA study


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KEYWORDS
Urolithiasis; Prevalence; Incidence

Abstract
Introduction: Urolithiasis is a disease having a high recurrence rate and associated morbidity. A not well quantified increase is being seen in recent years that could be related with various factors. The main purpose of our study has been to estimate urolithiasis prevalence and incidence in the region of Andalusia, determining which factors are associated.

Material and methods: We performed an observational and cross-sectional study. Using a multistage randomized procedure, we selected a sample of 2439 subjects, aging from 40 to 65 years old, who currently lived in Andalusia. Data was collected through phone interviews, questioning the chosen subjects about their kidney stones history, comorbidity and socio-demographic characteristics. We conducted a descriptive, bivariate and multivariate analysis with logistic regression.

Results: A total of 2439 subjects were surveyed. Subjects had mean age of 51.1 ± 7.61 years – standard deviation; (95% confidence interval – 95% CI: 50.70–51.30), 48.7% of whom were male. Prevalence of urolithiasis obtained was 16.4% (95% CI: 14.87–17.85%) and an incidence of 1.2 (95% CI: 0.74–1.64). Variables significantly associated with the presence of urolithiasis found in the multivariate study were: presence of a family history of kidney stones (odds ratio – OR: 1.91; 95% CI: 1.51–2.40, p < .001), hypertension (OR:1.58; 95% CI:1.24–2.02; p < .001), gout (OR:1.98; 95% CI: 1.26–3.12; p = .003) and a high BMI (OR: 1.60; 95% CI 1.19–2.17; p = .008).

Conclusions: A significant increase in the prevalence and incidence of urolithiasis is observed in the environment in regard to the previously available figures. The presence of a family history of urolithiasis, hypertension, gout as well as having a high BMI could influence the observed epidemiological changes in renal lithiasis.

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Prevalencia de la litiasis renal en Andalucía: resultados del estudio PreLiRenA

Resumen

Introducción: La urolitiasis es una enfermedad con alta tasa de recidiva y gran morbilidad asociada. Se está percibiendo un aumento no bien cuantificado en los últimos años que podría estar relacionado con diversos factores. El objetivo principal fue estimar la magnitud de la urolitiasis en Andalucía y determinar qué factores se hallan asociados.

Material y métodos: Realizamos un estudio observacional, transversal. Mediante procedimiento aleatorizado polietápico seleccionamos una muestra de 2.439 sujetos, de 40 a 65 años, residentes en Andalucía. La recogida de datos se realizó mediante encuesta telefónica, interrogiando a los sujetos sobre antecedentes de litiasis renal, comorbilidad y características sociodemográficas. Realizamos un análisis estadístico descriptivo, bivariado y multivariado (regresión logística múltiple).

Resultados: Fueron encuestados 2.439 sujetos, con una edad media de 51,1 ± 7,61 años-desviación típica (intervalo de confianza al 95% [IC 95%]: 50,70–51,30) de los cuales el 48,7% eran varones. La prevalencia de urolitiasis fue del 16,4% (IC 95%: 14,87–17,85) y la incidencia del 1,2% (IC 95%: 0,74–1,64). Como variables asociadas a la presencia de urolitiasis en el estudio multivariado encontramos la presencia de antecedentes familiares de litiasis renal (odds ratio [OR]: 1,91; IC 95%: 1,51–2,40; p = 0,001), la hipertensión arterial (OR: 1,58; IC 95%: 1,24–2,02; p = 0,001), padecer gota (OR: 1,98; IC 95%: 1,26–3,12; p = 0,003) y un índice de masa corporal elevado (OR: 1,60; IC 95%: 1,19–2,17; p = 0,008).

Conclusiones: Se constata un incremento importante de la prevalencia e incidencia de urolitiasis en nuestro medio con respecto a las cifras que previamente conocíamos. La presencia de antecedentes familiares de urolitiasis, la hipertensión arterial, la gota, unido a un índice de masa corporal elevado, podrían desempeñar un importante papel en los cambios epidemiológicos observados en la litiasis renal.

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Introduction

The prevalence of renal lithiasis (RL) is estimated at between 4 and 20%, with a peak incidence between the fourth and fifth decades of life.1 An important aspect of this disease is the high percentage of recurrences, ranging from 40 to 60% at years 5 and 9, respectively.2

The only epidemiological study at the national level until now was conducted in 1984, establishing an annual incidence of 0.27% and a prevalence of 4.16%.3 These results have served as a frame of reference for subsequent studies.4-5

A limitation to be taken into account is that most of the studies conducted are based on care-related data, so they do not reflect its true magnitude, since not all cases are reported (hidden morbidity).6-9

In the last few years, several studies have referred to an increase in the magnitude of the lithiasic disease especially in highly developed industrialized countries,6,10,12 and this seems to be due to a greater prevalence of cardiovascular risk factors. Dietary factors and lifestyles seem to play a crucial role in the risk of RL.10,13,14

Therefore, due to social and economic implications, it is necessary to gather more accurate and up-to-date data on the epidemiology of RL, for the development of strategies, promotion and prevention schemes, and clinical action protocols aimed at reducing and controlling this health issue.

The main aim of this study was to estimate the prevalence and incidence of RL in Andalusia in a population between 40 and 65 years of age. As a secondary aim, we set ourselves the objective of determining which factors (comorbidity and socio-demographic factors) are associated with it.

Materials and methods

A more detailed description of the methodology in this work has been previously published.15

An observational, cross-sectional, epidemiological study was conducted in the population scope. By using multistage randomized sampling method, we selected a sample of 2439 individuals, between 40 and 65 years of age, of both sexes, resident in Andalusia, who were interviewed by 2 people with previous experience in conducting surveys of a similar nature.

The exclusion criteria were: inability to understand interview questions, not speaking Spanish, not being resident in Andalusia or their refusal to participate.

Consent to participate in the study was obtained from all patients. The study was approved by the Ethics and Clinical Research Committee of the Reina Sofia Hospital in Córdoba.

For the estimation of the sample size, we took into account an expected proportion of RL of 5% (prevalence obtained from the study by Sánchez-Martín1), a level of confidence of 95% and an accuracy of ±1.1%. On the basis of a non-response rate of 25%, the estimated size was 2432 individuals.

We used a randomized sampling system stratified by province, sex, and age groups. Sample subjects were obtained from the user database of the Andalusian Health
Table 1 Prevalence of renal lithiasis by sex and age groups.

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>Prevalence (%) of renal lithiasis (95% CI)</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>40–44</td>
<td></td>
<td>13 (9.2–16.8)</td>
<td>14.7 (10.6–18.8)</td>
<td>13.8 (11.1–16.6)</td>
</tr>
<tr>
<td>45–49</td>
<td></td>
<td>12.1 (8.1–16.2)</td>
<td>16.8 (12.1–21.5)</td>
<td>14.4 (11.3–17.5)</td>
</tr>
<tr>
<td>50–54</td>
<td></td>
<td>17.5 (12.0–23.0)</td>
<td>19.2 (13.7–24.6)</td>
<td>18.4 (14.5–22.2)</td>
</tr>
<tr>
<td>55–59</td>
<td></td>
<td>17.4 (11.6–23.3)</td>
<td>15.9 (10.9–20.9)</td>
<td>16.6 (12.8–20.3)</td>
</tr>
<tr>
<td>60–65</td>
<td></td>
<td>23.8 (17.9–29.7)</td>
<td>16.7 (11.8–21.7)</td>
<td>20.1 (16.3–23.9)</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>16.2 (14.0–18.3)</td>
<td>16.5 (14.4–18.6)</td>
<td>16.4 (14.9–17.8)</td>
</tr>
</tbody>
</table>

95% CI: confidence interval for 95%.

Service. In order to check whether the sampling was representative of the study population, we took as a reference that population registered in the Spanish population census, provided by the National Institute of Statistics.

Sampling with replacement was used, for which a reserve list was made available with subjects of similar socio-demographic characteristics; when the originally chosen candidate was considered as ‘not locatable’, after having tried to contact them at least on three occasions, another one was chosen from that list.

The interview had a short average duration (10 min), in order to prevent dropouts due to a ‘fatigue’ effect. In order to verify the reliability of the information gathered, a concordance analysis (using the test-retest procedure) was conducted on a subsample of 40 subjects, and the results obtained in the original interview with those provided by a specialist urologist.

The study variables were: (1) RL (colloquial language was used: ‘kidney stones’), year of diagnosis, the professional who diagnosed them with this process, treatment received, spontaneous stone expulsion; (2) socio-demographic variables: age, sex, nationality, municipality of residence, level of studies and social class based on occupation; and (3) clinical variables: high blood pressure (HBP), diabetes mellitus (DM), hypercholesterolemia, gout, a family history of RL, weight (kg) and size (cm), from which body mass index was calculated (BMI = weight/size²).

Statistical analysis

EPIDAT 3.1 and SPSS 17.0 software was used. Descriptive statistics was carried out and the 95% confidence intervals (CI 95%) of the main study estimators were calculated. A bivariate analysis was then done to check the relationship between independent variables (socio-demographic and clinical ones) and the presence of RL, for which Chi-square tests, Fisher’s exact test, Student’s t test or ANOVA (after verification of normality using Kolmogorov-Smirnov test) were used. The contrasts used were bilateral (p < 0.05). Crude odds ratios (COR) were estimated with their respective CI 95%. Finally, a multivariate analysis was performed, where multiple logistic regression was used. In order to create the model, we used the ‘enter’ method of the SPSS software, where the socio-demographic variables and those covariables which proved to be statistically significant in the bivariate analysis were introduced. Social class was treated as a dummy variable, considering the lowest social class as the reference category. Goodness of fit was checked by using Hosmer–Lemeshow test.

Results

2858 people were contacted by phone over a period of six months in order to reach the pre-established sample size. 85.3% (n = 2439) of the subjects met the inclusion criteria and agreed to participate in the survey.

The mean age was 51.1 ± 7.6 years – standard deviation (SD) – (CI 95%: 50.70–51.30), 51.3% corresponding to women.

No significant differences were found between the study population and the sample with respect to the demographic variables (age, sex and province of residence).

The prevalence of RL obtained was 16.4% (CI 95%; 14.87–17.85), this being 16.5% in the case of women (CI 95%; 14.44–18.63) and 16.2% in men (CI 95%; 14.04–18.31), with a resulting men/women ratio of 0.93. The incidence obtained (year 2011) was 1.2% (CI 95%; 0.74–1.64).

As can be seen in Table 1, in the case of men prevalence increases with age, this being higher in the group from 60 to 65 years (23.8) (linear trend Chi-square = 12.939; p < 0.001).

Emergency and primary care physicians made the diagnosis of RL more frequently (51.2 and 27.5% respectively). In 13.5% of cases, the diagnosis was made by an urologist.

The spontaneous resolution rate was 29.64%, 71.46% of lithiasis subjects required treatment, medical expulsive treatment being the most widely used (Table 2).

The prevalence of cardiovascular risk factors in the sample was: HBP 26.9% (CI 95%; 25.08–28.64); DM 8.7% (CI 95%; 7.60–9.87); dyslipidemia 33.91% (CI 95%; 32.01–35.81); and gout 9.8% (CI 95%; 8.60–11.00). 29% (CI 95%; 27.17–30.81) of the subjects showed a family history (first grade) of RL.

Table 2 Type of treatment performed in patients with lithiasis.

<table>
<thead>
<tr>
<th>Treatment performed</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expulsive</td>
<td>233 (80.1)</td>
</tr>
<tr>
<td>Extracorporeal shock wave lithotripsy (ESWL)</td>
<td>38 (9.6)</td>
</tr>
<tr>
<td>Interventionist/surgery</td>
<td>14 (5.1)</td>
</tr>
<tr>
<td>Others</td>
<td>7 (2.1)</td>
</tr>
<tr>
<td>Does not remember</td>
<td>9 (3.1)</td>
</tr>
<tr>
<td>Total</td>
<td>301 (100.0)</td>
</tr>
</tbody>
</table>
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Table 3  Bivariate analysis of the variables associated with renal lithiasis.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Renal lithiasis (%)</th>
<th>p</th>
<th>cOR</th>
<th>95% CI for OR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>Yes</td>
<td></td>
<td>Lower</td>
</tr>
<tr>
<td>Foreigners</td>
<td>17.1</td>
<td>13.6</td>
<td>0.06</td>
<td>1.31</td>
</tr>
<tr>
<td>Family history</td>
<td>13.7</td>
<td>22.9</td>
<td>&lt;0.001</td>
<td>1.88</td>
</tr>
<tr>
<td>High blood pressure</td>
<td>14</td>
<td>22.9</td>
<td>&lt;0.001</td>
<td>1.83</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>15.8</td>
<td>22.5</td>
<td>0.015</td>
<td>1.55</td>
</tr>
<tr>
<td>Dyslipidemia</td>
<td>15.2</td>
<td>18.6</td>
<td>0.02</td>
<td>1.28</td>
</tr>
<tr>
<td>Gout</td>
<td>15.8</td>
<td>21.8</td>
<td>0.02</td>
<td>1.49</td>
</tr>
<tr>
<td>Overweight or obesity</td>
<td>13.3</td>
<td>18.5</td>
<td>0.001</td>
<td>1.48</td>
</tr>
</tbody>
</table>

95% CI: confidence interval for 95%; obesity: BMI ≥ 30; cOR: crude odds ratio; overweight: BMI = 25–29.9.

![Prevalence of kidney stones by sex according to BMI. Prevalence data expressed in percentages. BMI: body mass index; RL: renal lithiasis.](image)

Figure 1  Prevalence of kidney stones by sex according to BMI. Prevalence data expressed in percentages. BMI: body mass index; RL: renal lithiasis.

The mean BMI was 26.21 ± 4.41 (CI 95%: 26.04–26.39), with 17% of obese individuals (BMI ≥ 30) and 39% of overweight subjects (BMI: 24.9–29.9%) being found in the sample.

The BMI in patients with lithiasis was 26.97 ± 4.54 (CI 95%: 26.52–27.42), higher than that obtained in patients with no renal lithiasis (26.07 ± 4.37; CI 95%: 25.88–26.26; p < 0.001).

As shown in Fig. 1 there is a direct linear association between BMI values and the presence of RL in both sexes (Chi-square for men = 7.498; p = 0.006; Chi-square for women = 11.073; p = 0.001).

In the bivariate analysis (Table 3) the presence of a family history of RL, as well as suffering from HBP, DM, dyslipidemia, gout and/or obesity were significantly related to the presence of RL, whereas in the multivariate analysis (Table 4) the independent factors associated with the presence of RL were the following: belonging to the upper social class (class I) (OR = 1.49), the presence of a family history of RL (OR = 1.91), HBP (OR = 1.64), suffering from gout (OR = 1.98) and having a high BMI (OR = 1.03).

In the test–retest, a coincidence was found in the diagnosis of RL in 93.1% of subjects (CI 95%: 79.6–98.4).

Discussion

The lithiasic disease poses a major health issue, where it is necessary to know its true prevalence of so that it can be treated, not only for an improvement in the disease, but because, as shown by Parks and Coe in 1996,10 conservative treatment is cost-effective to avoid RL recurrences. There are several studies which have referred to an increase in the use of health resources for the treatment of these patients,10,12,17 which entails a significant socio-economic impact.18

In Spain, several epidemiological studies on RL have been conducted since the year 1977,19 but it was in 1984 when what can be considered as the only study at the national level with adequate methodology was published, establishing an annual incidence of 0.27% and a prevalence of 4.16%.3 This study has served as a reference for further work.5–9,11,20

Table 4  Multivariate analysis of the variables associated with renal lithiasis.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Wald test</th>
<th>p</th>
<th>OR</th>
<th>95% CI for OR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lower</td>
</tr>
<tr>
<td>Age</td>
<td>0.69</td>
<td>0.41</td>
<td>1.01</td>
<td>0.99</td>
</tr>
<tr>
<td>Sex</td>
<td>1.04</td>
<td>0.31</td>
<td>0.89</td>
<td>0.70</td>
</tr>
<tr>
<td>Social class I</td>
<td>4.54</td>
<td>0.03</td>
<td>1.49</td>
<td>1.03</td>
</tr>
<tr>
<td>Nationality</td>
<td>3.15</td>
<td>0.08</td>
<td>1.30</td>
<td>0.97</td>
</tr>
<tr>
<td>Family history</td>
<td>29.86</td>
<td>&lt;0.001</td>
<td>1.91</td>
<td>1.51</td>
</tr>
<tr>
<td>High blood pressure</td>
<td>14.88</td>
<td>&lt;0.001</td>
<td>1.64</td>
<td>1.28</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>0.63</td>
<td>0.43</td>
<td>0.86</td>
<td>0.59</td>
</tr>
<tr>
<td>Dyslipidemia</td>
<td>0.001</td>
<td>0.99</td>
<td>1.00</td>
<td>0.77</td>
</tr>
<tr>
<td>Gout</td>
<td>8.71</td>
<td>0.003</td>
<td>1.98</td>
<td>1.26</td>
</tr>
<tr>
<td>BMI</td>
<td>5.39</td>
<td>0.02</td>
<td>1.03</td>
<td>1.01</td>
</tr>
</tbody>
</table>

95% CI: confidence interval for 95%; BMI: body mass index; OR: odds ratio.

Omnibus test: 86.806, p < 0.001; Hosmer–Lemeshow test: 8.004, p = 0.433.
In 2007, Sánchez-Martín et al. conducted a review of the data available in Spain so far on the incidence and prevalence of RL, obtaining a mean incidence of 0.73% and a prevalence of 5.06%. Many of these studies used case-related data, which are not the most appropriate ones for estimating the true incidence and prevalence of this disease among the general population.

In countries where RL is included in population-based surveys, prevalence rates ranging from 3.5 to 18.5% have been found. This highlights the importance of RL for public health policies in different countries.

There are several studies referring to an increase of RL all across the world. Chronological studies conducted in the last few years showed a significant increase of this disease with respect to the previous data available in the same geographic areas. According to these studies, the highest incidence occurs between the third and fifth decades of life, a time with greater work activity with an important influence of dietary habits and lifestyles.

Therefore, in our study we have been able to verify that the prevalence and incidence of RL are higher than those found in other research reviews previously published in Spain, but being very similar to those obtained in the most recent international epidemiological studies.

This increase, especially in countries with greater industrial development, appears to be linked to changes in dietary habits and lifestyles that may play an important role in the risk of lithiasic disease and might be influencing this increase. Some recent researches have analyzed the role of cardiovascular risk factors in the occurrence of RL. Factors such as HBP, DM, high BMI and metabolic syndrome have been associated with an increased risk of suffering from RL.

In line with what has been reported in the literature, in the multivariate analysis we were able to note a directly proportional relationship between the presence of RL and blood pressure and BMI figures.

Obese patients show a series of changes in the urinary excretion of calcium, oxalate, citrate and uric acid that predispose them to the occurrence of RL. Bearing in mind that the WHO has considered obesity as one of the epidemics of the 21st century, these data might help explain the changes observed in the prevalence of RL in the last few years.

Likewise, gout was also significantly associated with the presence of RL. It is well known that patients with gout show a higher risk of suffering from RL, with a drop in urine pH being one of the factors responsible for this.

Another factor that might explain this high prevalence of RL in our environment is climate. Average temperature has been associated with the geographical variations of the lithiasic disease. The average temperature in Andalusia is high and higher than that in other Spanish regions. It would be interesting to expand the study to the rest of the Spanish territory, since weather conditions are different and an ecological correlation study illustrating differences in prevalence among the geographical areas of the country would support this hypothesis.

The improvement in diagnostic procedures in the last few years (ultrasound imaging, computed tomography) has considerably influenced the number of diagnoses in asymptomatic patients. Since this study has not only considered the diagnosis of symptomatic lithiasis, but also asymptomatic lithiasis, we believe that this might also have affected the increased prevalence of RL observed.

In our study, we have seen that the overall prevalence of RL was somehow higher in women (16.5%) than in men (16.2%), with a resulting men/women ratio of 0.93 and, although the differences found were not statistically significant, they go in line with what has been previously reported, with a decrease in the differences between both sexes that were illustrated in previous studies.

Considering that, as we have documented, the initial diagnosis is made in most cases either in the emergency department (51.2%) and in primary care (27.5%), with only 13.5% of cases being made by an urologist, it is important to make other professionals aware of the need for an appropriate clinical management of this disease.

Finally, one might say that despite phone survey being an appropriate and sufficiently contrasted method from the point of view of its validity and reliability to know the magnitude of certain health problems among the population (especially the population that does not attend health care services), it is true that this procedure has inherent limitations and disadvantages that may arise during its performance. In order to detect difficulties in the data collection phase (refusal to participate, understanding of the questions, etc.) a pilot study was conducted in a subsample of subjects. Although information biases might occur due to a lack of data verification (due to memory problems for example), RL, especially when it is symptomatic, due to its presentation form, is a disease that the patient often recalls without difficulty in most cases. When we evaluated the reliability of the diagnosis of RL by verifying the concordance between what was declared to the interviewer by the patient and what was reported a posteriori to an urologist, we obtained a satisfactory result (93% of coincidence).

Conclusions

The prevalence of RL in Andalusia is high in the age range studied, and substantially higher than that previously published in our environment. This increase is probably related to changes in the consumption pattern of dietary factors and in certain lifestyles, which should be studied in depth. These figures have major labor implications for the working population, where it generates a considerable expenditure, so we deem it important to make efforts in order to improve medical practice, both in its prevention as well as in its diagnosis and treatment.

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Conflict of interest

The authors declare that they have no conflict of interest.
References