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Association between Renal Stones Sonographic Findings and Demographic Data among Patients at Riyadh Hospitals, Saudi Arabia

Mahasin G. Hassan[1*], Tahani Alshammrani[1], Shahad Alshammeri[1], Faten Alotaibi[1], Sara Alzeryer[1], Reem Alharbi[1], Amal Almujalli[1], Sahar Mansour[1], Ibrahim Luttfi[2], Tasneem S. A. Elmahdi[3], Lubna Bushara[4], Halima Hawesa[1]

[1]Department of Radiological Sciences, College of Health and Rehabilitation Sciences, Princess Nourah bint Abdulrahman University, Riyadh, Saudi Arabia
[2]Home Health Care, Ministry of Health, Riyadh, Saudi Arabia
[3]Department of Radiological Sciences, Al-Ghad International Colleges for Applied Sciences, Al-Medina, Saudi Arabia
[4]Department of Medical Imaging and Radiation Sciences, Collage of Applied Medical Sciences, University of Jeddah, Saudi Arabia

Abstract

Background: Ultrasound is the primary imaging modality to identify renal stones (RS) in patients with acute flank pain. This study aimed to evaluate the presence, location, and size of RS diagnosed by ultrasound in association with age, gender, and body mass index (BMI) among patients at Riyadh hospitals.

Methods and Results: In this case-control study, a total of 250 records (130/52% for males and 120/48% for females) from 2018 to 2019 were reviewed from January to March 2020 at different hospitals in Riyadh. In this study, 150(60%) records of patients with RS and 100(40%) records of patients without RS were collected to evaluate the risk factor for RS formation in the central area of Saudi Arabia. A designed data collection sheet containing all variables (demographic and sonographic) of the study was used. Demographic data included gender, age, and BMI. Sonographic data included RS presence (yes, no), RS location (right kidney, left kidney, both kidneys), and RS size (small [<0.5 cm], average [0.5–1 cm], and large [>1 cm]). Statistical analysis was performed using statistical software package SPSS version 23.0 (SPSS Inc, Armonk, NY: IBM Corp).

The study found that RS were more common among males than females ($P<0.001$). The results show that in normal body weight, the frequency of stone presence was similar for right kidney and left kidney. In overweight patients, RS were more often observed in left kidney (P=0.000). We also found a significant association between BMI and RS size (P=0.049); the presence of smaller stones increases with BMI. There was no association between sonographic data and age (P>0.05)

Conclusion: Among patients at Riyadh hospitals, females are less affected by RS than males. Gender is a significant risk factor for the development of RS. The effect of BMI is obvious on renal stone location and size. (**International Journal of Biomedicine. 2022;12(4):580-583.**).

Keywords: kidney • renal stone • gender • demographic data • ultrasound

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Abbreviations

BMI, body mass index; **BW**, body weight; **RS**, renal stones; **RT**, right kidney; **LK**, left kidney.

Introduction

Renal stones (RS) are considered one of the most common diseases worldwide. Generally, calculi develop in one kidney, but sometimes in both kidneys.[1] Flank pain due to urolithiasis is a common problem with patients presenting to emergency departments. Radiology plays a vital role in diagnosing this problem. Many modalities can be used, including ultrasonography, X-ray and CT.[2]

Ultrasound is the primary imaging modality to identify RS in patients with acute flank pain.[3] Ultrasound detects the presence, location and size of RS. Kidney stones are seen as an echogenic focus that produces acoustic shadowing.[4]

Calculi can form in the kidneys at any age, but adults are under the threat of calculi creation in their kidneys more often than children. Climate influences people's diet plans, and it generally becomes a reason for the formation of calculi in their kidneys. Numerous other factors affect calculi formation in the kidney, including gender, the nature of the liquids consumed, and diet.[5]

In the US, a medical survey regarding calculi prevention discovered that the prevalence of calculi among women was 5% and among men, 12%.[1] In Japan, a study on the correlation of body mass index (BMI) with RS found that an increased BMI was a risk factor for Japanese men.[6]

In Saudi Arabia, result of studies in different parts of the country do not agree. A study conducted in the western region found that the middle-aged population in their third decade of life, as well as overweight and obese people, are at a high risk of developing urolithiasis.[7] However, another study in the eastern region found that the prevalence of RS is high among patients between 30 and 50 years of age, male gender and normal BMI.[8] There is a different climate in the central region of Saudi Arabia, which was the focus of our study, so the risk factors that affect the formation of RS there may differ.

This study aimed to evaluate the presence, location, and size of RS diagnosed by ultrasound in association with age, gender, and BMI among patients at Riyadh hospitals.

Materials and Methods

In this case-control study, a total of 250 records (130/52% for males and 120/48% for females) from 2018 to 2019 were reviewed using a picture archiving and communication system (PACS) from January to March 2020 at different hospitals in Riyadh. In this study, 150(60%) records of patients with RS and 100(40%) records of patients without RS were collected to evaluate the risk factor for RS formation in the central area of Saudi Arabia.

A designed data collection sheet containing all variables (demographic and sonographic) of the study was used. Demographic data included gender, age (classified into four groups: 18–37 years, 38–57 years, 58–77 years, and 78–97 years), and BMI (organized into four categories: underweight [<18.5 kg/m^2], normal weight [18.5–24.9 kg/m^2], overweight [>24.9–29.9 kg/m^2], and obese [>30 kg/m^2]). Sonographic data included RS presence (yes, no), RS location (right kidney [RK], left kidney [LK], both kidneys), and RS size (small [<0.5 cm], average [0.5–1 cm], and large [>1 cm]).[9]

Statistical analysis was performed using statistical software package SPSS version 23.0 (SPSS Inc, Armonk, NY: IBM Corp). Baseline characteristics were summarized as frequencies and percentages for categorical variables. Group comparisons were performed using chi-square test with Yates correction. A probability value of $P<0.05$ was considered statistically significant.

Ethical approvals were obtained from the research center at Princess Nourah Bint Abdulrahman University (PNU) before collecting data (IRB number: 20-0040).

Results and Discussion

Among 150(60%) records of patients with RS, about 44% of RS were located in right kidney, 50% - in left kidney, and 9% - in both kidneys simultaneously. About 20.8% of RS were small, 27.2% - average, and 12% large. Tables 1-2 show the distribution of sonographic data according to the demographic data (age, gender and BMI). There was no association between sonographic data and age ($P>0.05$) (Table 1). Gender showed an effect on the presence of RS (P0.001) (Table 2); BMI showed an effect on stone location ($P=0.010$) and stone size ($P=0.049$) (Table 3).

Table 1.

Association between age and sonographic data.

Age	RS presence		RS location			RS size		
	Yes	No	RK	LK	Both	Small	Average	Large
18-37 years	52	37	25	26	1	15	25	12
38-57 years	64	38	25	36	3	22	32	10
58-77 years	33	20	15	13	5	14	11	8
78-97 years	1	5	1	0	0	1	0	0
Total	150	100	66	75	9	52	68	30
P-value	0.156		0.596			0.474		

Table 2.

Association between gender and sonographic data.

Gender	RS presence		RS location			RS size		
	Yes	No	RK	LK	Both	Small	Average	Large
Female	57	63	27	27	3	24	22	11
Male	93	37	39	48	6	28	46	19
Total	150	100	66	75	9	52	68	30
P-value	0.000		0.799			0.300		

Table 3.

Association between BMI and sonographic data.

BMI	RS presence		RS location			RS size		
	Yes	No	RK	LK	Both	Small	Average	Large
Underweight	6	7	4	2	0	2	3	1
Normal BW	75	57	39	36	0	20	40	15
Overweight	62	36	19	35	8	29	23	10
Obesity	7	0	4	2	1	1	2	4
Total	150	100	66	75	9	52	68	30
P-value	0.082		0.010			0. 049		

Results obtained demonstrate that the age group between 38–57 years had a higher frequency of renal stones. It may be that this age group performed the most substantial activities, which led to dehydration. In the eastern region, the prevalence of renal stones was highest in patients aged 30–50 years. However, our results showed no significant association between sonographic data and age. A larger sample size may be needed to show the significance.

The left kidney was most affected by renal stones. The chi-square test indicated a nonsignificant association (P=0.596) between patients' age and the renal stone location. The presence of an average size of renal stones was observed somewhat more often, but without statistical significance (P=0.474). The study found that renal stones were more common among males than females (P<0.001). Different studies confirmed that the male gender is more affected.[8,10] There are various reasons for this result; heavy activities are performed by males, leading to dehydration, a high protein diet is spread among males, and males have a high prevalence of diabetes.[11] Gender did not affect the location or size of renal stones

The body mass index (BMI), first described by Adolphus Quetelet in the mid-19th century,[12] has been consistently used in a myriad of epidemiologic studies. However, the accuracy of body mass index in diagnosing obesity is limited, particularly for individuals in the intermediate body mass index ranges, in men, and in the elderly.[13] In a study performed by Romero-Corral et al.,[13] a BMI cutoff of ≥ 30 kg/m^2 had good specificity but misses more than half of people with excess fat.

Different studies[6,14] in different countries emphasized the effect of body mass index on the formation of renal stones. Our results regarding the effect of body mass index on the presence of renal stones is contrary to some literature data (P=0.082). However, the sample size may not be enough to show the significance. The effect of body mass index on renal stone location is obvious (P=0.010). The results show that in normal body weight, the frequency of stone presence was similar for right kidney and left kidney. In overweight patients, renal stones were more often observed in left kidney (P=0.000). However, this association needs more studies to justify these results. We also found a significant association between body mass index and renal stone size (P=0.049); the presence of smaller stones increases with body mass index. These stones can be impacted at the distal ureter and result in a hydroureter. Usually, these small stones are formed by uric acid, and the tendency toward uric stone formation increases with body mass index. On the other hand, larger stones are usually formed by calcium oxalate, which decreases with increasing body mass index.[15]

Conclusion

Among patients at Riyadh hospitals, females are less affected by renal stones than males. Gender is a significant risk factor for the development of renal stones. The effect of body mass index is obvious on renal stone location and size. The results show that in normal body weight, the frequency of stone presence was similar for right kidney and left kidney. In patients with overweight, renal stones were more often observed in the left kidney. The presence of smaller size stones increases with body mass index.

Competing Interests

The authors declare that they have no competing interests.

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***Corresponding author:** Mahasin G. Hassan, Department of Radiological Sciences, College of Health and Rehabilitation Sciences, Princess Nourah Bint Abdulrahman University, Riyadh, Saudi Arabia. E-mail: mghassan@pnu.edu.sa*

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