

Prevalence of Urolithiasis in Patients Presenting with Acute Flank Pain at Jordan University Hospital as Demonstrated by Unenhanced Helical CT Scan

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Abstract

Objectives: To identify the frequency and seasonal variations of renal stone disease in patients presenting clinically to Jordan university hospital with acute flank pain.

Materials and Methods: Six hundred twenty five consecutive patients who had acute renal colic and underwent unenhanced urinary tract CT were retrospectively reviewed. The presence or absence of urolithiasis, site, and number of urinary stones in each sex and in each season were determined.

Results: Renal stone disease was depicted in 40% of patients. The incidence of male to female ratio was 2.3:1. The prevalence ratio of urinary stones in male and female patients in summer and winter seasons were 1.7:1, and 1.5:1, respectively. The most common site of urinary stones was the pelvicalyceal system with a prevalence rate of 74%.

Conclusions: Renal stone disease is more common in male than in female patients; its frequency could be affected by dietary habits, socio-economic, and environmental conditions.

Keywords: Kidney, Ureter, Calculi, Computed Tomography, Renal Colic.

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Introduction

Acute flank pain is a common clinical presentation in the emergency departments and the pain is usually so severe that necessitates a rapid and efficient diagnostic modality to enable a rapid patient management. Although intravenous urography was considered the best diagnostic modality for a long time, the possible allergic reactions and nephrotoxicity related to the iodinated contrast material rendered this exam not so much desirable in the emergency settings beside the other known disadvantages.

The published diagnostic accuracy of Ultrasonography (US) in patients with urolithiasis is variable. Some authors found that this procedure is excellent,¹ while others found that it is of insufficient accuracy.²⁻⁴ The detection power of US in patients with urolithiasis is usually governed by several factors such as operator experience, site and size of stones, morphology of the patient, and the presence of abdominal distension.

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Uric acid, cystine, and struvite stones can be found in up to 20% of cases presenting with renal colic.⁵ However, the appearance of cystine and struvite stones on plain radiograph depends on their calcium content. Unenhanced Helical CT scan (UHCT) can show all types of stones as hyperdense structures whatever their chemical composition is.⁶ It is now considered by many authors as the most accurate diagnostic tool in patients with acute renal colic.^{3,7,8}

We aimed in this retrospective study to point out the prevalence and seasonal variation of urolithiasis in patients presenting at Jordan University Hospital (JUH) with acute flank pain, to determine its frequency in each sex and in each age group, and to define the most common sites of urinary stones by using UHCT scan.

Materials and Methods

In this retrospective study, patients with acute flank pain were only included. From January to August 2008, 625 consecutive patients (374 men, 251 women; mean age 51 ± 17 y; range, 14-78y) presented to JUH with acute renal colic underwent UHCT scan to evaluate the urinary system. All CT examinations were performed by using the same renal colic protocol without any vascular or oral opacification. Unenhanced helical CT scan was performed with a Somatom Plus 4 machine (Siemens, Germany). The images were obtained with the patient in the supine position during breath-hold plus quiet breathing. The explored area extended from the upper poles of both kidneys down to pubic symphysis using 5mm collimation with a table speed of 7.5mm/second giving a pitch of 1.5:1. Images were obtained with a 0.75-second gantry rotation by using 120 KVp and 206 mA giving 155 mAs. Multiplanar Reformation (MPR) in coronal oblique direction was used when the location of stone was uncertain. All CT examinations were reported on hard copy images by general radiologists having experience of 7-18 years in a teaching hospital. The presence or absence of urolithiasis was determined. In addition, the site, number of stones and presence or absence of associated ureteral and or pelvicalyceal system dilatation were also recorded.

To define the presence or absence of seasonal variation of renal stone disease in a country with a relatively hot summer climate, the patients who had their UHCT in the winter season (January-April) were defined as category A, and those in the summer season (May- August) as category B. In addition, the patients were stratified into four groups according to their age. Group I, for those aged < 20 y, group II, for patients aged between 21-40y, group III, and IV for those aged 41- 60y, and > 60 y, respectively. The prevalence of renal stone disease in each category, and in each patient's group was determined in each sex. Identification of phleboliths was based on morphologic criteria, such as round shape with or without central lucency, and by multiplanar reconstructed images in difficult cases as that allows a better identification of the ureter.

For statistical analysis, unpaired two-tailed student's t-test was used to define the significance difference in the mean number of urinary stones in summer and in winter seasons in each patient's sex. Anova single factor test was used to find out any statistically significant difference in the mean number of stones across the different age groups. Pearson's correlation test was served to define any correlation between the frequency of urinary bladder stones and patient's age in each sex.

Results

Renal stone disease was found in 253 of 625 patients (40%). There were 177 male patients with mean age of 48 ± 18 y, and 76 female patients with a mean age of 53 ± 15 y. The male to female ratio of renal stone disease was 2.3:1. There was a statistically significant difference in the mean ages between the two sexes ($p=0.03$).

The total number of urinary stones was 530 stones. There were 386 (73%) stones in male patients and 144 (27%) stones in female patients. The distribution of urinary stones in each sex is shown in table (1).

Table (1): Distribution of 530 urinary stones in each sex and season.

Site of Stone Seasons	Male		Female		Total Both
	Summer	Winter	Summer	Winter	
Calyceal	146(28%)	86(16%)	60(11%)	38(7%)	330(62%)
Renal Pelvis	26(5%)	13(2%)	9(1.7%)	10(1.9%)	58(11%)
Ureteric	43(8%)	34(6%)	15(3%)	7(1%)	99(19%)
Urinary bladder	28(5%)	10(2%)	3(0.6%)	2(0.4%)	43(8%)
Total	243(46%)	143(27%)	87(16%)	57(11%)	530(100%)

The number of urinary stones detected in men in the summer and winter seasons were 243, and 143 stones giving a prevalence ratio of 1.7:1, respectively, while in women these values were 87, and 57 stones, respectively with 1.5:1 ratio. There was no statistically significant difference found between the mean number of stones in both seasons neither in men nor in women (p=0.19, and 0.36, respectively), and similarly across different age groups (p=0.4).

Ninety five percent of urinary stones were detected in patients aged > 20 years old. The distribution of urinary stones according to patient's age groups irrespective to both sex and season is shown in table (2).

In patients with group I, there were nine (3.5%) patients having 26 stones (4.9%): 21 (80%) stones located in the Pelvi-Calyceal (PC) system, five ureteric stones (19%), and no urinary bladder stone detected.

In patients with group II, there were 79 (31%) patients having 176 stones (33%): 135 (76.7%) stones in the PC system, 40 (22.7%) ureteric stones, and one (0.56%) urinary bladder stone.

In patients with group III, there were 87 (34.5%) patients having 159 (30%) stones: 129 (81.7%) PC system stones, 23 (14.4%) ureteric stones, and six (3.7%) urinary bladder stones.

In patients with group IV, there were 78 (31%) patients having 169 (31.8%) stones: 105 (62%) PC system stones, 28 (16.5%) ureteric, and 36 (21.3%) urinary bladder stones.

The most common site of urinary stones was the pelvicalyceal system with a prevalence rate of 74%, followed by ureteric stones (18%), and then urinary bladder stones (8%). The lower calyceal group was the most common site of renal stones harbouring 29% (156 stones) of all PC system stones, and the most common site of ureteric stones was at its pelvic portion with an incidence rate of 69% (96 stones). The number of urinary bladder stones was significantly higher in men than in women (38 vs 6 stones). There was a positive correlation between the patients age and incidence of urinary bladder stones, it was stronger in male (r=0.34) than in female patients (r=0.24).

The PC system was dilated in 102 (40%) patients; it was mild in 60 (24%), moderate in 30 (12%), and marked in 12 (5%) patients.

Table (2): Distribution of urinary stones according to patients age groups.

	Group I <20y	Group II (20-40y)	Group III (41-60y)	Group IV >60y	All groups
Patients Number	9	79	87	78	253
Stones Number					
upper calyceal	0	29	21	17	67
middle calyceal	5	37	36	29	107
lower calyceal	8	54	51	43	156
renal pelvis	5	14	23	16	58
lumbar ureter	1	5	2	2	10
iliac ureter	0	9	8	4	21
pelvic ureter	3	9	9	14	35
UV junction	1	18	6	8	33
urinary bladder	0	1	6	36	43
Total	23	176	162	169	530

Discussion

The first published reports on the use of UHCT scan for imaging patients with renal colic was in 1995.⁹ Several authors have found that UHCT was superior to IVU for diagnosis of renal colic, and nearly one third of ureteric stones could be missed at IVU.^{8, 10-12} UHCT permits a rapid imaging of urinary system, excellent visualization of both radiolucent and radio-opaque stones, and elimination of risks that could be related to intravenous contrast-material injection.

The prevalence of urolithiasis have been described to be increased over time and that was attributed to dietary habits and long-term temperature changes.¹³⁻¹⁵ In U.S.A, an increase in the prevalence of stone disease was from 3.6 to 5.2% between the time periods 1976-1980 and 1988-1994 has been reported.¹⁶ According to several published studies performed in the USA, Japan, and India, renal stone disease showed marked geographic variability even in the same country.^{14,15,17} In one study performed in Saudi Arabia, the authors reported that the prevalence of urinary stones was 2.5 times in Saudi than in non-Saudi patients.¹⁸

The incidence rate of urinary stones in our study group (40%) was lower than the published rates of other studies performed in USA, and Europe.¹⁹⁻²³

Several authors had described the presence of seasonal variation of urinary stones disease, so that they were more frequent in hot seasons, and that was similar to our observation.^{18,24} In another study performed in South Australia, seasonal variation was only found with uric acid stones, being significantly increased during summer and autumn seasons.²⁵ This seasonal variation is related to increased perspiration, low urinary output in hot seasons, and low fluid intake that directly increases stone risk by increasing urinary saturation of stone-forming salts.

The mean age of our patients was similar to some reports^{19,20} and higher than others.^{22,24}

Although the frequency of urinary stones in our study was significantly lower in patients aged less than 20y (5%), no significant difference was found across the other age groups. In two different studies performed in South Asia, the authors in the first study found that renal stone disease was higher in middle-aged patients,²⁶ and in the second study, it was reported that the disease was more frequent in elderly patients.¹⁴ Some authors found that the incidence of uric acid stones only increased with patient's age,^{26,27} while other authors concluded that stone composition did not differ with patient age.¹⁷

Our results demonstrated that the highest prevalence of urinary stones (65%) was among patients aged 21-60y, and was 31% in middle age or in older patients. These observations suggest that the physically and mentally active persons are more liable to develop urinary stones.

The prevalence of urinary stones in our study group was two times in male than in female patients and that was in agreement with several studies performed in different races^{14,17,18,28} except in black and Hispanic populations where this ratio was found to be inversed.²⁸

Our results demonstrated that the prevalence of upper urinary tract stones in our patients was significantly higher than in lower urinary tract stones; it was similar to Asian studies,^{13,14,29,30} and in contradictory to European reports. In Europe, the published rate of ureteric stones was 60-85%, in patients with renal colic and that was much higher than our findings, and for kidney stones was 32% and that was much lower than ours.^{4, 31} The most common site of renal stones was the lower calyceal system (40%) and for ureteric stones was its pelvic portion (79%). This can be explained by a relative urine stasis in these dependent parts, and to the presence of an anatomical ureteric narrowing which favours a delayed urinary emptying.

The prevalence of urinary bladder stones was found to be highest in elderly patients, particularly in men and that can be related in part to the presence of urinary bladder wall hypotonia that may affect elderly patients irrespective to

sex, and to the presence of urine outflow obstruction caused by prostatic enlargement in men. Urinary bladder stones are also thought to be temperature independent and can be induced as a result of infection, and other factors.¹⁵

The prevalence rate of renal stone disease could be higher in our population if 3mm sections have been used, but that will be at the expense of radiation dose. With our technique of 5mm slice thickness small stones would not be depicted. In many studies,^{21-23,32} 5mm slice thickness was used and the prevalence rate of renal stone disease was higher in their patients than in ours. That means that there are other additional factors than the technical ones which may affect the outcome. In addition, the final diagnosis was only based on UHCT findings, and no other surgical or clinical follow-up proof was looked for in our study.

Conclusions

The prevalence of renal stone disease in our study group is less than that published in western countries, and it mainly affects the upper urinary system. Its frequency could be affected by several factors such as dietary habits, diuretic consumption, geographic, and socio-economic conditions. It is also influenced by seasonal variations being higher in summer than in winter seasons, and finally men are at a higher risk of forming stones than women.

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شيوع حصى المسالك البولية لدى المرضى الذين يشكون من ألم حاد في جانب البطن في مستشفى الجامعة الأردنية بناء على نتائج التصوير الطبقي الحلزوني دون مادة ملونة

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الملخص

الأهداف: لتحديد معدل تكرار وجود حصى المسالك البولية وتغيره بالنسبة لفصلي الشتاء والصيف لدى المرضى الذين راجعوا عيادات مستشفى الجامعة الأردنية ويشكون من ألم حاد في جانب البطن.

الطريقة: تمت مراجعة 625 مريضاً يعانون من ألم حاد في الجنب، وتم عمل صورة طبقية للمسالك البولية دون مادة ملونة وتمت مراجعة صورهم بأثر رجعي.

تمت دراسة الصور من حيث وجود او عدم وجود الحصى، مكان وجودها وعددها لدى كلا الجنسين في فصلي الشتاء والصيف.

النتائج: وجدت الحصى عند 40% وكانت نسبة الرجال الى النساء 1:2,3. تناسب الحصوات لدى الرجال والنساء في الصيف والشتاء كان على التوالي 1:1,7 و 1:1,5.

الاستنتاج: نسبة شيوع مرض حصى الكلى اكثر عند المرضى الذكور منها عند الاناث. معدل التكرار لوجود الحصى يتأثر بالعادات الغذائية، الحالة الاجتماعية والاقتصادية بالإضافة الى الظروف البيئية.

الكلمات الدالة: الكلية، الحالب، الحصى، صورة طبقية، ألم حاد في جانب البطن.