

The utility of unenhanced helical CT in assessing the frequency of ureterolithiasis in Saudi patients

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ABSTRACT

الأهداف: الأشعة المقطعية بدون حقنة صبغية إجراء بسيط وسهل. إلا أن هناك قليل من المخاطر الإشعاعية. تهدف هذه الدراسة إلى معرفة نسبة الحصوات في المرضى الذكور والإناث وأعمارهم في السعودية.

الطريقة: تم عمل الأشعة المقطعية على جهاز متعدد الشرائح ماركة جنرال إلكتريك. كل المرضى كانوا سعوديين. راجع الملفات الطبية الأطباء أخصائيي الأشعة. المرضى المدرجين كانوا سعوديين، وكانوا يشتكوا من المغص الكلوي أو دم في البول. أما الذين كان لديهم تشخيص سابق بحصوات كلوية أو ليس لديهم ألم فقد تم استبعادهم من الدراسة.

النتائج: كان العدد الإجمالي 650، جميع المرضى كانوا يشتكون من المغص الكلوي أو دم في البول. 220 مريضة بنسبة 33.8% و 430 مريض بنسبة 66.2%. نسبة الذكور إلى الإناث 1 إلى 2. 395 من 650 مريض كان لديهم حصوات حاليه. 2 منهم (0.5%) في الفئة العمرية من 15-50 سنة و 28 (7.1%) في الفئة العمرية من 51-65 سنة و 99 منهم (25.1%) في الفئة العمرية من 26-35 سنة و 84 (21.9%) في الفئة العمرية من 36-45 سنة و 25 (6.3%) في الفئة العمرية من 66-99 سنة و 28 (7.1%) في الفئة العمرية من 16-25 سنة و 99 (25.1%) في الفئة العمرية من 26-35 سنة و 106 (26.8%) في الفئة العمرية من 36-45 سنة و 84 (21.9%) في الفئة العمرية من 46-55 سنة و 51 (12.9%) في الفئة العمرية من 56-65 سنة و 25 (6.3%) في الفئة العمرية من 66-99 سنة. The most significant finding in our study is that as the patients age increases so does the percentage of stones up to the age of 56, with a peak at age group of 26-35 where stone percentage reaches 26.8%.

خاتمة: الأشعة المقطعية ذات فائدة في تشخيص نسبة حصوات الحالب في المرضى.

Objective: To identify 650 patients who underwent CT for renal colic, and review them for age and gender, in Saudi Arabia.

Methods: Scans were performed on a 16 multislice scanner. A total of 650 patients, with the clinical suspicion of ureteric colic were reviewed; 220 females (33.8%) and 430 males (66.2%), with a female to male ratio of 1:2. Exams were carried out from January 2005 to November 2006, at King Khalid University Hospital, Riyadh, Kingdom of Saudi Arabia.

Results: Three hundred and ninety five patients out of 650 had stones; 2 of 395 (0.5%) had stones in the 15-15

years age group, 28 (7.1%) in the 16-25 years age group, 99 (25.1%) in the 26-35 years, 106 (26.8%) in the 36-45 age group, 84 (21.9%) in the 46-55 age group, 51 (12.9%) in the 56-65 age group, and 25 (6.3%) in the above 66 years age group. The most significant finding in our study is that as the patients age increases so does the percentage of stones up to the age of 56, with a peak at age group of 26-35 where stone percentage reaches 26.8%.

Conclusion: Unenhanced helical CT is useful for the diagnosis of ureterolithiasis.

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Our institution is a tertiary referral for urology, and CT has been a diagnostic tool for renal and ureteric calculi. The CT has been an imaging modality of choice, since its inception in 1994 for the diagnosis of renal colic.¹ The exam is quick, efficient, and does not use contrast media, however, it involves radiation, which is a potential hazard. The aim of our study is to identify patients who underwent CT for renal colic, and review them for age and gender, in Saudi Arabia.

Disclosure. All authors disclose that there is no conflict of interest, and that this study is not sponsored by any company.

Methods. Case records of 650 patients who underwent unenhanced CT for the clinical diagnosis of renal colic from January 2005 to November 2006 were reviewed in January 2007, nearly 1-2 years post diagnosis. The study was approved by the hospital ethical committee. All patients were Saudi. A total of 650 patients with the clinical suspicion of ureteric colic were reviewed, 220 were female (33.8%) and 430 were male (66.2%), with a female to male ratio 1:2. No follow up was performed. Indications for CT were loin pain radiating to the testicles, and microscopic hematuria. Patients with a prior CT, ultrasound in the past 6 months for confirmed stones or suspicion of diagnosis of ureterolithiasis were excluded. Also, non Saudi patients were excluded from the study for demographical purposes. Scans were performed on a 16 Multislice Multidetector Scanner (GE Light Speed, (General Electric, Milwaukee, WI) using 2.5 mm collimation, and a pitch of 0.625 and table speed of 12.5, without oral or intravenous contrast.

Data analysis and statistical methods were the t test and chi square, as described in detail in the results section. Statistical Package for Social Sciences version 12 (SPSS Inc. Chicago Illinois) were used for the data analysis. This method will improve the interpretation by using the chi-square test to compare between 2 different groups (patients having stones and patients without stones). We assumed there was a statistical significant difference if $p < 0.05$.

Results. Age range for the 650 patients was as follows: 9 (1.4%) in the age group 5-15 years, 63 (9.7%) in the 16-25 year group, 152 (24.9%) in 26-35 the

year group, 163 (25.1%) in the 36-45 year group, 150 (23%) in the 46-55 year group, 79 (12.2%) in the 56-65 year group, and 34 (5.2%) in above 66 years (**Figure 1**). There were 395 from 650 who had stones, 2 out of 395 (0.5%) had stones in the 5-15 years age group, 28 (7.1%) in the 16-25 years age group, 99 (25.1%) in the 26-35 years, 106 (26.8%) in the 36-45 age group, 84 (21.9%) in the 46-55 age group, 51 (12.9%) in the 56-65 age groups, and 25 (6.3%) in the above 66 years age group (**Figure 1**). This difference in age groups, and presence of a stone is statistically significance ($p=0.011$), as the patient's age increases so does the percentage of

Table 1 - Age versus stone cross tabulation.

Characteristics	Value of Pearson square Likelihood ratio Linear by linear	Degrees of freedom	Level of significance (2-sided)
Pearson chi-square*	16.734*	6*	0.010*
Likelihood ratio*	16.625*	6*	0.011*
Linear by linear association*	7.857	1	0.005
N valid cases*	650	--	--
Pearson chi-square†	4.852†	6†	0.598†
Likelihood ratio†	4.629†	6†	0.592†
N valid cases†	395†		
Pearson chi-square‡	3.961‡	6‡	0.682‡
Likelihood ratio‡	3.968‡	6‡	0.681‡
N valid cases‡	650‡	--	--

*Age versus (vs) stones cross tabulation, †sex distribution vs stone cross tabulation, ‡sex distribution vs stone cross tabulation, N - number

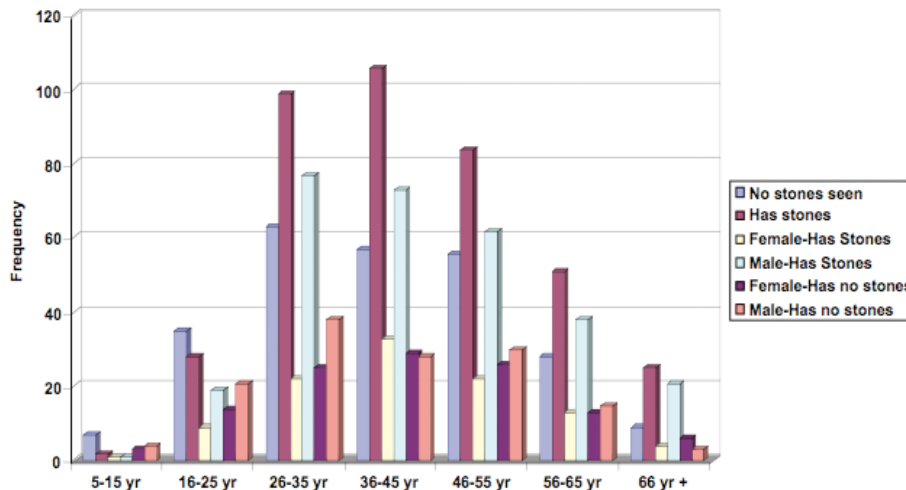


Figure 1 - Age distribution versus gender in finding of stones.



Figure 2 - Unenhanced helical CT at the level of L2, showing 4 x 3mm stone in the interpolar region of the left kidney (arrow).

stones. This however, was reversed at age 56 and above (**Table 1**). There was no statistical significance in the males or females when crossed tabulated against age groups (**Figure 1 & Table 1**), and there was no statistical significance for males or females ($p=0.592$) for those who had stones (**Table 1**).

Average age of patients with or without stones was 42.04 ± 14.06 years for all 650 cases. Average age for males was 42.25 ± 10 , average age for females was 41.64 ± 13.6 . There was no statistical significance ($p=0.601$). Three hundred and ninety five patients had stones, corresponding to 60.8%. Males who had stones were more than females, as there were 430 males in the study and out of those, 291 had stones (67.7%) while 104 out of 220 females had ureteric stones (47.3%) ($p < 0.001$).

Discussion. Helical CT for renal colic was first introduced in our institution, a tertiary referral for urology, in late 2003 as an imaging modality to detect ureterolithiasis, the practice of urology since then has revolutionized. This comes as no surprise as the same happened when it was first introduced in the west in 1995.^{1,2} The test has a high sensitivity, specificity, and diagnostic accuracy (more than 90%). Stone size can be assessed accurately along with its secondary effects.³ The radiation dose on average doubled the radiation risk, compared with excretory urography. However, the effective dose varied considerably, mainly as body mass, as well as the number of images taken at excretory urography.⁴ Advantages of CT is its excellent contrast resolution, its ability to measure the tissue attenuation coefficient on top of obtaining transaxial images, and reformation. Its main disadvantage is its high radiation dose. The aim of our study is to determine the utility

of unenhanced helical CT in assessing the frequency of ureterolithiasis in Saudi patients from an age group, and gender prospective.

The most significant finding in our study is that as the patients age increases so does the percentage of stones, till the age of 56 with a peak at age group of 26-35 where stone percentage reaches 26.8% after which it then decreases. This is likely related to the working age group where most work and are exposed more to the sun, and consume less water, that is in addition to any genetic predisposition. More studies need to be carried out in this matter. The second most significant finding in our study was that males had ureteral stones more than females, as 67.7% males had stones who presented with renal colic, where as only 47.3% of females had stones when presenting with renal colic. This can also be attributed in addition to genetic predisposition to the working groups, as more males work in Saudi than females, and furthermore, other factors such as sun exposure, dehydration, and lifestyle issues associated with risk factors such as obesity, may play a role. Further studies need to be performed on the Saudi population.

This is in contradiction to the recent studies^{5,6} that male predominance of nephrolithiasis and ureterolithiasis is decreasing, we think this contradiction is related to the special diet and lifestyle of Saudi's. Hypercalciuria is a strong risk factor for stone formation, the dietary factors associated with it is excessive animal protein intake, refined carbohydrates, and sodium.⁷⁻⁹ This is a major factor in the Saudi diet, which is rich in animal protein intake. The CT can also determine almost all types of calculi. It was sometimes difficult in our study to determine a phlebolith from calculi, particularly in elderly or patients whom have little retroperitoneal fat or those having non obstructive calculi.¹⁰ A useful sign to detect calculi was the soft tissue rim sign¹¹ (**Figure 2**), and is believed to represent edematous ureteral wall surrounding a ureteral stone, and was found to have a sensitivity of 77% and specificity of 92%.¹²

The study has a limitation in the relatively small number of the sample.

In conclusion, CT is very useful to detect ureteral and renal calculi, and although it is postulated that diet and lifestyle are to be blamed in getting ureterolithiasis as patients ages, further studies are required to determine why male Saudi patients are more prone to get calculi than females.

References

1. Smith RC, Essenmacher KR, Rosenfield AT, Choe KA, Glickman M. Acute flank pain: comparison of non-contrast-enhanced CT and intravenous urography. *Radiology* 1995; 194: 789-794.

2. Smith RC, Varanelli M. Diagnosis and management of acute ureterolithiasis: CT is truth. *AJR Am Roentgenol* 2000; 175: 3-6.
3. Katz DS, Lane MJ, Sommer FG. Unenhanced helical CT of ureteral stones: incidence of associated urinary tract findings. *AJR Am Roentgenol* 1996; 166: 1319-1322.
4. Eikefjord EL, Thorsen F, Rørvik J. Comparison of effective radiation doses in patients undergoing unenhanced MDCT and excretory urography for acute flank pain. *AJR Am Roentgenol* 2007; 188: 934-939
5. Scales CD Jr, Curtis LH, Norris RD, Springhart WP, Sur RL, Shuman KA. Changing gender prevalence of stone disease. *J Urol* 2007; 177: 979-982.
6. Stamatelou KK, Francis ME, Jones CA, Nyberg LM, Curhan GC. Time trends in reported prevalence of kidney stones in the United States: 1976-1994. *Kidney Int* 2003; 63: 1817-1823.
7. Tiselius HG, Ackermann D, Hess B, Boeve E. Stone disease: Diagnosis and medical management. *European Urology* 2002; 41: 5.
8. Houser M, Zimmerman B, Davidman M, Smith C, Sinaiko A, Fish A. Idiopathic hypercalciuria associated with hyperreninemia and high urinary prostaglandin E. *Kidney Int* 1984; 26: 176-182.
9. Thom JA, Morris JE, Bishop A, Blacklock NJ. Influence of refined carbohydrate in urinary calcium excretion. *Br J Urol* 1978; 50: 459-464.
10. Bell TV, Fenlon HM, Davison BD, Ahari HK, Hussain S. Unenhanced helical CT criteria to differentiate distal ureteral calculi from pelvic phleboliths. *Radiology* 1998; 207: 363-367.
11. Al-Nakshabandi NA. The soft tissue rim sign. *Radiology* 2003; 229: 239-240.
12. Heneghan JP, Dalrymple NC, Verga M, Rosenfield AT, Smith RC. Soft-tissue rim sign in the diagnosis of ureteral calculi with use of unenhanced helical CT. *Radiology* 1997; 202: 709-711.

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