DOI: https://doi.org/10.54393/pbmj.v5i11.822

PAKISTAN BIOMEDICAL JOURNAL

https://www.pakistanbmj.com/journal/index.php/pbmj/index

Volume 5, Issue 11 (November 2022)

Original Article

Detection of Urolithiasis Using Non-Contrast Computed Tomography

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ARTICLE INFO

Key Words:

Non-Contrast Computed Tomography, Urolithiasis, Hydronephrosis, Hydroureter, HU numbers

How to Cite:

Javed, N. ., John, A. ., Khalid, Q. ., & Awais Hamza, M. . (2022). Detection of Urolithiasis Using Non-Contrast Computed Tomography: Urolithiasis Using Non-Contrast Computed Tomography. Pakistan BioMedical Journal, 5(11). https://doi.org/10.54393/pbmj.v5i11.822

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Received Date: 9th August, 2022
Acceptance Date: 20th December, 2022
Published Date: 31st December, 2022

ABSTRACT

Kidney stone disease is one of the most frequent urinary system disorders, ranking third following urinary tract infection and prostate disease in urology departments, and is the most frequent by 10-15%. **Objective**: To detect urolithiasis in individuals with flank discomfort and renal colic using non-contrast computed tomography. **Methods:** A cross-sectional study was conducted at Chattha Hospital, Gondal Hospital, and Al-Amin diagnostic center. Prior to the non-contrast computed tomography KUB examination, a formal informed consent form was signed by each patient. In this study, a total of 126 individuals were examined, and all of them were diagnosed with urolithiasis and their incidental findings are evaluated on non-contrast computed tomography KUB. The average patient age was 44.2. For data analysis, the Statistical Package for the Social Sciences version 26.0 was used. The eligibility of patients remained determined using inclusion criteria. **Results:** According to the results of 126 urolithiasis patients, n = 71(56.3%) were males, n = 55(43.7%) were women, and the greatest ratio was n = 23, (18.3%) in the 51-60 year age group. The most prevalent clinical symptom of urolithiasis was renal colic n=74(35.1%).The right side (45.24%) was more affected than the left side (34.13%). The right renal pelvis (18.2%), has the highest percentage, and right vesico-ureter junction and left upper pole calyces (3.3%) has the lowest percentage. Patients having 1 stone has highest frequency (58.7%). since most of patients developed mild (8.7%) or moderate (16.7%) or severe (11.9%) of Hydronephrosis and mostly (74.6%) negative Hydro-ureter. **Conclusions:** In the research, males and patients aged 51–60 were more likely than females to have urolithiasis. The right side were more related to the NCCT KUB findings.

INTRODUCTION

Urolithiasis, often known as kidney stones, is a prevalent problem in the emergency department (ED) [1]. Urinary tract stones are rather frequent, with a lifetime frequency of up to 12% and recurrence rates of up to 50% [2]. Urinary stones have plagued mankind for ages, traces its origins back to 4000 B.C. in addition are the highest frequent disorder of the urinary system. The prevention of recurring kidney stones is still a key concern in terms of human health [3]. Prevention of stone formation necessitates a better knowledge of the processes involved in stone formation [4]. Stone production is not inclined to the development of any symptoms. Renal colic (severe cramping pain), flank pain (back pain), hematuria (bloody urine), obstructive uropathy (urinary tract disease), urinary tract infections, urine flow blockage, and hydronephrosis (dilation of the kidney) are later indications and symptoms of stone disease. These disorders can cause nausea and vomiting, as well as pain from the stone incidence [5]. When combined with nephrocalcinosis, nephrolithiasis accounts intended for 2 to 3% of all cases of end stage renal dysfunction [6]. The creation of renal calculi triggered by an imbalance in the solubility and precipitation of salts in the urinary system and kidneys is known as nephrolithiasis. Renal calculi develop when urine becomes "supersaturated" with insoluble compounds like phosphate (CaP) and calcium oxalate (CaOx) because of dehydration or a hereditary predisposition to excrete these ions excessively in the urine [7]. The formation of kidney stones is a biological process that entails physicochemical changes and urine supersaturation. A supersaturated

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solution includes dissolved solvent at typical operating conditions [8]. As a result of supersaturation, solutes precipitate in urine, resulting in nucleation and crystal concretions. When the concentration of two ions in a solution approaches their saturation point, crystallization occurs [9]. The transition from phase of liquid to phase of solid is regulated through pH and the precise amounts of additional components. The amount of urinary saturation in terms of stone-forming components such as phosphorus, calcium, oxalate, uric acid, cysteine, and little urine volume stand potential crystallization causes [10]. As a result, the thermodynamics (which results in nucleation) and kinetics of a supersaturated solution govern crystallization development (which includes rates of nucleation or crystal advancement) [11]. Supersaturation can therefore be avoided to avoid lithiasis. Stone formation has indeed been associated with a variety of characteristics, including race, nutrition, employment, and water hardness [12]. Renal stones can be radiolucent or radiopaque. Radiopaque renal stones emerge as well demarcated densities on high-quality plain abdomen radiographs. Following an intravenous contrast injection, radiography is used to determine the location of such stones inside the renal collecting system [13]. Ureteric stone is a kidney stone that is generally tiny and slides down into the ureter. It is often composed of undissolved mineral and can readily become trapped in a limited section of the ureter, producing obstruction anywhere originating at the ureter-pelvic junction (UPJ) to the ureterovesical junction (UVJ). This is a subsection of the larger subject of urolithiasis. Urolithiasis is a likely to experience among those people who have hematuria (blood in urine) and/or significant flank discomfort [14]. Men are more likely than women to be impacted [15]. The most effective imaging modality for evaluating renal colic has emerged as Computed Tomography KUB. CT KUB is preferred because of its ease of availability, lack of operator reliance, and image capturing is made simple. No contrast material is required to be administered orally or intravenously. CT KUB has the added benefit of detecting other than urinary disorders such as appendicitis, diverticulitis, or gynaecological diseases such as hemorrhagic cysts or ovarian inversion, which can resemble renal colic, are also possibilities [16]. The CT KUB verifies the existence of stones, as well as their size, position, thickness, and the occurrence of hydronephrosis. It also provides information for identifying the best treatment strategy [17]. The Computed Tomography KUB procedure designed for the detection of urinary stone disorder differs from a typical non contrast abdominal-pelvic CT investigation in that the acquisition parameters are altered. The area between the higher poles of both side's kidneys and the urethral bladder's base will be covered by the stone therapy [18]. CT KUB is presently recognized as the preferred mode of identification of urinary tract concretion as associated to traditional intravenous urography (IVU) since it is more sensitive and focused in detection of urinary concretion, faster, do not utilize intravenous (IV) contrast, and may identify additional disorders. [19]. The study's goal was to use computed tomography to diagnose urinary system stones in the kidney, ureter, and bladder (CT-KUB).

METHODS

A cross-sectional study was conducted at Chattha Hospital, Fazal Hospital, and Al-Amin diagnostic center. Prior to the non-contrast computed tomography KUB examination, a formal informed consent form was signed by each patient. Using a convenient sampling approach, the total participants for the study's duration included 126 patients. The sample size was determined using the mean of prior published research that were relevant [20-22]. Among them all patients were diagnosed urolithiasis are evaluated on non-contrast computed tomography KUB. The patients' average age was 44.2 years. The 51–60 age group was the most affected. Inclusion criteria were all patients aged between 10 and 80 years, including both genders (male and female). Patients excluded from this study were all CT KUB tests ordered by outside physicians (due to a lack of needed clinical information), patients diagnosed with a kidney stone in the previous 6 months, and/or those who had any positive urological imaging in the previous 6 months. Patients who had incomplete data at any point in time were also exempted. A systematic questionnaire was used to collect data, which asked about age and gender, clinical presentation, and NCCT KUB results. To cover the whole KUB, a multi-detector 64-slice CT scan scanner (Toshiba and GE Lightspeed) was employed with a thickness of about and an interval of approximately 5 mm. The eligibility of patients was determined using inclusion criteria. All patients were evaluated depending on whether or they did not meet the inclusion requirements. Patients who did not meet the inclusion criteria were ruled out. However, patients who were unable to meet the consideration criterion but did not even have consent were accepted. The findings of the NNCT KUB were obtained in accordance with the data collection sheet. The collected data were put into a Word spreadsheet before being transcripted into an SPSS spreadsheet. The Statistical Package for Social Science application was used to analyze the data that were entered (SPSS; version 22.0).

RESULTS

Table 1 shows that males were more likely than females to develop urolithiasis n=7 (56.3%) and n=55(43.7%) among

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126 patients. However male has highest frequency and female has lowest frequency (n=126).

Gender	Frequency (%)	Valid Percent	Cumulative Percent
Male	71 (56.3)	56.3	56.3
Female	55 (43.7)	43.7	100
Total	126 (100)	100	

Table 1: Participant Distribution according to the Gender (n=126)

Figure 1 shows that shows the majority 58.7% of patients developed 1 stone, 23.0% of patients developed 2 stones, 9.5% of patients developed 3 stones, 4.8% of patients developed 4 stones and 4.0% of patients developed 5 stones. However, 1 stone has the highest frequency and 5 stones has lowest frequency among all the patients having urolithiasis.

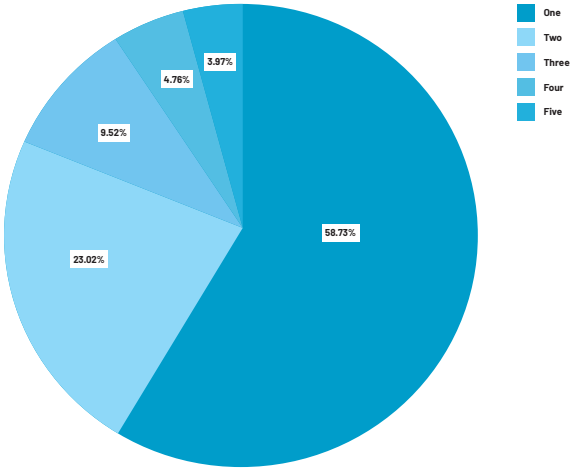

Figure 1: Distribution of participants according to the number of stones

Figure 2 shows that right renal pelvis is most frequent affected site with (18.2%), left renal pelvis (12.2%), left proximal ureter (8.3%), right proximal ureter (7.2%), right upper pole calyces (5.5), left mid pole calyces (5.5%), left vesicoureter (5.5%), right distal ureter (5.0%), left lower pole calyces (5.0%), left distal ureter (5.0%), right ureteropelvic junction (4.4%), right vesicoureter junction (3.3%), left upper pole clayces (3.3%). However, results shows that right renal pelvis has highest frequency and right vesicoureter junction and left upper pole calyces has lowest frequency.

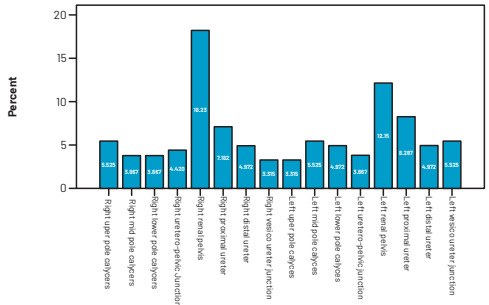

Figure 2: Distribution of participants according to affected side

Table 2 show that distribution of affected side were the 57 patients (most frequent side) was right side with (45.2%), 43 patients with left side (34.1%), and 26 patients with both sides by 20.6%. However in our study right side has highest a frequency.

Affected side	Frequency (%)	Valid Percent	Cumulative Percent
Right	57 (45.2%)	45.2	45.2
Left	43 (34.1%)	34.1	79.4
Both Sides	26 (20.6)	20.6	100
Total	126	100	

Table 2: Participant distribution according to affected side (n=126)

Table 3 show frequency and severity distribution of hydronephrosis. This shows that 79 patients with 62.7% have no hydronephrosis while 8.7% have mild, 16.7% have moderate and 11.9 have severe degree of hydronephrosis.

		Frequency (%)	Valid Percent	Cumulative Percent
Valid	Mild	11 (8.7)	8.7	8.7
	Moderate	21 (16.7)	16.7	25.4
	Severe	15 (11.9)	11.9	37.3
	No hydronephrosis seen	79 (62.7)	62.7	100.0
	Total	126 (100.0)	100.0	

Table 3: Participant distribution according to Hydronephrosis (n=126)

Figure 3 shows the frequency distribution of sign and symptoms in patients with uro-lithiasis. In our study renal colic 35.1%, dysuria 18.0%, flank pain 15.2%, hematuria 8.5%, CKD 6.6%, DM 5.7%, HTN & lumbar pain both with 4.3%, 4.3% respectively and tenderness with 2.4%. However, result showed that renal colic 35.1% has highest frequency and tenderness 2.4% has lowest frequency among all the clinical complaints in pateints with urolithiasis.

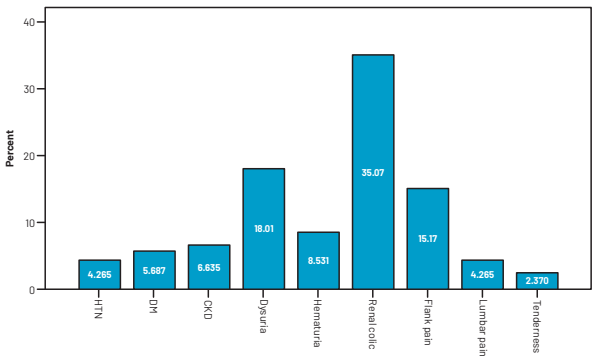

Figure 3: Signs and Symptoms of Patients

DISCUSSION

This study was conducted to assess the results of CT KUB in 126 patients with urinary tract stone at Gondal Hospital, Al-Amin diagnostic center, and Chattha Hospital. In this study, 126 patients were carried out, among them all patients were diagnosed with urolithiasis. The mean

DOI: https://doi.org/10.54393/pbmj.v5i11.822

patient age was 44.2. In our current study it is analyzed that the predominant gender was male (56.3%) patients and this what was reported (55.6%) in the study of Jaiswal *et al.*, in 2021 [23]. This prominence of gender (male) also agreed with (54.4%) the study of Alhassan *et al.*, in 2016 [24]. Another study proposed by Kuber *et al.*, in 2019 in which the male (54%) also agreed with our study. However, it showed that males were more likely than females to develop urolithiasis [25]. The current study analyzed the frequency distribution of affected side of the urinary tract were the 57 patients (most frequent side) was right side with 45.2%, 43 patients by left side with 34.1%, and 26 patients with both sides by 20.6%. However, in our study right side has the highest frequency which also agreed with the study proposed by Aljazouly *et al.*, in 2019, [26]. According to this, modern research revealed that most of the stone are located in both sides of renal pelvis. This distribution of stone location is agreed with a study proposed by Alhassan *et al.*, [24]. Likewise, it agreed with another study submitted by Kuber *et al.*, in 2019 [25]. However, it showed that renal pelvis has highest frequency in affected sites among all the sites. In our study, CT KUB revealed stones in majority of the cases. 58.7% patients developed 1 stone, 23.0% of patients developed 2 stones, 9.5% of patients developed 3 stones, 4.8% of patients developed 4 stones and 4.0% of patients developed 5 stones. However, 1 stone has highest frequency and 5 stones has lowest frequency among all the patients having urolithiasis. This was also demonstrated in a 2015 study conducted by Idress *et al.*, [22]. Our study analyzed that the frequency and severity distribution of hydronephrosis in which 79 patients with 62.7% have no hydronephrosis while 8.7% have mild, 16.7% have moderate and 11.9% have severe degree of hydronephrosis. However our study showed that mild degree of hydronephrosis had highest frequency which is accordance to the study conduct by Alhassan *et al.*, in 2016 [24]. Also, it was in accordance with another study proposed by Ali *et al.*, in 2018. He found that the majority of the patients complained of flank discomfort and microscopic hematuria [27]. The results of this study also in accordance to Shaaban *et al.*, which showed that renal colic 35.1%, dysuria 18.0% , flank pain 15.2%, hematuria 8.5%, CKD 6.6%, DM 5.7%, HTN & lumbar pain both with 4.3%, 4.3% respectively and tenderness with 2.4% [28]. However, result showed that renal colic 35.1% has highest frequency and tenderness 2.4% has lowest frequency among all the clinical complaints in patients with suspected urolithiasis.

CONCLUSIONS

According to the findings of this investigation, the CT KUB can reliably detect urinary tract stones. In addition, the vast majority of these stones are discovered in men. The number of stones on the right side of the urinary tract is substantially higher than on the left side. Furthermore, the majority of patients have one stone, with the majority of stones found in the renal pelvis, lower calyces, or mid ureter, with mild to severe hydronephrosis.

Conflicts of Interest

The authors declare no conflict of interest

Source of Funding

The author(s) received no financial support for the research, authorship and/or publication of this article

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