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Original Article

Diagnosis of Urinary Tract Urolithiasis using Computed Tomography

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ABSTRACT

Renal stone disease is the most common urinary system disease, existing in third after urinary tract infection and prostate disease in urological departments and accounting for 10-15% of all cases. **Objective:** To evaluate urolithiasis on Computed Tomography (CT KUB). **Methods:** It is a cross sectional study carried out at the private Sector Hospital of Gujrat, Pakistan over 4 months from December 2021 to March 2022. A sample size of 50 patients was calculated via a convenient sampling approach using the mean from previous related studies. Patients with kidney stones diagnosed on CT KUB scan were included after informed consent. The data was analyzed and entered using SPSS version 21. **Results:** The result of this study revealed that people in their 51s and 60s are the most affected and that males are 56% more likely than females to have kidney stones. The right kidney is the most prevalent location for stones. The calcium oxalate kidney stone scale ranged from 1 to 50 mm in diameter. And the correlation between the location of kidney stone and size is 0.94 so there is a moderate correlation between stone size and location. **Conclusion:** In conclusion, the CT equipment is fully capable of detecting and measuring stones, as well as determining their type and major component.

INTRODUCTION

Kidney stones, urinary tract infections, and prostate disorders are all frequent urinary system diseases, but urolithiasis is the most prevalent of them all [1]. Kidney, ureter, the urinary bladder, and the urethra make up urinary system [2]. The kidneys are in charge of producing urine, while the rest of the system is charge of removing it [3]. Poor oral fluid intake, high oxalate intake and a high salt intake are all common risks factors for stone development [4]. Kidney stones can be excruciatingly painful [5]. Kidney stones may not cause symptoms until they start moving down the ureters. In men, the pain in groin area due to renal stone is common [6]. Renal colic is a painful condition that comes and goes. Hematuria, nausea, vomiting, discolored or foul-smelling urine, chills, and fever are some of the other symptoms that may be present [7]. In pregnant women, renal stones are a prevalent cause of non-obstetrical stomach pain [8]. Right kidney is the most occouring site of kidney stones. The majority of renal calculi are made up of calcium oxalate crystals combined with various levels of calcium phosphate [9]. Calcium oxalate stones that are not associated to an acquired are known as idiopathic calcium oxalate stones [10]. They account for 50% of all calcium oxalate stones. Struvite in 10%, uric acid in 9%, and cystine-containing stones in 1% of patients are identified with renal calculi [11]. The majority of idiopathic calcium oxalate stones appear to form on the papillary surface of the kidney, either linked to a calcium phosphate subepithelial plaque known as Randall's plaque or within the apertures of terminal collecting ducts [12]. Chronic renal illness, hypertension, gout, diabetes mellitus, hyperlipidemia, obesity, endocrine disorders and malignancies are all medical conditions that increase the

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risk of kidney stones [13]. Over weight, hyperlipidemia, and type-2 diabetes mellitus are all linked to uric acid and calcium oxalate stones [14]. High urinary calcium oxalate saturation is also seasonal with men experiencing it in the summer and women experiencing it in the early winter [15]. The renal pelvis was shown to be the most common site for stones (18.3%) [16]. When ureter stones lead to hydronephrosis, 50.8 percent of stones induce glomerulonephritis (27.9% low, 57.4% intermediate, and 14.7% severe). The stones in the ureter is one of the most common site causing glomerulonephritis [17]. CT is the most effective for detecting and measuring stones, and their components [18]. To begin treatment, series of X-ray images from various angles are obtained, which are then combined with computer processing to provide cross-sectional images of bones and soft tissue inside the body [19]. A CT scan of the urinary tract can help a doctor figure out the cause of blood in the urine, obstruction, frequency or urgency of urination, and urine incontinence [20]. Urolithiasis affects persons in their 50s and 60s and males are 55% more likely than females to acquire kidney stones [21]. The expense of treating renal stones in the United States has been approximated at 2 billion dollars [22]. Kidney stone frequency varies greatly around the globe, with rates ranging from 1-5% in Asia, 5-9% in Europe, and 7-15% in America [23]. Renal stones impact somewhere around 1% to 16% of people across the world at some point in their life [24]. Ecological factors such as diet and lifestyle may play a role, as evidenced by the wide variety of rates and historical trend studies that show increased prevalence rates in recent years. In 2015, there were 22.1 million reported cases, with 16,100 deaths. The overall incidence of urolithiasis increased considerably throughout the course of the trial, rising from 108 per 100,000 in the first year intervals to 138 per 10,000 over the last year intervals. This study was intended to illustrate the characterization of renal stones using CT scan. The study identified most affected age group, gender as well as assessment of size, location and density of renal stones. The current study determined the location of renal stones and the prevalence of certain chemical compositions of different sizes of renal stones which can be helpful in further investigation at early times.

METHODS

It was a cross-sectional study conducted over 4 months. Data was collected from a private hospital. A sample size of 50 patients was calculated by a convenient sampling technique using the mean from previous related studies [24,7,25]. Neusoft 16 slices 120-140 KVP, 320 MAS, 5mm slice thickness CT equipment was utilized to collect KUB CT images. The patients who were diagnosed with kidney stones during CT scan were included. All of the patients who agreed to participate gave their verbal consent, and their medical histories were recorded.

RESULTS

This study included 50 patients of urolithiasis. The males were more commonly affected 28(56%) than females 22(44%). Table 1 show that the elderly age group patients more common to have renal stones 15(30%) and on second number adults are commonly effected 16(16). Table 2 show that the most common location of kidney stone was right pelvic kidney 15(30%) and 2nd most common location of stones was left pelvic kidney 8(16%). Table 3 show that the size of kidney stone most commonly found was 1-50mm in 16(32%). The second most common stone size in kidney was 51-100mm in 11(22%). Table 4 shows that the mean value of age groups was 28.200, Mean of value of stone size was 1.7200cm, std deviation of age and size of stones was 1.56087 and 1.65418. Table 5 shows cross-tabulation of location and size of kidney stones. Table 6 shows that the correlation between location of kidney stone and size was 0.94 so there was moderate correlation between stone size and location.

Age of Patients	Frequency	Valid%	Cumulative%
1-17years	6(12.0)	12.0	12.0
18-30years	5(10.0)	10.0	22.0
31-40years	8(16.0)	16.0	38.0
41-50years	10(20.0)	20.0	58.0
51-60years	15(30.0)	30.0	88.0
61-70years	6(12.0)	12.0	100.0
Total	50(100)	100.0	

Table 1: Frequency distribution of age group

Age of Patients	Frequency	Valid%	Cumulative%
Right Upper Ureter Stone	2 (4.0)	4.0	4.0
Right Distal Ureter Stone	5 (10.0)	10.0	14.0
Right Pelvic Kidney Stone	15 (30.0)	30.0	44.0
Left Pelvic Kidney Sytone	8(16.0)	16.0	60.0
Left Upper Pelvic Junction	7(14.0)	14.0	74.0
Right Pelvic Junction Stone	6(12.0)	12.0	86.0
Left Distal Ureter Stone	5(10.0)	10.0	96.0
Left Lower Ureter Stone	2(4.0)	4.0	100.0
Total	50(100.0)	100.0	

Table 2: Frequency distribution of the location of stones

Sizes of stones	Frequency	Valid%	Cumulative%
1-50	16(32.0)	32.0	32.0
51-100	11(22.0)	22.0	54.0
101-149	7(14.0)	14.0	68.0
150-200	7(14.0)	14.0	82.0
201-249	5(10.0)	10.0	92.0
250-300	4(8.0)	8.01	100.0
Total	50(100.0)	00.0	

Table 3: Frequency distribution of sizes of stones

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Report	Age of patients (yrs)	Sizes of stones (cm)
Mean	28.200	1.7200
SD	1.56087	1.65418
Minimum	1-17 years	1-50
Maximum	61-70 years	250-300
Median	3.0000	1.0000

Table 4: Descriptive statistics of age of patients and size of stone

sizes of stones * location of kidney Crosstabulation										
		Location Of Kidney								
		Right Upper Ureter Stone	Right Distal Ureter Stone	Right Pelvic Kidney Stone	Left Pelvic Kidney Sytone	Left Upper Pelvic Junction	Right Pelvic Junction Stone	Left Distal Yreter Stone	Left Lower Ureter Stone	Total
Sizes of Stones	1-50	2	5	9	0	0	0	0	0	16
	51-100	0	0	6	5	0	0	0	0	11
	101-149	0	0	0	3	4	0	0	0	7
	150-200	0	0	0	0	3	4	0	0	7
	201-2492	0	0	0	0	0	2	3	0	5
	50-300	0	0	0	0	0	0	2	2	4
Total		2	5	15	8	7	6	5	2	50

Table 5: Cross tabulation of Location and size of stone

Symmetric Measures		Value	Asymp. Se[a]	Approx. T[b]	Approx. Sig.
Interval By Interval	Pearson's R	.974	.010	20.413	.000[c]
Ordinal By Ordinal	Spearman Correlation	.942	.015	19.446	.000[c]
N		50			

Table 6: Correlation between location of kidney stone and size

DISCUSSION

In the current study total number of patients selected were 100 to evaluate kidney stones using computed tomography. The age of patients in this study ranged from 1 to 80 years. Kidney stones are most commonly presented in people with which low intake of water found. Computed tomography is the best modality to evaluate urolithiasis. In the current study, males were most commonly affected with kidney stones 28(56%) than females 22(44%) due to low fluid intake. A previous study [26] also reported that males were most commonly to have kidney stone than females. In the current study, it was observed that elderly people were most commonly involved in this disease. The age group of 51- 60 years had 15(30%) kidney stones and the second age group which was most commonly affected with this disorder was 41-50 years, 10(20%). Another study was done by Alhassan et al. [7] also concluded that elderly aged people were most commonly to have this disease. But adults also have this disease due to the habit of low intake of water. In this study, the most common site of kidney stones was right pelvic renal calculi. 15(30%) and the second most common location was the left pelvic kidney stone (17%) and the third most common location was the left upper pelvic junction 8(16%). This study reveals that the most common stones are present in the right kidney than the left kidney. A study done Babiker [25] also concluded that kidney stones most commonly occurred in the right kidney. In this study, the size of stone in most of the patients 16(32%) range from 50-100mm and 7(14%) patients have a stone size of 101-149mm. In most people, low intake of water was the most common reason for kidney stones. A previous study [26] also concluded that low intake of water was the main reason for kidney stones in most patients. This study was found that there is no correlation between lication of stone and stone size just as explain in a previous study [7]. The current study also observed that kidney stones are also caused by high salt intake and also due to diabetes mellitus but the main reason was the low intake of water. In the current study and previous studies, the modality used to evaluate kidney stones was computed tomography.

CONCLUSION

It is concluded that CT KUB scan is useful in the diagnosis of kidney stones.The chances of getting renal stones increases with age. The size of kidney stones in most patients is 1-50mm. It is also concluded that male patients more commonly have kidney stones 28(56%) than females 22(44) %. Most of the renal stones are present in the right kidney than the left kidney. According to the findings, kidney stones are most commonly caused by low fluid intake and diabetes mellitus. The correlation between the location of kidney stone and size was significant and there is a moderate correlation between stone size and location.

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