

Common site of urinary calculi in kidney, ureter and bladder region

RB Chand, AK Shah, DK Pant and S Paudel

Department of Radiology, Tribhuvan University Teaching Hospital, Maharajgunj, Kathmandu, Nepal

Corresponding author: Mr. Ram Bahadur Chand, Associate Professor, Department of Radiology, Tribhuvan University Teaching Hospital, Maharajgunj, Kathmandu, Nepal; email: rbchand2003@yahoo.co.in

ABSTRACT

Urolithiasis is an ancient disease with global distribution. It refers to stones originating anywhere in the urinary system. Urinary calculi or stones are the most common cause of acute urinary system obstruction. The study was aimed with finding out the common site of urinary calculus in kidney ureter bladder (KUB) region. This was a prospective cross-sectional study conducted from June 2012 to September 2012 at Tribhuvan University, Teaching Hospital, Maharajgunj. A total 240 urolithiasis patients were enrolled for plain KUB examination. Site of urinary calculus was identified by observing KUB film of the subjects under the supervision of radiologist. The data were analyzed prospectively with outcome measures of gender & stone location. Out of 240 patients, 138 were male and 102 were female with male to female ratio of 1.35:1. The age ranged from 9 to 83 years. Out of total 240 patients, 71.9% (187) patients belonged to productive age group (20-60 years). Total number of urinary calculi was 345 in which 208 were found in male patients and 137 were found in female patients. Of total 345 calculi, 237 were renal stones, 47 were ureteric stones, 22 of the stones were found in pelviureteric junction (PUJ), 33 of stones were found in vesicoureteric junction (VUJ), and 6 were in bladder. In conclusion, urinary stone disease is a major public health problem in a developing country like Nepal with male and productive age group predominance. Kidney stones are most common. Distal ureter is the most common site of ureteric stone.

Keywords: Common site, urinary calculus, KUB region

INTRODUCTION

Urolithiasis is an ancient disease with global distribution. It refers to stones originating anywhere in the urinary system. Urinary calculi or stones are the most common cause of acute urinary system obstruction. The prevalence and incidence of urolithiasis is reported to be increasing across the world. The problem of stone is more predominant in the productive age groups.¹

Nearly 10% of the U.S. population will develop a kidney stone in their lifetime. Upper urinary tract stones (kidney, upper ureter) are more common in the United States than in the rest of the world.² Approximately 1 in 1,000 adults in the United States are hospitalized annually for treatment of urinary tract stones, resulting in medical costs of approximately \$2 billion per year.^{3,4}

Researchers attribute the incidence of nephrolithiasis in the United States to a dietary preference of foods high in animal protein.⁵

Of those who develop stone, 50% will have a recurrence of forming another stone within the next six years. Urolithiasis is quite common in developing and under developed countries, where the recurrence of endemic bladder stone is quite common due to the dietary proteins.

Various investigations are available for the diagnosis

of urinary calculi including plain X-ray kidney ureter bladder (KUB), ultrasonography (USG), intravenous urography (IVU) and computed tomography (CT) scan. Though CT scan is now investigation of choice for detection and characterization of urinary calculi because of its high sensitivity rate, it is expensive and not widely available in all parts of the world. Radiation dose to the patient is also high. USG is good method for detection of kidney and bladder calculi and features of urinary obstruction. However, it has low detection rate for ureteric calculi. IVU requires use of iodinated contrast agent and gives high radiation dose. Plain X-ray KUB is cheaper and easily available investigation for the detection of radiopaque stone in KUB region. However it is not specific for urinary calculi. Since, KUB X-ray detects approximately 85-90% of urinary calculi and easily available, it was employed in our study.

Urinary calculi can be located anywhere in kidney, ureter and bladder. Management differs depending on the location of calculi, so it is important to locate the calculi in urinary tract. Only very few studies are done to see the common location of calculi. Therefore, this study was conducted to detect common location of urinary calculi using easily available plain X-ray KUB.

METHODOLOGY

The prospective cross-sectional study was conducted from June 2012 to September 2012 at Tribhuvan University, Teaching Hospital, Maharajgunj. A total 240 urolithiasis patients were enrolled. Patients were instructed to avoid high fiber diet on the day before examination. Laxative was prescribed to clean the bowel. The plain radiograph of KUB region was obtained with 500MA machine. The radiographs were first observed. The positive calculus radiographs were further observed by experienced Radiologist and classified according to their sites: Kidney, Pelvi-ureteric junction (PUJ), Ureter, Vesico-ureteric junction (VUJ) and urinary bladder. The data were analyzed prospectively with outcome measures of gender and stone location by Micro-soft Excel version 2007.

RESULT

Out of 240 patients, 138 were male and 102 were female, with male to female ratio 1.35:1. Total number of urinary calculus was 345 in which 208 were found in male patients and 137 were found in female patients. Age of the patient varied from 9 to 83 years. Out of total 240 patients, 187 patients belonged to productive age group (20-60 years). Analysis of age groups showed a high occurrence of urinary stones among adults between 20-29 years (30.42%). Urolithiasis in both male and female was observed highest in the age group 20-29 years (16.66% and 13.75% respectively) [Table-1].

Table 1. Age and sex wise distribution of urolithiasis patients (n=240)

Age(yrs)	Sex		Total
	Male	Female	
<10	0.4*	0	0.42
10-19	5	4.1	9.16
20-29	16.6	13.7	30.42
30-39	15.4	10.42	25.83
40-49	5.8	5.83	11.66
50-59	5.4	4.58	10
60-69	4.1	3.33	7.5
70-79	4.1	0.42	4.58
80-89	0.4	0	0.42
Total	57.5	42.5	100

* Indicates percentage

Of total 345 calculi 68.7% stones were renal stones, 6.38% stones were PUJ, 13.62% stones were ureter stones, 9.56% stones were VUJ and 1.74% stones were bladder [Fig. 1 and 2].

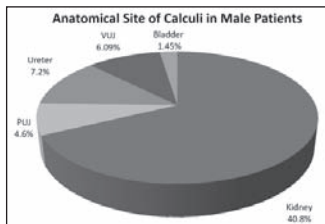


Fig. 1. Location of calculi in male patients

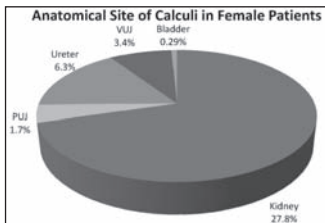


Fig. 2. Location of calculi in female patients

Of total 345 calculi 61.7% stones were renal stones. 121 stones were found in right kidney (79 in male and 42 in female) and 116 were found in left kidney (62 in male and 54 in female).

In both male and female, most stones were located in the lower pole followed by middle pole, upper pole and renal pelvis.

13.63% stones were ureteric stone. Most stones were present in lower ureter (55.31%) followed by upper (40.04%) and middle ureter (4.25%).

6.37% (22) of the stones were found in PUJ. 9.56% (33) of stones were found in VUJ. Total of 6 stones (1.74%) were present in bladder (5 in male and 1 in female).

DISCUSSION

Urolithiasis is a quite common problem in developing countries like Nepal. This problem is particularly important in the Nepalese context as it is quite common due to climate and socio economic status. Data comparing stone disease difference between races with in one country are available only for the united state.⁶ The incidence rates were highest for whites, followed by Hispanics and Asians. White men had the highest

kidney stone incidence rate where as Asian women had the lowest rates. Within the individual race, men still have a higher burden in comparison to women from the same race.⁷

Our study showed that male are more affected than female and incidence of stone disease is predominant in the productive age group which is in accordance with previous studies conducted in 2008.⁸ The incidence ratio of male and female was found to be 1.35:1. Similar types of study were conducted in NAMS, Bir Hospital and it was found that the incidence rate of male and female ratio was found to be 1.5:1 and 1:0.78 respectively.^{9,10} The male predominance may be because of large muscle mass of men as compared to women. Thus, the daily breakdown of the tissue results in increased metabolic waste and predisposition of stone formation. The other significant cause may be because of the male urinary tract being more complicated than the female. Women typically excrete more citrate and less calcium than men, which may particularly explain the higher incidence of stone disease in men.

REFERENCE

1. Ansari MS, Gupta NP. Impact of socioeconomic status and management of urinary stone disease. *Urol Int* 2003; 70: 255-61.
2. Victoriano R, Haluk A, Dean G, Assimos. Kidney Stones: a global picture of prevalence, incidence, and associated risk factors. *Rev Urol* 2010 Spring-Summer; 12(2-3): 86-96
3. Ramello A, Vitale C, Marangella M. Epidemiology of nephrolithiasis. *J Nephrol* 2000; 13 (Suppl. 3): 45-50
4. Tanagho EA, McAninch JW. Smith's general urology 2004; (16th ed). Norwalk, CT: Appleton & Lange
5. Billica W. Urolithiasis. (2004). Retrieved from <http://www.5ncc.com/Assets/Summary/TP0970.html>
6. Stamatelou KK, Francis ME, Jones CA et al. Time trends in reported prevalence of kidney stones in the United States: 1976-1994. *Kidney Int* 2003; 63: 1817-23.
7. Charles D. Scales Jr, Alexandria C. Smith, Janet M. Hanley, Christopher S. Saigal, Urologic Diseases in America Project
8. Prevalence of Kidney Stones in the United State. *European Urol* 2012; 62: 1-30.
9. Kumar A, Jauhari AC. Utilization of Nephrotoxic Drugs in Post-Operative Patients of Urolithiasis. *J Clin Diagnostic Res Urolithiasis* 2008; 2: 938-41.
10. Basnet S, Shrestha PM, Shakya R. Prospective study tamsulosin in medical management of distal uteric stone.
11. Urinary stones were found to be predominantly among the adult between 20-29 years age group and frequency of stone in anatomical site was found to be in order Kidney>Ureter >VUJ>PUJ>Bladder which correlates with previous findings.^{10,13}
12. However this study has some limitations. The plain KUB film has sensitivity of 45-59% and specificity of 64-77% for detecting ureteric calculi.¹⁴⁻¹⁶ Only radiopaque stones are detected by plain film so it is possible that radiolucent stones can be missed in plain film.
13. Urinary stones are more prevalent in male and in productive age group. This finding suggests that the direct and indirect cost of kidney stones will be continuous to rise in developing countries like Nepal, and efforts should be directed towards ameliorating the burden of urinary stone disease
14. Mukhia R, Shrestha K, Dahal P, Sharma VK. Study on chemical composition of urinary stones and its association with urinary tract infection. *Post graduate Med J* 2001; 8: 1-5.
15. Menon M, Resnick MI. Urinary Lithiasis: Etiology, diagnosis, and medical management. In ES. Campbell (Ed.), Campbell's urology. Philadelphia: W.B. Saunders (8th ed.); 2002.
16. Ahmadi ASR, Badr Y, Hazhir S, Hasanazadeh K. Family history and age at the onset of urinary tract calculi. *Urol J* 2007; 4: 142-5.
17. Ha-Jong S, Sung-Tae C, Ki-Kyung K. Investigation of the Location of the Ureteral Stone and Diameter of the Ureter in Patients with Renal Colic. *Korean J Urol* 2010; 51: 198-201.
18. Mutgi A, Williams JW, Nettleman M. Renal Colic: utility of the plain abdominal roentgenogram. *Ann Intern Med* 1991; 151: 1589-92.
19. Levine JA, Neitlich J, Verga M et al. Ureteral calculi in patients with flank pain: correlation of plain radiography with unenhanced helical CT. *Radiol* 1997; 204: 27-31.
20. Assi Z, Platt JF, Francis IR et al. Sensitivity of CT scout radiography and abdominal radiography for revealing ureteral calculi on helical CT: implications for radiologic follow up. *Amer J Roentgenol (AJR)* 2000; 175: 333-7.