

UROLITHIASIS

PRESENTATION AND ULTRASONOGRAPHIC EVALUATION

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PROF-1743

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ABSTRACT... Objectives: (1) To assess the common presenting features of urolithiasis. (2) To assess the role of Ultrasonography in its evaluation. **Design:** Cross sectional study. **Setting:** Khyber X rays, Khyber Medical Centre, Peshawar. **Period:** March 2010 to June 2010. **Material and Methods:** Data from patients presenting with urolithiasis for an ultrasound examination was analyzed for presenting complaints and ultrasound findings according to objectives of the study. **Results:** A total of 210 cases of urolithiasis were analyzed. The age wise categorization included pediatric population (9.5%), adult population (82.4%) and geriatric population (8.1%). Pain was the most common presenting complaint in all three age groups. Kidney was the most common site for renal calculi followed by ureter, bladder and urethra in descending order. Accompanying dysuria was present in 20% cases. Mild hydronephrosis was noted in 44.8%. Statistically significant difference was present between ultrasound findings in geriatric population and overall results. **Conclusions:** Urolithiasis continues to be a major cause of morbidity among population of all age groups. Overall trend of Ultrasonographic findings was applicable to pediatric and adult population. There has been significant difference of ultrasound findings among geriatric population from normal trend.

Key words: Urolithiasis, Kidney stones, Ultrasonography, Pediatric, Geriatric.

INTRODUCTION

Urolithiasis is a major cause of morbidity worldwide. Its history as a medical condition goes back to the times of Egyptian mummies¹. In our region it is shown to comprise around 50% of all urological cases². Different prevalence has been reported from various countries across the globe. In USA alone it has been shown to have prevalence of 16.4/1000 with 12% of population suffering from this condition at some point in their lives³. Moreover its annual expenses are around \$ 2 billion in USA alone⁴. Germany reported a prevalence of 4.7%,⁵ and its incidence in Kuwait was found to be 43.44%⁶. Its prevalence has been increasing in different parts of the world⁵. The fact that it mostly affects the working age group i.e. above 20 years with peak incidence in 40 to 59 years⁷, makes it a major socioeconomic burden on society. Similarly renal colic remains to be one of the leading presentations in emergency departments⁸.

Urinary stones develop from a variety of causes that include both metabolic and environmental. Some of these causes include "hypercalciuria, hypocitraturia, increased urinary acidity, hyperoxaluria, infections

(urease producers) and cystinuria"⁹. Majority of stones are of calcium oxalate type. This particular type was also found to be most prevalent in our region as well as in studies done in other parts of Pakistan¹⁰⁻¹³. Other types include calcium phosphate, magnesium ammonium phosphate (include struvite or staghorn calculus), uric acid and cysteine stones¹⁴. Less commonly, drug particles (e.g. indinavir) or mucoproteins (proteus infection) may cause urinary stones. Metabolic products of drugs (e.g. sulfa drugs, salicylates, triamterene and ephedrine) are also among causes of Urolithiasis¹⁵.

Urolithiasis mainly presents as colicky flank pain that may radiate to groin, back or periumbilical region. Some patients may be completely asymptomatic. Hematuria is also a frequent accompanying feature which may be gross or microscopic. Hydronephrosis and hydroureter are among the commonly associated findings¹⁵.

Complications of Urolithiasis include abscess formation, pyelonephritis, urinary fistula formation, ureteral scarring & perforation, urosepsis and loss of kidney secondary to longstanding obstruction¹⁶. In a study done in Karachi,

Pakistan, 20% of subjects with Urolithiasis had compromised renal function¹¹.

A number of imaging modalities are currently in practice for evaluation of Urolithiasis. They include X- ray of kidney, ureter and bladder (KUB), Ultrasonography, Nuclear scans & Computed tomography (unenhanced). Contrast studies include intravenous pyelography (IVP) and retrograde pyelography¹⁷. Ultrasound has benefits of being a quick and safe modality with no involvement of contrast agents or ionizing radiation, hence it is modality of choice in children and pregnant women^{18,19}. It also offers a safe alternative for patients with hypersensitivity to contrast agents and impaired renal function. Various studies have reported its sensitivity to be varying from 76% to 91% and its specificity to be 100% in detection of Urolithiasis^{18,20,21}.

Despite the limitation of occasionally missing stones (especially less than 2mm in size or those located at lower end of ureter), it is widely used imaging modality worldwide²².

The objectives of this study were to have an insight into presentation and ultrasonographic findings of Urolithiasis. It also aimed at analyzing any significant differences across various age groups and gender and to assess the generalization of overall results in our population.

MATERIALS AND METHODS

This study is a record based cross sectional study carried out from March 2010 to June 2010. The site for this study was Khyber X Rays, Khyber Medical Centre, Peshawar. Majority of the patients were referred by urologists followed by general surgeons for ultrasonographic evaluation. Detailed history of presenting complaints was recorded prior to conducting ultrasound examination. All patients were evaluated transabdominally by Toshiba Nemio 20® Doppler ultrasound scanner with 4.2MHz frequency transducer. Occasionally color Doppler was used to distinguish between pelviccalyceal system and dilated vasculature. Results were recorded in a standardized Microsoft Excel spreadsheet and analyzed accordingly.

Chi-square test of independence was utilized for statistical analysis. The data was analyzed using SPSS-17. The results were considered significant at $p < 0.05$ ($\alpha = 5\%$).

INCLUSION / EXCLUSION CRITERIA

Patients of all age groups presenting with Urolithiasis and undergoing ultrasound examination including pregnant women with urolithiasis were made part of the study. Patients presenting with similar complaints but urological disorders other than Urolithiasis were excluded from this study.

RESULTS

A total of 210 cases of Urolithiasis were analyzed. Overall the patient population ranged from 40 days to 80 years. Total number of male and female patients was 137 and 73 respectively with a male to female ratio of 1.9:1. The age wise categorization included pediatric population (15 years and less) with 20 cases (9.5%), adult population (16 years to 64 years) with 173 cases (82.4%) and geriatric population (65 years and above) with 17 cases (8.1%). (Table I) Data was also analyzed in relation to gender distribution across various presenting complaints and ultrasonographic findings. (Figure1).

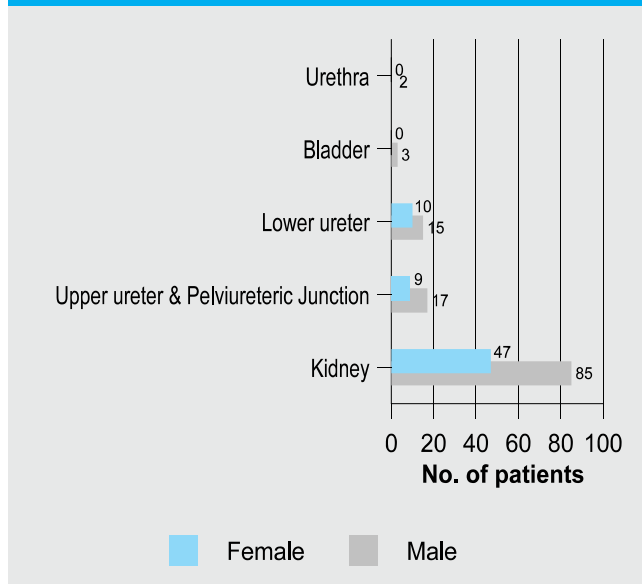
Table-I. Ultrasound findings in relation to age group

Population	Site of calculus (in %)				P-value
	Kidney	Ureter	Bladder	Urethra	
Overall	62.9	24.3	1.4	0.9	-
Pediatric	65	20	-	5	p=0.195
Adult	61.3	26.6	1.2	0.6	p=0.977
Geriatric	76.5	5.9	5.9	5.9	p=0.0002

Overall pain in left flank region was most common presenting complaint with 46 cases (21.9%) followed in descending order by bilateral flank pain (20%), right flank pain (17.6%), epigastric pain (3.8%), lower abdominal pain (3.3%) and non specific abdominal pain (2.4%). Associated symptoms included dysuria (20%), gross hematuria (4.3%) and history of passage of stones (2.9%) Rare presenting complaints included difficulty in defecation, dysmenorrhoea, and backache with 1 case

each. No hydronephrosis was seen in 104 cases (49.5%) mild in 44.8%, moderate in 3.8% and marked in 0.95% of cases.

Fig-I. Overall ultrasound findings in patients with urolithiasis



Left flank pain was most common presenting complaint in males (n = 137) with 35 cases (25.5%), followed in descending order by bilateral flank pain (22.6%), right flank pain (19.7%), epigastric pain (3.6%), lower abdominal pain (3.6%), nonspecific abdominal pain (1.5%). Associated symptoms included dysuria and hematuria with 18.9% and 5.1% of the male cases respectively.

The ultrasound examination in male patients revealed kidney stones to be most prevalent with 85 cases

(62.0%) of which 23 were on right side, 14 on left side and 48 bilateral. This was followed by stones at pelviureteric junction or upper ureter (12.4%), lower ureter (10.9%), bladder (2.2%) and urethra (1.5%). Staghorn calculus was found in 2 cases (1.5%) (Figure1). Accompanying cystitis was also present in 2 cases (1.5%).

The presenting features in females differed from that in males and overall population. Bilateral flank pain was present in 11 cases (15.1%), left flank pain also in 11 cases (15.1%), followed by right flank pain (13.7%), epigastric pain (4.1%), nonspecific abdominal pain (4.1%) and lower abdominal pain (2.7%), 16 cases (21.9%) had accompanying dysuria and 1 case (1.4%) had accompanying hematuria.

Ultrasound examination in females showed kidney to be the most common site for stones with 47 cases (64.4%) of which 17 cases had stones in their right kidney, 10 had them in left kidney and 20 had them bilaterally. This was followed by stones in lower ureter with 10 cases (13.6%), pelviureteric junction or upper ureter (12.3%). No stone was found in bladder or urethra in females (Figure1). Other findings included cystitis (4.1%) pyonephrosis (1.4%) and renal parenchymal disease due to longstanding Urolithiasis (1.4%).

For a total of 20 cases in pediatric population, pain was the most common complaint (75%) followed by nausea/vomiting (10%) and irritability (5%). The ultrasound examination revealed renal stones in 13 cases (65%) followed by ureteric (20%) and urethral (5%). No bladder stones were seen in this population

Table-II. Comparison of ultrasound findings in urolithiasis

Author	Year	Region	Site of calculus (in %)			
			Kidney	Ureter	Bladder	Urethra
Current study	2011	Peshawar, Pakistan	62.9	24.3	1.4	0.9
Asghar	2010	D.I Khan, Paksitan	18.5	5.5	-	-
Ahmad	2006	Peshawar, Pakistan	58.7	24.4	16.4	-
Arain	1997	Lahore, Pakistan	39.7	10.5	47.9	1.9
Volkmer	2002	Germany	41.8	47.2	9.1	1.8

(Table 1). Two cases (10%) had history of metabolic disorders and were found to have nephrocalcinosis. 8 cases (40%) had mild hydronephrosis as accompanying finding.

In Geriatric patients (n = 17) pain was a presenting complaint in 41.2%, associated dysuria was present in 47.1% and 29.4% had history of urological procedures. Stones were mostly found in kidneys (76.5%), followed by ureter (5.9%), bladder (5.9%) and urethra (5.9%) (Table1). Other findings included cystitis (47.1%), pyelonephritis (11.8%) and renal parenchymal disease due to longstanding Urolithiasis (5.8%). No hydronephrosis was seen in 52.9%, mild in 29.4%, and marked in 11.8%.

No statistically significant difference was found in either presentation or ultrasound findings across gender (p = 0.48 and 0.51 respectively). Similarly no significant difference was noted in presentation or ultrasound findings of pediatric population with overall results (p = 0.195). However a statistically significant difference was found in ultrasound findings in geriatric population compared to overall population (p = 0.0002) (Table I) implying the fact that the results are not generalizable on geriatric population.

DISCUSSION

The overall male to female ratio in our study was 1.9:1 (Figure 1) which correlates well with that observed in other studies from Pakistan, which lie in the range of 2.1:1 to 3.8:1.^(10, 11, 23) Same observation was seen in the available literature from Thailand (2:1). However it was significantly lower than that observed in Arab countries like Kuwait (9:1) and Saudi Arabia (5:1)^{6,24,25}.

The average age of presentation in our study was 33.1 years with majority of patients lying in 16 to 64 years of age group. This fact was supported by available literature from USA (which describes majority of patients to lie between 20 to 49 years)¹ and Peshawar, (with major patient population in 30 to 50 years age group)¹⁰. However the average age in our study was less than that observed in Karachi (44 years), Kuwait (41.91 years) and Thailand (40.3 years)^{2,6,24}.

Most common presenting complaint was left flank pain followed by bilateral pain. Similar pattern was observed in studies done in Kuwait, USA and Karachi^{2,6,8}.

Overall kidney stones were the most common ultrasound finding (62.9%). This result was consistent with study done by Ahmad et al. in Peshawar (58.66%)¹⁰ but higher than results observed in Germany (41.8%),²⁶ Thailand (40.3%)²⁴ and other parts of Pakistan like D.I Khan (31%),²⁷ and Lahore (39.7%)²³ (Table-II). These findings may support the argument that our population is more likely to develop kidney stones as compared to stones in other parts of urinary tract.

The incidence of ureteric stone was 24.2% (Table II). This finding was similar to that observed by Ahmad et al. in same population (24.41%)¹⁰ but higher than those quoted by studies from Lahore (10.49%) and D.I Khan (5.5%)^{23,27}.

Findings of vesical and urethral calculi were present in 1.4% and 0.9% of cases respectively (Table II). These results were lower than comparable literature from Germany (9.1 % & 1.8%), Peshawar (16.4% vesical calculi) and Lahore (47.94% vesical & 1.87% urethral)^{10,23,26}. The incidence of Staghorn calculus (1.4%) was in good agreement with findings by Asghar (D.I Khan) (1%) but much lower than that observed by Ahmad et al. (Peshawar) (16%)^{10,27}. These figures may provide an insight into changes in trends that may have occurred over time however further work is needed to establish this argument.

The presenting features in pediatric population of our study (pain = 75%) were quite different from those mentioned in available literature from Canada (63%) and Karachi Pakistan (58.5%)^{11,19}. However ultrasound findings (Renal stones = 65%) (Table I) were in good comparison to available international literature from Kuwait²¹.

Hydronephrosis (of varying degree) was present in 50.5 % of cases which was a good reflection of figure given by a study in Karachi (52.3%)²⁸ but lower than international data from Korea (68.7%)²⁹.

8% of cases comprised of Geriatric population (Table I). This figure was a good reflection of international data from USA (12%)³⁰.

CONCLUSIONS

Urolithiasis is a common and major cause of morbidity in all age groups of our population. The overall trend of Ultrasonographic findings was applicable to pediatric and adult population. Significant difference was seen among geriatric population in terms of ultrasonographic findings. The field is still open for further epidemiological work as far as this topic is concerned. This will not only help in understanding the burden of this disease in a better manner but will also help in identification and reduction of various risk factors responsible for urolithiasis.

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