Original Research Paper

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Urology

BILATERAL URETERIC CALCULI DISEASE PRESENTING AS ACUTE KIDNEY INJURY – A SINGLE INSTITUTION CASE COHORT.

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ABSTRACT **Background:** The incidence of a unilateral ureteric obstruction secondary to a stone is reported at 30-40% in literature. Patients usually present with the classic symptoms of renal colic, nausea,vomiting or even features of urosepsis. Others may be asymptomatic or have very atypical symptoms like generalised myalgia. Possible confirmatory radiologic tests include abdominal plain Xray film, ultrasonography of the kidney ureter and bladder, and most commonly, non-contrasted helical CT scan, which is the test of choice. Urgent urologic consultation and intervention is warranted in patients with urosepsis, acute renal failure, anuria, and/ or unyielding pain, nausea, or vomiting due to bilateral ureteric calculi disease. This article discusses a series of cases of bilateral ureteric calculi which were treated at Rajiv Gandhi Government General Hospital in Chennai. **Methods:** This study is a retrospective analysis of patients with Bilateral ureteric calculi at Rajiv Gandhi Government General Hospital Emergency department (ED). Patients were initially confirmed by imaging by CT scan, patients had to have baseline creatinine (Cr) and other blood investigations in the Emergency Department for comparison to be included. AKI was defined by kidney disease: Improving Global Outcomes (KDIGO). **Results:** Of the 30 total cases, 25 (approx. 83 %) had Acute kidney injury and approx 16% did not have AKI. 18 patients were over 40 years old and almost all the patients who were more than 40 had Acute kidney injury. 12 patents were younger than 40 years and in that 4 patients did not have acute kidney injury. Oliguria / anuria was present in 25 patients which also correlated with those having elevated renal parameters. Urinary tract infection (UTI) denoted by a positive urine culture was present in around 26 of the 30 patients. Most common location of the calculus was proximal ureter in almost 20 pateints.15 patients had severe urosepsis on presentation denoted by elevated Total White Blood cell counts and hypotension. Almost 20 patients had severe metabolic acidosis with or without pulmonary edema requiring emergency hemodialysis Almost 26 patients of the total 30 patients had been given a NSAID either at the Emergency Department or Outside at some other hospital for severe abdominal pain. 22 patients had either one sided loin pain, 2 patients were completely asymptomatic with no loin pain at all.and the remaining however had bilateral loin pain on admission. **Conclusion:** We have demonstrated a novel association between Bilateral ureteric calculi and AKI in a group of 30 patients. AKI(+) patients were older than 40 years and were more likely to present with acute kidney injury. AKI(+) patients had higher rates of UTI or urosepsis. Majority of the patients also required emergency hemodialsysis for optimisation which highlights the seriousness of the condition.

KEYWORDS :

INTRODUCTION

Urinary stone disease (USD) is common in the India, affecting 1 in 10 adults. The incidence of Ureteric stone disease has increased by 4–6% annually, and the number of stone forming adults has doubled in the last 10 years. While urinary stones are notorious for causing severe pain and renal colic, morbidity has traditionally been linked to urinary tract obstruction and/or infection . Acute kidney injury (AKI) is defined by an abrupt decrease in renal function and has been strongly linked to increases in morbidity and mortality in ureteric stone disease. USD-associated AKI is most often attributed to the obstruction of a solitary kidney or both kidneys simultaneously and occurs in 1–2% of adult stone formers. In adults, increases in creatinine (Cr) as small as 0.3 mg/dl have been linked to increased mortality; furthermore, AKI can increase hospital care costs and length of stay . While AKI is uncommon in adult USD formers, there is evidence that they are at increased risk for development of chronic kidney disease (CKD) independent of other comorbidities such as diabetes and hypertension. Therefore, the objective of this study was to evaluate acute bilateral ureteric calculus patients for AKI and to estimate the risk factors and factors ascertaining the long term morbidity in these patients.

MATERIALS AND METHODS

Study Design

This study was a prospective as well as a retrospective study of all patients admitted with bilateral ureteric calculus at Rajiv Gandhi Government General Hospital in Chennai for a period of one year from September 2023 to September 2024. All patents with calculus of kidney, ureter were included. Patents with vesical calculus and other lower urinary tract calculus were not included in the study. All charts were reviewed to confirm diagnosis of urinary stones, and patients were only included if they had radiographic imaging positive for stones [renal ultrasound or computed tomography (CT). Baseline blood investigation included complete hemogram, renal function tests including Blood urea and serum creatinine, coagulation profile echocardiogram and emergency nephrologist consultation was taken for all cases who had elevated renal parameters and their orders followed.

Data Collection

The data collected at the time of ED visit (age, sex, comorbdities, presenting clinical symptoms (flank pain, abdominal pain, nausea, vomiting, hematuria, and/or dysuria), serum chemistry, arterial blood gas analysis if renal parameters were elevated, urinalysis including culture, and imaging (renal ultrasound and CT). Abdominal X-rays of the kidney, ureter, and bladder (KUB) were not included as local practice patterns do not routinely utilize KUB as a screening tool in the ED, without also obtaining other imaging, due to the inability of KUB to evaluate patients for obstruction. Any urine culture with an organism growing >100,000 colony forming units was considered positive, even if the organism is not considered a traditional urinary infectious organism. Treatment in the ED including medications [intravenous fluids (IVF), pain medications, anti-emetics, alpha-agonists, and antibiotics] as well as discharge medications were identified.

AKI Definition

AKI was defined utilizing three well-established criteria: the Kidney Disease Improving Global Outcomes (Kdigo) ED visits were designated as either able or unable to evaluate for AKI based on serum Cr levels. If multiple Cr measurements were available, baseline Cr was defined as the lowest value within the defined time range. The glomerular filtration rate (GFR) was calculated using the bedside Schwartz formula. Any patient without available baseline serum Cr level was categorized as unable to evaluate for AKI and excluded from subsequent analysis.

Statistical Analysis

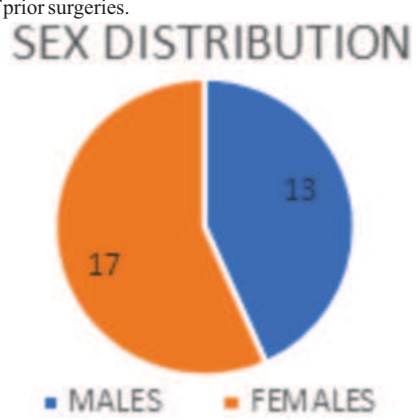
Patient data were analyzed by ED visit and the visits were then compared: AKI by the criteria of KDIGO, [AKI(+)] vs. those without AKI [AKI(–)]. Comparisons of the AKI(+) vs. AKI(–) groups were made with Chisquare or Fisher's exact test for categorical variables and Student t-tests or Wilcoxon Rank-Sum tests were performed for continuous variables. The Hodges–Lehmann Estimator and odds ratio confidence intervals were calculated where appropriate. Statistical analyses were completed using SAS . All statistical tests were two-

tailed with significance defined as $p < 0.05$. The Venn diagram was generated by using Venny 2.1 online software.

RESULTS

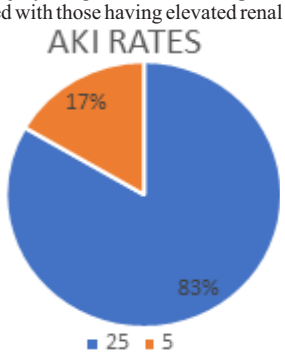
Demographics

A total of 30 patients, aged 30-58 around 13 patients were males and remaining 17 were females. All the patients belonged to either Chennai or surrounding districts of North Tamilnadu. All of them had mixed diet. 10 patients had underlying diabetes out which 7 were uncontrolled. 5 patients were hypertensive and 4 were having both hypertension and diabetes. 2 patients were having coronary heart disease. None of the patients had a history or renal colic and had no history of prior surgeries.



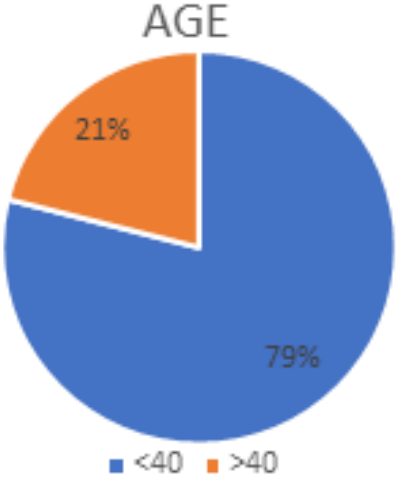
AKI Rates

Of the 30 total patients, all had adequate data to evaluate for AKI . Of the 30 total cases, 25 (approx. 83 %) had Acute kidney injury and approx. 16% did not have AKI. 18 patients were over 40 years old and almost all the patients who were more than 40 had Acute kidney injury. 12 patents were younger than 40 years and in that 4 patients did not have acute kidney injury. Oliguria / anuria was present in 25 patients which also correlated with those having elevated renal parameters.



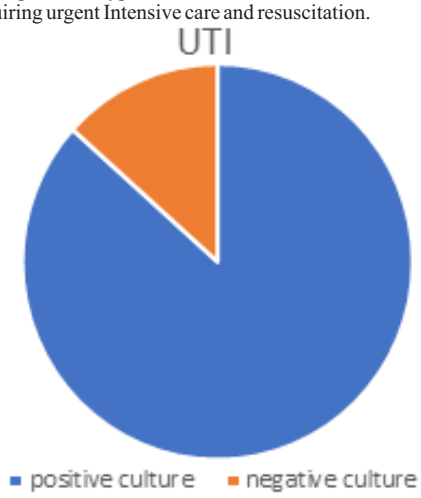
Age

Out of 30 patients 18 patients were above 40 years of age. 12 patients were less than 40 years of age. The limitation was that none in this study had their renal function tests (blood urea, serum creatinine) done in the past 5 years before they were affected by urinary stone disease. Hence their nadir creatinine was unknown.



Urinary Tract Infection

Urinary tract infection (UTI) denoted by a positive urine culture was present in around 26 of the 30 patients. In 26 patients 15 of them had severe urosepsis with hypotension and increased total white blood cell count requiring urgent Intensive care and resuscitation.

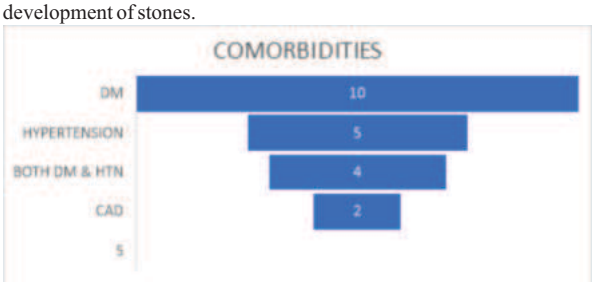


Location Of Stone

The most common location of the stone was proximal ureteric calculus. There was no reason for the same. None of the patients had any underlying anatomical abnormality of the genitourinary tract which predisposes them to stone formation.

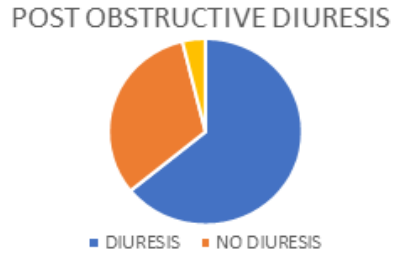
Comorbidities

10 patients had underlying diabetes out which 7 were uncontrolled. 5 patients were hypertensive and 4 were having both hypertension and diabetes. 2 patients were having coronary heart disease. As quoted in several studies earlier uncontrolled diabetes is noted risk factor for development of stones.



Post Obstructive Diuresis After Treatment

20 of the total 30 patients experienced post obstructive diuresis which were managed with intravenous fluid replacement and correction of electrolyte disturbances.



Treatment

Of the total 30 patients all of them were stratified into emergency and non-emergency patients. 5 patients who had normal renal parameters and who were asymptomatic were closely monitored for any warning signs like acidosis, elevated renal parameters, urine output, sepsis. Out of the 30 patents 20 had severe metabolic acidosis and oliguria/anuria and had to undergo emergency renal replacement therapy in the form of emergency hemodialysis. 26 of the 30 patients had positive urine culture and were treated with appropriate culture specific antibiotics. None of the patients received NSAID after admitted under our care.

All of the 30 patients underwent bilateral ureterorenoscopic lithotripsy with bilateral double j stenting either in emergency or elective basis. 20 patients experienced post obstructive diuresis and were treated with intravenous fluid replacement therapy and correction of electrolyte disturbances.

DISCUSSION

Postrenal causes of acute kidney injury occur when both ureters are obstructed or when one tract is obstructed in a patient with a single functional kidney.(SFK) Most commonly obstruction due to prostatic hypertrophy, cancer of the prostate or cervix, or retroperitoneal disorders and often presents in the outpatient setting. A neurogenic bladder can result in refluxing nephropathy and functional obstruction. Other less frequent postrenal causes of acute failure can be intraluminal, such as bilateral renal calculi, papillary necrosis, coagulated blood, bladder carcinoma, or extraluminal obstruction. Because postrenal causes are readily reversible, it is imperative to exclude them. Rapid evaluation of the patient in the emergency department demonstrated bilateral renal stones as the most common cause of acute renal failure in the emergency sitting.

Urinary stone disease is commonly seen in 1 of 10 people over a lifetime. Symptoms include severe colicky flank pain. Gross hematuria is present in 15 percent. Others may be asymptomatic or have atypical symptoms such as acute abdominal or flank/loin pain, nausea, urinary urgency or frequency,dysuria as difficulty in urinating, pain at the tip pf penis, or testicular pain

Calculi can have either calcium or uric acid. A study by Wang et al performed from February 2002 to December 2009 revealed an acute kidney injury prevalence of 0.72% in a series of 2,073 ureteral stone cases, with just 5 instances (33.3%, 5/16) attributed to bilateral ureteral stones. The research indicates that the risk factors for experiencing ARF in patients with ureteral stones include larger stones that are likely to cause impaction, ureteral stones in individuals with a single working kidney or existing kidney issues, and stones present in both ureters. Eighty percent of individuals with nephrolithiasis develop calcium stones, the majority of which are made up of calcium oxalate or, less frequently, calcium phosphate.The other primary types consist of uric acid, struvite (magnesium ammonium phosphate), and cystine stones. A single patient can have multiple types of stones at the same time (for example, calcium oxalate and uric acid). The likelihood of developing renal stone disease is affected by the composition of urine, which can be altered by specific illnesses and patient behaviors. For calcium oxalate stones, urinary risk factors are hypercalciuria, hyperoxaluria, hypocitraturia, and dietary risks like low calcium consumption, high oxalate consumption, high animal protein consumption, high sodium consumption, or inadequate fluid intake. The initial suspicion of stone disease is based on the clinical presentation. The most effective imaging technique to verify the presence of a urinary stone in a patient experiencing acute flank pain is a non-contrast enhanced computed tomography scan of the kidney, ureter, and bladder (CT KUB). This method can identify both stones and urinary tract blockages and has established itself as the gold standard for the radiologic diagnosis of stonerelated conditions. CT slices ranging from 5 mm to 10 mm in thickness are ideal for identifying stones.The specificity of helical CT approaches 100%, so a positive result verifies the diagnosis of kidney stone disease, and patients should receive proper treatment. When a CT scan verifies the existence of a stone, a standard abdominal Xray should be performed to determine if the stone is radiopaque. If CT is not accessible, plain abdominal Xrays should be conducted. Because 75% to 90% of urinary stones are radiopaque, including calcium, struvite, and cystine stones, radiolucent uric acid stones may be overlooked, as well as small stones or those positioned over bony structures, leading to undetected obstructions. The utility of an abdominal plain film is minimal when helical CT is accessible. Despite ultrasonography demonstrating high specificity (over 90%), its sensitivity is considerably lower compared to CT, generally falling between 11% and 24%. Therefore, ultrasonography is not commonly employed but is suitable as the first imaging examination when colic arises in pregnancy. It is effective for diagnosing urinary tract obstruction and can identify radiolucent stones that may be overlooked in kidney, ureter, and bladder Xray (KUB); nonetheless, ultrasonography might overlook small and ureteral stones.

Immediate action is required for a patient with an obstructed and infected upper urinary tract, potential kidney failure, severe pain or vomiting, inability to urinate, or severe obstruction of a single or transplanted kidney. Obstruction in the upper tract raises pressure in the renal pelvis, leading to a decrease in glomerular filtration and renal blood flow. Alleviating upper tract obstruction might necessitate either antegrade (percutaneous nephrostomy) or retrograde (cystoscopy and retrograde ureteral catheterization) methods. Urethral catheterization can be carried out right away, while other methods necessitate preparation. Intensive cooperation among nephrology, urology, and radiology departments is essential, and often, renal replacement therapy could be needed prior to alleviating the obstruction. A notable diuresis following the alleviation of obstruction (post-obstructive diuresis) can complicate the resolution of complete urinary tract blockage, via both proper (elimination of retained solute and water) and improper mechanisms (tubular concentrating dysfunction). Severe polyuria occurs infrequently and needs meticulous management to avoid volume depletion and potential pre-renal impairment, or excessive fluid resuscitation leading to increased dieresis. Obstruction can lead to a reduced distal tubular reaction to aldosterone, causing paradoxical hyperkalaemic acidosis once it is alleviated. This typically resolves on its own. A few individuals will experience lasting tubular damage and ongoing salt-wasting nephropathy.

About 5% of individuals with kidney stones also have hyperparathyroidism. Furthermore, the majority of stones in individuals with hyperparathyroidism are made up of calcium oxalate. The concentrations of serum calcium, phosphate, calcitriol, and parathyroid hormone are useful for diagnosing this condition. Primary hyperparathyroidism must be taken into account for patients experiencing recurrent kidney stones, particularly calcium stones, along with a high-normal or elevated serum calcium level.

CONCLUSION:

We have demonstrated a novel association between Bilateral ureteric calculi and AKI in a group of 30 patients. AKI(+) patients were older than 40 years and were more likely to present with acute kidney injury. AKI(+) patients had higher rates of UTI or urosepsis. Majority of the patients also required emergency hemodialsysis for optimisation which highlights the seriousness of the condition.

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