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Management of Calculus Anuria– Our Experience

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ABSTRACT: Aims and objectives- To determine the outcome of treatment for patients with calculus anuria
METHODS:A retrospective study was conducted at Department of Urology Kakatiya Medical College/MGM Hospital, Warangal from April 2019 to March 2021. All patients with a diagnosis of calculus anuria of all ages and either sex were included in the study. Detailed history, physical examination and examination of genitourinary tract was performed. Investigations included complete blood examination, blood urea, and serum creatinine, ultrasonography of KUB area, and X-Ray KUB and noncontrast CT abdomen KUB for radiolucent calculi.
RESULTS: Among the 37 patients the cause of anuria was bilateral obstruction by the calculi in 33 cases, unilateral obstruction with absent/peviureteric junction obstruction contralateral kidney in 4 cases. All patients underwent dialysis (either hemo or peritoneal dialysis). In most of the cases, ureteric double J stenting/percutaneous nephrostomy was done to relieve the obstruction. Two deaths were observed, despite emergency urinary diversion and appropriate treatment. Definitive management either ureteroscopic lithotripsy/percutaneous nephrolithotomy/ ureterolithotomy/ extracorporeal shock wave lithotripsy was done after renal parameters were normalized.
CONCLUSIONS: Calculus anuria is a urological emergency. Prompt and early intervention can save the life of patient and prevent to develop chronic renal failure.
KEY WORDS: Anuria, Calculus, and Management.

I. BACKGROUND

Urinary lithiases have been a major urological problem. A very high incidence is reported in Northern India, Thailand, Afghanistan, Turkey, Egypt, Japan, Indonesia, Middle East, Europe, Netherlands and Scandinavian countries.[1,2] In India the incidence of calculus renal failure is high. Urolithiasis constitutes about 10% to 25% of the total work load in the urological practice.[3] In about 5% of the patients presenting with acute renal failure, the cause is obstructive uropathy and urolithiasis is the most common cause of obstruction.[4] Calculus anuria is a urological emergency and anuria can be due to bilateral ureteric calculus impaction or unilateral ureteric calculus impaction of solitary kidney or the only functioning kidney. After the onset of obstruction, there is increased intrapelvic pressure, resulting in pyelolymphatic and pyelovenous urine back flow as well as fornix rupture and urine extravasation.[5] Therefore, the obstruction of the urinary tract causes significant kidney damage. Prompt and early intervention can save the patient from developing irreversible renal damage. Double J stenting, PCN, haemodialysis and peritoneal dialysis can be used as emergency procedure to manage calculus anuria after which definite treatment of stone can be performed, or an emergency operation can be performed in well-equipped centers. After relief of obstruction, kidney and life of the patient can be saved, results are better if obstruction is relieved earlier. After relieving the obstruction there is improvement in concentrating and acidifying ability of the kidney.[6] Purpose of this study was to determine the outcome of treatment for patients with calculus anuria.

II. METHODS

This study was carried out in the department of Urology Kakatiya Medical College /MGM Hospital, Warangal from April 2019 to March 2021.Thirty seven patients with calculus anuria of all ages and either sex were included in the study. Patients were admitted through emergency and OPD. On admission detailed history of pain, urinary output, fever, hematuria, and uremic symptoms with durations were recorded. Urine output between 0–100ml and 24 hours was regarded as anuria. General physical

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examination and systemic examination with especial reference to genitourinary tract was done and positive findings were recorded. Investigations included complete blood examination, Blood Urea, Serum Creatinine, serum electrolytes. Ultrasonography of KUB area was performed in all cases to see the size of stone, site of stone, degree of hydronephrosis, echogenicity, renal cortical thickness, and presence of either kidneys or solitary kidney. X-Ray KUB was taken for size and site of stone in the urinary tract. Non contrast CT scan of abdomen was done selectively for radiolucent calculi. In patients with normalized creatinine an IVU study was performed. All patients underwent dialysis (hemodialysis or peritoneal dialysis) for raised renal parameters.

Urinary diversion procedures like Double j stenting or percutaneous nephrostomy under ultrasound guidance were done on emergency basis to relieve the obstruction. Post procedure urine output was recorded; blood urea, serum creatinine, and serum electrolytes were also repeated when required during hospital stay of the patient. Prophylactic antibiotics were administered before any procedure. Once urine culture report was obtained, culture specific antibiotics were started. Depending upon the size and location of the stone, definite treatment was planned. The treatment modalities employed include - Ureteroscopic lithotripsy (URSL), Push back percutaneous lithotripsy (PCNL), Ureterolithotomy, Extracorporeal shock wave lithotripsy (ESWL).

III. RESULTS

Of the 37 patients, 30 (81%) were male and 7(19%) were female, with male to female ratio 4.3:1. The age ranged from 2 year to 56 years. Mean age was 29.5 years (Table-1). The duration of anuria varied between 1 to 8 days.

Along with anuria 21 patients (56.76%) had loin pain either right or left or both. Twelve patients (32.4%) had nonspecific complaints like back pain. Seven (18.9%) patients had fever at presentation. Twenty patients had uremic symptoms like vomiting, drowsiness, shortness of breath. Overt hematuria was seen in 5 patients. In children, anuria and uremic symptoms were the only presenting symptoms. Seven patients (18.9%) had prior H/O treatment for stone disease. On examination 7 patients were febrile, 4 patients had hypotension (systolic B.P. <100 mm of Hg).

Serum creatinine at presentation ranged from 4.5 - 24 mg % with mean creatinine of 11.7 mg%. In children creatinine ranged from 4.5 - 7.3 mg % with mean creatinine of 5.4 mg%. In adult's creatinine ranged from 6-24 mg% with mean creatinine of 12.9 mg%.

Hyperkalemia was present in 5 patients ranging from 5.8 to 7.2 mEq/l, who are managed by Inj.calcium gluconate, Sodium bicarbonate, dextrose - insulin infusion along with dialysis. Over all comorbidities were present in 6 (16.2%) cases, Diabetes Mellitus in 2 cases, Hypertension in 3 cases, both were present in one case.

Ultrasonography (USG) was performed in all cases; USG detected ureteric calculi in 39 renal units (55.7%), of which 11 were upper ureteric calculi (Sensitivity- 5 USG 7.8%) and 28 were lower ureteric calculi (sensitivity - 54.9%). In 31 renal units ultrasound showed only hydronephrosis or hydroureteronephrosis.

X - Ray KUB was done in all patients, among these in 28 renal units stone was not seen on X-Ray KUB may be because of radiolucent stone or poor bowel preparation, in these patients NCCT KUB done or directly taken for diagnostic ureterorenoscopy. In 42 renal units stones were visualized. Bilateral obstruction was present in 33 cases (89.2%) cases and unilateral calculi and associated congenital abnormalities - 4 (10.8%). In unilateral cases contra lateral pelviureteric junction obstruction (with thinned out cortex) was present in 2 patients; congenital absent kidney was observed in 2 cases. Among the unilateral cases-all 4 patients had lower ureteric calculi. In bilateral ureteric obstruction- 18 had bilateral lower ureteric calculi, 4 had bilateral upper ureteric calculi and 11 had Upper ureteric calculi on one side and lower ureteric calculi on other side. Stone size in the study was ranged from 0.8 cm to 2.5 cm. Associated renal calculi in 7 renal units.

Dialysis required in all patients. All paediatric patients (6), and 7 adult patients who were in sepsis and hypotension were managed with peritoneal dialysis. All other patients were managed by hemodialysis.

Seven patients had pyonephrosis (6 patients had unilateral, 1 patient had bilateral).These patients were managed initially by PCN after stabilization.

In two patients urine output increased spontaneously after dialysis without any intervention.

Of the 37 patients, 12 patients with serum creatinine of <10 mg%, without urosepsis underwent bilateral URSL in 10 patients, unilateral URSL in two patients with solitary kidney after dialysis without prior stenting /PCN.

Early Management

International Journal Dental and Medical Sciences Research
Volume 3, Issue 2,Mar-Apr 2021 pp 396-401 www.ijdmsrjournal.com ISSN: 2582-6018

Among the 6 children one child with solitary kidney directly taken for URSL, two children underwent bilateral DJ Stenting and other three children underwent ureterolithotomy on one side and DJ Stenting on other side.

In Adults

Among the 31 patients urine output was increased spontaneously in two patients after dialysis without any surgical intervention. Ten patients were underwent bilateral URSL, one patient with solitary kidney underwent unilateral URSL. Bilateral DJ Stenting was attempted in 11 patients (9 patients had bilateral ureteric calculi 2 patients had unilateral ureteric calculi with contralateral PUJO), all these patients had serum creatinine more than 12 mg%, among them bilateral DJ stenting was successful in 5 patients, DJ stenting was successful on one side and failed on the other side due to impacted calcul in 3 patients and DJ Stenting was failed on both sides in 3 patients, PCN was done for those failed cases. Six patients were underwent DJ stenting on one side, PCN on contralateral side for pyonephrosis. One patient underwent bilateral PCN for B/L pyonephrosis (Table 2).

Post obstructive diuresis was observed in 25 patients after early treatment. These patiens were managed meticulously so as to maintain euvolaemia.

Serum creatinine was normalized (normal creatinine according to age) in 20 patients (54%) after 7- 10 days. In 15 (40.5%) patients, whose creatinine was stabilized between 2-7 mg% at the end of 10 days, were discharged and observed for one month. In those patients who reviewed after one month, the repeated creatinine level normalized in 5 patients, creatinine level decreased but not normalized in 10(2-5mg%). In these patients 5 had co-morbid Illness, 1 patient had contralateral PUJO, 1 patient had solitary kidney, and 3 patients had one side pyonephrosis.

Normalized creatinine or stabilized level of creatinine does not depended on initial creatinine.

Four patients with septicemia were managed with higher antibiotics, dialysis and ventilator care, among them two were recovered from the sepsis but another two (5.4%) were died of septicemic shock and their creatinine was always above 10 mg% (one patient had bilateral pyonephrosis another had pyonephrosis on one side with contra lateral PUJO).

Late Management (Definitive)

After relief of obstruction and stabilizing patient, definite treatment of calculi was done. IVU done in all normalized creatinine patients

In Children

Three children who underwent prior urterolithotomy one side and DJ stenting on other side were underwent ureterolithotomy on other side. Among the two children who underwent prior bilateral DJ Stenting, one child underwent bilateral ureterolithotomy one side followed by other side and another child underwent ureterolithotomy one side and ESWL on another side.

In Adults

One patient underwent unilateral URSL, 8 patients underwent bilateral URSL, 2 patients underwent bilateral Pushback PCNL, 4 patients underwent URSL + Pushback PCNL and in 3 patients underwent URSL + ESWL. Table 3 & 4 showing definitive and overall definitive management of calculus anuria patients.

After definitive treatment serum creatinine was repeated after one month. 27 patients had serum creatinine <1.5mg/dl, 4 patients had 1.5 – 3.0 mg/dl and 4 patients had 3.0 – 5 mg/dl.

One patient with PUJO underwent Rt. Nephrectomy for nonfunctioning kidney in the follow up with recurrent loin pain. Renal calculi in 4 renal units were treated with PCNL, remaining 3 renal units were treated with ESWL along with ureteric calculi.

Age (Years)	**No. of Patients**
<12y	6
12-30y	11
30-45y	16
>45y	4

Table 1. Age Distribution of Calculus Anuric Patients

	B/L DJS	**DJS + PCN**	**B/L PCN**	**B/L URSL**	**Unilateral – URSL**	**Ureterolithotomy + DJS**
Anuria	7	3	3	10	2	3

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Anuria with sepsis	-	6	1			
Total - 35	**7**	**9**	**4**	**10**	**2**	**3**

Table 2. Early Management Modalities. B/L=Bilateral, DJS= Double j stenting, PCN=Percutaneous Nephrostomy, URSL= Ureteroscopic Lithotripsy

Procedure	**No. of Patients**
Bilateral URSL	18
Bilateral PCNL	2
URSL + Pushback PCNL	4
URSL + ESWL	3
Unilateral URSL	3
Bilateral ureterolithotomy	4
Ureterolithotomy + ESWL	1
Total	**35**

Table 3. Late (Definitive) Management. URSL= Ureteroscopic Lithotripsy, PCNL=Percutaneous Nephrolithotomy, ESWL=Extra Corporeal Shock Wave Lithotripsy

Procedure	**B/L Lower**	**Upper + Lower**	**B/L Upper**	**Unilateral Lower (with Contralateral PUJO or Absence)**
Bilateral URSL[18]	16	2		
Bilateral PCNL[2]			2	
URSL + Pushback PCNL[4]		4		
URSL + ESWL[3]		3		
Unilateral URSL[3]				3
Bilateral ureterolithotomy[4]	2	1	1	
Ureterolithotomy + ESWL[1]		1		
Total (35)	**18**	**11**	**3**	**3**

Table 4. Overall Definitive Management. URSL= Ureteroscopic Lithotripsy, PCNL=Percutaneous Nephrolithotomy, ESWL=Extra Corporeal Shock Wave Lithotripsy

IV. DISCUSSION

In the present study, majority of the patients with anuria (30%) did not have features of ureteric colic. They presented with history of lack of urine output and vague symptoms of malaise, weakness and loss of appetite or uremic symptoms. Chaabouni et al[7] observed that the symptoms in majority of their patients who had calculus anuria were polymorphic and nonspecific. This led to delayed presentation and permanent renal damage with poor prognosis.

Recurrent stone formers with underlying metabolic abnormality are likely to present with bilateral ureteric calculi. In the present study 20% patients had past history of stone disease. Routine stone analysis was not done in our study.

Although ultrasound is highly accurate in diagnosing in renal calculi, it is not very sensitive for ureteric calculi. In the present study sensitivity of ultrasound in diagnosing ureteric calculi was 55.7%. However sonography was quite sensitive in detecting sequele of ureteric calculi in the form of hydronephrosis, infected hydronephrosis/ pyonephrosis. Internal echoes suggestive of infection were seen in 7 out of 7 patients with pyonephrosis (100%). Ultrasound is also one of the useful modality for placement of percutaneous nephrostomy for draining the infected pelvicalyceal system.

In the present study plain CT scan of KUB region with thin sections (5mm) was highly sensitive in detecting bilateral ureteric calculi. Plain CT scan of KUB was done in the later part of the study to detect radiolucent calculi, when X-ray KUB did not reveal any radiopaque densities and ultrasound showed hydronephrosis. Bilateral ureteric calculi were seen in all the 12 patients, unilateral calculi in 4 along with contralateral

PUJO in 2 and contralateral absence in 2 in whom the

CT scan was performed. Smith et al[8] reported CT diagnosis to be 97% sensitive and 96% specific in patients with acute ureteric colic.

In addition to its ability in determining the size and location of stone, CT scan is particularly helpful in assessing the signs and sequele of ureteric obstruction, perinephric stranding, hydroureter, hydronephrosis, pyonephrosis and cortical thickness.[9]

In the present Study emergency intervention by DJ stenting / PCN in patients with anuria has improved the outcome. DJ stenting or PCN was done under local anaesthesia. Dialysis was required in all patients. In a similar study Bennani et al [10] performed emergency DJ stenting or percutaneous nephrostomy in patients with calculus obstructive anuria with good results. Mhiri et al recommended prompt renal drainage by percutaneous nephrostomy or Dj stenting in the management of calculus anuria, in their study the same percutaneous tract was used later for nephrolithotripsy.

Infection associated with ureteric stone is potentially life threatening urologic emergency. Urgent drainage of obstruction by stenting or PCN is essential. Definitive stone therapy should be delayed until urine is sterile and patient has recovered completely.[11] In the present study 7 patients who had associated infection along with anuria. Emergency PCN was done in all.

In our study emergency DJ stenting was failed in 6 patients due to impacted calculus. Morgentaler [12] defined impacted stone as one that cannot be bypassed by a wire or catheter. Roberts et al [13] defined it as a stone remaining at the same in the ureter for more than 2 months.

In two patients urine output increased spontaneously without any intervention. This may be because of resolution of edema or dislodgement of stone. These patients treated in the same admission after IVP.

In the present study the factors taken into consideration in choosing treatment modality include size of the stone, location, presence of nephrostomy and associated co morbidity.

URSL was the primary treatment modality in the present study, Bilateral URSL was done in 18 patients (36 renal units - 2 upper ureteric and 34 tower ureteric calculi).Pneumatic lithotripsy was the energy source used and is highly effective in stone fragmentation. Of these 18, B/L URSL was done in the same sitting in 12 pts. Overall 43 URSL procedures (18 bilateral and 7 unilateral) were performed.

Kupeli et al[14] evaluated 1970 cases of ureteric calculi, of these 1580 were treated by ESWL and 484 by URSL. They concluded that URSL is the most effective treatment of choice in lower ureteric stones and Pneumolithotrispy is the most effective and less complicated energy source. ESWL can be first line therapy in upper ureteric stones keeping other modalities (pushback PCNL / pushback ESWL) for unfragmented stones.

Bilateral pushback PCNL was done for 2 patients and unilateral pushback PCNL was done for 4 patients with upper ureteric calculi. In all patients pre-existing nephrostomy tract was used for PCNL

ESWL was done for 4 renal units as the stone migrated into PCS while doing URS, ESWL as a primary modality was infrequently used, as the facility is not available at our institute.

Overall 9 ureterolithotomies were performed. All ureterolithotomy patients are children. The main indication for ureterolithotomy was lack of small scopes for paediatric patients and large stones (>1.5cm).

In the present study post obstructive diuresis was seen in 25 patients after early treatment. Creatinine normalized in 20 patients (54%). In the remaining patients serum Creatinine remained between 2-5 mg% even after stone removal.

Calculus anuria occurs in patients with ureteric obstruction in a solitary kidney, obstruction in the only functioning kidney or in bilateral obstructed kidneys. The mechanism of renal damage in obstruction is not well understood. However possible mechanism is high intrapelvic pressure and decreased renal blood flow. Reversibility of renal function depends upon the duration and degree of obstruction. In one experimental study where there was severe partial obstruction of the ureters for 60 days the reversibility of renal function was only 8% over a period of one month after the relief of obstruction.[15] In another clinical study it was proved that prolonged obstruction caused irreversible renal damage.[16] Return of renal function depends upon many factors other than the duration and degree of obstruction, such as absence of infection, presence of intra-renal or extrarenal pelvis in obstructed kidneys.[17] Elderly age with associated comorbidity, sepsis and long duration of obstruction (> 4wks) are considered to be poor prognostic factors. About 94% of patients with calculus anuria were cured in our study, and only 6% of patients were expired.

Therefore results of our study are comparable with the results of Zhonghua et al, but difference is that we did emergency urinary diversion first, and after stabilizing the patient definite procedure was performed, where as in the study by Zhonghua et al they did emergency operation in majority of cases.[18]

Management in form of urinary diversion and definite surgical treatment can save the patient from developing chronic renal failure.[19]

Initial Serum creatinine level and level of obstruction had no influence on the reversibility of renal failure.

Sepsis is the main cause of morbidity and mortality (5.4%). In our study 7 patients presented with fever and 4 having hypotension. USG showed unilateral pyonephrosis in 6 and B/L pyonephrosis in one patient. Three patients improved with antibiotics, dialysis and urinary diversion. Four patients needed ventilatory support (critical care). Two patients are improved but other two succumb to death with septic shock.

V. CONCLUSIONS

Calculus anuria is a urological emergency, dialysis required in all cases. USG of abdomen is more sensitive in detecting the hydronephrosis but it is less sensitive for detection of ureteric calculi. Early intervention with DJ stenting / PCN is the initial treatment of choice. Bilateral URSL can be done as an emergency procedure in selected cases. The factors influencing the reversibility of renal failure include age, associated comorbdities (D. M, H. T. N.), duration of obstruction, associated sepsis, cortical thickness, diuresis after relieving obstruction. Initial creatinine or level of obstruction had no influence on the reversibility of renal failure. Majority of the patients with calculus anuria can be managed with endourological procedures.

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