RESEARCH ARTICLE

Evaluation of predictive factors of renal function recovery in renal failure secondary to urinary tract obstruction

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Abstract

Objective: To determine the factors associated with renal function recovery in individuals with kidney failure due to obstruction in the urinary tract.

Method: The prospective, descriptive study was conducted July 2020 to August 2021 at the Department of Urology, Sindh Institute of Urology and Transplantation, Karachi, and comprised adult patients of either gender who had renal failure secondary to obstructive urinary tract. Baseline data regarding patients' variables, including age, gender, duration of symptoms (<25 days or >25 days), haemoglobin (<9.85g/dl or >9.85g/dl), serum creatinine and renal cortical thickness (<16.5mm or >16.5 mm), was noted on a proforma. The variables were stratified to assess impact on renal recovery. Data was analysed using SPSS 23.

Results: Of the 126 patients, 43(34.13%) were males and 83(65.87%) were females. The overall mean age was 44.13±14.18 years. Renal recovery occurred in 67(78.8%) patients having duration of symptoms ≤25 days, and in 13(31.7%) patients with duration of symptoms >25 days (p<0.001). Renal recovery occurred in 41(58.6%) patients having haemoglobin ≤9.85g/dL and in 39(69.6%) patients having haemoglobin >9.85g/dL (p=0.2). Renal recovery occurred in 26(37.7%) patients with parenchymal thickness ≤16.5mm and in 54(94.7%) patients with renal cortical thickness >16.5mm (p<0.001).

Conclusion: Symptom duration ≤25 days, and renal parenchymal thickness >16.5mm were found to be predictive factors of good recovery in renal failure cases secondary to obstructive uropathy.

Key Words: Urinary obstruction, Obstructive nephropathy, Percutaneous nephrostomy, Renal failure.

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Introduction

Urinary tract obstruction can manifest at any age regardless of gender[1,2]. Urinary tract obstruction and its consequences are commonly referred to as obstructive uropathy, hydronephrosis and obstructive nephropathy [2]. Due to the length and relative complexity of the urinary tract, many different diseases can make it hard for urine to move from the renal papillae to the outside world[2].

The obstruction is usually caused by something mechanical, in which case the disease process may be intraluminal (calculi, detached papillae), intramural (stricture, ureteropelvic junction obstruction [UPJO] , vesico-ureteric junction obstruction [VUJO] and primary ureteral carcinoma), or external (ureteral cancer, pregnancy, retroperitoneal fibrosis, retrocaval ureter and pelvic mass) to the ductal system[2].

Obstruction of urine flow is accompanied by the manifestation of a rapid decline in renal function. If not addressed promptly, irreparable kidney damage might occur. Recent research indicates that people with nephrolithiasis have an increased risk of developing obstructive uropathy and ultimately ending up with chronic kidney disease (CKD)[3,4]. About 10-20% of obstructive uropathy is attributable to urolithiasis[5].

Management of renal failure due to urinary tract occlusion has varying clinical results, frequently dependent on the time and kind of surgical intervention[6].

Obstructive uropathy contributes to almost 10% of community-acquired acute kidney problems, and delayed treatment of ureteral obstruction has been demonstrated to affect kidney function, resulting in consequences like hypertension (HTN)[7]. Urosepsis is another sequelae of obstruction to urinary flow and is a medical emergency requiring rapid intervention with percutaneous nephrostomy (PCN) or double J (DJ) stenting to lower the rate of associated mortality[8 9].

Studies have sought to identify renal recovery predictors in individuals with renal failure due to kidney stones. Rajadass et al. reported that duration of symptoms, haemoglobin (Hb), and renal parenchymal thickness are

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predictors of recovery of renal function in obstructive nephropathy, which is renal failure secondary to obstruction of the urinary tract[9].

The current study was planned to determine the factors associated with renal function recovery in individuals with kidney failure due to obstruction in the urinary tract.

Patients and Methods

The prospective, descriptive study was conducted from July 2020 to August 2021 at the Department of Urology, Sindh Institute of Urology and Transplantation (SIUT), Karachi. After approval from the institutional ethics review committee, the sample size was calculated using the formula, N = Z2 x (P(100-P)/d2), where P = least frequency of duration of symptoms ≤25 days = 11.1%9 (for no recovery), Z = 1.96 and d = 5.5%. The sample was raised using nonprobability consecutive sampling technique from among patients presenting in SIUT emergency. Those included were adult patients of either gender who had renal failure secondary to obstructive urinary tract. Patients with established end-stage renal disease (ESRD) and those on regular maintenance haemodialysis were excluded.

After taking informed written consent from all the patients, baseline data was collected using a proforma regarding age, gender, duration of symptoms (<25 days or >25 days), Hb (<9.85g/dl or >9.85g/dl), serum creatinine and renal cortical thickness (<16.5mm or >16.5 mm).

Each patient received standard management, according to hospital protocols. Renal decompression was performed in all patients with percutaneous nephrostomy (PCN) or DJ stent placement. Each patient was prescribed broad-spectrum antibiotics, which were then changed depending on the urine culture results. After renal decompression, patients stayed in the hospital for 24-72 hours, and their kidney function was checked every day with serum creatinine.

In patients with severe metabolic acidosis on arterial blood gases (ABJ), persistent hyperkalaemia on serum electrolyte analysis, or fluid overload on chest X-ray (CXR), emergency haemodialysis was performed before decompression. Nadir creatinine was observed after a 6-week treatment period.

Data was analysed using SPSS 23. Mean and standard deviations were used to present age and duration of symptoms. Frequencies and percentages were calculated for gender, duration of symptoms, baseline Hb, renal parenchymal thickness on ultrasound (US), serum creatinine and renal recovery. Effect modifiers, such as age, gender, duration of symptoms, baseline Hb, renal parenchymal thickness and serum creatinine were stratified. Post-stratification, Chi-square test was applied to determine the association of these effect modifiers with renal recovery, which was the study outcome). P≤0.05 was taken as statistically significant.

Results

Of the 126 patients, 43(34.13%) were males and 83(65.87%) were females. The overall mean age was 44.13±14.18 years. The mean serum creatinine at baseline was 8.21±5.25md/dl (range: 2.50-24.00mg/dL). After six weeks, the mean serum creatinine level was 2.25±1.63mg/dl (range: 0.50-9.00mg/dL (Table 1).

Table-1: Age and serum creatinine at presentation and 6 weeks post-intervention

Mean S.D.	Age (Years)	Serum Creatinine at Admission (mg/dL)	Serum Creatinine after 6 weeks (mg/dL)
	44.13	8.21	2.26
	14.1	5.25	1.63

SD: Standard deviation.

Table-2: Presenting complaints

Symptoms	Frequency	Percentage (%)
Bilateral Flank Pain	57	45.2
Right Flank Pain	19	15.1
Left Flank Pain	20	15.9
Fever	36	28.6
Anuria	66	52.4

In terms of symptom frequency, 57(45.2%) patients had bilateral flank pain, 19(15.1%) right flank pain, 20(15.9%) left flank pain, 36(28.5%) fever, and 66(52.4%) anuria (Table 2).

The duration of symptoms was ≤25 days in 85(67.4%) patients and >25 days in 41(32.5%). Hb at admission was ≤9.85g/dl in 70(55.5%) patients and >9.85g/dl in 56(44.4%). The thickness of the renal parenchyma at admission was ≤16.5mm in 69(54.7%) patients and >16.5mm in 57(45.2%).

Renal function recovery was found in 80(63.4%) patients, and there was no renal recovery in 46(36.5%). In patients aged 18-44 years, recovery of renal function was found in 37(71.1%) patients, and in those aged 46-60 years, 43(58.1%) (p =0.134). Among male subjects, recovery was found in 47(56.6%), and among the females in 36(76.7%) (p=0.26). Renal recovery occurred in 67(78.8%) patients having duration of symptoms ≤25 days, and in 13(31.7%) patients with duration of symptoms >25 days (p<0.001). Renal recovery occurred in 41(58.6%) patients having Hb

≤9.85g/dL and in 39(69.6%) patients having haemoglobin >9.85g/dL (p=0.2). Renal recovery occurred in 26(37.7%) patients with parenchymal thickness ≤16.5mm and in 54(94.7%) patients with renal cortical thickness >16.5mm (p<0.001).

Discussion

Emergency decompression of the collecting system with PCN or ureteral stent insertion is the mainstay of therapy[10,11] for obstructive uropathy with sepsis. There are several benefits of inserting a PCN in an infected and blocked hydronephrotic renal system. In addition to monitoring output, it eliminates ureteral instrumentation, which can exacerbate urosepsis or lead to ureteral perforation[11]. Although ureteric catheterisation and PCN have comparable clinical outcomes, PCN placement has been proven to be less costly [8,12]. Considering these facts, experienced urologists at SIUT insert immediate PCN in nearly all patients presenting with renal obstruction. It has been demonstrated[5,13-15] that delay in relieving ureteral obstruction for more than two weeks cause long-term kidney damage and associated morbidity. To expedite renal recovery, PCN installation should not be delayed. Within 6 hours, patients with obstructive uropathy and urosepsis should have urological intervention in the form of urgent low-level invasive treatment; PCN or ureteral stenting [15].

Serum creatinine, creatinine clearance, or urine output can be used as tools for determining renal recovery. The drop in serum creatinine concentration can be used to determine renal recovery. Based on earlier research[15], the current study opted to utilise a nadir creatinine of 2mg/dl to define renal recovery in order to have two comparison groups. Numerous variables have been implicated in influencing renal recovery following obstruction alleviation. These include the age of the patient, the length and severity of obstruction, the existence of pyelolymphatic reflux, the compliance of the collecting system, concomitant infection, and the concurrent use of nephrotoxic drugs[16,17]. Long-term follow-up with complete or partial recovery following acute renal failure revealed that age and the lack of concomitant illness were related to a more favourable prognosis, as has been reported earlier[18]. Higher preoperative creatinine, proteinuria >300mg/day, renal cortical atrophy, stone load >1500mm2, and recurrent urinary tract infection (UTI) were linked with renal impairment in a large retrospective analysis of patients with kidney failure being treated for nephrolithiasis[16]. Patients with kidney stones have a lower creatinine clearance than those without kidney stones[19,20]. A case-control study revealed that HTN and diabetes significantly enhance the risk of CKD in individuals with kidney stones[21].

The current findings regarding factors related to renal recovery were comparable to earlier reports[9].

The current study has limitations of a small sample size which was due to its single-centre orientation. There is need for similar prospective multi-centre studies.

Conclusion

Symptom duration ≤25 days and renal parenchymal thickness >16.5mm were found to be predictive factors for good renal recovery in cases of renal failure secondary to urinary tract obstruction.

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Conflict of Interest: None.

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