Prediction of Renal Function Recovery in Obstructive Renal Failure Due to Stones

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Abstract

Two hundred and thirty-nine patients with renal and ureteric calculi associated with renal failure were evaluated for recovery potential before definitive surgery. Ultrasonography was carried out pre-operatively in all, followed by percutaneous nephrostomy (PCN) as an initial management before definitive surgery. Diethylene triamine penta acetic acid (DTPA) scan was done in 125 patients after percutaneous nephrostomy, findings of pre- operative DTPA scan were correlated with post-operative drop in serum creatinine. Urine pH, urine Na', initial diuresis, creatinine clearance and serum creatinine were measured serially after 24 hours and then every week for 6 weeks. Patients were re- evaluated with serum creatinine after 3 months of surgery. Ultrasonography was found to be reliable in predicting future recovery of renal functions in 76.5% cases and true obstruction of shorter duration (F4-group) on DTPA scan in 81.9% cases. Urine pH of 6 or less, post-PCN diuresis and natriuresis were good prognostic indicators. PCN was found to be most reliable method of predicting future recovery of renal function after relief of obstruction with 97.8% accuracy (JPMA 47:159, 1997).

Introduction

The renal damage associated with urinary stones is the result of a sequence of pathophysiological events starting from obstruction, reduction in renal blood flow and effects of infection. The future recovery of renal function depends on duration of obstruction[1], whether it is complete or partial and the presence or absence of infection[2,3]. Several investigators have attempted to predict recoverability of kidney function pre- operatively. The gross inspection of kidney at operation and histologic evaluation have been the basis of recovery potential in the past, however, these were subjective and unreliable[4]. Diverse views were held about the most sensitive and appropriate method and there were advocates for ultrasonography[5], DTPA scan[6], urine pH[7] and PCN[4]. The purpose of this study was to evaluate the prognostic and predictive value of functional recovery of renal functions by ultrasound, DTPA scan, PCN, urine pH, post PCN diuresis, urinary Na+ in patients with unilateral and bilateral renal and uretenc calculi with renal failure.

Patients and Methods

Two hundred and thirty-nine patients with calculus renal failure and proven hydronephrosis on ultrasound seen from January, 1989 to March, 1991 were included inthe study. After admission, complete blood picture, ESR, blood urea, serum creatinine, serum electmlytes, X-ray kidney, ureter, bladder (KUB) and ultrasound was done in every case. Size of kidneys, degree of hydronephrosis. and cortical thickness was determined. Hydronephrosis on ultrasound was taken as an indication of PCN and sign of obstruction with recovery potential. PCN was done underlocal anaesthesia, 8FR cook PCN set was used. 24 hour urine was measured from PCN tube for urine volume, creatinine clearance, urine pH, urnary Nat, on 1st day then at weekly interval for 4 weeks and later 6 weekly. Serum creatinine was also done at these times to see the clinical response after relief of obstruction. Post PCN serum

creatinine below 3 mg/100 ml and creatinine clearance of more than 10 mI/min was taken as recoverable group and above 3 mg/100 ml were considered as. poor/no recovery. After definite surgery, these results were correlated with postoperative serum creatinine at 3 months follow-up.
DTPA diuretic renography was done afterinitial relief of obstruction by PCN in those who could be moved to nuclear medical centre, Jinnah Postgraduate Medical Centre, Karachi. Renogram curves were analysed into three functional groups (F) with little modification as described by Bahar et al[8]. F-3= poor/markedly reduced uptake, no peak (rising curve), partial response to lasix. This represents chronic partial obstruction. F-4= good/fair uptake function, no peak (rising curve) slight orno response to frusemide. This represented true obstruction of shorter duration. F-5 slight/no uptake (>backgmund) followed by plateau curve and no/sluggish response to frusemide. This represents severe obstructive nephropathy. Analysis of uptake function, response to frusemide and relative renal function was noted from renogram curve and fmdings were correlated with surgical out-come. P-values were calculated by Chi-square test.

Results

Pie-operative evaluation in 239 patients showed drop in serum creatinine after PCN in 187 (78.2%) patients. These were labelled as potentially recoverable group. On comparing these results with post-operative outcome, 183 (76.5%) out of 187 cases after definite surgeiy remained with stable serum creatinine of less than 3 mg/100 ml. This proves 97.8% accuracy of PCN in prediction of future recovery of renal functions (Table I).

Table I. Prognostic value of PCN in future recovery of renal functions.

Post-PCN drop in S. Creatinine		S. Creatinine after definitive surgery	
S. Creat. <3 mg	S.Creat. >3 mg	S. Creat.<3 mg	S. Creat. >3 mg
187 (78.2%)	52 (21.7%)	183 (76.5%)	56 (23.4%)

Data based on 239 patients.

Urine pH in infection free patients was evaluated for prediction of future recovery of renal function in 221 patients. These patients either had a negative culture at the time of admission or were treated with appropriate antibiotics before pH examination. One hundred and twenty (86%) of 139 patients with the pH less than 6 had recovery after surgery, while 27 (6l.4%)of44 having a urine pH rangingfmm6. 1-7.1, showeddropofserumcreatinineless than 3 mg/100 ml. In 38 patients whose urine pH was more than 7.1, sixteen (42.8%) showed recovery of renal functions. Patients withpH less than6 showedbetter chances of recovery when compared to other two groups (P<0.001).
Post-obstructive diuresis, natriuresis was noted in 239 patients after PCN. Total of 122 (51.0%) patients produced Data based on 125 patients.
The study included 239 patients of renal and ureteric calculi with renal failure, There were 192 (80.5%) males and 47(19.5%) females. Majority belonged to 3rd and 4th decade. Blood urea ranged from 70-550 mgand serum creatinine from 3-35 mg/l00 ml at the time of admission, Pre-operative ultrasound findings showed hydronephrosis of varying degrees in all cases, PCN was done in all cases with hyd.ronephrosis and were followed by open surgery for stones. On post-operative evaluation, recovery was seen in 183 urine volume of more than 2-8 liters/24 hours followed by 79 (33.2%) with urine output of 1-2 liters while 38 (15.8%) produced volume of less than 1 liter. Onthe other hand, 39.4% patients demonstrated massive natriuresis while 46.0% showed normal urine sodium excretion, These

findings were evaluated in two groups i.e., those who recovered and not recovered and it was found that in recoverable group 64.4% patients had urine output of 2-8 liters/24 hours after relief of obstruction, while in non- recoverable group post-obstructive diuresis was noted in 4 (7.1%) only. Massive natriuresis was noted in 97(53.1%) in recoverable as compared to 12(21.4%) in non-recoverable group (P<0.001) (Table II).

Table II. Post-PCN diuresis, natriuresis and its correlation to renal function recovery.

Group	Water diuresis L/24 hours			Urinary sodium Meq/L		
	<1	1-2	>2-8	<30	30-150	>150-730
Recovery n=183	0.0	65 (35.6%)	118* (64.4%)	0.0	86 (46.9%)	97 (53.1%)
Non-recovery n=56	38 (67.9%)	14 (25.0%)	4 (7.1%)	35 (62.6%)	9 (16.0%)	12 (21.4%)

Data based on 239 cases
*P<.001

DTPA diuretic renography was done in 125 patients after PCN but before definite surgery. In F3 group, 27 patients with 54 renal units were found to have partial chronic obstruction. In F4 group, 63 patients with 87 renal units were found with true obstructive pattern with good, fair uptake function while 35 (66 renal units) patients were grouped in F5 (severe obstructive nephropathy) with slight or no uptake function. Renographic findings were correlated with outcome of surgery. InF4 group, 51(81.9%) patients dropped their serum creatinine (<3 mg/100 ml) after surgery followed by 12 (44.4%) cases in group F3 while only 9 (25.7%) patients demonstrated drop in serum creatinine in F5 group (Table III).

Table III. DTPA diuretic renography findings and its correlation to future recovery of renal functions after surgery.

Functional group Pre-oper. Evaluation	No. of patients	Renal function Improved S. Creatinine <3mg	Renal function Not improved S. Creatinine >3 mg
		N (%)	N (%)
F-3	27	12 (44.4)	15 (55.5)
F-4	63	51 (81.9)*	12 (19.1)
F-5	35	9 (25.7)	26 (74.3)

Data based on 125 patients.
*(P<0.001)

There was statistically significant difference in these groups F4 group was found to have betterchance of recovery (P<0.001).

Discussion

Renal failure is the worst complication of upper tract stone disease which is potentially recoverable in

many cases if obstruction is relieved at an early stage[9]. However, before defmitive surgery it is of cardinal importance for the urologist to distinguish between recoverable and non-recoverable kidneys. Various methods of determining the reversibility of renal damage have been reported. Among them ultrasound is a non-invasive and good screening test to diagnose hydronephrosis, thickness of renal cortex in calculus renal failure patients but its value in prediction of recovery potential needs furtherstudies as inourcase it was helpful in only 76.5% cases and in remaining 23.5% cases although hydronephmsis was present on ultrasound and on visual inspection it was thought to have adequate cortex but no recovery of renal function in tenns of drop in serum creatinine was found after relief of obstruction. Ultrasound may be used appropriately in patients with chromc calculus renal failure for diagnosis of hydronephrosis but it can give falsely normal studies in some acute obstructive calculus anuna patients[11] and those with staghorn calculi. On assessing the predictive value of temporary percutaneous nephrostomy tube for relief of obstruction and measuring the urine pH, urinary sodium, initial diuresis, creatinine clearance and serum creatinine we found it the most accurate method of predicting the recovery potential in obstructive renal failure due to stone disease. This finding is in agreement with Gillen Water[11] and Taha et al[4]. Inability to acidify urine maximally is the known distal tubular defect due to chronic urinary tract obstruction[12]. The role of urine pH in prediction of renal functional recovery in unilaterally non- functioning kidneys has been reported from Sudan[7,13]. Present study has explored the importance of this simple test in bilateral renal obstruction and solitary obstructed kidneys with renal dysfunction and we found it very useful and reliable guide to subsequent recovery of renal functions.

On correlating the findings of post PCN diuresis and natriuresis with recovery potential, it was found that those who recovered showed diuresis ranging 2-8 liters/24 hours in 64.4% cases and natriuresis in 53.l% butonthe otherhand, 65 (35.6%) patients having normal urine output showed recovery and 86 (46.4%) patients with normal urine sodium excretion also recovered their renal functions. This finding is similar to observation of Bishop[14] who found no significant relationship with recovery of function and diuresis. In his cases normal urine output was quite consistent with improvement. In this study patients with urine sodium of less than 30 meq and urine output of less than I liter did not show any fall in plasma creatinine. This supports the idea that post-obstructive diuresis and natriuresis are good prognostic signs. Howards[15] also concluded the same observation trom review of literature on this subject. Barrat and Williams[16] studied obstructive uropathy in children and found urine sodium as a sign of reversibility. Our experience of DTPA diuretic renography in this study revealed that in F4 group patients who had good/fair uptake function with delayed/no excretion after frusemide, had got better chances of recovery. This finding was similar to Bahar et al[8]. Although there is general consensus that better the uptake function on DTPA, beuer are chances of recovery[17] but 12(19. l %)cases inF4 group did not recover. On the other hand, 9 (25.7%) patients in F5 group with minimum or no uptake function showed recovery post-operatively. This finding is in agreement that, even non-visualization of kidneys on DTPA may recover[18]. The present data and review of literature shows that ultrasound and DTPA scan can be of help in management of calculus renal failure and in predicting the renal function recovery in 76.5% and 81.9% cases respectively. Urine pH less than 6, post- obstructive diuresis and natriuresis are good prognostic indicators of recovery of renal functions. PCN was found to be the most accurate and simple method of predicting the recovery potential with 97.8%accuracy.

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