Journal of Surgical Sciences (2016) Vol. 20(1)

JOURNAL OF SURGICAL SCIENCES

Original Article

UROLITHIASIS ASSOCIATED WITH RENAL IMPAIRMENT: MANAGEMENT AND ITS OUTCOME

Md. Jamal E Rabby[1], Md. Masud Zaman[2], Mohammad Ali[3], Md. Kabirul Hassan[4], Md. Shohidul Islam[5], Md. Mustafizur Rahman[6], ATM Ashaduzzaman[7]

Abstract

Background: Urolithiasis may be associated with various degree of renal impairment secondary to a combination of obstruction, urinary infection, long standing calculus, stone burden, frequent surgical intervention, and co-existing medical diseases.

Objective: The purpose of the study is to predict the factors those have a significant impact for outcome of the patients with renal impairment following treatment of urolithiasis.

Methods: Fifty patients of urolithiasis with renal impairment were enrolled in this prospective study, carried out between 1st July, 2008 and 30th June, 2009, at department of Surgery, Shaheed Ziaur Rahman Medical College Hospital, Bogra. Patients with renal impairment was defined as a baseline serum creatinine of >1.2mg/dl and/or on the basis of DTPA isotope renogram findings (mild, moderate or severe impairment). Definite management was carried out by means of open surgery, ESWL or in combinations available at study place. Follow-up after 3 months, the postoperative renal functional outcome was defined as improved (>20% fall in serum creatinine), stabilized (<20% rise or <20% fall in serum creatinine), or deteriorated (>20% rise in serum creatinine). Renal function was also assessed by the impression made from the graph of DTPA isotope renogram (normal functioning or mild, moderate and severe impairment). Predictive factors to be evaluated for the stone clearance and renal functional outcome were age of the patients, duration of symptomatology and urolithiasis, associated diseases (hypertension and diabetes mellitus), stone burden, stone number and associated urinary infection.

Results: After 3 months of follow-up, the overall stone clearance rate was 76%. Out of 50 patients, 27 patients (54%) showed improvement, 19 patients (38%) showed stabilization, and 04 patients (08%) showed deterioration in their renal function. Age <40 years, duration of symptoms <6 months, stone burden <5 cm^2 and single urinary stone were significant predictors of subsequent good renal functional outcome.

Conclusion: The renal recoverability rate after treatment of urinary stone disease could be predicted by age, duration of symptoms, stone burden and stone number.

Key words: Urolithiasis, Renal impairment, management and outcome.

1. Junior Consultant, Department of Surgery, Shaheed Ziaur Rahman Medical College Hospital (SZMCH), Bogra
2. Assistant Professor, Department of Urology, Jessore Medical College.
3. Junior Consultant, Department of Surgery, Sadar hospital, Brahmanbaria
4. Junior Consultant, Department of Surgery, Gaibandha
5. Junior Consultant (Surgery), Rajshahi
6. Registrar, Department of Surgery, SZMCH, Bogra
7. Assistant Professor, Department of Surgery,Dhaka Medical College

Correspondence to: Dr. Md. Jamal E Rabby Junior Consultant, Department of Surgery, SZMCH, Bogra, Tel.: +8801716638414, E-mail: drrabby@yahoo.com

Introduction

Urolithiasis continues to be an important cause of renal impairment particularly in developing countries. It is the most common chronic kidney condition, after hypertension.[1]

Renal insufficiency, is defined by a baseline serum creatinine of >1.5mg/dl.[2] It also occurs when the glomerular filtration rate (GFR) falls by at least 50ml/min and may be mild moderate or severe.3 Serum creatinine alone is not the ideal estimate of renal function; creatinine clearance and renal scan are more reliable in this regard.[3]

The etiology of renal insufficiency in patients with urolithiasis is multifactorial and includes renal obstruction, urinary infection, long standing calculus, stone burden, recurrent urinary stones, frequent surgical interventions and coexisting medical disease.[4] Renal dysfunction may potentially be reversible in many patients with stones and renal insufficiency if suitable measures to achieve a stone free renal unit are taken at earliest.[5] Assessment of these factors has great impact for the postoperative renal functional outcome in the management of these patients.[3]

Management of urinary stones has witnessed a revolutionary change in past two decades with the introduction of extracorporeal shock wave lithotripsy and endourological modalities. Open surgery is now consider for branched or complex renal calculi, urinary tract obstruction, large bladder calculi and following failure of minimal invasive procedure.[6]

Urinary stone disease is one of the major contributing factors resulting in chronic renal impairment in our country. If prompt measures are undertaken to predict the factors of outcome along with application of available definite treatment to these patients to maximize the renal function, the morbidity and dependency on dialysis may be reduced and time to progression to end stage renal disease may be delayed.

Methods

Fifty patients of urolithiasis with renal impairment were enrolled in this prospective study, carried out between 1st July, 2008 and 30th June, 2009, at department of Surgery, Shaheed Ziaur Rahman Medical College Hospital, Bogra. Patients with renal impairment was defined as a baseline serum creatinine of >1.2mg/dl and/or on the basis of DTPA isotope renogram findings (mild, moderate or severe impairment). Definite management was carried out by means of open surgery, ESWL or in combinations available at study place. Follow-up after 3 months, the postoperative renal functional outcome was defined as improved (>20% fall in serum creatinine), stabilized (<20% rise or <20% fall in serum creatinine), or deteriorated (>20% rise in serum creatinine). Renal function was also assessed by the impression made from the graph of DTPA isotope renogram (normal functioning or mild, moderate and severe impairment). Predictive factors to be evaluated for the stone clearance and renal functional outcome were age of the patients, duration of symptomatology and urolithiasis, associated diseases (hypertension and diabetes mellitus), stone burden, stone number and associated urinary infection. Statistical analysis with the data of renal function was correlated with characteristics of the patients, stones and change in the post treatment serum creatinine (improved and stabilized compared with deteriorated) with chi square test by using SPSS program version 14. A p value of $\leqslant 0.05$ was considered statistically significant.

Results

Demographic and calculus data of 50 patients are summarized in Table- I. Their mean (SD) age was 39 (12.7) years (ranging from 16 to 65 years) presented with mean serum creatinine level of 1.63 (0.26) mg/dl, of those 07 patients had serum creatinine level of >2.0mg/dl. Twenty eight (56%) patients required open surgery, 12 patients (24%) treated by ESWL while 10 patients (20%) needed surgery with ESWL. Preoperative stenting was done in 08 patients for the stone at lower calyxes and ureter (Table-II). Follow up after 3rdmonth, overall 27 patients (54%) showed improvement,19 patients(38%) showed stabilization and 04 patients (8%) showed deterioration in their renal function (Table-III). Stone clearance was achieved in 38 patients (76%), while 12 patients had residual fragments. Seven out of 12 patients of residual fragment at lower calyces cleared with ESWL after 3rd month and 05 patients had sent to Urologist for ancillary procedure in the form of PCNL, ureteric catheterization or stenting etc. Of seven factors assessed age <40 years, duration of symptoms <6 months, stone burden <5 cm2 and single urinary stone were found statistically significant; while associated disease, associated urinary infection and residual fragments had no significant impact on renal functional outcome after 3rd month of treatment (Table-IV). Renal recoverability was also assessed by the impression made from pre and post treatment graph of DTPA isotope renogram (normal functioning or mild, moderate and severe impairment), though it was not statistically tested (Table-V & VI).

Table- I

Demographic and calculus data of 50 patients with urolithiasis and renal Impairment

No. of Patients	: 50
No. of total renal unit	: 100
No. of involve renal unit	: 66
Mean age (years)	: 39 ± 12.7
Sex	
Male	: 34 (68%)
Female	: 16 (32%)
Stone number	
Single	: 32 (64%)
Multiple	: 18 (36%)
Calculus Type:	
Renal :	
Partial/Complete Staghorn	: 13
Pelvic	: 20
Calyceal	: 10
Ureteric	: 08
Bladder	: 05
Renal + Ureter	: 05
Bilateral Renal	: 06
Mean Calculus size (cm<)	: 6.9 ± 6.2
Preoperative ureteric Stenting (for calyceal & ureteric stone)	: 08
Associated urinary infection	: 28 (56%)
Associated diseases (no. of cases)	
Hypertension	: 04
Diabetes mellitus	: 04
Hypertension & Diabetes mellitus	: 07
Mean preoperative Serum Creatinine (mg/dl)	: 1.63 ± 0.26

Table-II

Treatment options

Name of treatment	No. of cases	Percentages
Surgery	28	56%
ESWL	12	24%
ESWL + Surgery	10	20%
Total	50	100%

Table-III

Renal function outcome after 3rd month treatment (according to percentages changes in serum creatinine)

Outcome	No. of Patients	Percentages
Improved (>20% fall in serum creatinine)	27	54%
Stabilized (>20% fall or <20% rise in serum creatinine)	19	38%
Deteriorated (>20% rise i n serum creatinine)	04	8%
Total	50	100%

Table-IV

Predicting postoperative renal function outcome after 3rd month

Factors		Renal function outcome: Improved No. of patients	Improved %	Stabilized No. of patients	Stabilized %	Deteriorated No. of patients	Deteriorated %	P value (predictive of improvement)*
Age of the patients (in years)	<40 (16-39) n=30	22	73%	08	27%	0	0	0.001 (S)
	≥40 n=20	05	25%	11	55%	04	20%	
Duration of symptoms	<6 months n=21	17	81%	04	19%	0	0	0.008 (S)
	>6 months n=29		38%	14	48%	04	14%	
Associated diseases	Hypertension n=04		0	03	75%	01	25%	0.290 (NS)
	Diabetes mellitus n=04	01	25%	02	50%	01	25%	
	Hypertension & Diabetes mellitus n=07	01	14.5%	04	57%	02	28.5%	
Stone burden (cm^2)	<5 n=25	18	72%	07	28%	0	0	0.041 (S)
	5-10 n=10	05	50%	04	40%	01	10%	
	>10 n=15	04	27%	08	53%	03	20%	
Associated urinary infection	Yes n=28	14	50%	12	43%	02	7%	0.882 (NS)
	No n=22	13	59%	07	32%	02	9%	
Stone nature	Single n=32	23	72%	09	28%	0	0	0.001 (S)
	Multiple n=18	04	22%	10	56%	0	0	
Residual fragments	Yes n=12	02	16.5%	06	50%	04	33.5%	0.203 (NS)
	No n=38	25	66%	13	34%	0	0	

Improved and stabilized vs. deteriorated; S = Significant; NS = Not Significant

Table-V
Pretreatment Isotope Renogram (DTPA)

	Normal	Mild impairment	Mode rate impairment	Severe impairment	Total
Rt. Kidney	13(26%)	21(42%)	15(30%)	01(2%)	50
Lt. Kidney	18(36%)	22(44%)	10(20%)	0	50

Table-VI
Isotope Renogram (DTPA) 3rd month after treatment

	Normal	Mild impairment	Moderate impairment	Severe impairment	Tota l
Rt. Kidney	30(60%)	12(24%)	08(16%)	0	50
Lt. Kidney	34(68%)	10(20%)	06(12%)	0	50

Discussion

Rajesh et al. 2 obtained 84 nephrolithiasis patients associated with renal insufficiency in which 33 patients (39.3%) showed improvement, 24 (28.6%) and 27 (32.1%) showed stabilization and deterioration in their renal function respectively. Of the 11 factors assessed, age <15 years, higher baseline serum creatinine, protienuria >300mg/dl, renal cortical atrophy, stone burden >15 cm^2 and recurrent urinary infection were significant predictors of subsequent renal function deterioration. Witherow and Wichham[7] suggested that renal function recovery in patients with stone disease depends on adequate blood pressure control, stone size and stone clearance status.

In this study, age <40 years (range 16-39), duration of symptoms <6 months, stone burden <5 cm^2 and single stone had significant impact on postoperative renal functional improvement. While associated hypertension and diabetes mellitus, urinary infection and residual fragments had no significant impact. Renal function improved rate was found 72% for stone size <5 cm^2, while it was deceases from 50% to 16.5% for stone size 5-10 cm^2 and >10 cm^2 respectively. This study also showed urolithiasis with associated disease had a poor improvement and 04 such patients deteriorated 03 months after intervention had associated hypertension and diabetes mellitus. This study supported by similar previous study. [8]

Gupta et al.[8] studied 33 patients experienced mild to moderate grade renal insufficiency and their mean serum creatinine before and after intervention was 3.2mg% and 1.2 mg% respectively. With <1 year follow up 92.3% of patients with serum creatinine <2 mg/dl, 74.4% of patients with serum creatinine between 2 and 3 mg/dl, and 56.5% of patients with serum creatinine between 3 and 6 mg/dl revealed improved or stabilized renal function. Twenty seven patients out of 84 found deteriorated in which 26 patients with serum creatinine value was >2 mg/dl. The prognosis for the patients with serum creatinine values >6 mg/dl was the poorest.

In this series as in others[2,8] 86% patients with serum creatinine values <2 mg/dl revealed improved or stabilized in their renal function. Seven patients with serum creatinine values was≥ 2 mg/dl, in which 03 patients showed stabilized and 03 patients deteriorated in their renal function.

In another study, Paryani et al.[4] forty three urolithiasis patients with renal insufficiency. Seven patients had partial or complete staghorn calculi and eighteen had bilateral renal calculi. In their series 23 (55%) patients were treated with open surgery showed significant improvement in renal function. Thirteen (30%) patients treated with ESWL and six (15%) patients with PCNL. About 50% of the patients required ancillary procedures in the form of lithotripsy or ureteroscopy following open surgery for residual calculi or concomitant ureteric stone.

In this study, twenty eight (56%) patients treated with open surgery, 12 patients (24%) with ESWL and 10 patients (20%) treated with combined surgery and ESWL. Six patients required ESWL for bilateral renal stone and for residual stone after surgery. Four patients needed open surgery following ESWL due to impacted residual stone at lower ureter. Residual fragment was found in 04 patients at lower calyx and 08 patients with multiple stone. Seven such patients stone was cleared with ESWL and rest of these sent to the Urologist for ancillary procedure.

Kelleher and associates[9] studied prospectively patients with urographically proven acute calculus obstruction using 99m Tc- DTPA renography to see any renal impairment. They had shown on statistically significant relationship between the presence of obstruction on renography and the subsequent requirement for intervention.

In this series in comparison to others[10] GFR from DTPA renogram not included to determine the renal functional outcome, but renal recoverability was compared with the impression from DTPA Renogram (normal, mild, moderate or severe impairment) before and after three month of intervention.

Abdullah and associates[11] had shown the success rate of ESWL was 76% for stone≤ 10 mm and while it was 47% for stone >20 mm. The success rate decreases from 87.3% to 88.5% for stone in renal pelvis and upper calyx respectively to 69.5% for lower calyceal stones. The success rate was for single stone was 78.3% and 62.8% for multiple stones. The presence of ureteric stent had a significant impact on the stone free rate.

In this present study, ESWL had done in 22 patients (12 alone and 10 in combined with surgery) for stone at renal pelvis (09), calyces (10) and upper ureter (03). Stone size was selected <3 cm (largest diameter) with no distal obstruction. Preoperative 08 patients had ureteric stent for stone at ureter and upper calyx. The stone free rate was higher for stones in renal pelvis (8/9, 88%), upper and mid calyces (5/6, 83.3) and upper ureter (100%) compared to lower calyx which was (1/4, 25%). The stone free rate was also higher for single stone (6/7, 86%) and lower for multiple stones (10/15, 67%). These findings are supported by similar previous study[11].

Conclusion

Patients of urolithiasis associated with renal impairment showed improvement of renal function after early intervention to relief the obstruction. Renal recoverability rate was poor in patients with long standing obstruction and in multiple stones.

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