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Endourological Management of Urolithiasis in Transplanted Kidneys

ABSTRACT

Introduction: Renal transplantation is, now, considered as the best and long-term treatment option for patients with end-stage renal disease. When kidney transplant recipient patient develops urolithiasis, it can be a challenge deciding how to treat these patients the early diagnosis of such condition is essential, as the patient is relying on a single kidney. Post-transplantation urolithiasis can be easily managed with urological intervention. **Objectives:** The objectives of this study were to evaluate mode of presentation, diagnosis, and endourological approach to urolithiasis in post-renal transplant. **Materials and Methods:** We reviewed a series of patients who underwent surgical treatment for post-renal transplant urolithiasis at our institution from 1998 to 2018. Their mode of presentation, investigations, treatments, complications, and outcomes were recorded. Investigations included one or more of the following; ultrasonography, plain abdominal X-ray, intravenous urography, and computed tomography. Various methods include ureterorenoscopy (URS), retrograde intrarenal surgery (RIRS), percutaneous nephrolithotomy (PCNL), Lap-assisted PCNL, combined laparoscopic and RIRS approach – endoscopic combined intrarenal surgery (ECIRS). **Results:** We treated 21 patients who underwent a form of endourological treatment of urolithiasis after renal transplant. Mode of presentation was asymptomatic – 13 patients, three patients with anuria, one patient each hematuria, acute renal failure, pain at graft site, and two patients with urinary tract infection/fever. Ultrasound was used as an initial investigation and CT scan was used to plan surgery. Investigations revealed 5 patients with multiple calculi in the calyx, 10 patients with renal pelvic calculi, 2 patients with partial stag-horn calculi, 3 patients with ureteric calculi, and 1patient with a bladder calculi, among other sites Treatment methods included RIRS in 2 patients, URS in 1 patient , PCNL in 2 patients, Lap-Assisted PCNL in 7 patients, Combined Lap-Assisted PCNL and RIRS-ECIRS in 4 patients, and Cystolithotripsy in 1 patient. Energy modalities user were Ho-laser, combination of ultrasound, and pneumatic lithotripsy (Lithoclast Master) and ultrasonic energy (Shock Pulse). There were no intraoperative complications reported. Two patients had small stone fragments on post-operative imaging. All patients were stone-free on followed up after 6 weeks. **Conclusion:** Endourological techniques are feasible, safe, and effective modality for the treatment of transplant lithiasis with minimal intraoperative or post-operative complications and with a good stone clearance rates.

Key words: Renal Transplant, Urolithiasis, Endourology

INTRODUCTION

Renal stones after transplantation have high morbidity due to risk of obstruction, sepsis, or relative loss of allograft function. These stones usually are asymptomatic and discovered during imaging studies.[1] This explains the delay in diagnosis of urolithiasis in such patients. Post-transplant stones can be treated with observation, shock wave lithotripsy, endoscopic, percutaneous, or open surgery.[2] The treatment option must be individualized for each patient with an aim to achieve complete clearance. We, herein, report outcomes of those patients who underwent endourological management for urolithiasis in transplanted kidneys.

MATERIALS AND METHODS

We conducted a retrospective analysis of, urolithiasis patients form January 1998 to December 2018 in transplanted kidneys, who were either referred to our institute, or were following up at our institute and were diagnosed with a urinary tract calculi in post-transplanted kidney.

Inclusion criteria

All patients who received a living-donor kidney transplant for the 1st time and treated with endourological techniques for urolithiasis were included in the study.

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Exclusion criteria

Patients <14 years of age, patients unfit for a procedure, cadaveric kidney recipients were excluded from the study.

The data collected for the present study were age and sex of recipient and donor; history of dialysis; the underling disease of end-stage renal disease. The diagnosis of kidney stones after transplant was confirmed with ultrasonography (US) and surgical planning was based on computed tomography (CT) scan.

Urolithiasis presenting with graft dysfunction, hematuria, unexplained fever, pain, or anuria was investigated by immediate US and early liaison with the urological surgeon was implemented for cases of obstruction.

RESULTS

Demographic Data

Patients presented with renal allograft urolithiasis were 21 15 (71.4%) men and 6 (28.6%) women; mean age 39.5 years, range (14–65) [Table 1].

Patients presented with urolithiasis on an average of 2.5 (1–6) years after transplantation; 3 (14.2%) presented within a year of their transplant. The presentation was with hematuria in 7 (33.3%), loin pain over the graft in 3 (14.2%) patients, oliguria or anuria in 1, sepsis in one, and rising serum creatinine levels in 6 (28.5%).

Diagnosis and stone characteristics

Ultrasound was the most commonly done initial investigation −16 (76.1%). Ultrasound suggested cause of renal dysfunction along with an estimate stone size, location, and obstruction (Hydroureter/hydronephrosis) [Table 2].

CT scan was done in 18 (85.7%) patients before undertaking endourological procedure. The exact size, number, location, and condition of kidney along with relation to surrounding organs could be noted.

Mean stone size was 1.9 cm. (0.8–4.2 cm), majority of the stones were found in kidney − 17 (80.9%), 3 (14.2%) in ureter, and 1 (4.7%) in bladder. In the kidney, most common location of stone was renal pelvis −10 (47.6%), 5 (23.8%) presented as calculi involving multiple calices, and 2 (9.5%) staghorn calculi. In the ureter, most common location was lower ureter −2 out of 3.

Most common stone composition was calcium oxalate −12 (57.1%), 5 (23.8%) were struvite, and 4 (19%) were composed of uric acid.

Treatment modality

Larger renal pelvic stones (>1.5 cm) were treated with laparoscopically assisted PCNL −7 (33.3%) cases, mean stone size treated was 1.8 cm, with a mean operating time of 114 min [Table 3]. PCNL was successfully performed

Table 1: Demographic data

Variable		
Age	14–65 years	Mean 39.5 years
Sex		
Male	15	
Female	6	
Initial presentation	Hematuria (most common)	UTI (2nd)/Raised creat
Duration of transplant	1–6 years	Mean 2.5 years
H/o Urolithiasis	4	
Comorbidities	Hypertension (Mc)	
Initial kidney disease	Glomerulonephritis (Mc)	

Table 2: Diagnosis and stone characteristics

Variable	Value	Mean
Initial diagnosis	USG –16	X-ray –5
Surgical planning	CT–18	
Size	0.8–4.2 cm	Mean 1.9 cm
Location		
Staghorn	2	
Multiple calyx	5	
Pelvis	10	
Ureter	3	
Bladder	1	
Composition	Calcium oxalate (Most common)	Struvite, uric acid

in 2 (9.5%) cases with average time of 91 Min. Combined lap-assisted PCNL and retrograde intrarenal surgery (RIRS) endoscopic combined intrarenal surgery (ECIRS) was performed in 4 (19%) patients for staghorn calculi and pelvic calculi with extension into calyx, with a mean operative time of 138 min. RIRS was performed in 5 (23.8%) cases, for relatively smaller (<9 mm) calyx calculi and upper ureteric calculi, ureterorenoscopy (URS) was performed in 2 (9.5%) patients and cystolithotripsy in one patient. The most frequently employed form of energy was laser, which was either used on its own in 10 (47.6%) patients, or in conjunction with ultrasonic energy (Shock Pulse) in 4 (19%) patients, pneumatic lithotripsy (Lithoclast Master) was used in 7(33.3%) patients. Clearance, which was defined as fragments less than 4 mm, was achieved in 19 (90.4%) instances, 2 (9.5%) patients required staging, and 3 (14.2%) patients suffered recurrence on follow up.

All patients were stented after the procedure (except after cystolithotripsy) for a minimum period of 14 days, decision to remove stent was individualized. Patients were followed up after 6 weeks.

Table 3: Treatment modality

Operative modality	Number of patients	Stone clearence	Operative time (AVG)	Recurrance	Staging	Challenges
RIRS	5	Yes	68 min	Nil	No	Unfamiliar anatomy
URS	2	Yes	52 min	Nil	No	Ureteroneocystostomy makes ureteroscopy more difficult
PCNL	2	Yes	91 min	1	1	Inflammatory capsule around the transplant limits pyelocaliceal dilatation and nephroscope movements
Laparoscopic assisted PCNL	7	Yes	114 min	1	No	An increased risk of urinary fistula
Combined Lap assisted PCNL and RIRS – ECIRS	4	Yes	138 min	1	1	
Cystolithotripsy	1	Yes	34 min	Nil	No	

Table 4: Complications

Complications	
Nil	2
Fever	5
Blood transfusion	1
Dialysis	3
UTI	2
AKI	1

Complications

All patients undergoing PCNL were observed in ICU for 12 hours, and longer if indicated. Blood transfusion was required in one(4.7%) patient, 3 (14.2%) patients had fever in post-operative period and UTI was diagnosed in 2(9.5%) patients. Dialysis was required in 3(14.2%) patients and 1(4.7%) patient had AKI [Table 4]. The nephrology team was involved in post-operative management. There was no Mortality within 3 months of any procedure.

DISCUSSION

We analyzed 21 patients who underwent endourological techniques for post-renal transplant urolithiasis. The average age of study population was 39.5 (14–65) years, more frequently in males (15, 71.4%). Few studies all reported an average age of about 41 years and included cadaveric and liver renal donors.[3,4] The reported mean time of lithiasis presentation post-transplantation in several series is 1.6–3.6 years,[5] similarly, in our series, we report 2.5 years (mean). The most common comorbidity was hypertension (7, 33.3%).

Nephrolithiasis of the transplanted kidney can result in significant morbidity and a devastating loss of renal function if obstruction occurs.[1,6] Renal colic is absent in such patients as the transplanted kidneys and ureter are denervated. Symptoms mimicking acute rejection or recurrent infections may cause injuries similar to those of chronic pyelonephritis.[5,7] Therefore, if ongoing asymptomatic obstruction occurs, acute renal failure or a syndrome similar to acute rejection may be the first clinical signs of disease. In our series, most common presenting symptom was hematuria (7, 33.3%), but most patients had no symptoms (13, 61.9%) and were under regular surveillance and were found to have stone as a work up for AKI or rising creatinine.

As with most reports,[3,6] ultrasound (16, 76.1%) was employed as the initial investigation in our series. Plain X-rays of the abdomen are generally unable to visualize the stone,[12] which are often situated over the pelvic bones. Moreover, final intervention planning was done after a CT scan of abdomen and pelvis.

Transplanted kidney is effectively single functioning renal unit and treatment should be on similar principles.[5,7] In general, for patients with obstructing calculi, we opted for swift resolution of the obstruction through nephrostomy (2, 9.5%) or insertion of a ureteric Double-J stent (8, 38.1%) followed by definitive management at a later date.

Due to the superficial position of the transplanted kidney, nephrostomy drainage and subsequent PCNL is relatively straightforward,[8] we recommend that this be carried out on larger calculi (>1 cm) in specialist centers with a large PCNL experience. Percutaneous removal of calculi from transplanted kidneys was first described in 1985 by Hulbert *et al.* Krambeck reported a series of 13 percutaneous nephrolithotomies (using a 27 F endoscope) on renal transplants.[9] PCNL has been used to treat stones in transplant kidneys up to 5 cm in one recent series.[6] The superficial lie of the transplant kidney facilitates the percutaneous approach. The patient is generally supine and the approach is usually through an anterior calyx. Care must be taken not to cause an inadvertent bowel injury and combination with laparoscopy can minimize intraoperative complications. We performed 13 PCNLs, either stand alone or in combination with laproscopy and/or RIRS in the present study, with staging required in two patients and stone recurrence in three patients. PCNL is difficult in transplanted kidneys due to the dense fibrosis which makes the puncture and tract dilation difficult undertaking. PCNL can be augmented with laparoscopy to guide the puncture and dilation avoiding injury to peritoneal organs and monitoring blood loss.[10] In

cases where calices were not accessible by rigid nephoscope, RIRS was introduced and a combined laparoscopic-guided PCNL and RIRS (ECIRS) was performed to achieve complete clearance.

Flexible ureteroscopy was necessary in 5 (23.8%) patients, for calyx stones and upper ureter calculi and lower ureteric calculi −2 (9.5%) was managed with Semi-Rigid URS, Holmium laser was used for stone pulverization, although challenging but effective means for treating stones in transplant kidneys. Access to these kidneys may be difficult due to their position in the pelvis and the location of the neo-ureteric orifice. Basiri reported a failure rate of 23% due to poor endoscopic visualization of the ureteric reimplantation or the impossibility of guide placement.[11] Ureteric reimplantation usually consists of ureteroneocystostomy, which makes ureteroscopy more difficult, while pyeloureterostomy facilitates endourological procedures. Del Pizzo reported the feasibility of URS/RIRS technique in a series of 14 cases of transplant ureteroscopy.[12]

Challacombe *et al*. recommend that treatment with ESWL for unobstructive smaller stones of <1.5 cm is usually sufficient, but needs repeated sessions and sometimes an axillary procedure. Other concerns that the position of the transplanted kidney would impair stone clearance with ESWL.[2,4] There are potential difficulties in locating transplant calculi due to the overlying bony pelvis.

We attempted to achieve complete clearance using Endoscopic Methods, PCNL (and variations) for >1.2 cm, and URS/RIRS for Size <1.2 cm and successfully performed in 19 (90.4%) case. There was no mortality within 3 months of procedure. Intra- and post-operative complications were managed conservatively in collaboration with nephrology unit.

Our study had several limitations. First, it was a retrospective study of a relatively small number of cases and metabolic evaluation was not performed in this study. Despite these limitations, we have demonstrated the efficiency and safety of minimally invasive procedures in the treatment of urolithiasis following renal transplantation.

CONCLUSION

Transplant urolithiasis requires renal physicians and urologists to maintain vigilance and a high index of suspicion. Based on the patients' characteristics combined usage of two or more, minimal invasive procedures are beneficial to improve the efficiency and promote recovery after surgery. We recommend that such patients be managed in specialist centers that have all readily available endourological methods.

REFERENCES

1. Rhee BK, Bretan PN Jr., Stoller ML. Urolithiasis in renal and combined pancreas/renal transplant recipients. J Urol 1999;161:1458-62.
2. Bhadauria RP, Ahlawat R, Kumar RV, Srinadh ES, Banerjee GK, Bhandari M. Donor-gifted allograft lithiasis: Extracorporeal shockwave lithotripsy with over table module using the Lithostar Plus. Urol Int 1995;55:51-5.
3. Ortiz CT, González-Satué C, Canals LR, Feixas SC, Miranda EF, Lucía FA, *et al*. Incidence and treatment of urinary lithiasis in renal transplantation. Actas Urol Esp 2001;25:357-63.
4. Challacombe B, Dasgupta P, Tiptaft R, Glass J, Koffman G, Goldsmith D, *et al*. Multimodal management of urolithiasis in renal transplantation. BJU Int 2005;96:385-9.
5. Streeter EH, Little DM, Cranston DW, Morris PJ. The urological complications of renal transplantation: A series of 1535 patients. BJU Int 2002;90:627-34.
6. Klingler HC, Kramer G, Lodde M, Marberger M. Urolithiasis in allograft kidneys. Urology 2002;59:344-8.
7. Abbott KC, Schenkman N, Swanson SJ, Agodoa LY. Hospitalised nephrolithiasis after renal transplantation in the United States. Am J Transplant 2003;3:465-70.
8. Gedroyc WM, MacIver D, Joyce MR, Saxton HM. Percutaneous stone and stent removal from renal transplants. Clin Radiol 1989;40:174-7.
9. Hulbert JC, Reddy P, Young AT, Hunter DW, Castaneda-Zuniga W, Amplatz K, *et al*. The percutaneous removal of calculi from transplanted kidneys. J Urol 1985;134:324-6.
10. Yuan HJ, Yang DD, Cui YS, Men CP, Gao ZL, Shi L, *et al*. Minimally invasive treatment of renal transplant nephrolithiasis. World J Urol 2015;33:2079-85.
11. Basiri A, Simforoosh N, Nikoobakht M, Moghaddam MM. The role of ureteroscopy in the treatment of renal transplantation complications. Urol J 2004;1:27-31.
12. Del Pizzo JJ, Jacobs SC, Sklar GN. Ureteroscopic evaluation in renal transplant recipients. J Endourol 1998;12:135-8.

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