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Charuhas V. Thakar · Abigail Lara · Mahesh Goel
Joseph V. Nally Jr.

Staghorn calculus in renal allograft presenting as acute renal failure

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Abstract Background: Urolithiasis is a rare complication in renal transplant recipients. We report a case of a staghorn calculus occurring in renal allograft, presenting as anuric renal failure with Gram-negative sepsis. Methods and Results: A 48-year-old Caucasian female, with end-stage renal disease due to autosomal dominant polycystic kidney disease, underwent cadaveric renal transplantation in 1986. Sixteen years after transplant, she presented with Gram-negative sepsis with *Proteus mirabilis* and acute anuric renal failure in the allograft. After undergoing an emergency nephrostomy and treatment of sepsis, a staghorn calculus was subsequently removed by percutaneous nephrolithotomy. Based on the stone analysis and history of urinary tract infections with urease splitting bacteria, the calculus was thought to be infection-induced. Conclusion: Although a rare complication, urolithiasis in an allograft can be associated with significant morbidity. Immediate recognition is critical to restore renal allograft function and to treat associated serious infection in an immunocompromised patient.

Keywords Acute renal failure · Renal allograft · Urolithiasis

C. V. Thakar (✉)
Department of Nephrology and Hypertension,
The Cleveland Clinic Foundation, Desk A-51,
9500 Euclid Avenue, Cleveland, OH 44195, USA
E-mail: drcharu@hotmail.com
Tel.: +1-216-4448898
Fax: +1-216-4449378

A. Lara
Department of Internal Medicine,
The Cleveland Clinic Foundation,
Cleveland, Ohio, USA

M. Goel
Glickman Urologic Institute,
The Cleveland Clinic Foundation, Cleveland, Ohio, USA

J. V. Nally Jr.
Department of Nephrology and Hypertension,
The Cleveland Clinic Foundation, Cleveland, Ohio, USA

Introduction

The occurrence of urolithiasis in renal allografts is an uncommon complication. The frequency of allograft lithiasis is usually less than 2% [1, 2, 3, 4, 5, 6] but has been reported up to 7% in some studies [7]. In a recent series of 1,027 patients undergoing renal transplantation over a 7 year period, there were only 19 patients diagnosed and treated for urinary stones [6].

Despite the knowledge of this potential complication, the diagnosis and treatment of renal allograft calculi may be difficult and can be associated with significant morbidity. In contrast with non-transplant patients, the clinical features of nephrolithiasis after transplant can vary widely, from painless hematuria to more serious complications such as anuric acute renal failure. The temporal relationship of lithiasis also varies widely with respect to the transplant surgery. Stone formation has been reported as early as 3 months after transplantation [2] and as late as up to 10 years after transplantation.[1]

Various metabolic abnormalities are associated with the occurrence of stone disease in allografts, including hyperparathyroidism, hypercalcemia, hyperuricemia, etc. Risk factors such as urinary tract infections and technical aspects of surgery are particularly prevalent among transplant recipients. There have been rare reports of staghorn calculi in renal transplant patients.[8, 9, 10, 11, 12, 13] We report a case of a staghorn renal calculus occurring 16 years after transplantation, presenting with acute anuric renal failure and Gram-negative sepsis.

Case report

A 48-year-old Caucasian female reached end-stage renal failure secondary to autosomal dominant polycystic kidney disease and was initiated on hemodialysis in June of 1986. She underwent cadaveric kidney transplantation in October of 1986. The patient had an uneventful postoperative course without any episodes of rejection and was maintained on an immunosuppressive regimen including prednisone and azathioprine. The renal function was

stable with serum creatinine concentration ranging from 1.50 to 2.00 mg/dl. Most recently, from January to April of 2002, it had ranged between 1.2 and 1.5 mg/dl.

Significant past medical history included hypertension, gout, bilateral hip replacement surgeries, deep vein thrombosis complicated by pulmonary embolism and recurrent episodes of psuedomembranous colitis secondary to *Clostridium difficile*. The patient also gave a history of recurrent urinary tract infections with the most recent episode documented in November of 2001 secondary to *Proteus mirabilis*.

In April 2002, the patient presented to the emergency room with a 2-day history of fever, chills, emesis and diarrhea. On physical examination, the patient was morbidly obese with a temperature of 39°C, a heart rate of 98 beats/min and was hypotensive with a blood pressure of 70/52 mm of Hg. Systemic examination did not reveal any abnormal findings. A Foley catheter was placed revealing a scant amount of blood-stained urine. The relevant laboratory data revealed a white blood cell count of 6,300/mm^3, a blood urea nitrogen concentration of 54 mg/dl, serum creatinine of 3.7 mg/dl and serum potassium of 5.7 mg/dl. Urinalysis showed a pH of 7.5 along with presence of red and white blood cells, more than 25 per high-power field. Ultrasonography performed revealed normal-sized transplanted kidney with majority of calyces and pelvis filled with renal calculi, consistent with a staghorn calculus. The rest of the ureter could not be visualized due to body habitus. A CT scan performed subsequently confirmed the presence of a 4.3×2.8-cm staghorn calculus in the right iliac fossa, with the largest component of the calculus involving the upper pole. Smaller stones were noted to be present in the lower pole. A 1×0.7-cm calculus was noted in the proximal transplanted ureter, with hydronephrosis and hydroureter. Urine and blood cultures were positive for *Proteus mirabilis* resistant to ciprofloxacin and nitrofurantoin but sensitive to cephalosporins. A subsequent 24-h urine chemistry analysis was performed, which revealed calcium 84.9 mg/24 h (normal range, 100–300 mg/24 h), creatinine 0.801 g/24 h (normal range, 0.8–1.8 g/24 h), oxalate 74 mg/24 h (normal range, 10–50 mg/24 h), potassium 36 mmol/24 h (normal range, 30–99 mmol/24 h), sodium 286 mmol/24 h (normal range, 40–220 mmol/24 h). It should be noted, however, that this was not the ideal setting for metabolic evaluation of a urine specimen. There were no urine chemistries available in this case, prior to this clinical presentation.

The patient was initially treated with volume resuscitation and broad-spectrum antibiotics. On the 2nd day of admission, the patient remained anuric with serum creatinine rising up to 4.5 mg/dl and underwent emergency percutaneous nephrostomy of the transplanted kidney, with a 10-French APD nephrostomy tube. Urine output was restored and the serum creatinine level improved over the next 2 weeks; she was continued on cephalexin for a total duration of 6 weeks. Her immunosuppressive regimen was left unchanged, after receiving stress doses of steroids followed by a rapid taper. The hospital stay was further complicated by an infection related to the intravenous catheter with *Candida albicans*. Four weeks after hospitalization the patient was discharged to a subacute care facility in stable condition (serum creatinine of 1.4 mg/dl) with a percutaneous nephrostomy in place.

Six weeks after the initial admission, percutaneous nephrolithotomy via two tracts was performed with complete removal of the staghorn calculus. The operative findings revealed an obstructing calculus with a bifid collecting system. Kidney stone analysis revealed a total calculus weight of 0.0235 g and molecular composition of magnesium ammonium phosphate of 70% and calcium phosphate of 30%.

Discussion

Urolithiasis is an unusual complication in renal allograft recipients, but can be associated with significant morbidity. Mundy et al. [1] reported one of the earliest series of renal calculi in 1,000 consecutive transplant recipients. Urinary calculi occurred in only two of these patients. In a more recent analysis, Hayes et al. [3] reported a series of 892 patients who underwent renal transplantation at our institution, between 1977 and 1988. Ten patients developed urinary calculi during this time period, with an overall frequency of 1.1%. Calculi were diagnosed at a mean time period of 13 months after transplantation. Among those with renal calculi, seven patients had more than one metabolic abnormality, including calcium and uric acid metabolism. Although a rare complication, urolithiasis can present with severe obstructive uropathy in an allograft or serious systemic infection in an immunocompromised host, as was the case in our patient.

The temporal relation between transplantation and occurrence of calculi is highly variable. It has been reported to occur as early as 3 months [2] and up to as late as 10 years after transplantation [13]. We report the occurrence of allograft stone 16 years after transplantation. Although the majority of the calculi occur de novo, there have been few reports indicating donor graft lithiasis [14]. In one of the most recent and largest series of 1,179 transplants in 1,027 patients, Klingler et al. [6] reported 19 patients with urolithiasis. In nine patients, stones were transplanted from donors, whereas ten patients formed de novo stones.

With regard to the major risk factors of stone formation, no single case series has sufficient power to identify independent risk factors, since the number of events is very small. The most prevalent risk factors associated with stone disease include hyperparathyroidism, hypercalcemia, hypocitraturia, hyperuricemia and renal tubular acidosis. Hyperparathyroidism is one of the most prevalent metabolic abnormalities associated with stone formation in transplant recipients. In a series of 1,500 transplant recipients between 1976 and 1992, Benoit et al. [15] reported 12 patients with urinary calculi. Hyperparathyroidism was demonstrable among eight of these patients. Similarly, in a series of 892 transplants reported by Hayes et al. [3], hyperparathyroidism was present among 50% of stone formers.

Along with the metabolic risk factors, infection-induced stones are more common in transplant recipients. Hess et al. [13] reported the prevalence of major crystalline components in 334 cases of stones in non-transplant patients and compared it to the 49 cases of stones in transplant patients reported in the literature. Calcium oxalate and/or phosphate were the major components of the stones in both groups, whereas struvite- or infection-induced stones occurred more frequently in transplant patients as compared to non-transplant cases of calculi (42.9% vs 4.8%, respectively). In another study, Brien et al. [4] reported their experience in transplant patients between 1968 and 1979. There were six patients with urolithiasis among 426 transplant recipients. The composition of the calculi was uniform in five out of six patients and was exclusively composed of struvite and carbonate apatite, which are typically associated with urinary tract infections with urease-splitting bacteria.

Both of these series indicate a relatively high frequency of infection-related stones in transplant recipients.

In our patient, the only metabolic abnormality recorded was a mildly elevated oxalate excretion, although serum parathyroid hormone levels were not measured. Based on the stone analysis, however, we believe that the major contributory risk factor in our patient was urinary tract infection. Recurrent infections with urea-splitting bacteria lead to an alkaline urine pH, which may contribute to the formation of staghorn calculus.

To our knowledge, a case of staghorn calculus presenting as acute anuric renal failure in a renal allograft has not been reported. We report such a case, which also presented with Gram-negative sepsis secondary to *Proteus mirabilis*. The treatment of allograft stones does not differ from the current principles of management of non-transplant stones. However, special attention needs to be given to immunocompromised patients, especially in the presence of active infection or sepsis. Our patient was successfully treated, initially with appropriate antibiotic coverage and percutaneous nephrostomy to relieve obstruction; followed by percutaneous nephrolithotomy for the stone removal.

In conclusion, although urolithiasis is a rare complication among kidney transplant recipients, it can be associated with significant morbidity. Early recognition and treatment is critical to restore allograft function and to treat serious infections in these immunosuppressed patients.

References

1. Mundy AR, Podesta ML, Bewick M, Rudge CJ, Ellis FG (1981) The urological complications of 1000 renal transplants. Br J Urol 53: 397
2. Cho DK, Zackson DA, Cheigh J, Stubenbord WT, Stenzel KH (1988) Urinary calculi in renal transplant recipients. Transplantation 45: 899
3. Hayes JM, Streem SB, Graneto D, Hodge EE, Steinmuller DR, Novick AC (1989) Renal transplant calculi. A reevaluation of risks and management, Transplantation 47: 949
4. Brien G, Scholz D, Oesterwitz H, Schubert G, Bick C (1980) Urolithiasis after kidney transplantation–clinical and mineralogical aspects. Urol Res 8: 211
5. Kovacs J, Zilahy M, Banyasz T, Gomba S (1998) Evaluation of apoptosis and cell proliferation in experimentally induced renal cysts. Urol Res 26: 411
6. Klingler HC, Kramer G, Lodde M, Marberger M (2002) Urolithiasis in allograft kidneys. Urol 59: 344
7. Motayne GG, Jindal SL, Irvine AH, Abele RP (1984) Calculus formation in renal transplant patients. J Urol 132: 448
8. Hume DM, Lee HM, Williams GM, White HJ, Ferre J, Wolf JS, Prout GR Jr., Slapak M, O'Brien J, Kilpatrick SJ, Kauffman HM Jr., Cleveland RJ (1966) Comparative results of cadaver and related donor renal homografts in man, and immunologic implications of the outcome of second and paired transplants. Ann Surg 164: 352
9. Dubernard JM, Martin X, Neyra P, Touraine JL, Malik MC, Traeger J (1980) Successive appearance of carcinoma, tuberculosis and nephrolithiasis in a renal allograft. J Urol 124: 540
10. Nadler RB, Hoffman TA, McClennan BL, Clayman RV (1996) Corynebacterium urealyticum (CDC Group D2) associated with staghorn calculus: treatment by percutaneous debulking and chemolysis. J Endourol 10: 31
11. Sola R, del Rio G, Villavicencio H (1990) Staghorn renal stone in a transplanted kidney. Urol Int 45: 188
12. Jain AB, Angrisani L, McMaster P (1986) Staghorn calculus in a renal allograft. Transplant Proc 18: 959
13. Hess B, Metzger RM, Ackermann D, Montandon A, Jaeger P (1994) Infection-induced stone formation in a renal allograft. Am J Kidney Dis 24: 868
14. Van Gansbeke D, Zalcman M, Matos C, Simon J, Kinnaert P, Struyven J (1985) Lithiasic complications of renal transplantation: the donor graft lithiasis concept. Urol Radiol 7: 157
15. Benoit G, Blanchet P, Eschwege P, Jardin A, Charpentier B (1996) Occurrence and treatment of kidney graft lithiasis in a series of 1500 patients. Clin Transplant 10: 176