Case Report

Ex-vivo partial nephrectomy after living donor nephrectomy: Surgical technique for expanding kidney donor pool

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Abstract

Renal transplantation has profound improvements in mortality, morbidity, and overall quality of life compared to renal replacement therapy. This report aims to illustrate the use of ex-vivo partial nephrectomy in a patient with a renal angiomyolipoma prior to living donor transplantation. The surgical outcomes of the donor nephrectomy and recipient transplantation are reported with 2 years of follow-up. Both the donor and recipient are healthy and without any significant comorbidities. In conclusion, urologic techniques such as partial nephrectomy can be used to expand the living donor pool in carefully selected and well informed transplant recipients. Our experience demonstrated a safe and positive outcome for both the recipient and donor, and is consistent with other reported outcomes in the literature.

Key Words: Angiomyolipoma, living donor, partial nephrectomy, renal transplant

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INTRODUCTION

Angiomyolipoma (AML) represents the most common benign renal neoplasm with an incidence estimated at <0.2% in the general population.[1] AML is classically thought to be a solid "triphasic" tumor with dysmorphic blood vessels, smooth muscle cells, and mature adipose tissue.[2] The adipose component is what gives the pathognomonic finding on cross-sectional imaging with the presence of fat within the renal neoplasm, which helps differentiate this benign entity from other potentially malignant renal neoplasms. While there are times that fat poor AMLs are unable to be identified on computed tomography (CT) or magnetic resonance imaging, the majority of incidentally detected AMLs have some adipose component which aids in preoperative detection.[3] Twenty percent of AML are associated with tuberous sclerosis complex while the remaining 80% are deemed to be sporadic in nature.[4] Tumor size is the most reliable predictor of AML rupture and therefore guides surgical or endovascular management of these tumors. Suspicion of malignancy and likelihood of rupture, hemorrhage or renal failure invariably dictate the need for intervention, with angioembolization forming the main-stay of treatment for most symptomatic AMLs, and asymptomatic AMLs over 4 cm.[4] Surgical excision of large AMLs is also often performed.

Kidney transplantation is a limited resource associated with significant improvement in clinical and quality of life outcomes among patients with end-stage renal disease (ESRD). Suitable

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organs for kidney donation can be limited by both benign and malignant masses. We present a case of a donor kidney with renal AML, which was excised *ex-vivo* and transplanted successfully with 2-year follow-up. The surgical technique will be outlined, and the nuances discussed for successful transplantation of renal allografts with AML.

MATERIALS AND METHODS

Kidney donor history

The donor was a 55-year-old woman with no significant medical history who was undergoing a living-related kidney donor evaluation to donate to her brother-in-law. She had no personal history of hypertension, diabetes mellitus, hematuria, proteinuria, pyelonephritis, psychiatric disorders, or any malignancy. As part of her evaluation, she underwent triphasic renal CT scan which revealed 2.6 cm left lower pole renal mass with fat content consistent with AML [Figure 1]. None of the associated sequalae of tuberous sclerosis was noted in this patient's history.

Laparoscopic donor nephrectomy

A hand-assisted laparoscopic left donor nephrectomy was performed in the standard fashion. Before the nephrectomy, the patient was given a dose of antibiotic prophylaxis in accordance with our institutional guidelines. She was placed in the left flank position after the induction of general endotracheal anesthesia. A 7 cm midline incision was carried into the peritoneum to accommodate the GelPort. The abdomen was insufflated to 20 mmHg before the insertion of a 5-mm camera port and a 10-mm working port. The nephrectomy was then performed using the standard transperitoneal approach by mobilizing the colon along the white line of Toldt. The ureter and gonadal vein were identified and traced toward the lower pole of the kidney. The renal hilum was then dissected out. The adrenal gland was dissected off the kidney, and the adrenal vein was clipped and divided as it branched off the renal vein. The kidney was dissected posteriorly and completely mobilized before stapling and dividing the renal vessels. The ureter, dissected to the level of the iliac vessels, was transected with laparoscopic scissors, and the specimen was removed through a midline incision.

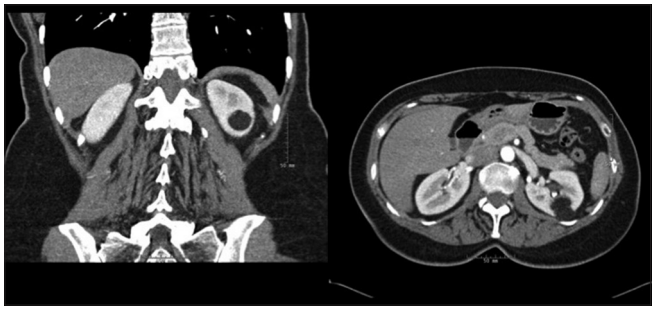

Figure 1: 2.6 cm left lower pole mass in coronal view and transverse view

Ex-vivo partial nephrectomy and transplantation

The recipient was prepared for transplantation using an extended right Gibson incision through which the right native nephrectomy was performed. The transplant urologist joined the nephrectomy team for the transaction of the hilar vessels and ureter of the donor specimen. The kidney was immediately placed in an ice bath and flushed on the backbench table. The kidney was prepared for transplantation in the standard fashion by lengthening the vessels.

Next, a partial nephrectomy was performed *ex-vivo*. The neoplasm was circumscribed using a scalpel, and the incision was carried down to the renal collecting system using Metzenbaum scissors. A renorrhaphy was performed by oversewing the collecting system using 4–0 chromic sutures. The partial nephrectomy was then reapproximated over surgical and chromic bolsters. The renal artery and vein were then irrigated with heparinized-saline, and no leak was noted. The transplant was then performed with vascular anastomosis of the donor left renal vessels to the recipient's right external iliac vessels. Meticulous hemostasis was noted after unclamping of the iliac vessels, and the total revascularization time was 45 min under cold ischemia. An extravesical ureteroneocystostomy was performed over a Greene transplant ureteral stent. The kidney was noted to be making urine after revascularization. The wound was closed in layers over a Jackson-Pratt drain at the site of the nephrectomy, and the patient was extubated and transferred to the postanesthesia care unit for the standard postoperative management.

RESULTS

The donor was discharged on postoperative day 2. Her postoperative course was notable for microscopic hematuria associated with the urinary tract infection, which resolved with treatment. Seventeen months following her nephrectomy, her serum creatinine was 1.05 mg/dL from a preoperative level of 0.89 mg/dL.

The recipient had a deep vein thrombosis postoperatively requiring anticoagulation with warfarin; as a result, he did not undergo his protocol biopsy between 3 and 6 months following transplantation. However, his biopsy at 1 year showed minimal chronic interstitial fibrosis and inflammation. His allograft function was stable with his creatinine at 1.5 mg/dL at 23 months posttransplantation. Interestingly, the patient underwent two separate abdominopelvic CT scans for abdominal pain which showed a stable allograft with no evidence of a renal mass.

DISCUSSION

The number of patients on waiting lists for renal transplantation has steadily increased over the last decade

with the rate of renal transplantation remaining relatively stable, with the number of deceased donor kidneys available for transplantation remaining relatively stable.[5] This has meant that the number of patients with ESRD on chronic dialysis has increased with a corresponding increase in the number of patients deemed to be medically acceptable candidates to receive a kidney transplant. Chronic dialysis is associated with many long-term side effects which invariably make kidney transplantation the preferred method for renal replacement therapy for ESRD; however, transplantation is limited by the number of available organs.[6] There is an increasing incidence of ESRD in the United States, which is compounded by increasing rates of cardiovascular disease and diabetes mellitus. There is an opportunity to supplement the deficiency of adequate deceased donor kidneys with living donors. Moreover, living donor renal transplant recipients demonstrates a significant improvement in posttransplant outcomes.[7] There are opportunities to expand the inclusion criterion for living donor kidney similar to measures taken with deceased donor (i.e., donation after cardiac death and extended criteria donation), especially among potential donors with benign renal lesions.[8-10] Such expansion of the kidney donor pool serves to especially benefit patients who often wait considerably longer waiting times on kidney donor lists, such as African-Americans.

Bissada *et al*. reported the first case live donor renal transplantation after *ex vivo* allograft excision of AML.[10] Chen *et al*. subsequently reported the first *in vivo* partial nephrectomy of a 7 cm AML before living unrelated donor kidney transplant.[11] Fritsche *et al*. described leaving a 1 cm centrally located hyperechoic lesion consistent on CT with AML in a living-related donor kidney transplant, citing the risk of hemorrhage, and false aneurysm formation.[12] Most recently, a case of successful living donor renal transplantation after 7 cm *ex vivo* AML excision was reported with 36 months follow-up.[9]

Our case corroborates the aforementioned case report with *ex vivo* excision of a 2.6 cm AML and successful living donor renal transplantation with 24-month follow-up with stable serum creatinine and blood urea nitrogen in both donor and recipient and also demonstrates the surgical technique in video. The recipient has not required any further dialysis, which has greatly benefited his quality of life.

CONCLUSION

This case report demonstrates the use of a urologic surgical technique to expand donation criteria for renal transplantation. An *ex-vivo* partial nephrectomy was performed with excellent result, and the recipient has maintained good renal function without the need for hemodialysis since his transplant in October of 2011.

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Conflicts of interest
There are no conflicts of interest.

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