In vivo partial nephrectomy of angiomyolipoma with concurrent transplantation

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Introduction/objective: *To describe a novel management approach to patients presenting for living renal donation who have a suspicious renal mass or cyst and review the current literature for the management of renal allografts containing masses.*

Materials and methods: *We retrospectively reviewed the preoperative, intraoperative, and postoperative records of both the donor and recipient for pertinent imaging, laboratory results, and complications. We also performed a Medline search to review the world literature of such cases, using the key words that we have listed for this article.*

Results: *In our reported case, an angiomyolipoma (AML) was confirmed intraoperatively in the donor, the donor nephrectomy was completed, and the graft was successfully transplanted. There were no postoperative complications. The recipient remains off dialysis with a serum creatinine of 2.4 mg/dl at 18 months of follow-up. Review of the current literature supports using a similar strategy for both renal masses and suspicious cysts. Furthermore, it confirms the safety and benefits of using a laparoscopic surgical approach to similar patients in the future.*

Conclusions: *Intraoperative pathologic analysis of small renal lesions in a renal allograft is a feasible procedure for potential kidney donors. In the future modifying this approach with a combined laparoscopic partial and donor nephrectomy will minimize the morbidity to the donor. Applying this technique may have a positive effect on organ supply.*

Key Words: nephrectomy, kidney transplantation, angiomyolipoma

Introduction

The growing incidence of end stage renal disease (ESRD) has increased the demand for renal transplantation. Despite intense efforts, demand for donated kidneys greatly exceeds supply. Often, once a willing donor volunteers, clinicians reject the kidney during initial screening for one of several reasons. Accordingly, the United Network for Organ Sharing (UNOS) has extended its criteria to include marginal kidneys into the donor pool. The UNOS registry shows that marginal cadaveric kidney transplantation is associated with a reduction in mortality over maintenance dialysis for transplant candidates.[1] We agree with others that this logic can be extrapolated to include the living renal donor pool, which has recently exceeded the cadaveric pool in annual supply of kidneys.[2-4]

One such extended criterion is a kidney with a benign renal lesion. Radiographic differentiation of benign from malignant is uncertain, however, despite the advances of modern imaging. One particular benign lesion, the angiomyolipoma (AML), can be identified

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on CT scan by the pathognomonic presence of fat. Still, there are reported cases of fat-containing renal cell carcinomas, making the transplantation of kidneys with fat-containing lesions precarious.[5] The diagnosis of AML is thus ultimately pathologic. We describe the first report of an unrelated *in vivo* partial nephrectomy without renal hilum clamping performed together with donor nephrectomy for a kidney with an AML.

Materials and methods

We retrospectively reviewed the preoperative, intraoperative, and postoperative records of both the donor and recipient for pertinent imaging, laboratory results, and complications. We also performed a Medline search to review the world literature of such cases, using the key words that we have listed for this article.

Results

A 55-year-old white male with ESRD secondary to glomerulonephritis, having failed two cadaveric renal transplantations, presented to our clinic. After compatibility studies confirmed his 53-year-old wife as a suitable donor, she underwent donor evaluation. CT scan, when compared to a previous non-contrast scan 4 years earlier, revealed the interval development of a 1.5 cm left fat-containing renal mass, Figure 1. Although radiographically consistent with an AML, interval growth raised concerns that this lesion could be a fat-containing RCC.

Given the exophytic nature of the mass and the donor's desire to give her kidney, we offered her a partial nephrectomy with intraoperative frozen section to confirm the pathology. If the lesion was benign, the patient consented to completion donor nephrectomy and the transplant team was standing by with the recipient. However, we would forego donor nephrectomy if frozen section revealed a malignant or indeterminate diagnosis.

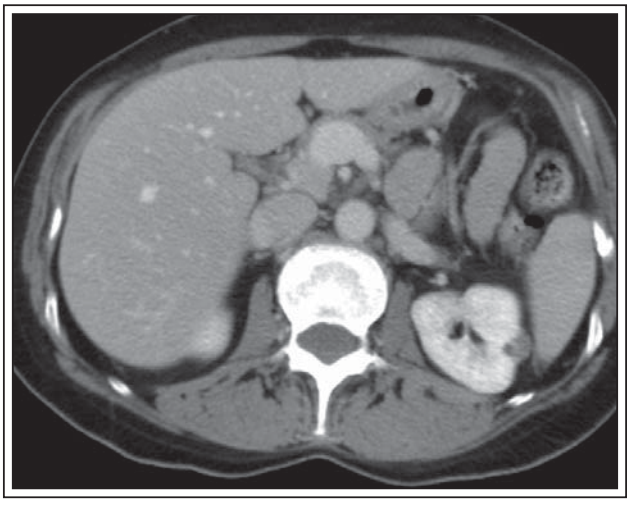

Figure 1. Exophytic 1.5 cm enhancing left renal mass.

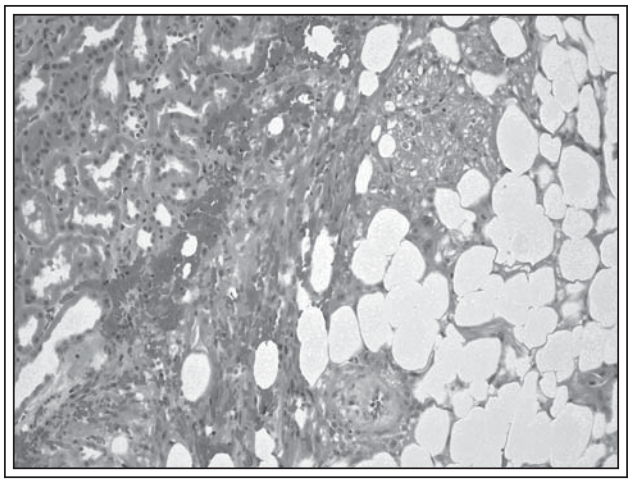

Figure 2. Excised renal mass on final pathologic specimen under high power. The specimen is stained with H&E and displays the pathognomonic characteristics of an angiomyolipoma.

In February 2006, the patient underwent a left open partial nephrectomy. After administration of mannitol, however, we did not clamp the renal hilum or cool the kidney, as has classically been described for an open partial nephrectomy. We excised the mass uneventfully and obtained hemostasis using argon beam coagulation, bolstered sutures, and tissue sealant. Frozen section confirmed the diagnosis of AML with negative surgical margins, Figure 2. The kidney was next removed and successfully transplanted. The estimated blood loss was 75 ml and postoperative donor creatinine never changed, staying level at her baseline of 1.1 mg/dl (ref 0.7 mg/dl-1.4 mg/dl). The recipient kidney functioned well immediately, reaching a creatinine nadir of 1.5 mg/dl. He remains hemodialysis-free and, despite one episode of acute rejection, his most recent creatinine at 18 months of follow-up is 2.4 mg/dl.

Discussion

The transplant community continues to pursue ways to increase donated kidneys. The greatest potential for achieving this goal is through living donors. Although the cadaveric renal pool has remained fairly stagnant over the last decade, living donor kidneys have more

than doubled, taking over the absolute number of cadaveric kidneys around the year 2001. Recent strategies to increase the living donor pool include paired-donor kidney exchanges, transplantation across ABO or HLA barriers, the use of altruistic donors, and the use of expanded-criteria living donors.[6] The transplantation of a kidney with a small, benign renal lesion has been recognized as a viable alternative for this purpose.

Despite the poor sensitivity of imaging modalities in differentiating benign form malignant renal masses, CT scan can diagnose AML with high specificity.[7] Moreover, with a prevalence of 0.3% of the population, transplantation of these kidneys can have a positive impact on the overall donor pool.[8]

In 1993 the first report of a simultaneous AML excision and transplantation was published.[9] In this report, the mass was excised *ex-vivo* on the back-table, thus exposing the kidney to unnecessary ischemic time. This method is similar to an auto-transplantation strategy for treatment of complex renal tumors.[10]

In 2000, Chen et al described an open partial donor nephrectomy for a 7 cm AML and subsequent transplantation utilizing renal hilar clamping.[11] Although postoperative recipient creatinine fell to 1.8 mg/dl, there was no long term follow-up.

In our case, because of the exophytic nature of the lesion, we thought it safe to perform the partial nephrectomy *in vivo* without hilar clamping. We believed that this would maintain perfusion to the graft until the time of donor hilar ligation, thus theoretically minimizing ischemic time. Furthermore, if the mass proved to be malignant, the patient would have already undergone curative treatment.

The risk of transplanting an occult malignancy has been described, but fortunately is extremely rare.[12] There are several reports, however, of de novo allograft malignancies developing post transplantation.[12,13] Treatment strategies for these patients has evolved from open nephrectomy to partial nephrectomy. Recently, two reports of kidney recipients who underwent nephron sparing surgery for tumor demonstrate this as a viable strategy, and these patients have remained off dialysis for 22 and 6 months, respectively.[14,15]

Since the 1990's, laparoscopic donor nephrectomy has quickly approached the gold standard of open partial nephrectomy. Long term data convincingly shows that renal allograft function is not compromised with laparoscopic excision.[16,17] Interestingly, a report from 2003 describes the safe laparoscopic procurement of a kidney several months after a partial nephrectomy for an AML.[18] In this case, the surgeons were fully aware that the partial nephrectomy patient would later donate that same kidney, but wanted that kidney to fully recover after the reperfusion injury from the hilar clamping during the partial nephrectomy. Based on these outcomes, we believe it is safe to apply a laparoscopic approach to our case in the same setting. Although there is no direct evidence, one can infer from both the laparoscopic donor nephrectomy and laparoscopic partial nephrectomy data that long term graft function should be equivalent to an open approach.

As imaging modalities improve, the discovery of small, indeterminate renal lesions will increase. Renal cysts, depending on their appearance, vary in malignancy. Although kidneys with simple renal cysts are often transplanted, there is one concerning report where routine pathologic examination confirmed a malignant cyst 10 days post transplant, resulting in immediate nephrectomy.[19] This case, however, is more an exception than the rule. Moreover, a study of renal cysts found incidentally by CT showed a prevalence of 8% and 41.2% in patients younger than 40 and overall, respectively.[20] Application of our technique to the abundance of patients with concerning renal cysts could more significantly impact kidney shortages.

Conclusions

There continues to be a gap between potential renal recipients and available kidneys. A significant portion of potential kidney donors may have small, benign-appearing renal lesions. We describe a safe technique for removing a suspected AML, confirming its pathology intraoperatively, and completing transplantation while minimizing the risk to long term graft function. Application of this technique beyond AML, to all indeterminate small renal lesions and renal cysts, could significantly impact organ availability. Finally, a laparoscopic approach could further minimize donor morbidity. □

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