The Role of Endovascular Procedures in the Diagnosis and Management of Transplanted Kidney Extrarenal Pseudoaneurysms: A Case Series

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INTRODUCTION

Pseudoaneurysms of the transplanted kidney can be divided into two categories: those internal to the renal parenchyma (parenchymal pseudoaneurysms) and those involving the main renal artery or iliac artery at the anastomosis (extrarenal pseudoaneurysms [EPSAs]) [1, 2]. Parenchymal pseudoaneurysms are common and usually iatrogenic secondary to biopsy, and can be successfully treated with the use of packed coils. EPSAs in contradistinction are very rare (< 1%), may have several different etiologies without a clear single treatment, and have been reported in the past to require transplant nephrectomy. Here we report the cases of four patients who were diagnosed angiographically with EPSAs, discuss the clinical scenarios and imaging findings that led to their diagnosis, and describe the treatment modalities and outcomes in the current era.

CASE PRESENTATIONS

Case 1

A 33-year-old man received a kidney from a living-related donor. The initial transplantation was complicated by three episodes of intraoperative thrombosis of the transplanted renal artery requiring surgical thrombectomies with anastomotic revisions, as well as the development of a perigraft hematoma that required surgical evacuation. The patient had delayed graft function but eventually gained renal function. Two months post transplant, the patient was noted to have a rise in creatinine to 4.7 mg/dL from a baseline of 3.2 to 4 mg/dL. The patient did not have fevers, chills, nausea, or vomiting and was hemodynamically stable. A renal ultrasound was performed which demonstrated elevated velocities in the proximal transplanted renal artery with parvus tardus waveforms in the parenchymal arteries, suggesting transplant renal artery stenosis (Figure 1A-B). The concern for stenosis prompted a renal transplant angiogram which revealed two EPSAs of the main renal artery, one at the origin of the renal artery and another 1 cm distally (Figure 1C). It was then decided to treat the EPSAs surgically by bypassing them with a vascular graft. The open repair was complicated by renal vein injury leading to significant blood loss (6500 mL) requiring multiple blood transfusions and ultimately lead to graft sacrifice. Interventional radiology then placed a covered stent inside the external iliac artery, successfully occluding the residual pseudoaneurysm (Figure 1D). The patient was then placed back on dialysis and remained alive 3 years post nephrectomy. The EPSAs are believed to have been caused by repetitive mechanical surgical manipulation of the anastomosis and graft renal artery that had become necessary secondary to the intraoperative thromboses and thrombectomies.

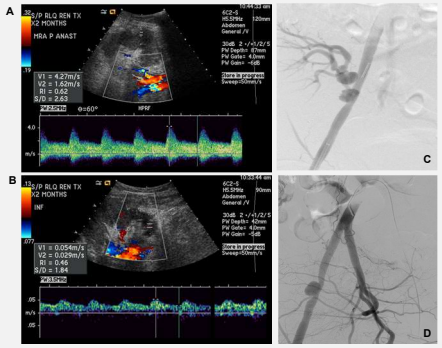

Figure 1: 33-year-old male, status post renal transplant, who developed EPSAs. A-B: Transplant renal ultrasound demonstrated elevated velocities (A) and low intraparenchymal resistive indices with parvus tardus waveforms (B) suggesting transplant renal artery stenosis. C: Conventional angiogram demonstrates two EPSAs. D: Conventional angiogram demonstrates residual pseudoaneurysm after transplant nephrectomy, which was treated with a covered stent.

Case 2

A 58-year-old man received a renal graft from a deceased donor. His postoperative course was complicated by multiple admissions for urinary tract infections of mixed flora which were treated with levofloxacin, hydronephrosis of the transplanted kidney requiring a nephroureteral stent, and a peritransplant hematoma which did not require surgical evacuation. An ultrasound performed subsequent to nephroureteral stent placement demonstrated high velocities within the main renal artery and parvus tardus waveforms in the intraparenchymal vessels, and concern for transplant renal artery stenosis was raised. However, as the patient did not have hypertension or increased creatinine, no further imaging follow up for arterial stenosis was pursued. Two months post-transplant, the patient experienced right lower quadrant pain over the renal graft site without fevers, chills, nausea, or vomiting. The patient was hemodynamically stable. A transplant renal ultrasound demonstrated a 1.4 x 1.1 cm EPSA in the proximal portion of the transplanted renal artery. Interventional radiology performed an angiogram, confirming the EPSA which was compressing the two arterial branches emanating from the main renal artery (Figure 2A). Framing coils were placed in the pseudoaneurysm, which was then internally packed with coils (Figure 2B-C). No residual flow was seen within the pseudoaneurysm after coil packing with persistent stenosis of the branching transplant renal arteries (Figure 2C). The patient was discharged in stable condition. Two weeks later the patient underwent an angiography which demonstrated persistent narrowing of the branch renal arteries, which were successfully treated with drug-eluting stents (Figure 2D). Since then, the patient maintains a functioning renal transplant without recurrence of the pseudoaneurysm in the last two years. In the setting of a peritransplant hematoma and repetitive urinary tract infections, it is thought that this EPSA was mycotic in origin.

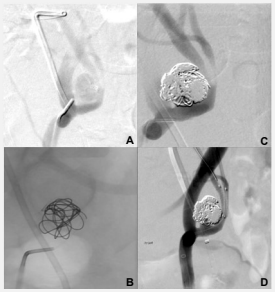

Figure 2: 58-year-old male, status post renal transplant, who developed an EPSA. A: Angiogram demonstrated an EPSA which compressed two branches of the transplanted renal artery. B-C: Framing coils were placed in the pseudoaneurysm (B), which was then internally packed with coils (C). D: The EPSA compression of the branches of the transplanted renal artery were treated with stents.

Case 3

A 48-year-old female received a deceased-donor kidney transplant which was complicated by Klebsiella and Pseudomonas sepsis on postoperative day three which was treated with antibiotics. She was discharged in stable condition on postoperative day six. One week later, the patient presented with pain over the renal transplant site with fever and hypotension. A renal transplant ultrasound was performed and unremarkable. She was admitted to the hospital and started on empiric vancomycin and piperacillin/tazobactam. On hospital day one, she became acutely anemic prompting an abdominal noncontrast CT, which revealed an 11 x 8 cm hematoma in the retroperitoneum superior to the transplanted kidney with a rounded hypodense area in the region of the transplanted renal artery (Figure 3A) suggestive of a pseudoaneurysm. However, since this was a noncontrast study, this could not be proven. IR performed an angiogram which demonstrated a pseudoaneurysm adjacent to the anastomosis (Figure 3B). Given the acute nature of the hemorrhage, the patient was taken emergently to the operating room for surgical exploration. In the operating room, the pseudoaneurysm was visualized. The renal artery appeared friable, and surgical repair was not feasible. The patient underwent a transplant nephrectomy and was placed back on dialysis. In this case, the EPSA was considered mycotic.

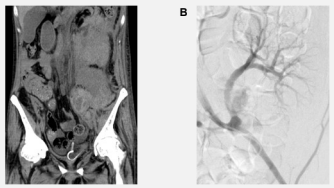

Figure 3: 48-year-old female, status post renal transplant, who developed an EPSA. A: Coronal noncontrast CT of the abdomen and pelvis demonstrates a large heterogeneous collection within the left renal fossa with a smaller hypodense collection in the region of the transplanted renal artery anastomosis. B: Conventional angiogram confirmed the suspicion for an EPSA.

Case 4

A 61-year-old man received a deceased-donor renal transplant whose postoperative course was complicated by pseudomonas sepsis on postoperative day three as well as a peritransplant hematoma requiring surgical evacuation. Three months after transplantation, the patient presented with pain over the transplant site. The patient was diagnosed with Clostridium difficile colitis and treated with vancomycin. An ultrasound of the transplanted kidney at the time revealed increased velocities in the transplanted renal artery with intraparenchymal parvus tardus waveforms, concerning for transplant renal artery stenosis. A repeat ultrasound showed similar findings however, a 2.7 cm pseudoaneurysm was also noted at the proximal renal artery (Figure 4A). IR performed a angiogram which confirmed the presence of a non-anastomotic EPSA which was packed with microcoils without framing (Figure 4B-C) leaving no residual flow within the pseudoaneurysm. On hospital day two, the patient developed a fever, and blood cultures revealed Pseudomonas. The bacteremia was presumed to be secondary to mycotic EPSA manipulation. The patient was placed on IV cefepime and discharged on hospital day three in stable condition. One month later, with the patient on continued IV treatment for bacteremia, a follow up ultrasound revealed a new enlarging wide-necked pseudoaneurysm distal to the original pseudoaneurysm, which measured 3.2 x 1.8 cm (Figure 4D). An angiogram was performed which confirmed the presence of a new posterior non-anastomotic EPSA. This was treated with packed coil placement however, post-coiling angiogram demonstrated persistent filling of the pseudoaneurysm. Given the wide neck of the pseudoaneurysm, plans were made to remove the graft surgically. In preparation for the anticipated external iliac artery ligation required for the nephrectomy, a left femoral to right femoral bypass was created and the right external iliac artery distal to the graft arterial anastomosis was ligated. The plan at that time was to let the bypass heal and then proceed with transplant nephrectomy four weeks later. However, at the follow up, the decision was made to try to salvage the graft instead of removing it as the patient responded well to the continued antibiotics and maintained reasonable graft function. He underwent ligation of the right common iliac artery proximal to the graft, ligation of the right internal iliac artery, ligation division of the distal graft renal artery, and insertion of a bypass graft from the right common iliac artery to the proximal juxtahilar renal artery. The patient was able to recover maintain transplant renal function for a year. In this case, the EPSA was considered to be mycotic.

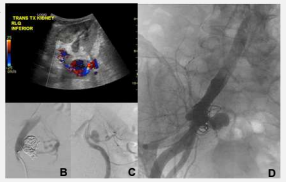

Figure 4: 61-year-old male, status post renal transplant, who developed EPSAs. A: Initial ultrasound demonstrated a rounded collection in the renal hilum with the "yin-yang" sign of a pseudoaneurysm. B-C: Conventional angiogram confirmed the presence of an EPSA (B) with subsequent coiling (C). D: Subsequent conventional angiogram demonstrated a new EPSA more distally.

DISCUSSION

- EPSAs are rare complication encountered in < 1% of renal transplant recipients.
- Clinical and lab factors suggestive of ESPA include rise in Cr, pain over transplant site, fever, hypotension. Other studies have found pulsatile pelvic mass and lumbosacral plexopathy to be associated [3-6].
- In 3 out of 4 cases, EPSA were not appreciated on ultrasound. This can be due to technical errors including depth of transplanted vasculature and obscuration by bowel gas, as well as low prevalence to warrant a search. Interestingly, in three cases, renal artery stenosis was expected most likely due to compression of the transplant renal artery secondary to compression by the expanding pseudoaneurysm, which suggests if new onset renal artery stenosis is observed, a careful search for a pseudoaneurysm should be considered. Angiography remains the gold standard for diagnosis as 2 out of 4 cases solely relied on conventional angiography for the diagnosis.
- In the past, prognosis of EPSAs was poor and often lead to graft sacrifice [6-8], but this cohort showed 2 out of 4 who were able to maintain graph function with the use of endovascular alone and combined surgical and endovascular approaches. Surgery alone led to nephrectomy.
- Management of EPSA depends on the acuity. If the patient is stable, less invasive techniques and approaches may be consider.
- Non-infected EPSAs can be successfully managed endovascularly. In contrast, the optimal treatment for infected EPSAs remains unclear. Our patient that underwent successful endovascular treatment of a mycotic EPSA had received a course of antibiotics prior to the endovascular treatment. At least one previous case report did also document that a course of antibiotic therapy prior to the endovascular repair resulted in a successful outcome [9]. It is possible that pre-procedural antibiotics may help decrease the risk of graft sacrifice. It is still unclear if there is a role for post-procedural antibiotics.

CONCLUSIONS

In conclusion and based on our experience, clinical outcomes of EPSAs in the current era may have improved as half of the patients in our series were able to retain a functioning graft after the therapeutic intervention. An endovascular approach continues to play a central role in the diagnosis and management of clinically stable EPSAs. Discerning whether an EPSA is mycotic has important potential implications for the treatment of the aneurysm itself and the potential need for peri-procedural administration of antibiotics. In the clinically stable patient, at least a pre-interventional course of antibiotics may be prudent.

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