

## CASE REPORT

# High Risk Cardiovascular Candidate for Renal Transplantation: A Journey to Success

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The most common cause of mortality after a kidney transplant is a cardiovascular event. This is why most patients with poor cardiovascular status are denied a transplant. A 70-year-old male, ESRD from hypertensive nephropathy, was declined renal transplantation in the United States for advanced age, severe coronary disease and abdominal aortic aneurysm. The patient sought a second chance at a possible transplantation here in the Philippines. After a comprehensive cardiovascular evaluation, he underwent coronary artery bypass graft for a three-vessel disease followed by endovascular aneurysm repair (EVAR) which he tolerated well. After four weeks, he underwent a living-related kidney transplantation with immediate allograft function. On postoperative day 5, after catheter removal, the patient was unable to void spontaneously. He was diagnosed with benign prostatic obstruction and underwent transurethral resection of the prostate. He tolerated this and voided freely since catheter removal. One year later, the patient has a functioning allograft and stable cardiac status. High risk patients with cardiovascular disease may be given a chance at kidney transplantation after a meticulous evaluation and optimization.

**Key words:** Renal transplantation, endovascular aneurysm repair (EVAR)

### Introduction

The incidence of end-stage renal disease (ESRD) is rising and kidney transplantation has been the preferred treatment for these patients. This allows for a better quality of life with an overall survival benefit of at least 10 years and good allograft survival of up to 20 years compared to those who remain on dialysis.<sup>1</sup>

Most patients with ESRD have multiple co-morbidities hence the importance of proper screening and selection of patients prior to transplant surgery. Absolute contraindications for kidney transplantation include severe cardiac or pulmonary disease, active infection, active drug abuse, and uncontrolled psychiatric disease. An

acute cardiovascular event is usually the cause of death with a functioning allograft. For this reason, most transplant centers will not proceed with a transplant among high-risk cardiac patients. The authors experience shows that a patient with severe cardiovascular disease need not necessarily be disqualified from receiving a kidney transplant provided that his conditions are addressed accordingly prior to the planned kidney transplant procedure.

There is a strong association between abdominal aortic aneurysms (AAA) and renal failure brought about by atherosclerosis and chronic kidney disease. With the advancements in technology, endovascular aneurysm repair (EVAR) has brought favorable results in terms of morbidity and operative

time. An increasing number of ESRD patients with AAA have undergone EVAR successfully but only a few have been reported.<sup>2</sup>

George et al published in 2001 the first successful renal transplantation in a patient after EVAR for AAA. Outcomes showed that the transplanted kidney maintained a normal serum creatinine level of 1.3 mg/dL without any progression of peripheral vascular disease.<sup>3</sup> In 2007, Shrestha et al reported another successful renal transplantation on a 54-year old male who underwent endovascular bifurcated stent graft (EVBSG) for AAA. Post-operatively, patient had an uneventful course in the hospital. MAG-3 renogram showed a well-perfused kidney 5 days after the surgery. Serum creatinine levels dropped from 1100 umol/L to 140 umol/L on day 10. At 6 months post-surgery, the serum creatinine levels remained stable at 115 umol/L.<sup>2</sup>

There is a rapid rise in cases of AAA in ESRD patients on chronic hemodialysis. Despite severe cardiovascular disease being an absolute contraindication to kidney transplantation, current developments in coronary interventional surgery and aortic aneurysms such as minimally invasive CABG and EVAR, respectively have provided good outcomes for these types of patients allowing for successful and uneventful renal transplantation. Only two reports have been published as of today. This report will further demonstrate that with the proper diagnostics and management, patients with severe cardiovascular disease can be optimized well enough for kidney transplantation.

## **The Case**

The patient is a 70-year-old male diagnosed with end-stage renal failure secondary to hypertensive nephrosclerosis and has been on hemodialysis thrice a week since 2021 through a brachiocephalic arteriovenous graft on the left. He has a history of ischemic heart disease and underwent percutaneous coronary intervention with placement of 3 cardiac stents last 2018 in Hawaii. He is maintained on aspirin, atorvastatin, carvedilol, losartan, calcium carbonate, sevelamer, cinacalcet, and vitamin D. He is a previous 50-pack-year smoker and alcoholic beverage drinker.

The patient was initially assessed for a possible kidney transplantation in the United States but

failed evaluation due to severe cardiovascular disease resulting from multiple-vessel coronary disease and abdominal aortic aneurysm. The patient opted for a second opinion at this medical center.

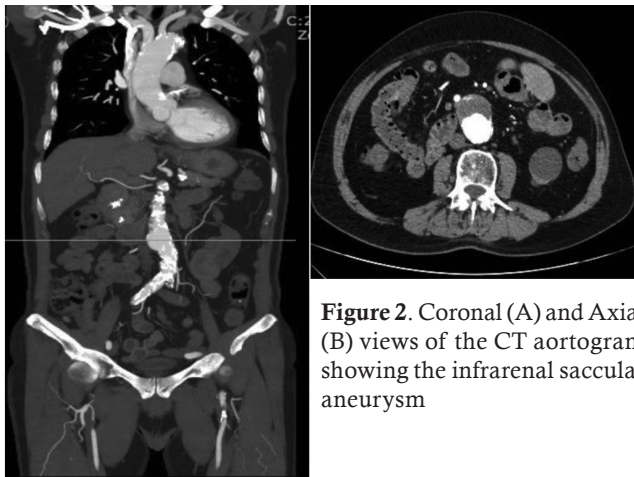
As part of the pre-transplant evaluation, he underwent dobutamine stress echocardiogram which revealed an ST segment elevation in leads II, III, aVF, V4-V6 with ST depression in leads I, aVL, and V2, consistent with severe ischemic disease of the inferolateral wall. Echocardiogram showed an akinetic basal inferior septum and inferior wall. His laboratory results showed an elevated Troponin I level of 29.5. Although the patient was asymptomatic, these were considered critical findings.

A coronary angiogram was performed (Figure 1) showing chronic total occlusion of the middle portion of right coronary artery with intercoronary collaterals from the septal branches of left anterior descending artery, severe coronary artery disease of ostial, proximal and middle left anterior descending artery, proximal left circumflex artery and first obtuse marginal artery; moderate coronary artery disease of middle left circumflex artery. Immediate consult was sought with the cardiovascular surgical team. The patient underwent minimally invasive coronary surgery - coronary artery bypass grafting (off-pump) (MICS-CABG OPCAB) using left internal mammary artery (LIMA) on October 27, 2023.



**Figure 1.** Coronary angiogram

A CT aortogram (Figure 2) was done and confirmed the presence of an infrarenal saccular aneurysm measuring 5.1cm x 3.2 cm x 3.7 cm (previously 5 cm x 3.1 cm x 3.5 cm) with mural thrombus along its anterior-right paramedian aspect. The non-enhancing thrombus had a maximum thickness of 2.1 cm without dissection or contrast extravasation seen. Eight days later, on November 4, 2023, the patient then underwent endovascular aneurysm repair (EVAR) of infrarenal saccular aneurysm.



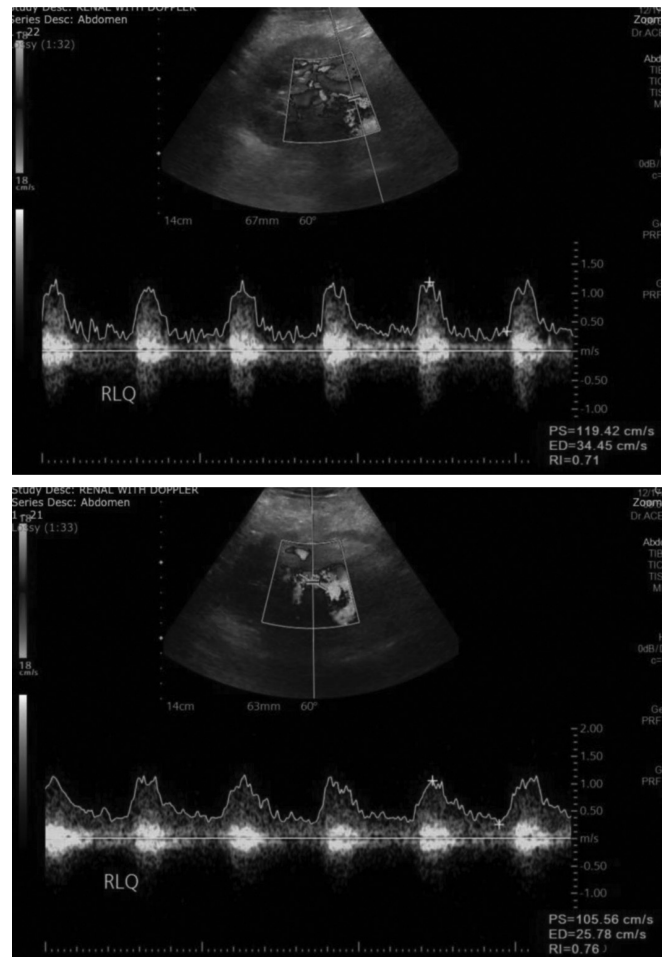
**Figure 2.** Coronal (A) and Axial (B) views of the CT aortogram showing the infrarenal saccular aneurysm

In the interim, the patient complained of moderate lower urinary tract symptoms. Laboratory tests yielded an elevated prostate-specific antigen at 7.3 ng/mL with 20 grams of prostate on imaging. Patient underwent transperineal biopsy of the prostate on November 29, 2023 which showed benign prostate hyperplasia and was started on tamsulosin 400 mcg/tablet once daily at bedtime and solifenacin 5mg/tablet once daily.

The patient made an uneventful recovery and underwent a living kidney donor-transplantation four weeks later on December 8, 2023. Donor CT angiogram showed bilateral single main renal artery and vein. Intraoperatively, the renal vein was anastomosed to the right external iliac end-to-side using Prolene 5-0 sutures, continuous technique, followed by the end-to-side anastomosis of the right renal artery to the right external iliac artery using Prolene 6-0 sutures, continuous technique. Immediate reperfusion of the allograft with good turgor and color was noted. The total vascular anastomosis time was 42 minutes. The allograft

ureter was spatulated and anastomosed to the anterolateral surface of the urinary bladder dome using PDS 6-0 sutures, continuous technique. Bladder serosa was apposed using continuous PDS 6-0 sutures with an antireflux repair over an indwelling ureteral stent. Intraoperatively, patient was maintained on dobutamine, norepinephrine, and dopamine due to hypotension with blood transfusion of 2 units of packed red blood cells. There were no post-operative complications.

Induction was done using rabbit anti-thymocyte globulin (rATG) 72.3mg induction with pre-treatment with methylprednisolone 125-250mg intravenously. On post-operative day 1, the renal allograft doppler (Figure 3) showed good cortical vascular flow or perfusion. The peak systolic velocity of the aorta is 100 cm/sec. The renal vein is patent. Serum creatinine improved from 4.6 to as low as 0.6 mg per dL. Patient was discharged on postoperative day 7.



**Figure 3.** Renal power doppler ultrasound of allograft kidney

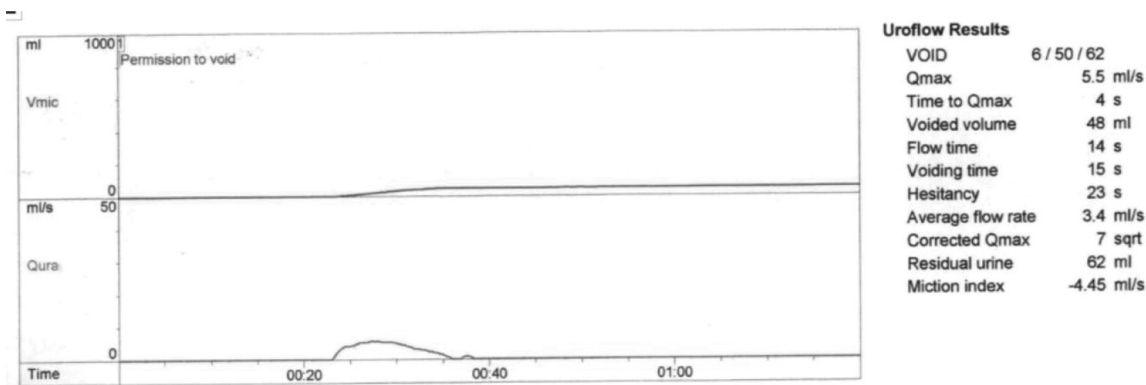


Figure 4. Uroflowmetry tracing

Two days since discharge, the patient complained of terminal dysuria with occasional gross hematuria prompting consultation at the Emergency Department. Serum creatinine was at 0.82 mg/dL. Ultrasound showed prostate gland size of 17 grams with only 6 mL urine residual. Repeat power doppler gave a peak systolic velocity of the aorta is 110 cm/sec. Tacrolimus Trough level was at normal levels. Patient was the advised admission. Further workups revealed a low Qmax at 5.5 ml/seconds (average Qmax 3.4 mL/seconds) and a 62 mL urine residual on Uroflowmetry with bladder scan (Figure 4). After clearances were secured, the patient was then scheduled for Cystoscopy, ureteral stent removal with transurethral incision and resection of the prostate on December 22, 2023. Post-operatively, the patient remained stable. Foley catheter was hooked to cystoclysis and was maintained for 2 days. Patient was able to void freely after catheter removal. All throughout this period, the patient had adequate urine output and stable allograft function. At one-year follow-up, he maintained stable renal function and good cardiovascular status.

## Discussion

The meticulous pre-transplant evaluation of any ESRD patient hinges on the principle that the donated allograft is a very scarce commodity. Therefore, for every transplant surgery to be considered worthwhile, the transplanted recipient should have an anticipated long-term survival of at least 10 years with a functioning allograft. Severe cardiovascular disease has been considered an

absolute contraindication to renal transplantation. This is because the most common cause of death among recipients with a functioning allograft is a serious cardiovascular event.

This strong association between abdominal aortic aneurysms (AAA) and renal failure resulting from atherosclerosis and chronic kidney disease remains to be a rate-limiting step in the clearance of potential candidates for renal transplantation. Patients are denied of the definitive procedure solely due to high-risk cardiovascular disease.

As developments in coronary interventional surgery and aortic aneurysms such as minimally invasive CABG and EVAR emerge, these patients are provided the opportunity to undergo renal transplantation with very favorable outcomes. Two studies mentioned earlier have been published and have produced efficacious outcomes.

A collaborative effort with different specialties consisting of transplant surgery, nephrology, cardiology, cardiovascular and urology service is key to the success in managing these patients.

## Conclusion

The authors' experience with this case demonstrates that ESRD patients with severe cardiovascular disease may still undergo renal transplantation after a comprehensive pre-operative planning and collaboration with an excellent cardiovascular team. As technological advancements arise, the authors continue to modify the recipient acceptance criteria and increase the pool of patients for kidney transplantation.

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