

Transitory Peaked Waveforms With Elevated Velocities in Doppler Sonography After Renal Transplant

Juan Pablo Idrovo,¹ Tee Yin Teo,¹ Kavim G. Shah,¹ Ping Wang,¹ Madhu C. Bhaskaran,²
John Pellerito,³ Daniel Putterman,⁴ Jeffrey Nicastro,¹
Gene F. Coppa,¹ Ernesto P. Molmenti¹

Abstract

Vascular complications after a renal transplant are rare and critical. Duplex Doppler evaluation constitutes the primary imaging modality in renal transplant. Early diagnosis and appropriate intervention to address potential complications are crucial in graft survival. This report describes a 25-year-old woman who underwent a live-donor renal transplant. During a routine study 4 hours after surgery, she was found to have high peak flow velocities suggestive of stenosis. An angiogram obtained as a result of this finding showed no abnormalities. A repeat duplex Doppler sonogram performed 12 hours later revealed normal waveforms and velocities.

Postrenal transplant vascular complications are rare but may represent a significant morbidity factor for patients and grafts. Peak wave forms, elevated velocities, and a tardus-parvus configuration are suggestive of vascular disorders that require aggressive evaluation. In our patient, the Doppler ultrasound, angiogram, and lack of clinical signs were compatible with a renal artery vasospasm. This entity, despite its reversibility in the majority of instances, may cause severe graft injury if it does not regress promptly.

Key words: *Kidney, Ultrasound, Organ transplant, Vascular, Complications*

From the ¹Departments of Surgery, ²Nephrology, ³Radiology, and ⁴Interventional Radiology, North Shore University Hospital, 300 Community Drive, Manhasset, NY 11030, USA

Acknowledgements: None of the authors declares any conflicts of interest.

Address reprint requests to: Juan Pablo Idrovo MD, Departments of Surgery, North Shore University Hospital, 350 Community Dr. Manhasset, NY 11030, USA

Phone: +1 (516) 562 2800 Fax: +1 (516) 562 1022 E-mail: jidrovo@nshs.edu

Experimental and Clinical Transplantation (2011) 6: 421-424

Introduction

Renal allograft perfusion deterioration in the early postoperative period is regularly associated with ischemic damage, drug toxicities, and rejection.¹ Nevertheless, vascular complications such as arterial spasms, thrombosis, and transplant renal artery stenosis are rare, but have critical consequences.²⁻⁴ Doppler sonography is one of the key interventions used in renal surveillance postoperatively, because early detection of such events have been shown to improve surgical outcomes.⁴ While Doppler sonography examination measures organ perfusion by determining the flow in renal vessels, angiography is usually necessary to define the anatomic origin of abnormal findings.⁵⁻⁷ Severe renal artery spasms have not been presented as case reports. We describe a case of severe transitory renal artery spasm after an uneventful renal transplant.

Case Report

A 25-year-old woman with diabetes mellitus type 1, chronic hypertension, and end-stage renal disease on hemodialysis underwent a live-donor renal transplant surgery. The left kidney from the donor was implanted onto the left external iliac vessels without complications. Four hours after surgery, a routine renal Doppler ultrasound (Figure 1) demonstrated a tardus-parvus configuration (suggestive of inflow obstruction) at the segmental, interlobar, and arcuate arteries. Examination of the main renal artery anastomosis demonstrated peaked systolic and end diastolic waveforms with elevated velocities up to 848 and 493 cm per second. The renal vein showed no abnormalities. A renal angiogram (Figure 2), obtained soon thereafter as a result of these findings, showed no disorders.

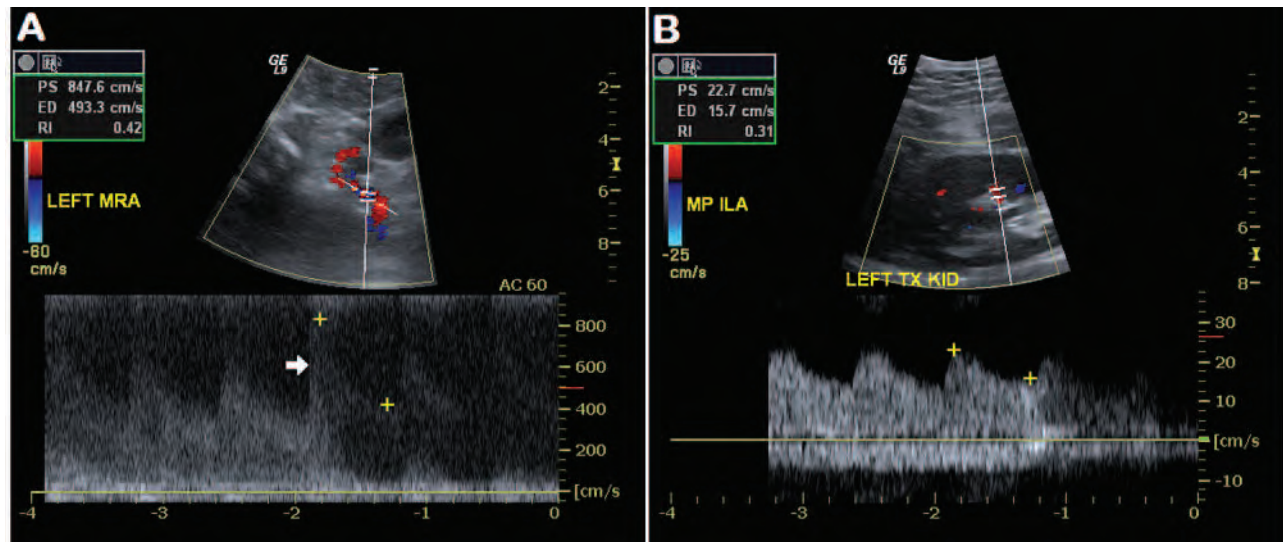


Figure 1. (A) Color Doppler US image showing the renal artery in the region of the anastomosis. Pulsed-wave color Doppler US image showing a peaked systolic waveform (arrow) with short acceleration time in the stenotic segment. Velocity at the prestenotic region is 100 cm/s, and velocity at the stenotic segment is 847.6 cm/s (B) Color Duplex Doppler US image shows a tardus-parvus waveform at level of the intrarenal arteries.



Figure 2. Angiogram obtained with right common iliac access, shows no stenotic segments along the renal vessels.

The patient was managed conservatively, remained asymptomatic (with normal laboratory values), and a creatinine level that kept improving postoperatively (Figure 3). A renal Doppler ultrasound repeated 12 hours later showed normal renal arterial waveforms with an interval decrease in peak systolic velocity, suggesting resolved arterial spasm.

Discussion

The overall incidence of surgical complications after kidney transplant is usually 5% to 10%.⁸ Among

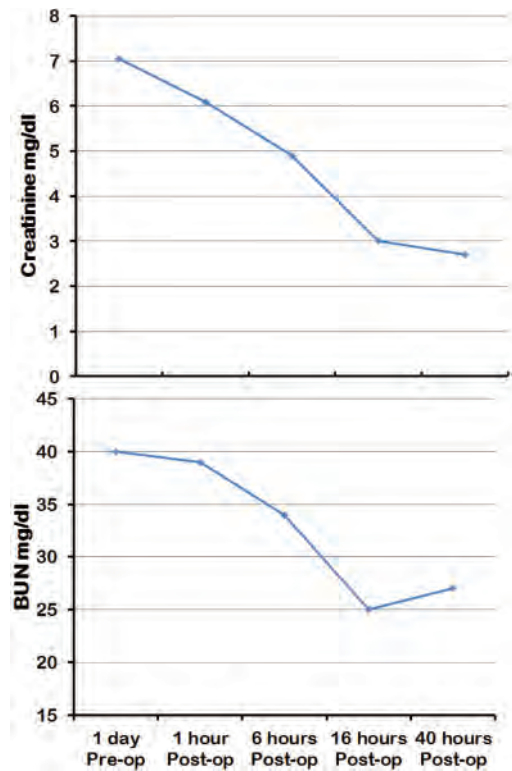


Figure 3. Creatinine (A) and BUN (B) values in the preoperative and postoperative periods.

these, vascular complications (eg, thrombosis and stenosis of the transplant renal artery, hemorrhagic events, and vasospasms)⁹ represent a significant morbidity factor that could affect surgical outcome.¹⁰ Many of these complications are either technical, or associated with vessel torsion, or kinking at the time of graft placement.¹¹

Early diagnosis and appropriate intervention to address potential complications have been demonstrated to be crucial in graft survival.⁸ Thus, Doppler ultrasonography is an excellent noninvasive modality for transplant evaluation early postoperatively. Stenotic segments that appear as regions of focal color aliasing can be further evaluated with duplex Doppler techniques to characterize and grade the abnormality.⁴ In general, a significant reduction in the diameter of the renal vessel is appreciated as peaked waveforms with elevated peak systolic and end diastolic velocities (180 to 200 cm/s or greater), marked distal turbulence (spectral broadening), and the presence of tardus-parvus waveforms.^{4,12}

Endothelial damage and intimal flap may not be visualized with Doppler sonography, and delays in diagnosis may result in renal artery thrombosis and graft loss.⁴ Thus, vascular complications early in the posttransplant period should be much higher on the list of differential diagnoses, and angiographic confirmation is indicated.

In our patient, Doppler sonography revealed peaked systolic and end diastolic waveforms with extremely elevated velocities and an intrarenal tardus-parvus configuration suggesting a vascular stricture. Nonetheless, the patient did not present marked clinical signs. An emergent angiogram done 2 hours after the abnormal Doppler sonography report, allowed us to exclude a deadly disorder before a potential decompensation. Lastly, an adequate patient and graft outcome in association with a normal repeat duplex Doppler ultrasound reading 12 hours later correlated with a transitory renal artery spasm. Such findings permitted us continue a standard postoperative management.

Vasospasm is a common problem in vascular surgeries. It can be associated with hypoperfusion and subsequent organ dysfunction. In renal transplant surgery, vasospasm is a rather rare phenomenon manifested by an acute, transitory onset of mild oliguria and hypertension. Peak Doppler velocities can be up to 4 to 5 times the normal reading. In severe cases (and depending on duration), they can lead to ischemia and thrombosis of the graft. Because postoperative vasospasms reverse with time, supportive therapy is usually effective. Razzaghi, in his study, compared lidocaine and furosemide's affect in treating renal vasospasm suggesting the use of lidocaine as a better agent to

increase early diuresis and improve graft function.⁹ In our patient, the transient vasospasm reversed promptly with no further complications until the present date.

Hyperacute rejection and renal vessel thrombosis are entities associated as well with acute reduction of renal perfusion. Hyperacute rejection becomes evident after the renal artery is unclamped, and is manifested by swelling, cyanotic congestion of the graft, and anuria. Immediate transplant nephrectomy is usually required. On the other hand, renal vessel thrombosis often constitutes a surgical emergency. The treatment of choice is immediate surgical exploration, although thrombolytic therapies could be considered in poor operative candidates. Immediate surgery is required when renal artery thrombosis occurs and despite the best of efforts, nephrectomy is frequently necessary.

Transplant renal artery stenosis is the most-common vascular complication after renal transplant,¹³ although in most instances, it takes place months after the transplant. Clinically, it presents as worsening hypertension and/or renal failure. Transplant renal artery stenosis surgical treatment is associated with a 15% graft loss, a 5% mortality, and carries significant risk to injure the renal hilar structures.¹⁴

In summary, postrenal transplant vascular complications are rare but may represent a significant morbidity factor for both patients and grafts. Doppler ultrasound is the imaging modality of choice in kidney transplant. Peaked wave forms, elevated velocities, and a tardus-parvus configuration are suggestive of vascular pathologies and require aggressive evaluation.

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