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Overcoming the bend: Successful endovascular management of acute-angled transplant renal artery stenosis with angioplasty and stenting

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Abstract

Introduction: Transplant renal artery stenosis (TRAS) remains one of the most frequent vascular complications following renal transplantation, potentially leading to graft dysfunction and refractory hypertension. Endovascular therapy, particularly angioplasty with or without stenting, has become the preferred treatment due to its minimally invasive nature and high technical success rates.

Case Presentation: We report a 35-year-old male who underwent renal transplantation in June 2024 and presented to the interventional radiology department with progressively increasing antihypertensive requirements over three months. He had a history of transplant renal artery stenosis (TRAS) that had been treated with percutaneous balloon angioplasty three months after transplantation. The initial angioplasty resulted in symptomatic relief, with gradual tapering and discontinuation of all antihypertensive medications and normalization of renal Doppler parameters.

However, over the subsequent three months, the patient experienced a recurrence of hypertension, requiring escalation to four antihypertensive agents for adequate control.

Doppler ultrasonography revealed a peak systolic velocity (PSV) of 450 cm/s at the stenotic segment and a renal artery-to-aortic ratio exceeding 4, consistent with significant TRAS.

Intervention: Under general anesthesia, left common femoral artery access was achieved. Angiography demonstrated a tight ostial stenosis at the transplant renal artery with an acute anastomotic angle. After initial predilatation with a 4 × 8 mm balloon, a 4 × 9 mm drug-eluting stent was successfully deployed across the lesion. Post-stenting angiogram confirmed restoration of normal luminal diameter and flow.

Outcome: The patient's blood pressure normalized post-procedure, allowing discontinuation of all antihypertensive medications. Post-stenting Doppler showed normalization of intrarenal waveforms.

Conclusion: Endovascular stent angioplasty offers a safe and effective modality for treating TRAS, ensuring prompt restoration of graft perfusion and blood pressure control while preserving graft function.

Keywords: Transplant renal artery stenosis, angioplasty, stenting, renal transplant, endovascular management, case report

Introduction

Transplant renal artery stenosis (TRAS) is a well-recognized cause of post-transplant hypertension and allograft dysfunction, with reported incidence ranging between 1% and 23% of renal transplant recipients ^[1, 2]. The condition is most commonly related to technical factors at the arterial anastomosis, intimal hyperplasia, kinking, or immunologic vascular injury ^[3].

Early identification and management are crucial, as progressive stenosis can lead to graft ischemia, impaired function, and even loss of the transplanted kidney ^[4].

Noninvasive imaging modalities such as color Doppler ultrasonography, CT angiography, and MR angiography are valuable in diagnosis. However, digital subtraction angiography (DSA) remains the gold standard, allowing both definitive diagnosis and simultaneous therapeutic intervention ^[5].

We present a case of post-transplant hypertension secondary to TRAS successfully managed with angioplasty and stenting, highlighting the procedural technique and clinical outcome.

Case Presentation

Demographics and Clinical History

A 35-year-old male, who underwent a live-related renal transplantation in June 2024, presented to the Interventional Radiology department with gradually increasing antihypertensive requirements over the preceding three months. Initially well controlled on two agents, he required four antihypertensives to maintain normal blood pressure at presentation. He had a history of transplant renal artery stenosis (TRAS) that had been treated with percutaneous balloon angioplasty three months after transplantation. The initial angioplasty resulted in symptomatic relief, with gradual tapering and discontinuation of all antihypertensive medications and normalization of renal Doppler parameters. However, over the subsequent three months, the patient experienced a recurrence of hypertension, requiring

escalation to four antihypertensive agents for adequate control.

Clinical Findings and Investigations

- **Blood pressure:** 120/80 mmHg on four antihypertensive drugs.
- **Serum creatinine:** 1.6 mg/dL (stable).
- No clinical evidence of graft tenderness or bruit.

Doppler Ultrasonography

- Peak systolic velocity (PSV) at the stenotic segment: ~500 cm/s. (Fig.1)
- Post-stenotic velocity: 350 cm/s.
- Renal artery-to-iliac velocity ratio >3. (Fig.2)

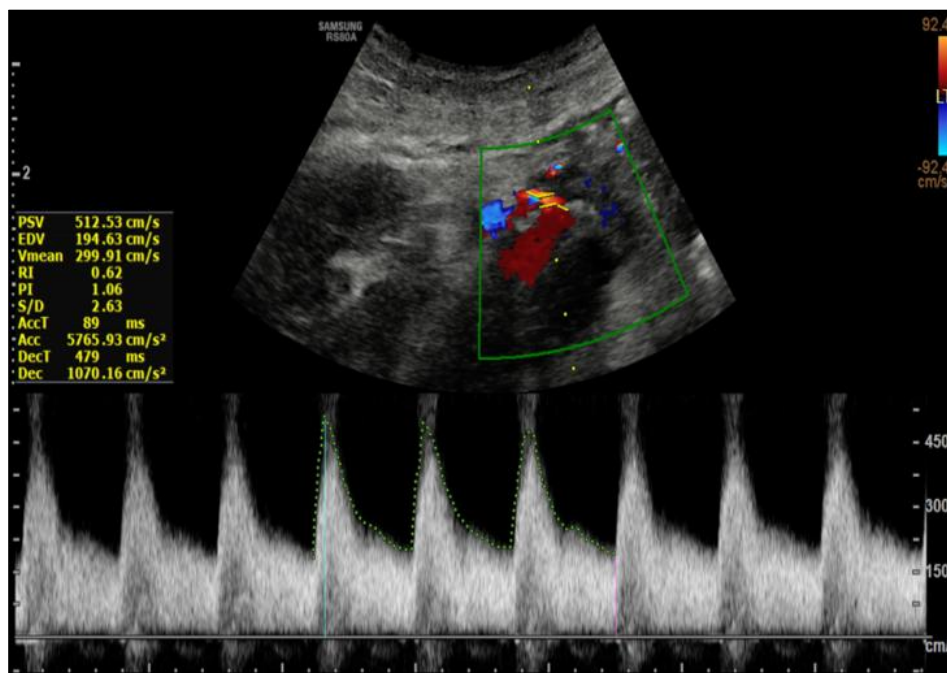


Fig 1: Velocities at the proximal transplant renal artery showing critical stenosis

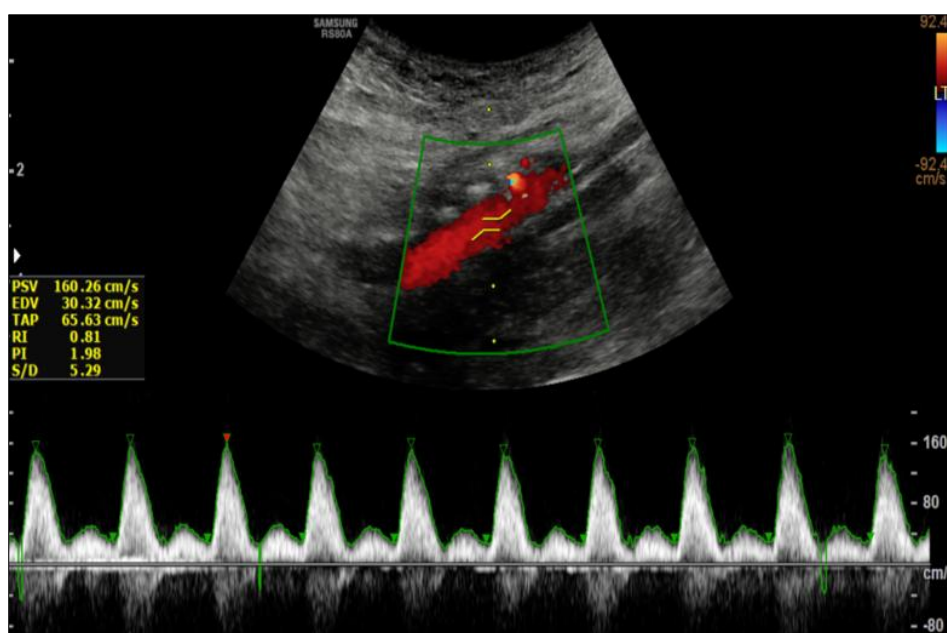


Fig 2: Velocities at the iliac artery demonstrating the renal artery- iliac ratio to be > 3

Intraparenchymal arteries demonstrated *parvus-tardus* waveforms, confirming hemodynamically significant stenosis. (Fig.3).

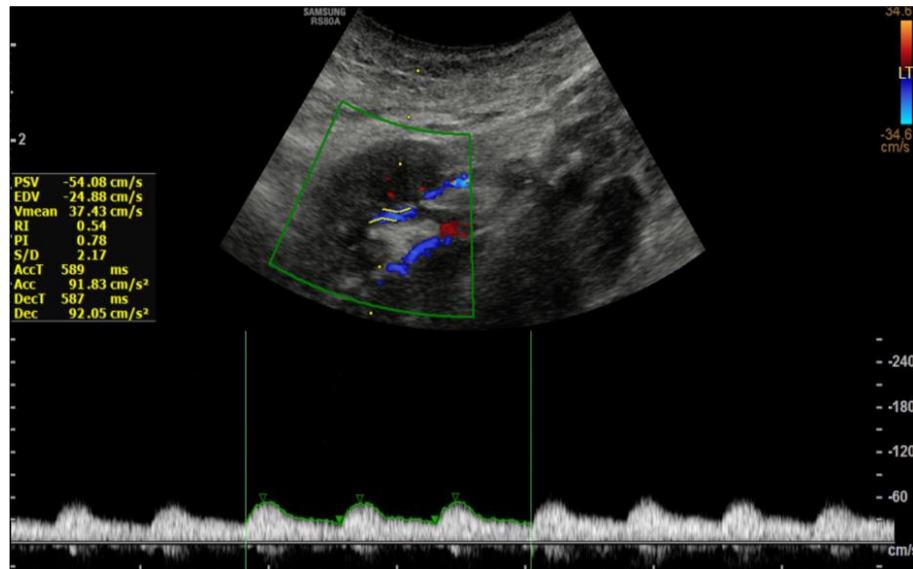


Fig 3: Intra-parenchymal arteries demonstrating parvus tardus waveform

A diagnosis of transplant renal artery stenosis (TRAS) was made, and the patient was planned for transplant renal artery angiography with possible angioplasty and stenting. Pre-procedure loading dose of dual antiplatelets was administered in the form of Clopitab A 150 mg (two tablets).

Diagnostic Assessment

Under fluoroscopic guidance, left common femoral artery access was obtained using a 5 Fr sheath. Crossover to the right iliac system was performed with a 4 Fr Head hunter catheter and 0.035" Terumo wire. Angiography revealed a tight ostial stenosis at the anastomotic site of the transplant renal artery extending approximately 8 mm, associated with an acute anastomotic angle. (Fig.4).



Fig 4: Tight ostial stenosis at the origin of transplant renal artery (Red arrow)

Therapeutic Intervention: The procedure was performed under general anesthesia and aseptic precautions.

Access and Catheterization

The 5 Fr sheath was exchanged for a 6 Fr × 45 cm destination sheath, parked within the right common iliac artery for stable support. Using a 4 Fr H1 catheter and 0.014" BMW guidewire, selective cannulation of the upper polar branch of the transplant renal artery was achieved despite acute angulation. (Fig.5).

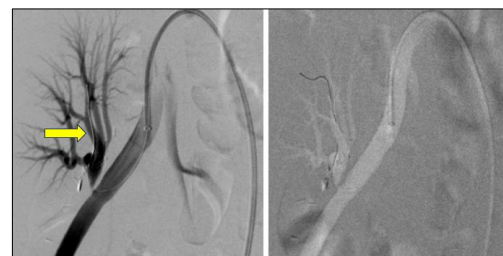


Fig 5: Selective cannulation of upper polar branch of transplant renal artery for adequate purchase. (Yellow arrow)

Balloon Angioplasty

Predilatation was performed using a 4 × 8 mm balloon, with transient improvement in vessel caliber. (Fig.6, 7)

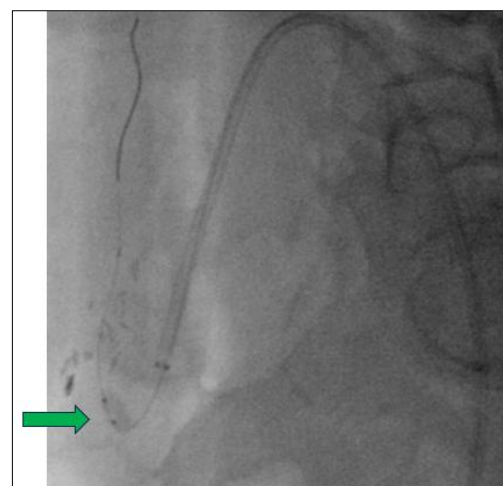


Fig 6: Pre-dilatation with 4 x 8 mm balloon (Green arrow)



Fig 7: Mild to moderate Improvement in vessel caliber (Black arrow)

Stent Deployment

A 4 × 9 mm drug-eluting stent (DES) was deployed across the ostial lesion, ensuring complete coverage of the stenotic segment. (Fig.8, 9).

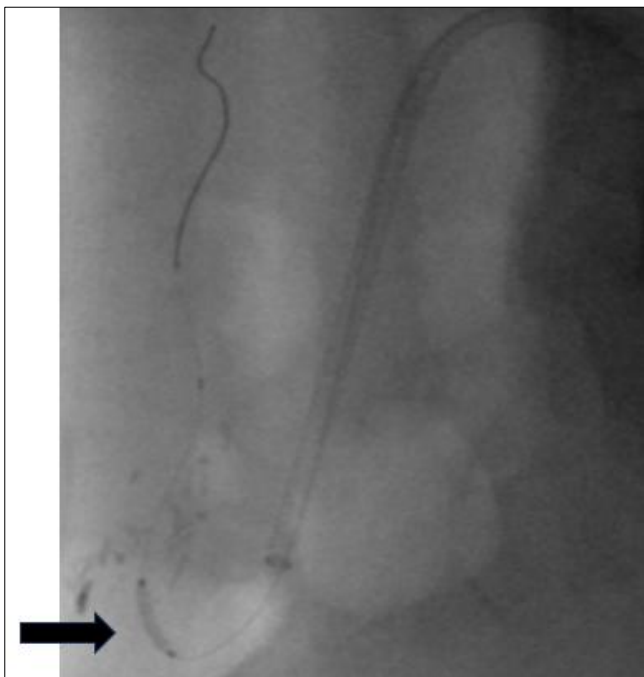


Fig 8: 4 x 9 mm Stent placed across the stenosed segment (Black arrow)

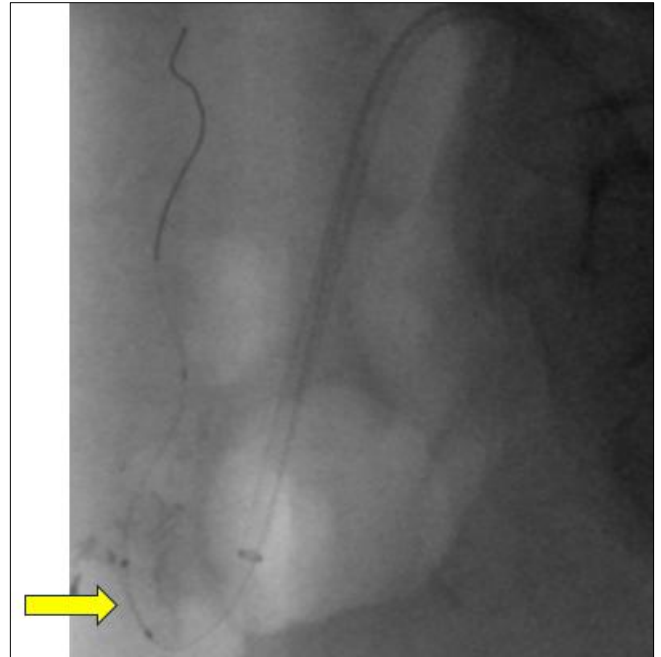


Fig 9: Precisely deployed Stent across the stenosed segment (Yellow arrow)

Post-Stent Angiography

Final angiogram demonstrated free antegrade contrast flow with complete disappearance of the stenotic waist and no residual luminal narrowing with magnified view taken to demonstrate the precise location and expansion. (Fig.10, 11)



Fig 10: Post-stenting angiogram Antegrade normal flow with no residual stenosis. (Red arrow)

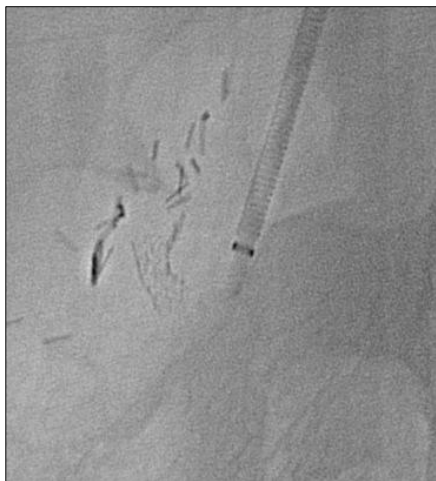


Fig 11: Magnified view of the deployed stent

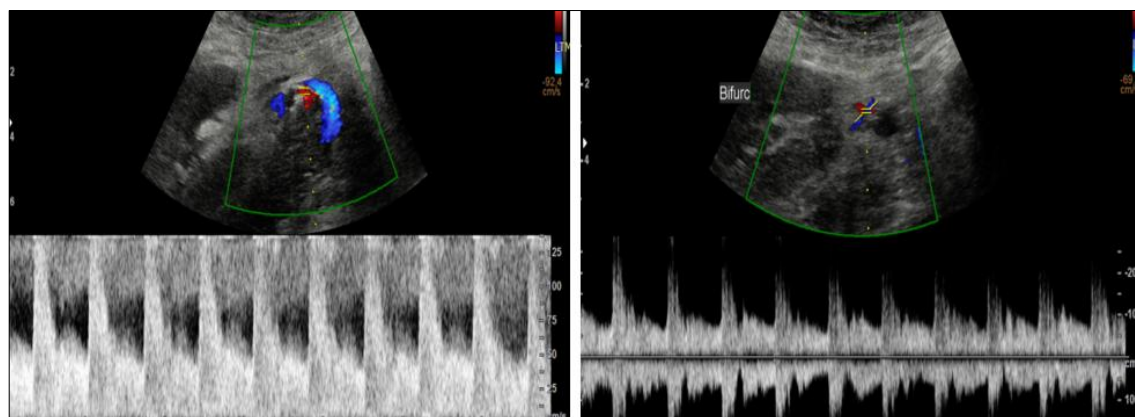


Fig 12, 13: Normal flow velocities in the transplant renal artery (PSV <150 cm/s)

Discussion

TRAS is a major vascular complication that can present as resistant hypertension, worsening graft function, or even flash pulmonary edema [6]. The majority of lesions are anastomotic in location, often related to technical issues such as intimal trauma, suture-induced fibrosis, or kinking at the arterial anastomosis [7].

Historically, surgical revision was the mainstay of therapy; however, percutaneous transluminal angioplasty (PTA) with or without stenting has emerged as the preferred treatment due to lower morbidity and high success rates. Several studies have reported technical success exceeding 90% and clinical improvement in up to 85% of cases [8-10].

Drug-eluting stents are favored over bare-metal variants, especially in small-caliber transplant arteries, as they reduce neointimal hyperplasia and restenosis rates [11]. The case described highlights the importance of careful catheter selection and wire manipulation in tortuous or acutely angled anastomoses, where wire dislodgment is a frequent challenge.

Early recognition and prompt endovascular management restore renal perfusion, reduce ischemic injury, and optimize graft survival. Post-intervention Doppler surveillance remains essential for early detection of restenosis.

Conclusion

Endovascular angioplasty with stenting provides a safe, minimally invasive, and highly effective therapeutic option for transplant renal artery stenosis. In this case, the intervention achieved complete anatomical and functional

Post-Procedure Care

The patient tolerated the procedure well. He was advised strict limb immobilization, TPR/BP monitoring, and continued on dual antiplatelet therapy with Clexane 0.6 mg subcutaneously twice daily for 48 hours.

Outcome and Follow-Up

The immediate post-procedural course was uneventful. The patient's blood pressure normalized, allowing tapering and eventual cessation of antihypertensive medications.

Post-stenting Doppler ultrasonography demonstrated:

- Normal flow velocities in the transplant renal artery (PSV <150 cm/s). (Fig.12, 13)
- Restoration of normal *triphasic* intrarenal arterial waveforms.
- Patent stent with no evidence of restenosis.
- Patient was kept on dual antiplatelet therapy.

restoration, normalization of blood pressure, and sustained graft function.

Patient Perspective

The patient reported significant improvement in well-being and complete withdrawal from antihypertensive therapy following the procedure, expressing satisfaction with the outcome and rapid recovery.

Informed Consent

Written informed consent was obtained from the patient for the procedure and for publication of this case report, including accompanying clinical details and images.

Conflict of Interest

Not available.

Financial Support

Not available.

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