

# Arterial Duplex Values Differ Among Transplant Renal Angiography Patients With and Without Revascularization, Whereas Comorbidities and Demographics Did Not Impact Outcomes

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## Introduction

Renal artery stenosis is the most common vascular complication following kidney transplantation.<sup>1</sup> Percutaneous angiography offers a definitive diagnosis, though it is associated with ionizing radiation exposure, thromboembolism, pseudoaneurysm, and vessel dissection.<sup>2</sup> While numerous studies have investigated traditional duplex parameters of >60% stenosis to reduce unnecessary angiograms, there remains a lack of consensus on the definitive criteria for transplant stenosis.<sup>3,4</sup> Our aim was to evaluate duplex parameters and potential risk factors for angiographically-significant transplant renal artery stenosis.

## Methods

A retrospective review was performed of kidney transplant patients at a single academic center managed with renal duplex screening followed by percutaneous angiography between January 1, 2019 to March 31, 2023. Duplex-derived peak systolic velocities were measured along the donor renal artery, anastomosis suture-line, and recipient iliac artery. Renal-to-iliac artery peak systolic ratios were also obtained. The decision to proceed with renal angiography was based on peak velocities >180-200 cm/s, elevated peak systolic ratios, and other case-specific factors raising high suspicion for transplant stenosis. During renal angiography, subjects with ≥70% angiographic cross-sectional narrowing or mean pullback pressure gradients of ≥10% underwent balloon angioplasty. Both duplex-derived peak systolic velocities and renal-to-iliac artery peak systolic ratios were then correlated with angiographic findings through receiver operating characteristic analysis. Comparisons of basic demographics, screening duplex values, and angiographic outcomes were performed using Student's t-test and  $\chi^2$  analysis.

## Results

Characteristic	No. (%)	
	Diagnostic-Only (n = 8)	Interventional (n = 9)
<b>Basic Demographics</b>		
Age, mean (SEM), years	66.0 ± 3.0	54.0 ± 4.8
Male	4 (50.0%)	8 (88.9%)
<b>Race/Ethnicity</b>		
Caucasian	4 (50.0%)	5 (55.5%)
Hispanic	3 (37.5%)	2 (22.2%)
Other	2 (25.0%)	1 (11.1%)
<b>Patient History</b>		
Anti-Hypertensive Drugs, mean (SEM)	1.9 ± 0.3	1.9 ± 0.4
BMI ≥ 30	2 (25.0%)	3 (33.3%)
Hypertension	8 (100%)	9 (100%)
Hyperlipidemia	3 (37.5%)	3 (33.3%)
Peripheral Artery Disease	6 (75.0%)	2 (22.2%)
Coronary Artery Disease	6 (75.0%)	5 (55.6%)
Diabetes Mellitus	6 (75.0%)	6 (66.7%)
TIA or Stroke	2 (25.0%)	2 (22.2%)
<b>Renal Artery Duplex Findings</b>		
PSV of Renal Artery, mean (SEM), cm/s	271 ± 15	412 ± 38**
PSV of EIA, mean (SEM), cm/s	179 ± 9	240 ± 48
Overall PSV, mean (SEM), cm/s	271 ± 15	426 ± 34**
Renal/EIA Ratio, mean (SEM)	1.5 ± 0.1	2.2 ± 0.4
<b>Procedural Details</b>		
Technical Success	8 (100%)	9 (100.0%)
CO2 Angiography	6 (75.0%)	9 (100.0%)
Iodine Contrast Used, mean (SEM) cc	0.9 ± 0.1	0.7 ± 0.2
Pullback Pressures Obtained	0 (0.0%)	4 (44.4%)
Pressure gradient ≥10 mmHg, %	0 (0.0%)	1 (11.1%)
Angioplasty Count, mean (SEM)	0	1.6 ± 0.3

**Table 1:** Summary of demographics, renal duplex values, and procedural outcomes for patients undergoing renal angiography for concern of transplant stenosis. "Diagnostic-only" refers to patients without evidence of angiographic stenosis, whereas the "Interventional" group includes those who required revascularization.

SEM, standard error of the mean; BMI, body-mass index, TIA, transient ischemic attack; PSV, peak systolic ratio; EIA, External Iliac Artery

\*: p-value < .05

\*\* : p-value < .01

## Conclusions

We observed differences in overall peak systolic velocities ( $p=.0012$ ) and peak transplant renal artery velocities ( $p=.0032$ ) among kidney transplant patients who underwent angiography, with and without revascularization. Factors of demographics, race/ethnicity, number of anti-hypertensives, and comorbidities did not impact interventional outcomes. Further investigations are recommended to define optimal duplex parameters.

## Limitations

This retrospective study is limited by its small sample size and its heavy reliance on the accuracy of patient chart records. The quality of screening duplex and angiographic findings are also highly operator-dependent; therefore, patient selection bias and overgeneralization of results must be considered.

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