Who Is The Right Patient For The Renal Artery Duplex Examination?

Laurence Needleman, MD
Philadelphia, PA

Two approaches

- Identify risk profile for RAS. Can we identify clinical clues to predict RAS?

or

- Study those likely to benefit from revascularization

- New wrinkle: renal denervation
  - "renal denervation presents a novel treatment strategy for patients with **uncontrolled** blood pressure." AHA
  - Patients with RAS greater than 50% have been excluded from trials

Hypertension

AHA SCIENTIFIC STATEMENT

Revascularization for Renovascular Disease: A Scientific Statement From the American Heart Association

Vivek Bhalla, MD, Vice Chair; Stephen C. Textor, MD, Chair; Joshua A. Beckman, MD; Ana I. Casanegra, MD, MS; Christopher J. Cooper, MD; Esther S.H. Kim, MD, MPH; James M. Luther, MD, MSCI; Sanjay Misra, MD, FAHA; Gustavo S. Oderich, MD; on behalf of the American Heart Association Council on the Kidney in Cardiovascular Disease; Council on Hypertension; Council on Peripheral Vascular Disease; and Council on Cardiovascular Radiology and Intervention

Bhalla V, Textor SC, Beckman JA et al. Revascularization for Renovascular Disease: A Scientific Statement From the American Heart Association. *Hypertension*. 2022; 79: e128-e143.

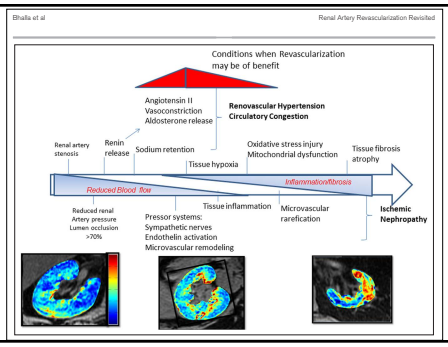

Table 2. Populations and Characteristics Considered for Renal Revascularization

Clinical populations
Unilateral renal artery stenosis with characteristic syndromes (see below)
Fibromuscular dysplasia with hypertension*
High-risk clinical syndromes*
Rapidly progressive hypertension*
Rapidly declining estimated glomerular filtration rate*
Flash pulmonary edema*
Bilateral renal artery stenosis with progressive loss of renal functional mass
Single native kidney renal artery stenosis

Special populations:
Renal allograft: transplant renal artery stenosis with or without calcineurin inhibitors
Episodic, circulatory congestion with bilateral atherosclerotic renovascular disease
Progressive loss of glomerular filtration rate with occlusive atherosclerotic renovascular disease and no other kidney disease (ischemic nephropathy)
Aortic disease with renovascular protection as part of endovascular repair
Left-ventricular assist device
Radiation-induced renovascular disease with clinical syndromes
Other diseases: eg, Takayasu arteritis, extrinsic vascular compression
Pediatric patients with mid aortic syndrome or fibromuscular variants

Renovascular Hypertension

- **Restoring blood flow has not demonstrated overall improved outcomes**
- Renovascular hypertension is a manifestation of renovascular disease. This is a hemodynamic disorder. Ischemic nephropathy indicates permanent scarring from hypoxia, inflammation, fibrosis
- **There are minor hemodynamic effects until 70-80% stenosis**
- Atherosclerotic renovascular disease is present in 6.8% of the population over 65.
- 14-40% of people with PAD have stenosis greater than 50%
- Hypertensives: 0.1-5% renovascular hypertension
- Resistant hypertension (dxed at cardiac cath) is 14-24%
- FMD: renal involvement in 63%, hypertension as presenting signs in 57%
- Other diseases: aneurysm, dissection, comprestion, infraction, mid aortic syndrome, obstruction by stent grafts, transplant obstuction

Suspected FMD

- Particularly women with early-onset
- Accelerated, malignant, resistant hypertension
- Small kidney
- May be 7-8% in hypertensive women younger than 50

Refractory hypertension

- Resistant hypertension is uncontrolled hypertension despite 3 or more hypertensive classes including a diuretic or hypertension requiring 4 or more clases
- *24%* of patients referred for angiography for resistant hypertension have atherosclerotic renovascular disease

Systematic Review

Prevalence and Risk Factors of Renal Artery Stenosis in Patients Undergoing Simultaneous Coronary and Renal Artery Angiography: A Systematic Review and Meta-Analysis of 31,689 Patients from 31 Studies

Konstantin Schwarz [1,3], Ida Straume Bah [2], Maximilian Will [1,4], Chun Shing Kwok [4,5], Julia Mascherbauer [3], Marko Kumric [6], Josko Bozic [6] and Josip A. Borovac [2,7,*]

Schwarz K, Straume Bah I, Will M et al. Prevalence and Risk Factors of Renal Artery Stenosis in Patients Undergoing Simultaneous Coronary and Renal Artery Angiography: A Systematic Review and Meta-Analysis of 31,689 Patients from 31 Studies. *Diseases*. 2024; 12: 208.

Multivessel cardiac disease
13% undergoing catheterization had significant RAS
3.7% bilateral
6.5% severe

Table 3. Clinical factors associated with the risk of RAS occurrence during coronary angiography in CAD patients.

Variable	Risk Ratio (RR)	95% Confidence Interval	*p*-Value	Heterogeneity *
Female sex N = 27 studies	1.27	1.03–1.57	0.030	High I^2 = 92%
Diabetes mellitus N = 28 studies	1.22	1.10–1.36	<0.001	Moderate I^2 = 57%
Arterial hypertension N = 19 studies	1.33	1.21–1.46	<0.001	High I^2 = 94%
Dyslipidemia N = 24 studies	1.10	1.06–1.14	<0.001	Moderate I^2 = 59%
Current smoking N = 24 studies	1.00	0.94–1.06	0.930	Low I^2 = 26%
Chronic kidney disease N = 13 studies	2.62	2.04–3.37	<0.001	Moderate I^2 = 66%
Three-vessel disease N = 17 studies	1.56	1.30–1.87	<0.001	High I^2 = 81%
Left main disease N = 10 studies	1.78	1.28–2.47	<0.001	Moderate I^2 = 52%
Peripheral artery disease N = 13 studies	2.11	1.40–3.16	<0.001	High I^2 = 94%

Characteristics Suggestive of Clinical Benefit from Revascularization

- New-onset hypertension
  - Hypertension less than 1 year had nearly double cure or improvement
  - Duration less than 5 years also had significantly higher cure rate.
    - Lateralized renal increased the likelihood even further
- Nonproteinuric hypertension with unilateral disease.
  - Proteinuria can be a sign of irreversible kidney damage.
- Lateralization of renin activity , especially when associated with short duration of hypertension

Kidney function decline

- 11-22% of patients initiating hemodialysis have bilateral renovascular disease
- Good sign for revascularization when kidney volume exceeds what GFR would suggest.

Other criteria to consider in CKD

- Renal size
  - Less than 7 cm in long dimension unlikely to recover from revascularization
  - Renal volume, cortical size also suggested
    - Normal volume with low function may be favorable
- Biopsy with interstitial fibrosis/atheroemboli unlikely to recover renal function

Validation of a prediction rule for renal artery stenosis

Pieta Krijnen[a], Ewout W. Steyerberg[b], Cornelia T. Postma[a], Karin Flobbe[c], Peter W. de Leeuw[d] and M.G. Myriam Hunink[e,f]

Objectives We previously developed a prediction rule to estimate the probability of renal artery stenosis. This rule should be validated before it can be used reliably to select hypertensive patients for renal angiography. We determined the validity of the prediction rule in recent patients and in other settings.

Design We studied three aspects of validity (agreement between predicted and observed probability of stenosis, discriminative ability, and clinical usefulness) in 180 more were referred for renal angiography, the number of referrals was reduced by 20%, while 9% of patients with a stenosis were missed.

Conclusions The prediction rule was valid in more recently treated patients in other settings. If used conservatively, the rule can reliably exclude a small proportion of patients from angiography. *J Hypertens* 23:1583–1588 © 2005 Lippincott Williams & Wilkins.

Table 1 Prediction rule for quantifying the probability of renal artery stenosis

Predictor	Score[a] Persons who never smoked	Former or current smokers
Age[b]		
20 years	0	3
30 years	1	4
40 years	2	4
50 years	3	5
60 years	4	5
70 years	5	6
Female sex	2	2
Signs and symptoms of atherosclerotic vascular disease[c]	1	1
Onset of hypertension within 2 years	1	1
Body mass index < 25 kg/m^2	2	2
Presence of abdominal bruit	3	3
Serum creatinine concentration[b]		
40 μmol/l	0	0
60 μmol/l	1	1
80 μmol/l	2	2
100 μmol/l	3	3
150 μmol/l	6	6
200 μmol/l	9	9
Serum cholesterol level > 6.5 mmol/l or cholesterol-lowering therapy	1	1

Clinical clues for RAS

- New onset hypertension in patient less than 30 or greater than 55
- Accelerated or resistant hypertension
- Severe hypertension with other areas of known atherosclerosis
- Unexplained deterioration of kidney function on treatment.
- Renal function deterioration after ACE inhibitor, angiotensin receptor blocker, EVAR
- Atrophic kidney (around 8 cm)
- Difference of kidney size more than 1.5 cm.
- Flash pulmonary edema
- Systolic heart failure (54% had evidence of renal artery disease)
- Abdominal bruit

Characteristics suggestive of clinical benefit from revascularization
Recent onset or exacerbation (<1 y) of hypertension*
Absence of proteinuria*
Identifiable activation of renin-angiotensin system*
Hyperreninemia*
With unilateral renal artery stenosis, lateralization of renal vein renin*
Younger age
Radiographic evidence of progressive renal artery occlusion
Treatment-resistant hypertension (documentation of hypertension by ambulatory blood pressure and medication adherence)
Angiotensin-dependent glomerular filtration rate

Bhalla V, Textor SC, Beckman JA et al. Revascularization for Renovascular Disease: A Scientific Statement From the American Heart Association. *Hypertension*. 2022; 79: e128-e143.