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Renal Artery Stenosis: Optimizing Diagnosis and Treatment

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Abstract Renal artery stenosis (RAS) is the most commonly caused by atherosclerosis, with fibromuscular dysplasia being the most frequent among other less common etiologies. A high index of suspicion based on clinical features is essential for diagnosis. Revascularization strategies are currently a topic of discussion and debate. When revascularization is deemed appropriate, atherosclerotic RAS is most often treated with stent placement, whereas patients with fibromuscular dysplasia are usually treated with balloon angioplasty. Ongoing randomized trials should help to better define the optimal management of RAS. (Prog Cardiovasc Dis 2011;54:29-35)

Keywords: Renal artery stenosis; Stent; Peripheral vascular disease

Renal artery stenosis (RAS) is somewhat unusual as a vascular disorder, although renal artery ischemia can present as one of several overlapping clinical syndromes. Although several disease states can cause RAS (Table 1), most patients are affected by atherosclerotic lesions, with fibromuscular dysplasia (FMD) being a distant second cause. Atherosclerosis typically occurs in older individuals, may present with hypertension or renal insufficiency, and has an equal prevalence in men and women. In contrast, FMD is more often seen in young women and is usually associated with hypertension without renal insufficiency.[1]

Diagnosis

With an understanding of the etiologic possibilities, consideration of the diagnosis of RAS should incorporate an understanding of the likely etiology (Table 2). One example would be a young (<35 years old) woman who presents with resistant hypertension and normal renal function. It is reasonable to proceed with a noninvasive screening study such as duplex ultrasound to rule out renovascular disease. A second example would be an older man with known atherosclerotic coronary artery disease who has difficulty in controlling hypertension and mild chronic kidney disease. He should be evaluated for atherosclerotic RAS with a noninvasive screening test.

Screening for atherosclerotic RAS

A limited literature addresses the clinical factors that are predictive of finding atherosclerotic RAS and that may be useful in guiding appropriate screening. One of the early efforts, by Krijnen and coworkers[2] in 1998, described clinical characteristics that were predictive of a RAS with imaging. Importantly, in a follow-up publication in 2005, the results from the earlier work were validated. In brief, the authors demonstrated that older age, smoking history, and an elevated serum creatinine were significant predictors of atherosclerotic RAS in both the development and validation samples.[3]

Several other investigators have evaluated the use of abdominal angiography at the time of cardiac catheterization, specifically focusing on the "risk factors" that are

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Abbreviations and Acronyms

ACC = American College of Cardiology

ACE = angiotensin-converting enzyme

AHA = American Heart Association

ARB = angiotensin receptor blockers

CTA = computed tomography angiography

FMD = fibromuscular dysplasia

MRA = magnetic resonance angiography

RAS = renal artery stenosis

predictive of finding angiographically significant RAS. Cohen et al[4] demonstrated that elevated serum creatinine, advanced age, peripheral vascular disease, multiplicity of cardiovascular medications, hypertension, female gender, and multivessel coronary artery disease were important (Fig 1). Others have described factors including multivessel coronary disease, diabetes, carotid disease, abdominal bruit, pulmonary edema, and advanced age as factors.[5] Several have created risk scores to predict which patients are likely to benefit from screening.[4,5]

A number of expert panels have evaluated the topic of screening for RAS. The first was part of the American Heart Association/American College of Cardiology (AHA/ACC) guidelines committee on peripheral vascular disease, and the second was a committee assembled by the AHA to evaluate screening at the time of cardiac catheterization.[6,7] The guidelines for screening are summarized in Table 3.

Diagnostic methods

Invasive angiography has been considered the "gold standard" for the diagnosis and evaluation of RAS. Currently, the most commonly used methodology is intra-arterial digital subtraction angiography.[8] Carbon dioxide can be used for intra-arterial angiography,[9] but image quality is reduced, and this may create greater uncertainty about lesion severity unless combined with judicious use of iodinated contrast.[10]

Table 1
Causes of main RAS

FMD
Atherosclerosis
Traumatic thrombosis or avulsion: usually due to blunt trauma
Nontraumatic thrombosis: hypercoagulable states
Thromboembolism
Renal or aortic dissection
Renal artery aneurysm
Congenital
William syndrome
Takayasu arteritis

Table 2
Increase risk of RAS

- Onset of hypertension ≤30 or ≥55 y
- Malignant, accelerated, or resistant hypertension
- Unexplained renal dysfunction
- Development of azotemia with an ACE inhibitor or ARB medication
- Unexplained size discrepancy of ≥1.5 cm between kidneys
- Cardiac disturbance syndrome (flash pulmonary edema)
- Peripheral arterial disease (abdominal aortic aneurysm or ABI <0.9)
- Multivessel coronary artery disease

Abbreviation: ABI, Ankle Brachial Index.

Duplex ultrasonography is an excellent screening test for RAS because it is nontoxic, involves no exposure to ionizing radiation, and, in capable hands, is reliable.[11] The major limitation to this method is its dependence on technician skill for acquisition of adequate images. In duplex ultrasound, peak systolic and end-diastolic velocities of the renal artery as well as the ratio of velocities in the renal artery to the aorta are obtained. Sensitivities of 92.5% to 98% and specificities of 96% to 98% have been reported.[12,13] A number of factors may limit image quality and, thus, the diagnostic accuracy of the test including obesity, bowel gas, and recent food intake.

Magnetic resonance angiography (MRA) and computed tomography angiography (CTA) are both noninvasive imaging methods that can visualize RAS (Fig 2). A meta-analysis by Vasbinder suggests that duplex ultrasonography is inferior to MRA and CTA; however, the safety of duplex ultrasonography makes it ideal as an index strategy

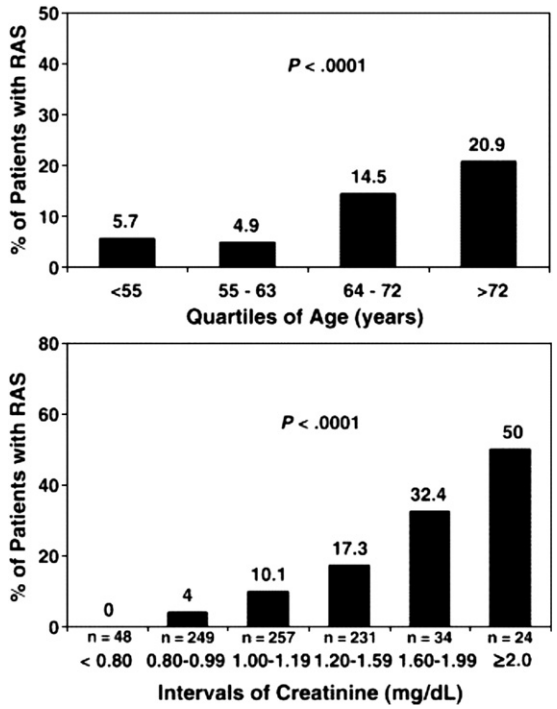

Fig 1. Relationship of age and creatinine with the prevalence of significant RAS. From Cohen et al.[4]