Renal Artery Stenting

Device recommendations for RAS.

BY THOMAS A. SOS, MD


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ACCESS SITES

- >90% femoral artery
- High brachial artery for very difficult or no femoral access (occluded abdominal aorta or iliac arteries, etc.)

DIAGNOSTIC DEVICES

- Arterial puncture
- 95%: PulseView needle (AngioDynamics, Queensbury, NY); a diaphragm in the hub prevents free blood from entering the work environment; pulsations in a side arm tube indicate successful arterial entry.
- 5%: Micropuncture set with or without ultrasound guidance.

Guidewire

- .035-inch Bentson wire (Cook Medical, Bloomington, IN) is used for vascular entry and for initially entering the renal artery. An angled hydrophilic wire is rarely necessary.

Aortogram

- 4-F OmniFlush catheter (AngioDynamics, Inc.): See Tips & Tricks.

Selective Renal Artery Catheterization

- Recurve-type diagnostic catheter, such as the Sos Omni Selective (AngioDynamics, Inc.)

Sheath

- A 5-F or 6-F Ansel (Cook) or similar 35-cm- to 50-cm-long sheath is used with the diagnostic catheters and the .014-inch X 8-inch and .035-inch stent systems, respectively.

INTERVENTIONAL DEVICES

Renal Artery Embolic Protection

- I do not use one; a nontraumatic and effective filter appropriate for the renal artery has yet to be devised.

Guidewires for Angioplasty/Stenting

- .035-inch system: TAD II (Covidien, Hazelwood, MO) has a stiff, shapeable shaft, soft tapered platinum tip. Rarely, hydrophilic guides are used.
- .014-inch/.018-inch system: Ironman (Boston Scientific Corporation, Natick, MA)

Angioplasty Balloon Catheters

- Usually over-the-wire or rapid-exchange/monorail types are used.

Stents

- .035-inch: OmniFlex (AngioDynamics, Inc.). These are very vessel-conformable platinum alloy nonferrous and are therefore MR-transparent stents.
- .014-inch/.018-inch: We prefer vessel-conformable stents.

Tips & Tricks

Accurate Imaging and Stent Placement

Procedural notes for stent placement in the renal arteries.

GUIDEWIRE

A .035-inch Bentson straight long floppy-tipped wire is our universal access wire. If the tip is caught under a plaque, the wire tip will not move further to dissect it, but rather this wire is soft enough to form a loop, which herniates past the plaque and leads with this atraumatic loop into the aorta. As the loop continues to herniate into the aorta, the wire tip is eventually pulled out from under the plaque into the aorta as the loop is advanced. Therefore, it is almost impossible to dissect a very diseased iliac artery. Rarely are curved or straight hydrophilic guidewires necessary.

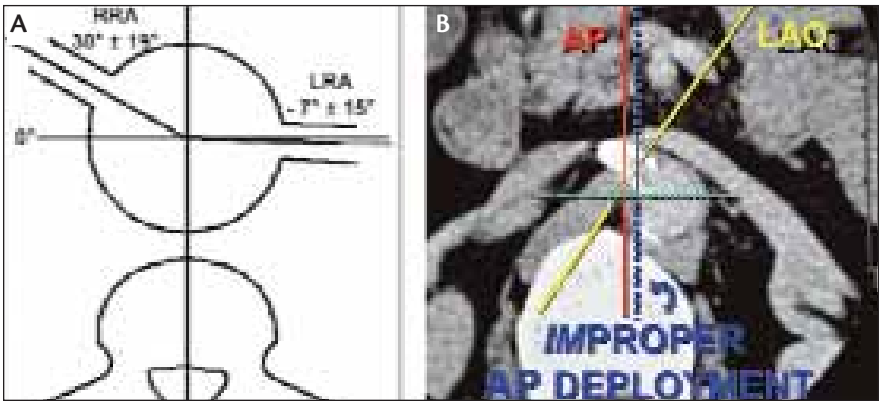

Figure 1. The sagittal origins of the renal arteries from the aorta (A, B).

AORTOGRAM

A 4-F OmniFlush nonreflux flush catheter without a sheath is initially used to avoid a larger-than-necessary entry hole, unless previous imaging and physiologic studies have confirmed a high likelihood of a significant renal artery stenosis. If a significant lesion is likely, a 5-F–long guiding sheath, which will allow introduction of diagnostic and interventional devices, is placed initially (Figures 1 and 2).

For imaging the aortorenal anatomy, the sideholes of the catheter should be at the T12-L1 interspace (the renal arteries typically arise at the top of the L1 vertebral body). Nonreflux flush catheters avoid flow of contrast cephalad to the catheter, thus avoiding dilution, filling of undesired vessels (celiac and superior mesenteric arteries), and concentrate contrast in the area of interest. Using good digital subtraction imaging and the catheter technique described previously, it is possible to obtain an aortogram using a total of only 10 mL of half-strength iodinated contrast medium injected at 10mL/s (equivalent to only 5 mL of full-strength contrast). To avoid having to obtain multiple aortograms, it is important to use the appropriate obliquity, usually approximately 20° to 30° left anterior oblique (LAO) for the right and anteroposterior (AP) for the left renal artery ostium. If the anatomy is not known from previous cross-sectional imaging, a 15° LAO projection is a good compromise.

An analysis of 150 CT scans showed that the right renal artery arises approximately 30° ventrally, and the left renal artery arises almost laterally from the aorta in the axial plane. Therefore, for imaging of ostial stenoses and stent deployment for the right renal artery, an approximately 30° LAO projection (the exact angle can be determined from an axial MRA or CTA) must be used. If the vertical beam is used for stent deployment, the stent will be placed improperly, and it will not cover the ostium into the aorta (dotted vertical line).

SELECTIVE RENAL ARTERY CATHETERIZATION

Recurve-type diagnostic catheters (Sos Omni Selective, shepherd's crook, etc.) allow easy access even to renal arteries, which are frequently steeply downward oriented (Figure 3). Note that this type of catheter should never be moved caudally in the aorta with only a few centimeters of wire extending from the tip. To move it caudally, approximately 10 cm of floppy Bentson wire should lead; the wire forms a smooth nontraumatic arc against the aortic wall. Once the catheter is below the renal artery, approximately 1 to 2 cm of the floppy tip of the Bentson wire should extend from the catheter tip. Initial renal artery entry should be achieved by advancing the catheter/wire combination cephalad in the same plane as the renal artery arises from the aorta. The tip of the wire will enter the funnel-like ostium with a prominent flick. The wire can then be advanced through the stenosis followed by the diagnostic catheter. This technique avoids unnecessary multiple nephrotoxic contrast hand injections and minimizes catheter manipulation while searching for the ostium in the diseased abdominal aorta, which can result in cholesterol embolization. The translesional pressure gradient should then be measured, and antispasmodic medication should be given. If a "filter" is desired, it can be introduced then, or alternatively, stenting can be continued with a .035-inch or .014-inch/.018-inch low-profile system.

STENTING

To avoid improper stent placement, especially leaving the ostium uncovered, stents should be deployed in the obliquity that best profiled the lesion on diagnostic imaging, and at least 1 to 2 mm should extend into the aorta and past the stenosis (Figure 1B).

.035-Inch System

Exchange for a short floppy-tipped, stiff-shaft wire (TAD II), which can be precurved to fit the aortorenal angle. A thin-walled 6-F–long sheath with a very tapered tip introducer is advanced gently across the lesion, the introducer is withdrawn, and the stent is advanced to the proper position across the stenosis. The sheath is withdrawn into the aorta, and the stent position is confirmed by an arteriogram using 5 mL of half-strength contrast injected at 7 mL/s.

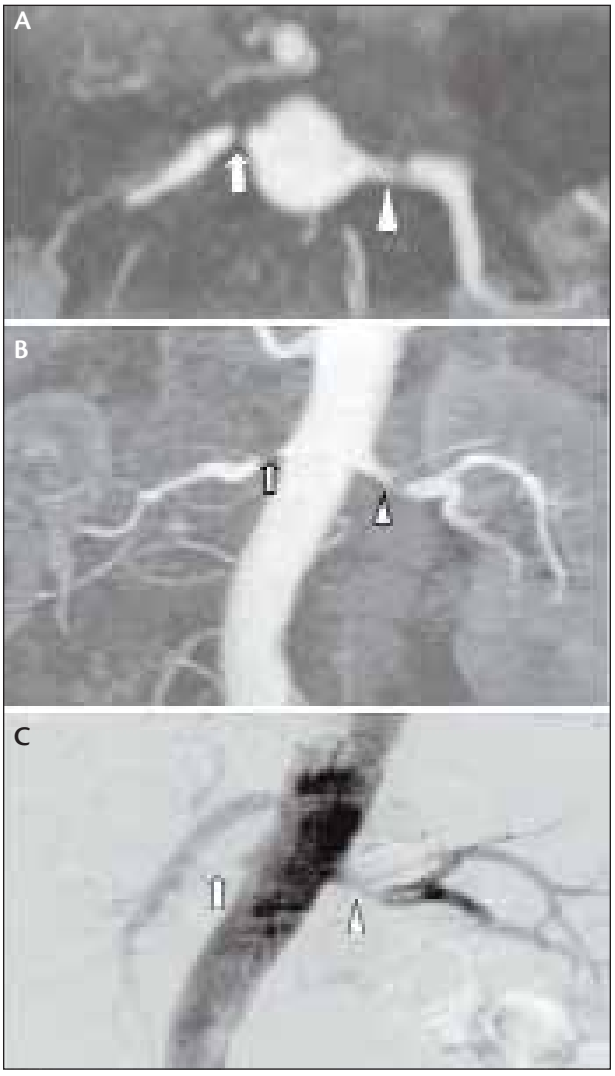

Figure 2. Proper obliquity for diagnosis of ostial right renal artery stenosis (vertical arrow). Note also presence of proximal left renal artery stenosis (arrowhead). Axial MRA (A), 25° LAO MRA (B), 25° LAO DSA aortogram using a nonreflux flush catheter and only 10 mL of half-strength iodinated contrast (equivalent to 5 mL of full-strength contrast) (C).

.014-Inch/.018-Inch System

A stiff-shaft wire with a short soft tip (Ironman) is introduced with its tip until the tip begins to accordion; it is then pulled back approximately 1 cm. The desired stent is introduced over the wire through the long 5-F sheath with the tip kept in the aorta just below the renal artery. The stent can be on a rapid-exchange or double-lumen type catheter. Predilation is rarely necessary.

CONCLUSION

Intervention for atheromatous renal artery stenosis must be performed with special attention to limiting nephrotoxic iodinated contrast and unnecessary manipulation in the diseased aorta and renal artery, especially in patients with ischemic nephropathy. ■

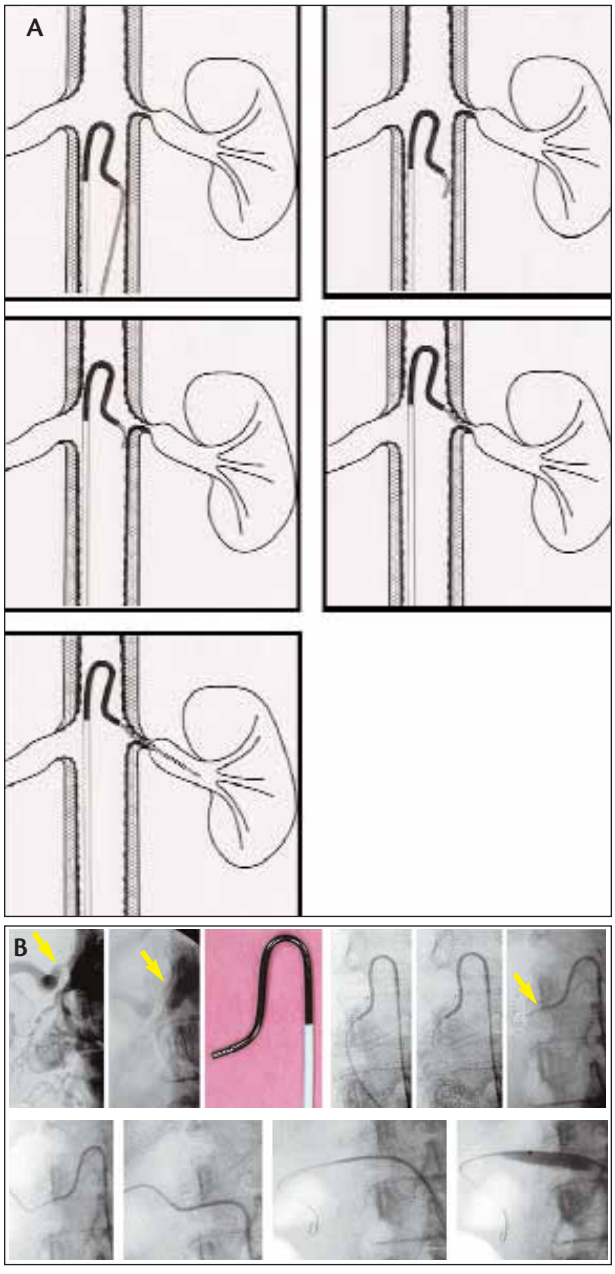

Figure 3. Crossing a renal artery stenosis with the wire "flick" technique for entering the stenotic renal artery. A diagram (A) and radiographic images (B) illustrating the use of the flick (arrows) and stenting.

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