Combining Embolic Protection and the No-Touch Technique

How a combination of two techniques can be used for successful and safe renal artery revascularization.

BY ANDREW HOLDEN, MBChB, FRANZCR

A procedure-related deterioration in renal function after renal artery stent revascularization occurs at an incidence of 10% to 20% in many reported series.[1,2] Many authors have postulated that atheromatous embolization is a major cause of this acute decline in renal function. Techniques to minimize the incidence and impact of atheromatous embolization during renal artery revascularization have received increased attention and include the use of embolic protection devices and the "no-touch" technique. In this article, the feasibility of combining these two techniques will be demonstrated and the potential benefits discussed.

TECHNIQUE

Before a renal artery revascularization is performed, noninvasive imaging (computed tomographic or magnetic resonance angiography) should be reviewed to define the best projection to profile the renal artery ostia. This would then be the working projection during the revascularization procedure, avoiding additional angiographic runs. Initial aortography with a pigtail catheter is still recommended so that the renal artery ostia can be superimposed over osseous structures (Figure 1A). This reduces subsequent catheter manipulation and contrast dose.

All subsequent catheter exchanges and manipulations are performed to minimize the risk of renal artery atheroembolization. The pigtail catheter is initially exchanged over a stiff guidewire for a long sheath, positioned in the infrarenal aorta (Figure 1B). This maximizes torque control of the subsequently introduced and appropriately shaped guide catheter. Guide catheter selection is again influenced by aortorenal artery anatomy as demonstrated on noninvasive imaging. The guide catheter is advanced over its central dilator into the suprarenal aorta. Before removing the central dilator, the stiff guidewire is exchanged for an 0.018-inch Thruway guidewire (Boston Scientific Corporation, Natick, MA); this is stiff enough to keep the guide catheter tip away from the aortic wall but does not straighten the curve of the guide catheter (Figure 1B). The guide catheter is then withdrawn and gently rotated to profile the renal artery ostium. An embolic filter guidewire is manipulated through the stenosis (Figure 1C) and deployed in the distal main renal artery (Figure 1D). A balloon-expandable stent is introduced over the filter guidewire with small volumes of contrast injected through the guide catheter lumen to confirm accurate stent positioning (Figure 1E). Before the stent is deployed, the aortic guidewire is removed because this may alter final positioning of the stent (Figure 1F). The stent is then deployed with the embolic filter in place, the renal artery aspirated for embolic debris, and the filter recaptured (Figure 1G).

This procedure can be performed using a distal embolic filter mounted on a guidewire or delivered over a pre-existing guidewire (Figure 2). Initial passage of a 0.014-inch guidewire separate to the filter allows a lower crossing profile and better torque control for manipulation through severe stenoses. The separate guidewire-filter system is probably technically easier to use in this situation.

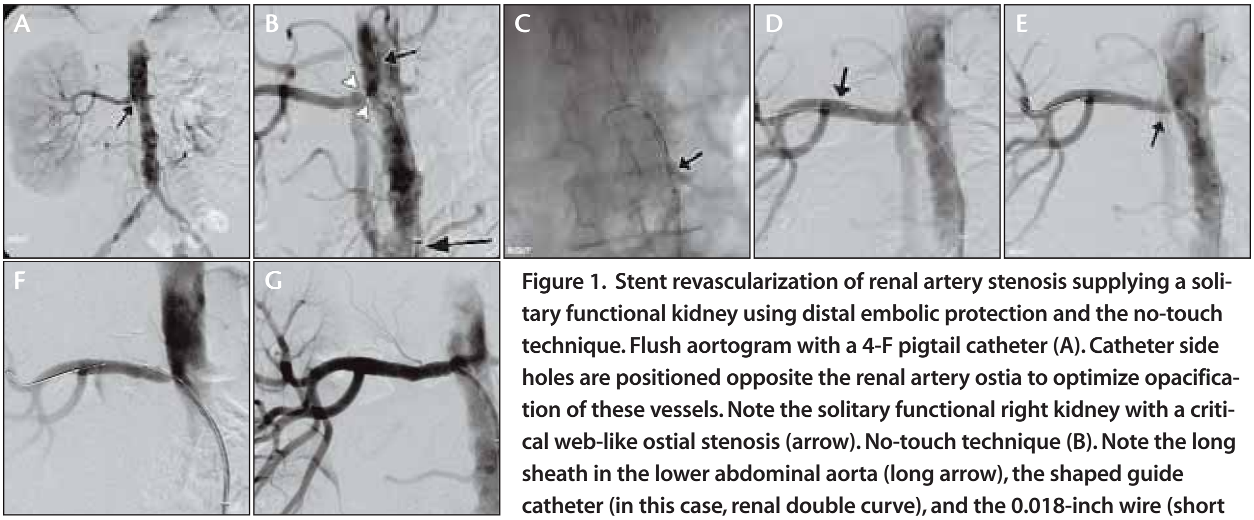

Figure 1. Stent revascularization of renal artery stenosis supplying a solitary functional kidney using distal embolic protection and the no-touch technique. Flush aortogram with a 4-F pigtail catheter (A). Catheter side holes are positioned opposite the renal artery ostia to optimize opacification of these vessels. Note the solitary functional right kidney with a critical web-like ostial stenosis (arrow). No-touch technique (B). Note the long sheath in the lower abdominal aorta (long arrow), the shaped guide catheter (in this case, renal double curve), and the 0.018-inch wire (short arrow) that keeps the catheter tip away from the aortic wall, preventing embolization. The renal artery ostial stenosis is well demonstrated (arrowheads). The tip of the AngioGuard embolic filter (Cordis Corporation, Bridgewater, NJ) 0.014-inch guidewire is coaxially advanced into the proximal main renal artery (C). Note the embolic filter in the guide catheter (arrow). AngioGuard embolic filter deployed in the distal main renal artery (arrow) (D). A Cordis Genesis balloon-expandable stent (arrow) is introduced over the filter guidewire and accurately positioned (E). The aortic guidewire is removed before the stent is deployed (F). Completion angiogram after stent deployment and filter recapture (G).

Figure 2. Stent revascularization of renal artery stenosis in an early branching renal artery using distal embolic protection and the no-touch technique. Early branching right renal artery with a high-grade stenosis (A). An 0.018-inch aortic guidewire facilitates a no-touch technique (long arrow). The 0.014-inch renal guidewire has been advanced into the larger upper pole lobar artery (short arrow). An Emboshield embolic filter (Abbott Vascular, Santa Clara, CA) is advanced separately over the pre-existing 0.014-inch guidewire and deployed in the lobar artery (arrow). After removal of the aortic guidewire, an Abbott Herculink Elite balloon-expandable stent is deployed (C). Completion angiogram after retrieval of the embolic filter (D).

DISCUSSION

The results of published randomized controlled trials and meta-analyses of quality observational trials have shown that the treatment of all-comers with renal artery stenosis using stent revascularization may not offer a benefit over medical therapy in terms of blood pressure control or renal preservation.[3-5] However, in almost all published series, a subgroup of patients have clearly benefitted from stent revascularization—these patients can be termed the "favorable responders." There are a number of clinical and anatomical parameters that can be used to identify favorable[6] and unfavorable[7] responders (Tables 1 and 2).

Once favorable responders are identified, it is important to revascularize these patients as safely as possible. Important adjuvant techniques include periprocedural intravenous hydration, minimizing iodinated contrast volumes, and the antioxidant N-acetylcysteine. A procedure-related significant deterioration in renal function after renal artery stent revascularization occurs in 10% to 20% of cases. The likely etiology is atheromatous embolization occurring as a result of manipulation and disruption of atheromatous plaque at the renal artery ostium.

Atheroembolization occurs during manipulation of the atheromatous renal artery ostium in ex vivo[8] and clinical studies.[9-11] These clinical studies have shown distal embolic protected renal artery stent revascularization is

TABLE 1. FAVORABLE CLINICAL AND ANATOMICAL PARAMETERS FOR RENAL ARTERY REVASCULARIZATION
• Severe renal artery stenosis (≥ 80% diameter loss)
• Sudden onset of hypertension
• Hypertension resistant to medical therapy
• Recent and progressive decline in renal function
• Patients requiring global revascularization
• Significant decline in renal function when commenced on an ACE inhibitor

TABLE 2. UNFAVORABLE CLINICAL AND ANATOMICAL PARAMETERS FOR RENAL ARTERY REVASCULARIZATION
• Medically well-controlled hypertension
• Elderly patients (> 80 years)
• Severe chronic renal impairment (estimated glomerular filtration rate < 20 mL/min)

technically feasible and is associated with a high yield of embolic particles of varying sizes. Single-center, prospective, nonrandomized trials have reported excellent results for renal preservation when stent revascularization is combined with embolic protection, possibly superior results to historical series of unprotected stent revascularization. However, the only randomized controlled trial reported to date, the small RESIST trial, showed that the used of embolic protection devices was associated with significantly improved renal function only when combined with abciximab.[12] This suggests that current filter devices may result in platelet activation, which may potentially offset the advantage of embolic capture.

The no-touch technique has been developed in an attempt to minimize catheter manipulation of the atheromatous renal artery ostium and prevent embolization.[13] In the original descriptions, a 0.035-inch guidewire was used as the aortic wire, but in this description, a 0.018-inch guidewire is used. The smaller-caliber guidewire is strong enough to keep the tip of the guide catheter away from the aortic wall, maintains catheter shape, and allows more space in the catheter lumen for delivery of an embolic filter and stent. Although the no-touch technique has not been proven to be beneficial in any randomized trial, there is no doubt that catheters and guide wires can catch and disrupt atheromatous plaque at the renal artery ostium during revascularization procedures, potentially with deleterious consequences.

It is important that procedures are not made more complex without supportive evidence of a benefit. Procedural complexity can result in prolongation of procedure time, and procedural complications that may offset any perceived advantages. Fortunately, the addition of the no-touch technique can make embolic protected renal artery revascularization technically easier because the guide catheter can be manipulated into an optimum position opposite the renal artery ostium with relative freedom.

CONCLUSION

Although stent revascularization is not beneficial in all patients with atherosclerotic renal artery stenosis, a group of "favorable responders" do benefit from revascularization. In these patients, it is important to minimize the risks associated with treatment, especially atheromatous embolization. Combining embolic protection with the no-touch technique is feasible and may result in a lower embolic burden to the renal vasculature. ■

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