Complications of Renal Artery Stenting

Diagnosis and management of stent malposition and antegrade arterial dissection.

BY ANDREW HOLDEN, MBChB, FRANZCR

A 48-year-old woman presented with difficult-to-control hypertension despite triple antihypertensive therapy and mild chronic renal insufficiency (CRI) with a serum creatinine of 112 umol/L (1.3 mg/dL) (normal 40–100 umol/L [.5–1.1 mg/dL]). The patient experienced a significant rise in serum creatinine level when commenced on an ACE inhibitor that was then discontinued. An MR angiogram showed an atherosclerotic critical ostial right renal artery stenosis, and the patient was referred for endovascular revascularization.

An initial abdominal aortogram confirmed the critical right renal artery stenosis with poststenotic dilatation (Figure 1). A renal double-curve guide catheter was then introduced, and a 15° left anterior oblique projection was selected to optimally profile the right renal artery ostium (Figure 2). Intra-arterial heparin (5,000 IU) was injected via the guide catheter to achieve an activated clotting time >250 seconds. One hundred micrograms of intra-arterial glyceryl trinitrate was also injected. In view of the mild CRI, embolic protection was used with primary passage of a distal filter, the FilterWire EZ (Boston Scientific Corporation, Natick, MA). The ostial stenosis was predilated to a diameter of 4.3 mm at 12 atm (Figure 3). Subsequently, the stenosis was stented using a 6-mm X 15-mm balloon-expandable Palmaz Blue stent (Cordis Corporation, Warren, NJ) and dilated to a diameter of 5.4 mm at 6 atm (Figure 4).

Completion angiography revealed two complications: distal malposition of the stent with the ostial stenosis not adequately treated and extensive antegrade dissection of the main renal artery distal to the stent (Figure 5).

Figure 1. An abdominal aortogram shows the high-grade ostial right renal artery stenosis with a degree of poststenotic dilatation.

Figure 2. A renal double-curve guide catheter was positioned at the right renal artery ostium in a 15° left anterior oblique projection. This projection optimally profiles the right renal artery ostium relative to the aortic wall.

INITIAL COMPLICATION MANAGEMENT

The distal stent malposition was initially treated with a 6-mm X 12-mm balloon-expandable Palmaz Blue stent. This was deployed more proximally and again dilated to a diameter of 5.4 mm at 6 atm (Figure 6). The proximal stent extended into the aortic lumen, covering the ostial

Figure 3. Predilatation of the right renal artery stenosis shows an embolic filter deployed in the distal right main renal artery.

Figure 4. Stenting of the proximal right main renal artery using a 6-mm X 15-mm balloon-expandable stent dilated to a diameter of 5.4 mm.

Figure 5. Completion angiography demonstrating two complications: distal malposition of the stent with the ostial stenosis not adequately treated and extensive antegrade dissection of the main renal artery distal to the stent.

Figure 6. A second stent is deployed more proximally to adequately treat the ostial stenosis.

stenosis (Figure 7). The distal dissection was associated with arterial dilatation over a considerable length of the main renal artery. To control this, an 8-mm-diameter, 30-mm-long nitinol self-expanding Precise stent (Cordis Corporation) was deployed without balloon dilatation (Figure 8). A further 100 µg of intra-arterial glyceryl trinitrate was injected to control spasm at the embolic filter landing zone. Completion angiography demonstrated satisfactory control of the dissection (Figure 9). The embolic filter was recaptured with no persistent arterial abnormality at the filter landing zone (Figure 10). The filter contained macroscopic debris, including atheromatous fragments and thrombus.

SUBSEQUENT MANAGEMENT AND FOLLOW-UP

The patient was managed with overnight intravenous hydration. Her serum creatinine level the next day was normal (86 umol/L). CT angiography performed on the second day after intervention demonstrated a patent right main renal artery with an adequately treated renal artery ostium and no evidence of a persistent dissection (Figure

Figure 7. After deployment of a second stent, the ostial stenosis is adequately covered. Note the antegrade dissection is associated with significant dilatation.

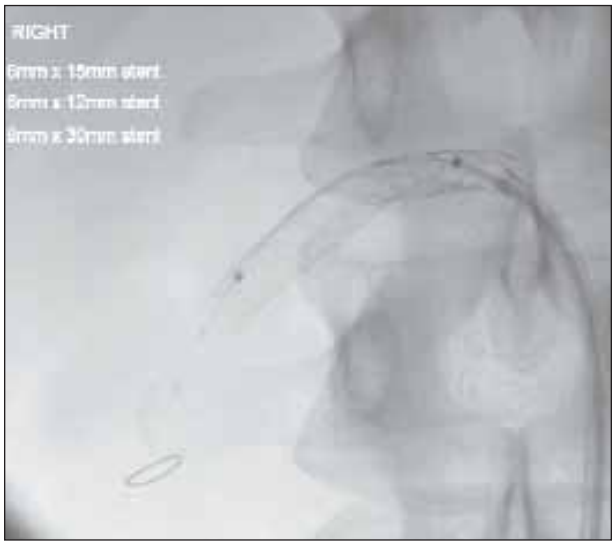

Figure 8. A nitinol self-expanding stent is deployed to control the antegrade dissection.

Figure 9. Completion angiography with the embolic filter in place demonstrates adequate treatment of both complications.

Figure 10. The embolic filter is removed without complication.

11). The patient was discharged on clopidogrel 75 mg for 1 month and long-term aspirin. At outpatient follow-up 6 months after intervention, the patient was normotensive on two antihypertensive medications and had normal renal function. A renal Doppler ultrasound performed at that time showed no evidence of a residual or recurrent right renal artery stenosis or dissection.

DISCUSSION AND TEACHING POINTS

Primary stenting of ostial atherosclerotic renal artery stenosis is considered the treatment of choice because stenting is associated with improved procedural success, patency, and reduced restenosis rates when compared to angioplasty alone.[1] In several nonrandomized trials, distal embolic protection has been shown to be associated with improved outcomes in terms of renal preservation when used in patients with background ischemic nephropathy when compared to historical comparisons.[2]

Careful completion angiography after renal artery stenting is important to identify suboptimal results and complications. Maintaining a guidewire across the treated artery and the use of a guide catheter located at the renal artery ostium facilitate the identification and rapid treatment of complications. Complications include significant residual stenosis, stent malposition, transadventitial renal artery rupture, antegrade renal artery dissection, retrograde aortic dissection, and distal embolization.[3,4] Transadventitial renal artery rupture and retrograde aortic dissection are usually

Figure 11. A CT angiogram obtained 2 days after intervention demonstrates satisfactory remodelling of the antegrade dissection. Maximum-intensity projection (A). Volume-rendered projection (B).

due to oversizing of the angioplasty balloon/stent and can often be managed with a covered stent.[5,6] For this reason, balloon-expandable covered stents should be available whenever renal artery angioplasty and stenting are performed. Distal embolization can be controlled with a distal filter, but in the absence of embolic protection, strategies include thrombolysis and aspiration thrombectomy.[7]

Accurate placement of a stent at the renal artery ostium is a common challenge. Malpositioning may result in the stent advancing into the renal artery, leaving the ostial lesion inadequately treated (as occurred in this case) or the stent projecting a significant distance into the aortic lumen with potential complications, including tilting or even complete dislodgement embolization of the stent. Techniques to avoid stent malpositioning include the use of multiple projections to accurately profile the renal artery ostium relative to the aortic wall and predilatation of the stenosis to avoid proximal or distal migration (termed *watermelon seeding*) of the stent during balloon inflation. Although both these techniques were used in this case, distal malpositioning of the stent still occurred. Adequate treatment of the ostial stenosis is obviously important if therapeutic benefit is to be obtained, and this is best achieved with a second stent. The second stent can usually be placed accurately, supported by the existing stent and with the use of the guide catheter for angiographic control.

Antegrade dissection is an uncommon complication after renal artery stenting and is usually associated with aggressive balloon dilatation. In this case, a semicompliant balloon was inflated within the stent to a conservative diameter and not to the diameter of the segment of the poststenotic dilated vessel. Management strategies for antegrade dissection include conservative treatment, prolonged balloon angioplasty, placement of a balloon-expandable stent, or placement of a self-expanding stent. Conservative treatment is appropriate if the dissection is minor and not flow limiting. Dissection associated with vessel dilatation is seen in most cases of antegrade dissection after renal artery stenting. In this situation, angioplasty or balloon-expandable stenting carries the potential of extending the dissection. The use of a nitinol self-expanding stent potentially provides a more controlled repair of the dissection.

CONCLUSION

Stent malpositioning and antegrade dissection are complications associated with stenting of atherosclerotic renal artery stenoses. These complications can be recognized and effectively managed. ■

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