Renal rescue after inadvertent coverage during endovascular aneurysm repair

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ABSTRACT

Inadvertent renal artery obstruction during endovascular aortic repair is a rare but serious complication. In such cases, endovascular recanalization is typically attempted; however, it can be challenging, leading to many severe cases. Moreover, if treatment is delayed, the blockage time of the renal artery poses a problem. We encountered a case of inadvertent renal artery occlusion during endovascular aortic repair. In this case, bailout stent implantation through a gap between the aortic wall and a stent graft made by a balloon catheter was effective in reducing the renal ischemia time and facilitating the revascularization procedure. (J Vasc Surg Cases Innov Tech 2024;10:101411.)

Keywords: Endovascular aortic repair; Ischemia; Renal artery obstruction; Revascularization; Stents

Endovascular aortic repair (EVAR) for abdominal aortic aneurysms (AAAs) carries a potential risk of renal artery occlusion. In general, prompt endovascular reconstruction is the standard approach to address this issue, but its difficulty and poor backup force often lead to increased case severity. In recent years, reconstruction using a steerable sheath with a flexible tip has been reported[1]; however, problems such as difficulty in approaching the renal artery and a prolonged renal ischemia duration remain. We report a case of inadvertent renal artery occlusion during EVAR in which bailout stent implantation through a gap between the aortic wall and a stent graft, made by a balloon catheter, was very effective in reducing the renal ischemia time and facilitating the revascularization procedure. The patient provided written informed consent for the reporting of his case details and imaging findings.

CASE REPORT

A 75-year-old man had undergone EVAR for an AAA at another hospital 3 years before admission and was followed up at our outpatient clinic. He was in a frail state after a brain hemorrhage and had a history of paroxysmal atrial fibrillation and hypertension, in addition to delirium after the previous EVAR. The AFX endovascular AAA systems BEA25-90/I16-30 and A28-28/C95-O20 V (Endologix) were used in the previous surgery. Plain computed tomography (CT) revealed an increase in the aneurysm diameter over time (50 mm at the first visit and 55 mm before admission) and migration of the proximal extension to the distal region. Contrast-enhanced CT revealed a type Ia endoleak from the dorsal side (Fig 1). The proximal neck had no calcification or thrombus, and the length and diameter were 18 mm and 25 mm, respectively. The neck aneurysm angulation was 55°. Endovascular treatment was considered appropriate due to the patient's clinical history, and an Aorfix proximal extension (Lombard Medical) was added because of its purported ability to accommodate neck flexion effectively. The proximal extension diameter was selected as 27 mm based on the proximal neck diameter.

The surgery was performed by a cardiovascular surgery specialist under general anesthesia using a percutaneous technique and included using the right common femoral artery for the proximal extension, with the aid of a curved ultra-stiff guidewire (Cook Medical) and the left artery for contrast. Proximal extension was deployed after positioning with contrast (Fig 2, *a*). After deployment, the contrast revealed right renal artery occlusion. It was believed that the ventral side of the fish mouth shape covered the renal artery due to the inadequate angle of view (Fig 2, *b*). Renal artery reconstruction was initially attempted using stent placement. First, a 20F sheath (Dryseal; W.L. Gore & Associates) was inserted from the right common femoral artery, and a guiding sheath (Parent Plus 60; Medikit) was inserted from the left common femoral artery. Although the guidewire was passed into the right renal artery using a guiding catheter, stent insertion was difficult because of the poor backup force. Due to concerns regarding the renal ischemia time, a 0.035-in. guidewire (Radifocus; Terumo Corp) was advanced from the left common femoral artery to the outside of the proximal extension and near the right renal artery, where a 6 × 40-mm balloon catheter (ULTRAVERSE; Becton Dickinson) was expanded to create a gap around the ostium to ensure blood flow to the renal artery (Fig 3, *a*). Contrast administration after balloon dilation showed restored blood flow to the renal artery, and the time after proximal extension placement was 30 minutes. A steerable sheath (Agilis NxT; Abbott Cardiovascular) was then inserted through the 20F sheath, in which the stiff wire was already inserted. The tip was

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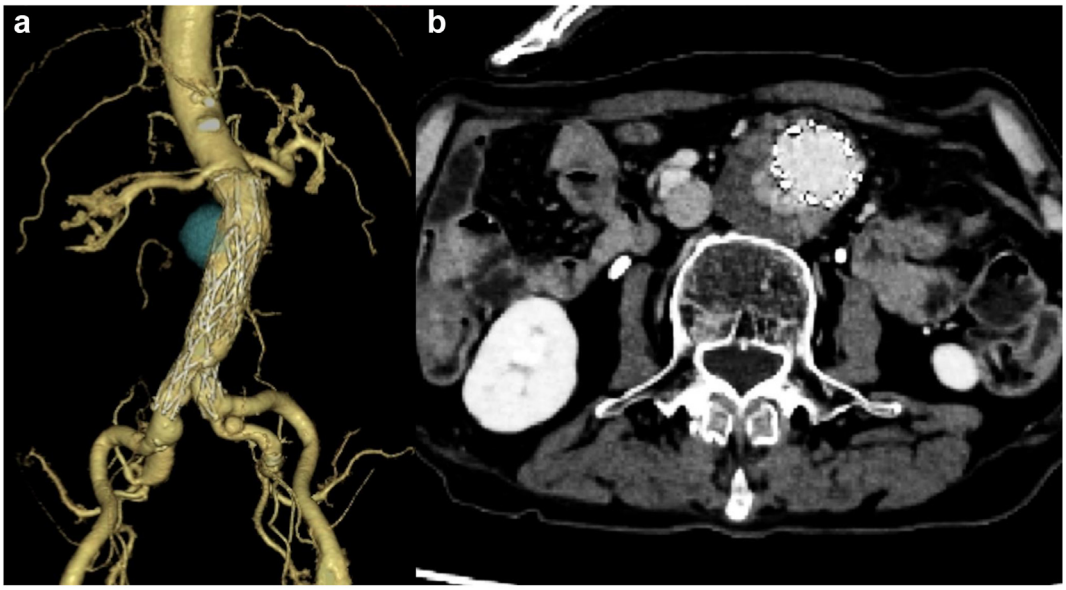

Fig 1. Preoperative contrast-enhanced computed tomography (CT) findings. **a,** The AFX endovascular abdominal aortic aneurysm (AAA) systems BEA25-90/l16-30 and A28-28/C95-O20 V are placed. **b,** Type Ia endoleak from the dorsal side is observed in the delayed phase.

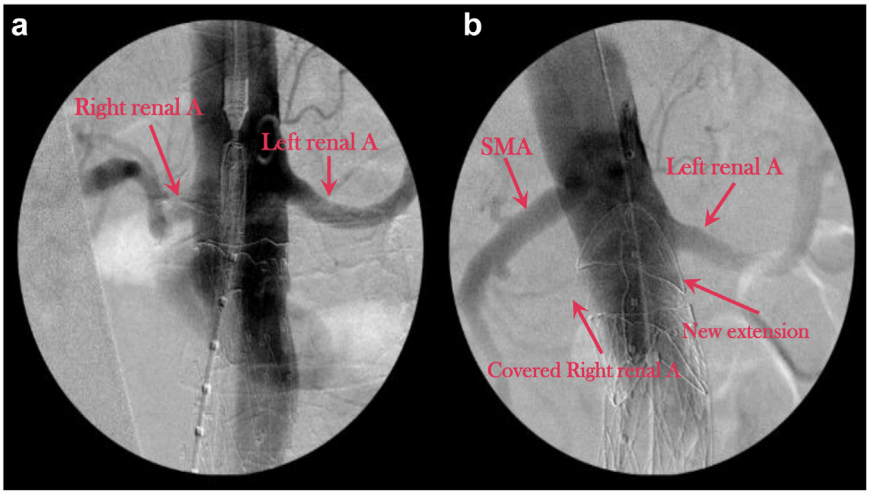

Fig 2. Intraoperative angiography findings. Contrast-enhanced findings before (**a**) and after (**b**) placement of the proximal extension. The right renal artery (*A*) is covered with the new extension. In addition, the superior mesenteric artery (*SMA*) can be seen above the occluded right renal artery.

bent to match the angle of the renal artery, and a 0.014-in. guidewire was inserted into the right renal artery through the gap (Fig 3, *b*). Delivery of a 6 × 18-mm stent (Express SD; Boston Scientific) was favorable and deployed with balloon dilation of the proximal extension. After stent placement, the proximal extension portion covering the renal artery was displaced to the distal edge of the stent. The blood flow of the renal artery was fully recovered (Fig 4), and there was no evidence of an endoleak in the aneurysm.

The postoperative course was uneventful. Contrast-enhanced CT revealed no structural stenosis of the renal arteries (Fig 5) or evidence of endoleaks. Postoperative ultrasound revealed no renal artery stenosis, and blood tests revealed no signs of renal dysfunction. The patient was discharged on postoperative day 11. Six months postoperatively, the patient was doing well, with no aneurysm enlargement or renal function deterioration.

DISCUSSION

Inadvertent obstruction of the renal artery during EVAR can cause irreversible renal damage, representing a relatively rare, but serious, complication. Renal artery reconstruction encompasses two main approaches:

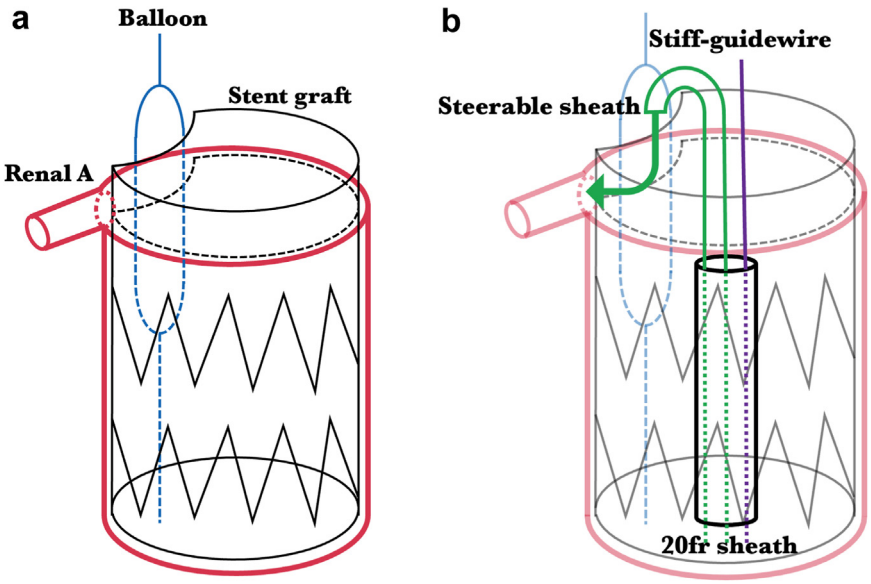

Fig 3. Schema of the procedure. **a,** A 6 × 40-mm balloon catheter (ULTRAVERSE, Becton Dickinson) was expanded to create a gap around the ostium to ensure blood flow to the renal artery. **b,** A guidewire was inserted into the right renal artery through the gap.

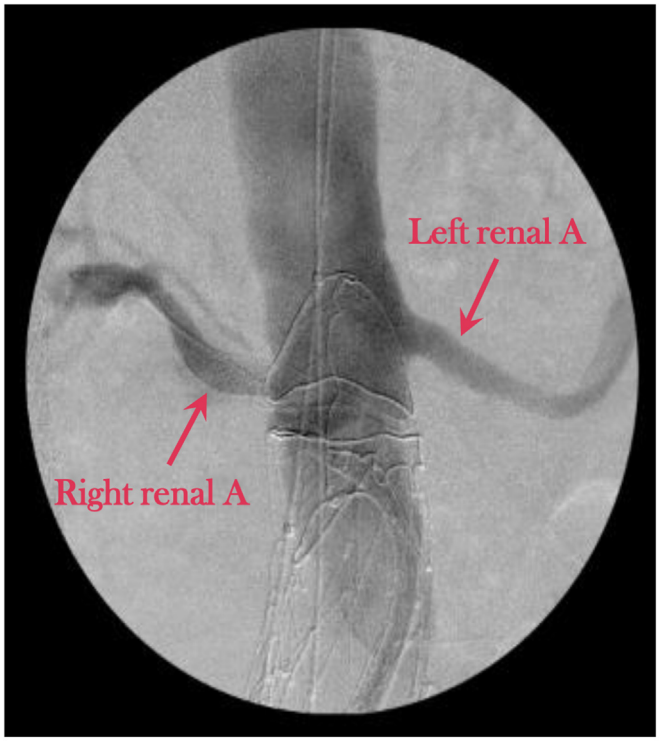

Fig 4. Intraoperative angiography findings. Contrast-enhanced findings after stenting showing restoration of blood flow to the renal artery (*A*).

open surgery and endovascular treatment. Although open surgery is reliable, its high invasiveness has prompted the exploration of various endovascular treatment interventions. Stent or covered stent placement has become increasingly common when the artery is approachable.[2-5] However, accessing vessels obstructed by stent grafts can be challenging. Some reports suggest puncturing the graft using the Brockenbrough procedure,[6,7] and others describe fenestration of grafts with a laser catheter.[8] However, these techniques require familiarity, making their use less suitable for emergencies. In recent years, a steerable sheath with a flexible tip has been used to treat AAAs,[9] and the usefulness of a steerable sheath has been demonstrated for renal artery recanalization.[1] However, regardless of the renal artery reconstruction method, the renal artery ischemia time is associated with irreversible problems. Therefore, rapid resumption of renal blood flow is essential. In this study, we successfully reduced the time of renal blood flow interruption by inflating the balloon near the renal artery and outside the stent graft.

Another advantage of this method is that it facilitates access to the occluded vessel, which is highly beneficial for artery reconstruction using a steerable sheath. Moreover, instead of solely relying on a steerable sheath for renal artery reconstruction, stability in the perpendicular direction to the aorta can be achieved by inserting it into a large-diameter sheath with a stiff wire. Even if this method is unsuccessful, as long as renal blood flow is ensured, conversion to open surgery can be considered without time constraints. Furthermore, if the device is misaligned during placement of a fenestrated endograft, this technique could be useful to create enough space to cannulate the target visceral vessel. Although this was a case of additional proximal extension, the same procedure could be performed in conventional EVAR before

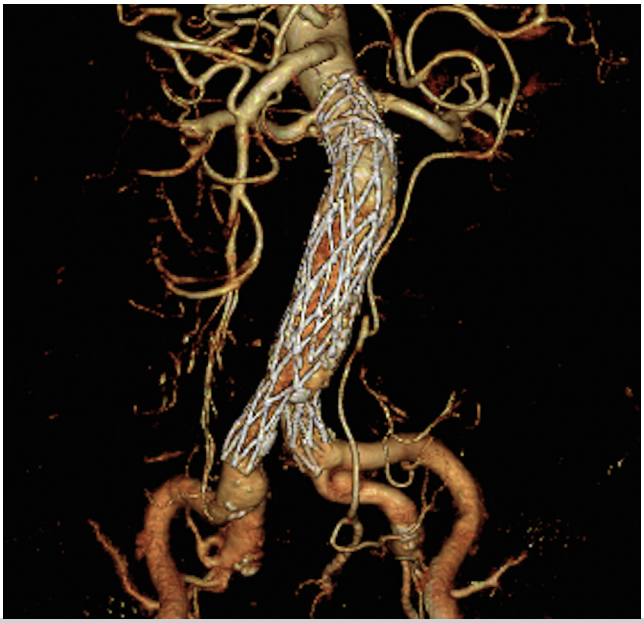

Fig 5. Postoperative contrast-enhanced computed tomography findings. A 27 × 38-mm size Aorfix proximal extension was added. The renal artery orifice is preserved, and there are no findings suggestive of stenosis.

deployment of the contralateral leg. If balloon delivery is difficult, it might be helpful to use a guiding sheath and catheter in combination and expand the balloon gradually to create space. Using a larger balloon can also be advantageous.

Stenting and chimney procedures for renal artery preservation during EVAR have been reported to have good mid-term results in terms of both type Ia endoleak incidence and renal artery patency.[3] However, its long-term durability has not yet been clarified, necessitating further studies.

CONCLUSIONS

In cases of inadvertent occlusion of the visceral artery during EVAR, balloon catheter dilation outside the stent graft allows for rapid resumption of blood flow and facilitates artery reconstruction.

DISCLOSURES

None.

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