Salvage of bilateral renal artery occlusion after endovascular aneurysm repair with open splenorenal bypass

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ABSTRACT

We report renal salvage maneuvers after accidental bilateral renal artery coverage during endovascular aneurysm repair of an infrarenal abdominal aortic aneurysm. A 79-year-old man with an infrarenal abdominal aortic aneurysm was treated with endovascular aneurysm repair. Completion angiography demonstrated coverage of the renal arteries. Several revascularization techniques were attempted, including endograft repositioning and endovascular stenting through the femoral and brachial approach. The patient eventually underwent open splenorenal bypass with a Y Gore-Tex graft (W. L. Gore & Associates, Flagstaff, Ariz). After 3 months, computed tomography showed no evidence of endoleak and patent renal arteries. Renal function was well maintained, and the patient did not require dialysis. (J Vasc Surg Cases and Innovative Techniques 2017;3:163-6.)

Endovascular aneurysm repair (EVAR) provides several theoretical renal advantages compared with open repair. The absence of cross-clamping, reduced surgical trauma, decreased embolization risk, and decreased hemodynamic instability are favorable to kidney function. However, increase in contrast material exposure, endovascular manipulation, risk of renal artery occlusion, and reperfusion after limb ischemia give rise to concerns of renal damage.[1] Acute renal failure after EVAR has an incidence rate of 0.9% to 6.7%, comparable to open repair.[2] We present an uncommon complication of EVAR with bilateral renal artery occlusion and a novel, time-efficient salvage technique with splenorenal bypass. Written informed consent for this publication was obtained.

CASE REPORT

A 78-year-old man presented for EVAR of an infrarenal abdominal aortic aneurysm. Medical history was significant for an appendectomy, myocardial infarction, gastroesophageal reflux, peptic ulcer disease, hypothyroidism, dyslipidemia, and diffuse large B-cell lymphoma treated with chemotherapy.

The abdominal aortic aneurysm, incidentally detected during lymphoma surveillance, initially measured 4.8 cm but had dilated to 5.5 cm and met criteria for repair. The infrarenal aortic neck was 2.8 cm in diameter and 2 cm in length with minimal angulation. Anatomy was otherwise suitable for EVAR, despite tortuous iliac arteries. A Medtronic Endurant II (Medtronic, Minneapolis, Minn) stent graft was used.

Bilateral femoral percutaneous access was obtained, and a 30- × 103-cm Endurant II main body bifurcated graft was advanced through the right femoral access and placed in the pararenal position, verified by arteriography. As the top cap of the main body was released, the graft advanced several millimeters. Although the exact cause of this is unknown, it is likely that torque built up in the ipsilateral iliac artery pushed the stent graft proximally on release from the delivery system. Limbs were advanced and deployed in the usual fashion. Completion arteriography showed exclusion of the aneurysm; however, neither renal artery was visualized (Fig 1).

Repositioning of the stent graft with balloon traction was unsuccessful. Although the left renal artery was successfully cannulated with a reverse curve catheter, it would not advance over the upper margin of the stent graft. Given this partial cannulation and institutional historical success with endovascular salvage, we persisted with endovascular maneuvers. Attempts at cannulation from brachial access were unsuccessful.

Given the risk of contrast nephropathy and furthering renal ischemic time, open renal revascularization was performed. After a midline laparotomy, the renal arteries were exposed. Doppler signals displayed dampened monophasic signal. The splenic artery was easily identified through superior retraction of the pancreas. A hepatorenal and standard splenorenal bypass was considered; however, the splenic and right and left renal arteries were all easily accessible without retractor repositioning. A Y graft originating from the splenic artery was the most expeditious method for re-establishment of renal blood flow, avoiding further dissection and vein harvest.

An 8-mm ringed heparin Gore polytetrafluoroethylene (W. L. Gore & Associates, Flagstaff, Ariz) graft was anastomosed end to side to the splenic artery, tunneled posterior to the splenic vein, and anastomosed end to end to the left renal artery. A second

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Fig 1. Bilateral renal coverage at completion angiography.

Fig 2. Computed tomography angiogram 3 months postoperatively displaying abdominal aortic aneurysm graft with no endoleak and patent renal bypass graft.

polytetrafluoroethylene graft was anastomosed proximally end to side to the splenorenal conduit and anastomosed distally end to end to the right renal artery. Total renal ischemia time was deemed around 4 hours, although presence of Doppler signals suggested that flow was never completely interrupted.

Postoperatively, the patient's urine output was consistently above 0.5 mL/kg/h. The patient's creatinine concentration increased from a baseline of 80 μmol/L to a peak of 270 μmol/L and gradually recovered to 120 μmol/L by postoperative day 10. Dialysis was not required. The remainder of his postoperative recovery was uneventful.

At 1-month follow-up, the patient was doing well with no evidence of renal failure or further complications. Computed tomography angiography performed 3 months postoperatively displayed no endoleak, patent renal bypass, and good renal parenchymal enhancement (Fig 2). The follow-up visit at 9 months after the operation revealed no concerns; the patient's creatinine concentration was 112 μmol/L, and his estimated glomerular filtration rate was 53 L.

DISCUSSION

Renal artery occlusion is a rare complication of EVAR with a reported incidence of 0.1% to 3.5%.[3-6] However, the incidence may be under-reported, with as many as 40% of surveyed UK surgeons experiencing bilateral renal occlusion during EVAR.[3] Malposition of the stent graft occurs at varied frequency, ranging from 2% to 13.2% of cases,[7-9] usually identified at completion angiography.

Renal salvage options include manual repositioning of the graft, endovascular stenting of the renal arteries, and conversion to open surgery. Repositioning is performed with caudal traction by either balloon inflation at the neck[10] or a transfemoral wire positioned across the graft bifurcation.[10,11] This maneuver exerts a significant amount of stress on the anchoring metallic hooks, thus risking tearing of the aorta. A secondary method of renal salvage involves stenting the renal arteries.[12] If the coverage is minimal, an encroachment technique can be used whereby a stent is deployed above the main aortic graft, pushing it distally and opening the renal ostium.[12,13] If the coverage is more significant, a snorkel or chimney graft is usually required, whereby the stent is positioned in parallel to the main graft.[14] Although the success rate is high with snorkel placement at 98.9%,[15] complications of these techniques include an occlusion rate of 4.5% and renal failure rate of 13.3% of occluded grafts.[16] A final endovascular technique involves in situ fenestration of the graft with a trans-septal needle or by radiofrequency or laser burning.[17] This technique is commonly used to revascularize occluded aortic branches during thoracic EVAR and has been described for renal stenting as both planned and salvage procedures.[18,19] A recent systematic review suggested that the technique is feasible, safe, and associated with low morbidity.[20]

As risk of postoperative renal dysfunction increases after 40 minutes of complete renal ischemia,[21] conversion to open surgery should be considered if endovascular access is not achieved within this time. Conversion to open surgery is a rare event in EVAR, ranging from 0.8% to 5.9%.[22,23] Once open, an endovascular stent may be placed through puncture of a surgically exposed renal artery,[24] or a bypass may be performed. Although

the suprarenal aorta is an option for proximal anastomosis of renal bypass,[25] disadvantages include clamping requirement, further ischemia to the kidneys, and challenging dissection. The stent graft extended into the left external iliac artery and thus made iliorenal bypass difficult. The splenic artery is readily accessible and was therefore the conduit of choice for the left renal artery inflow. For the right renal revascularization, the hepatic artery is commonly used[3]; however, it requires extensive dissection. We opted to revascularize the right renal from the splenorenal conduit to decrease operative and renal ischemia time. A disadvantage of this technique is that both renal arteries are dependent on a single inflow vessel; however, the increase in flow could alternatively protect against thrombosis.

All documented cases of renal bypass for renal salvage have reported good outcomes and no mortality, renal failure, graft thrombosis, or reintervention. A review of renal bypass performed for atherosclerotic disease demonstrated an operative mortality of 2.6% and graft thrombosis rates of 5.2% within 30 days and 10.6% within 33 months.[26]

CONCLUSIONS

Renal artery coverage during EVAR procedures remains a rare although under-reported event. Several techniques exist to salvage the renal arteries, including endograft repositioning and stenting. Open renal bypass remains a viable and safe alternative. We describe renal artery salvage with construction of a Y graft to bilateral renal arteries with splenic artery inflow. This novel technique provides a time-efficient solution for inadvertent renal coverage during EVAR.

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