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Case Report

Hybrid Repair of an Abdominal Aortic Aneurysm: Debranching with Endovascular Aneurysm Repair in a Patient with Horseshoe Kidney

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Abdominal aortic aneurysm (AAA) with associated horseshoe kidney (HSK) poses a technical challenge when performing conventional open surgical repair because of possible complications including renal infarction, neuralgia, and collecting system disruption. Endovascular aortic repair (EVAR) is considered the first-line treatment for this pathology, allowing for aneurysm repair without isthmus bisection. However, whether to sacrifice commonly presenting aberrant renal arteries during EVAR is a point of controversy. We report a case in which hybrid repair was performed for AAA to preserve aberrant renal vasculature in a patient with HSK.

Keywords: horseshoe kidney, abdominal aortic aneurysm, hybrid repair

Introduction

Horseshoe kidney (HSK), a form of bilateral fused renal ectopy, is the most common congenital kidney anomaly, occurring in 0.25% of all newborns.[1] If a patient with HSK develops an abdominal aortic aneurysm (AAA), then performing open repair is difficult because as the isthmus of the HSK blocks the field of view. Endovascular aortic repair (EVAR) is considered the first-line treatment for this pathology, but patients with HSK commonly present with one or more accessory renal arteries originating directly from the abdominal aorta. Treatment of accessory renal arteries during EVAR is thus controversial. We report a case in which hybrid surgical repair was performed for AAA in a patient with HSK and aberrant renal vasculature.

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Case Report

A 75-year-old man with HSK was referred for treatment of a 5.0 cm infrarenal AAA and a 3.0 cm right internal iliac artery (IIA) aneurysm in April 2014. The patient had a past history of occult hematuria in 2014. Physical examination revealed no evidence of Marfan syndrome. His pulse was 72 bpm, regular, and collapsing in nature. His blood pressure was 120/80 mmHg, and there was no dilatation of the jugular vein. Huge masses were easily palpable in his abdomen. Laboratory data showed no renal dysfunction (blood urea nitrogen, 20 mg/dl; creatinine, 0.73 mg/dl). Neither pyuria nor bacteriuria was detected. Computed tomography (CT) revealed a 5.0 cm diameter infrarenal AAA and a 3.0 cm diameter right IIA aneurysm as well as a HSK (**Fig. 1**). A CT angiogram revealed 5 mm left and 5 mm right main renal arteries supplying the superior poles of the HSK. A pair of accessory renal arteries, 2.2 mm and 1.2 mm in diameter, supplied the isthmus arising from the left common iliac artery.

Open repair of AAA in patients with HSK has been associated with significant procedural risks given the challenges posed by inadequate exposure of the aneurysm and renal vasculature. On the other hand, EVAR can lead to renal dysfunction because of the exclusion of aberrant renal arteries. After considering both options, we chose EVAR with concomitant surgical revascularization of the aberrant renal artery. Coil embolization was performed for the enlarged right IIA (30 mm), and required preoperative extension of the stent graft limb into the right external iliac artery (EIA). As the left common iliac artery was too short for landing, bypass from the left EIA to the left IIA was planned in order to preserve pelvic circulation. The surgery was performed under general anesthesia. The aberrant renal arteries, left EIA, and left IIA were isolated by retroperitoneal exposure via a pararectal incision. Both common femoral arteries were also exposed. The great saphenous vein was harvested from the left thigh. After administering 5000 U intravenous unfractionated heparin, one of the aberrant renal arteries (2.2 mm) was

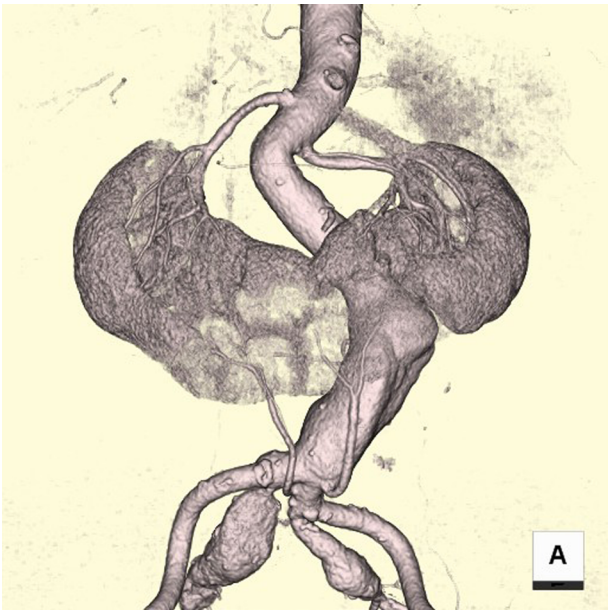

Fig. 1 Three-dimensional reconstruction of infrarenal abdominal aneurysm with aberrant renal arteries originating from a left common iliac artery.

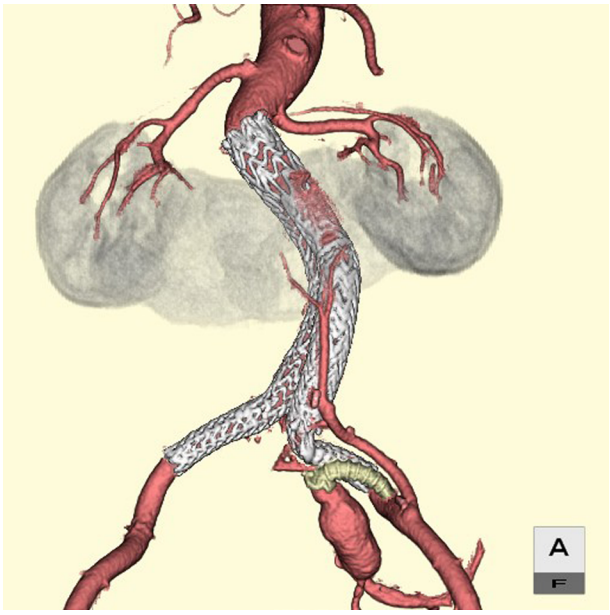

Fig. 2 Three-dimensional reconstruction of endovascular abdominal aortic aneurysm, large saphenous vein graft to the aberrant renal artery, and a 6 mm expanded polytetrafluoroethylene graft from the left external iliac artery to the left internal iliac artery.

anastomosed to the great saphenous vein in an end-to-side fashion; the other artery (1.2 mm) was sacrificed, as we considered it too small and unnecessary to preserve. Following division of the left IIA, the proximal end of the left IIA was closed using a Hem-o-lok clip (Weck Closure Systems, Research Triangle Park, NC). The distal portion of the IIA was bypassed to the left EIA using a 6 mm expanded polytetrafluoroethylene (ePTFE) graft. The great saphenous vein graft, which was anastomosed to the aberrant renal artery, was connected to the left EIA in an end-to-side fashion. Given the relatively short renal ischemic time of 29 min, we did not provide intraoperative renal protection.

Once needle access was obtained, an 8 French (Fr) sheath was inserted into each femoral artery. A bifurcated Excluder endograft (W. L. Gore, Flaggstaff, AZ, USA) was then deployed from the right common femoral artery. The right iliac limb was landed at the right EIA, and care was taken to position the left iliac limb proximal to the debranching anastomosis (**Fig. 2**). The proximal and distal fixation sites were set with a Coda balloon. Patency of the right and left renal arteries and the bypass grafts emanating from the left EIA was confirmed (**Fig. 3**). The final intraoperative angiogram found no evidence of endoleak. The total operative time was 322 min.

The postoperative course was uneventful, and the patient was discharged on postoperative day 7 without any complications. A postoperative CT angiogram revealed patency of the stent graft and debranching vessels. Endoleak was not observed. At the time of discharge, the patient's renal function was unchanged from baseline.

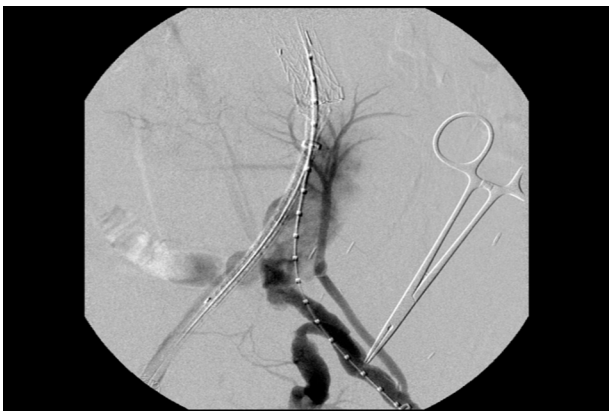

Fig. 3 Retrograde intraoperative digital subtraction angiography showing a large saphenous vein graft supplying 75% of the renal isthmus to the aberrant renal artery.

Discussion

HSK is the most common congenital renal fusion anomaly, occurring with a prevalence as high as one in 400.[2] The blood supply of the HSK can vary, with abnormalities reported in 80% of patients.[3] Although AAA associated with HSK is rare, occurring only in 0.12% of patients,[4] surgical challenges arise in the management of the renal isthmus and aberrant renal vasculature.

Although effective, the conventional open approach has been associated with significant procedural risks. The isthmus can be resected to fully expose the entire aneurysm

via a transabdominal approach. Stroosma et al. reported that the isthmus of the HSK should be resected in about 30% of cases using a transabdominal approach.[5] The potential need to bisect the kidney at the renal isthmus in order to gain access to the aorta may disrupt the collecting system, resulting in hemorrhage, hematoma formation in the retroperitoneum, and vascular prosthesis infection associated with urine leakage.[6] On the other hand, Osawa et al. suggested that a retroperitoneal approach might be unsuitable when the ureters run from the renal pelvis at the lateral wall of the HSK to the posterior side of the pelvis, with the semicircular course of the ureters facing laterally.[7] If that is the case, the HSK cannot be turned medially over the aorta.

EVAR using a stent graft has recently become an alternative treatment for patients with AAA. This procedure is less invasive, and has satisfactory mid-term results compared with conventional open surgical repair. The success of EVAR requires adequate proximal and distal seal zones. Chan et al. concluded that sacrificing accessory renal arteries during EVAR did not cause any significant problems,[8] although covering accessory renal arteries is not ideal because renal ischemia and/or type-2 endoleaks may occur. O'Hara et al. reported that renal ischemia occurred in 74% of procedures, and recommended reconstruction of larger accessory arteries (>2 mm).[9] Patients with preexisting renal insufficiency may also benefit from a more aggressive revascularization approach. Carnicelli et al. described a transabdominal hybrid surgical approach to treat aberrant renal vasculature in patients with AAA associated with HSK.[10] We selected a retroperitoneal approach via a pararectal incision because the accessory renal arteries, which should be preserved, originated from the left common iliac artery. While careful follow-up is necessary for younger patients, hybrid repair may be the optimal surgical approach for AAA in patients with HSK.

Conclusion

Hybrid repair combining reconstruction of accessory renal arteries and EVAR was successfully performed for AAA in a patient with HSK. We believe this procedure may allow for the optimal management of AAA associated with HSK.

Disclosure Statement

All authors declare no conflict of interest.

Author Contributions

Study conception: KK
Data collection: KK
Investigation: KK
Writing: KK
Critical review and revision: all authors
Final approval of the article: all authors
Accountability for all aspects of the work: all authors

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