Laparoscopic nephrectomy with ex vivo repair of aneurysm and autotransplantation

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ABSTRACT

The perceived prevalence of renal artery aneurysms is increasing, probably because of the widespread use of cross-sectional imaging. The majority of these aneurysms are found incidentally and are asymptomatic. There are no clear guidelines for when to repair these aneurysms, although most practitioners recommend intervention around the 2- to 3-cm size cutoff. These can be managed endovascularly or with open surgery; however, aneurysms at the hilum may require a complex repair to avoid nephrectomy. We present a case of a hilar renal artery aneurysm managed with laparoscopic nephrectomy with ex vivo aneurysm resection and repair followed by autotransplantation. (J Vasc Surg Cases and Innovative Techniques 2020;6:24-6.)

Keywords: Renal artery aneurysm; Autotransplantation; Ex vivo repair

CASE REPORT

A 69-year-old man with hypertension and multiple sclerosis was found to have an incidentally noted right renal artery aneurysm (RAA) on a magnetic resonance imaging spine study obtained for his multiple sclerosis. Confirmatory computed tomography angiography demonstrated a 3-cm complex RAA at the hilum of the right kidney with four main branches entering the renal parenchyma (Fig 1). Because of the distal branching of the artery and involvement of multiple large branches, the aneurysm was not amenable to endovascular or open in vivo repair. For these reasons and the patient's generally good health, we chose to pursue an alternative surgical approach with laparoscopic nephrectomy, ex vivo reconstruction, and reimplantation.

Access to the abdomen was gained through Hassan technique with a 12-mm port, and three additional 5-mm ports were placed. The right kidney was dissected in standard fashion, mobilizing the renal artery proximally to the aorta and the right renal vein to the level of the inferior vena cava. The ureter was identified and dissected distally to the level of the iliac vessels. A right-sided Gibson incision was created through which an Endo Catch bag (Medtronic, Minneapolis, Minn) was placed, and a modified wound protector was used to maintain pneumoperitoneum. At this time, the ureter was clipped and divided. An endo-GIA stapler (Medtronic) with a vascular load was used to control and to divide the right renal artery at the level of the aortic takeoff, and two additional firings were used to control and to divide the renal vein with a small cuff of inferior vena cava.

The kidney was removed using the Gibson incision and taken to the back table, where it was placed on ice and flushed with iced static preservation solution until asanguineous. The multilobulated aneurysm was identified, and the four main branches were isolated with vessel loops (Fig 2). The smallest branch was <1 mm in diameter and was ligated with silk ties; the aneurysm was then sharply excised from the trifurcation of the remaining arteries. The two most superior renal artery branches were spatulated together, and a 1-cm piece of healthy proximal renal artery was then used to join these spatulated arteries with the third lower pole branch in an end-to-side manner for complete autologous reconstruction of the renal artery (Fig 3). The anastomoses were checked for leaks using iced static preservation solution, and the kidney was prepared for reimplantation. The kidney was reimplanted through the previous Gibson incision using standard end-to-side anastomoses to the right common iliac artery and veins with 6-0 and 5-0 Prolene suture, respectively, and the ureter was implanted into the bladder over a 6F double J ureteral stent.

The patient was transitioned to the ward with a Foley catheter. Routine renal ultrasound examination of the transplant demonstrated three patent renal artery branches with good parenchymal perfusion. An acute kidney injury developed with a peak serum creatinine concentration of 1.95 mg/dL from the baseline value of 0.69 mg/dL; however, this improved throughout the hospital stay, and the patient was discharged home in good condition on postoperative day 5. He was seen 2 and 6 weeks postoperatively with well-healed incisions, return to regular activities, and serum creatinine concentration of 0.98 mg/dL. The patient consented to publication of all case details and images in this case report.

DISCUSSION

Although previously thought to be exceptionally rare, RAAs are estimated to occur in ~1% of patients undergoing computed tomography angiography or conventional

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Author conflict of interest: none.

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The editors and reviewers of this article have no relevant financial relationships to disclose per the Journal policy that requires reviewers to decline review of any manuscript for which they may have a conflict of interest.

2468-4287

https://doi.org/10.1016/j.jvscit.2019.11.009

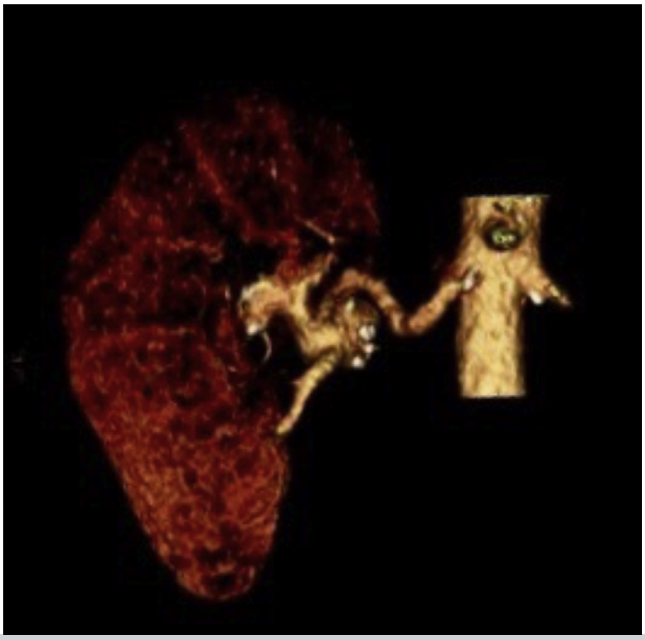

Fig 1. Three-dimensional reconstruction of kidney and portion of aorta. The renal artery demonstrates a bilobed complex 3-cm aneurysm at the hilum with multiple branches extending from the aneurysm.

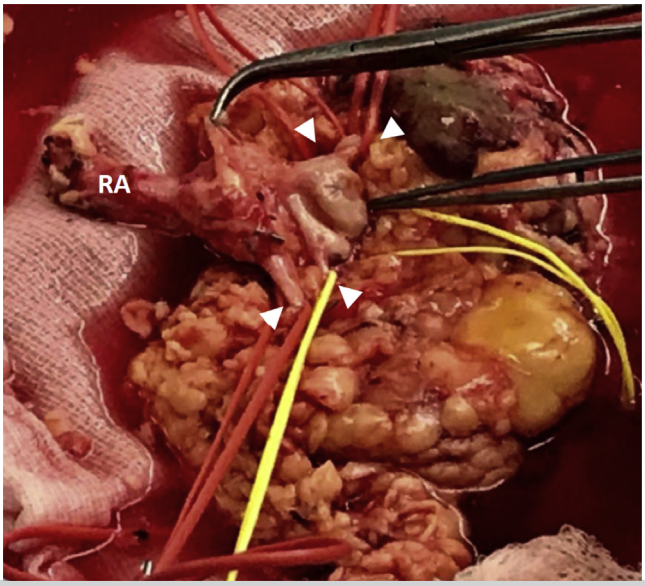

Fig 2. Ex vivo view of kidney with aneurysm and four segmental renal arteries (*arrowheads*) and main renal artery (*RA*).

visceral angiography.[1] As the majority of these aneurysms are noted incidentally, there remains considerable question about management, including the technique and when to intervene. When patients do present with symptoms, they traditionally include hematuria, flank or abdominal pain, and hypertension. Despite numerous proposals regarding hypertension, it is unclear whether this is a cause of RAA or merely a side effect of the

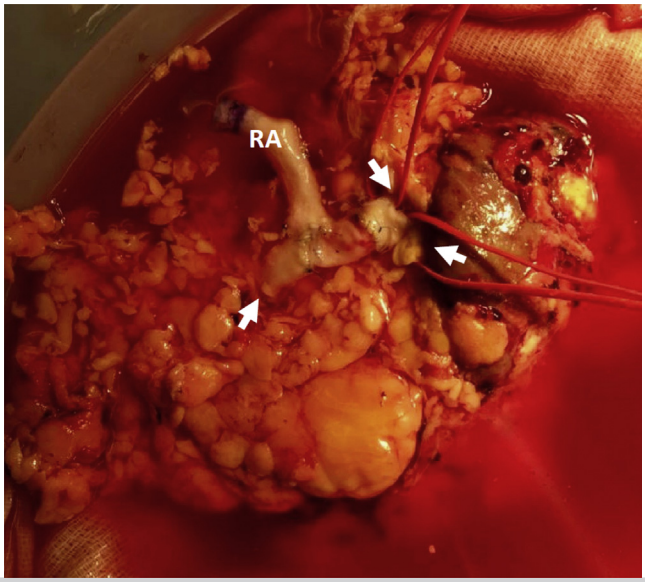

Fig 3. Ex vivo view of reconstructed renal artery (*RA*) with remaining segmental renal arteries (*arrows*).

aneurysm. One potential mechanism is due to turbulent flow in the renal artery and increased renin production; other theories include concomitant renal artery stenosis, kinking of the renal artery, and distal embolization to the renal parenchyma.[2] Although the mechanism is unclear, it has been noted that some patients have had improved hypertension after treatment, but despite this, it is not considered to be a treatment indication.[3,4]

Symptoms related to RAA can depend on the type of aneurysm and its location. Locations include extraparenchymal (~90%) and intraparenchymal (<10%) aneurysms. The most common causes of RAA are atherosclerosis, polyarteritis nodosa, congenital, and fibromuscular dysplasia.[5,6] A small portion of the extraparenchymal aneurysms include hilar RAAs, which occur at the distal portion of the renal artery.[2] Although these aneurysms are considered extraparenchymal, they are often close to the hilum and require more complex interventions.

RAAs can be managed in a number of different ways. The rationale regarding intervention vs observation is related to the presentation and symptoms as well as to the risk for future morbidity. Although RAA has been reported to lead to a number of complications including dissection, renal infarction, and obstructive uropathy, the greatest drive for treatment is the high mortality associated with spontaneous rupture and the unknown true rate of rupture with RAA.[7] Most recently, Klausner and et al[8] have advocated for repair of aneurysms >3 cm, with symptoms, or in women of childbearing age.

Following the decision to manage surgically, RAA can be managed with either open or endovascular techniques. Endovascular stent placement and embolization are less invasive options pending proper anatomy. Open

interventions include aneurysm repair with primary anastomosis, renal artery implantation, and renal artery bypass; complete nephrectomy may be required if reconstruction is not possible.[3] Another possible approach as used in our case is nephrectomy with ex vivo aneurysm repair and reconstruction with autotransplantation.[9] This method has also been described in combination with laparoscopy to further reduce surgical insult to the patient as it has been shown to reduce operative times and length of stay.[10] Another potential advantage of this technique is avoiding the need for a laparotomy and open intraperitoneal surgery while decreasing the size of the transplant incision needed. Last, by performing this repair under ice and cold perfusion, renal metabolism and warm ischemia time are both reduced. As in our patient, this procedure is well tolerated without significant morbidity and allows aneurysm repair without loss of renal function.

CONCLUSIONS

RAAs are being noted more frequently in large part because of increased use of cross-sectional imaging. Although they are usually asymptomatic, the indication for treatment and the method of intervention are not standardized. Recent data recommend repair above 3 cm, in symptomatic patients, and in women of childbearing age because of risk of rupture. Repair can be managed with a variety of techniques including endovascular, open surgical, and even ex vivo repair with autotransplantation. Repair is complicated when the aneurysm is located in the renal hilum. We present a case of laparoscopic nephrectomy with ex vivo repair of a hilar RAA and autotransplantation. This case demonstrates adequate vascular resection while maintaining renal function.

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Submitted Aug 30, 2019; accepted Nov 12, 2019.