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Case Report

Successful Endovascular Abdominal Aortic Aneurysm Repair Following Surgical Mobilization of an Accessory Renal Artery in the Setting of Horseshoe Kidney

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Abstract

There are several reported cases of successful endovascular repair of abdominal aortic aneurysm (AAA) in patients with concomitant horseshoe kidney, in which accessory renal arteries were sacrificed. We describe a case of horseshoe kidney and AAA in which a surgical vascular conduit to accessory renal arteries created favorable anatomy for endovascular aneurysm repair (EVAR) while preserving renal perfusion. Although there are inherent risks in both open and endovascular AAA treatment when anatomic anomalies are present, combined therapies may provide a satisfactory and safe alternative, as reported in this case.

Keywords: Abdominal Aortic Aneurysms (AAA); Endovascular Aneurysm Repair/Endovascular Aortic Repair (EVAR); Horseshoe Kidney

Introduction

Horseshoe kidney, a congenital fusion anomaly of the kidneys, has been shown by autopsy series to be present in 1:710 patients with abdominal aortic aneurysms (AAA) [1]. Fusion of the lower renal poles is present in 90% of patients with horseshoe kidney, and up to one third have other associated congenital abnormalities [2]. A variable vascular supply is typical, with multiple accessory renal arteries possible. These features of horseshoe kidney can substantially increase the complexity of open surgical aneurysm repair. Endovascular aneurysm repair (EVAR) of AAA has become a widely accepted alternative to open surgery [3]. Currently nearly half of patients with AAA eventually undergo EVAR [4]. The advantages of EVAR are well documented and include decreased periprocedural morbidity and mortality, shorter hospital stay, and a low rate of systemic complications [5]. EVAR has been reported in several patients with horseshoe kidney and AAA, but in each instance one or more accessory renal arteries were sacrificed. We describe a case in which a surgical vascular conduit to two accessory renal arteries was used to optimize the aortic anatomy and allow successful AAA exclusion with EVAR without sacrificing the arterial supply of the horseshoe kidney.

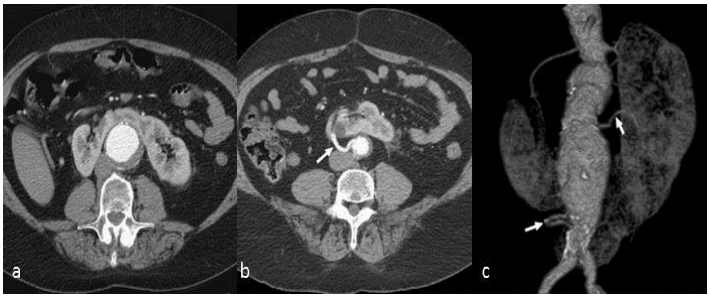
Case Report

A 62 year old male with a medical history significant for hypertension, hyperlipidemia and horseshoe kidney with normal renal function, presented with clinically significant enlargement of a known AAA and associated abdominal and back pain. The aneurysm had enlarged from 3.8cm to 5cm over a three year period, with the accompanying development of pain, prompting the decision for intervention. Although open surgical aneurysm repair was an option, given the presence of a horseshoe kidney, EVAR was favored if technically possible.

Contrast–enhanced computed tomography (CT) of the abdomen and pelvis with multiplanar reformatted images was obtained, in order to evaluate the vascular supply of the horseshoe kidney and delineate aneurysm morphology.

This demonstrated that the entire right moiety and the upper one-fourth of the left moiety of the horseshoe kidney were supplied by single renal arteries that arose above a well-defined aneurysm neck. However, two accessory renal arteries arose from the aneurysm and provided blood supply to the isthmus and left moiety of the horseshoe kidney (Figure 1). The remaining features of the CT were otherwise favorable for EVAR. Given these findings, a combined open surgical and endovascular approach to treatment was decided upon.

Figure 1



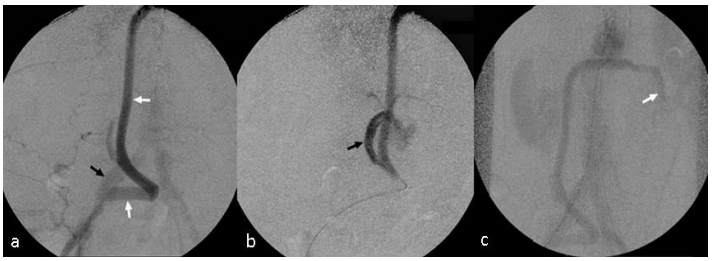
a: Axial image from a contrast enhanced CT shows an abdominal aortic aneurysm and a horseshoe kidney

b: A large accessory renal artery (white arrow) arises from the distal infrarenal aorta and supplies the isthmus

c: Three dimensional coronal CTA reformation demonstrates the aneurysm, horseshoe kidney, and two accessory renal arteries (white arrows)

The patient first underwent open surgical creation of an expanded polytetrafluoroethylene (ePTFE) vascular conduit from the distal right common iliac artery to the mobilized accessory left renal artery (Figure 2). The accessory renal artery supplying the isthmus of the horseshoe kidney was then mobilized from its origin just above the aortic bifurcation and was also anastomosed to the conduit (Figure 2). Bilateral femoral artery cut downs were then performed to provide access for introduction of the stent-graft. Digital subtraction angiography (DSA) of the newly created vascular conduit demonstrated patency, with eccentric plaque narrowing the renal artery to the isthmus. This stenosis was treated with placement of a 5.0 x 19 mm balloon mounted Express® SD stent (Boston Scientific, Natick, MA). Subsequently a Talent™ stent-graft (Medtronic, Minneapolis, MN) measuring 34 mm diameter x 155 mm in length, with a 16mm flared distal iliac limb was introduced via the left femoral artery and was uneventfully deployed, with the proximal seal zone immediately below the main renal arteries. The right iliac limb was then introduced and deployed, taking care to avoid covering the vascular conduit to the renal arteries. Completion DSA showed appropriate positioning of all endograft components but also documented a proximal type I endoleak. This was treated by placement of a 50 x 10 mm Palmaz stent (Johnson and Johnson, Bridgewater, NJ) at the proximal seal zone of the endograft. Repeat DSA verified endoleak resolution and patency of the stent-graft as well as of the renal arteries. At clinical follow up two weeks after EVAR, the patient was asymptomatic and maintained normal renal function. Subsequent follow up contrast-enhanced CT revealed appropriate stent-graft position, no endoleak and satisfactory perfusion of the horseshoe kidney (Figure 3). Two years following EVAR the patient has remained clinically well.

Figure 2



a: Digital subtraction angiography (DSA) image demonstrates an e-PTFE bypass graft (white arrows) originating from the right common iliac artery (black arrow) used for revascularization of the accessory renal arteries noted on the pre-procedural CTA

b: The accessory renal artery (black arrow) supplying the isthmus has been anastomosed to the conduit

c: Delayed DSA image shows that the accessory renal artery (white arrow) supplying the bulk of the left moiety of the horseshoe kidney is patent following revascularization with the surgical conduit.

Figure 3

Three dimensional coronal CTA reformation after EVAR shows that the aneurysm has been excluded by the endograft. The vascular conduit (large white arrows) is patent as are the native renal arteries (small white arrows).

Discussion

Since the introduction of EVAR for the treatment of AAA, successful aneurysm exclusion in the setting of horseshoe kidney has been documented in approximately 15 cases. These reports have validated the overall safety of EVAR in this

clinical setting and have highlighted its superiority to open surgery in certain regards, particularly in the emergent setting [6]. Horseshoe kidney can significantly complicate open surgical aneurysm repair, as the renal isthmus often directly overlies the aneurysm sac and multiple anomalous renal vessels are frequently present. Thus, EVAR is an attractive alternative in these patients if there is appropriate aneurysm morphology. A thorough evaluation of anatomic and physiologic issues, such as renal function, is necessary in order to properly select patients. Potential renal complications of EVAR in the setting of horseshoe kidney include renal impairment or failure, renal infarction, and new onset of hypertension. The literature suggests that patients with a normal serum creatinine level prior to EVAR are likely to maintain normal renal function following intervention [7]. Renal complications appear to be infrequent, and have predominantly consisted of minor renal infarctions, none of which have had significant functional consequences [1].

Current cross-sectional imaging technology with CT or MR provides exquisite anatomic detail and allows comprehensive pre-procedural assessment of the aneurysm, horseshoe kidney and the renal arterial supply. In the majority of reported cases, multiple minor anomalous renal arteries were deliberately sacrificed at EVAR, either by stent-graft exclusion or by intentional occlusion with coils [8,9]. Although fenestrated stent-grafts have been used to preserve flow to anomalous renal arteries, [10] to our knowledge this is the first reported case of surgical revascularization of the anomalous blood supply to a horseshoe kidney to allow for successful EVAR. This approach is feasible and may allow EVAR to be considered in a wider range of patients for whom sacrifice of anomalous renal arteries is not an option. The case further emphasizes various issues that should be considered during EVAR, such as the intraoperative recognition and treatment of significant endoleaks or procedural-related compromised renal arterial perfusion. The placement of an intravascular stent in the mobilized renal artery supplying the isthmus of the horseshoe kidney also represents a unique intervention that likely would not have occurred under different circumstances.

In conclusion, this case adds to the growing body of literature supporting the safety and feasibility of EVAR in patients with concurrent horseshoe kidney and AAA. Combined open surgical and endovascular techniques may be the best option for some patients and may provide an alternative to the common practice of sacrificing anomalous renal vessels.

Conflict of interest

Author 1, Author 2, Author 3 and Author 4 report that no conflicts of interest in the preparation of this manuscript.

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