Vascular Specialist International
Vol. 31, No. 2, June 2015
pISSN 2288-7970 • eISSN 2288-7989

Case Report

Open Surgical Repair of Abdominal Aortic Aneurysm Coexisting with Horseshoe Kidney

Ahram Han[1]*, Suh Min Kim[2]*, Chanjoong Choi[1], Sang-Il Min[1], Jongwon Ha[1], and Seung-Kee Min[1]

[1]Department of Surgery, Seoul National University College of Medicine, Seoul,
[2]Department of Surgery, Seoul Metropolitan Government-Seoul National University Boramae Medical Center, Seoul, Korea

Horseshoe kidney (HSK) is the most common congenital abnormality of the urologic system encountered during abdominal aortic aneurysm (AAA) surgery. Here, the authors report a case of AAA coexisting with HSK that was successfully treated by open surgery. Two accessory renal arteries of 2.5 mm and 3.1 mm were reimplanted. One of the implanted arteries later occluded and infarct of the isthmus developed, but there was no impairment of renal function. The authors discuss the complexity of the surgical treatment of AAA coexisting with HSK, and place focus on which accessory renal arteries should be reconstructed.

Key Words: Abdominal aortic aneurysm, Kidney/abnormalities, Renal artery

Received May 3, 2015
Revised June 8, 2015
Accepted June 10, 2015

Corresponding author: Seung-Kee Min
Department of Surgery, Seoul National University Hospital, 101 Daehak-ro, Jongno-gu, Seoul 110-744, Korea
Tel: 82-2-2072-2318
Fax: 82-2-766-3975
E-mail: skminmd@snuh.org
Conflict of interest: None.

*These authors contributed equally to this work.

Vasc Spec Int 2015;31(2):54-57 • http://dx.doi.org/10.5758/vsi.2015.31.2.54

INTRODUCTION

Horseshoe kidney (HSK) is the most common congenital abnormality of the urologic system [1]. When an abdominal aortic aneurysm (AAA) coexists with HSK, the management of AAA becomes complex. The isthmus of the HSK, formed by fusion of the inferior poles, frequently lies in front of the aneurysm and hinders its exposure. Frequent variation of the renal arteries further complicates surgery [2]. We present here a case of an infrarenal AAA with a HSK, which was successfully treated using an open surgical approach, and review the technical challenges associated with the case. Written informed consent was obtained from the patient for publication of this manuscript and any accompanying images.

CASE

A 66-year-old man was referred to our clinic for an asymptomatic AAA. Computed tomography (CT) urography revealed a 6.6 cm infrarenal AAA and a HSK with a wide parenchymatous isthmus, and CT angiography showed multiple renal arteries (Fig. 1A, B). Four of the accessory renal arteries arose from the aneurysm body, and supplied the inferior poles and isthmus. Two of these, arising from the upper part of the aneurysm were relatively large with diameters of 2.5 mm and 3.1 mm. Initially, the patient had normal renal function with a serum creatinine of 1.00 mg/dL.

Open surgical repair was decided due to short common iliac arteries, angulation of the neck greater than 60 degrees, and the presence of two relatively large accessory renal arteries. The operation was performed through a long midline incision. Transperitoneal dissection along the

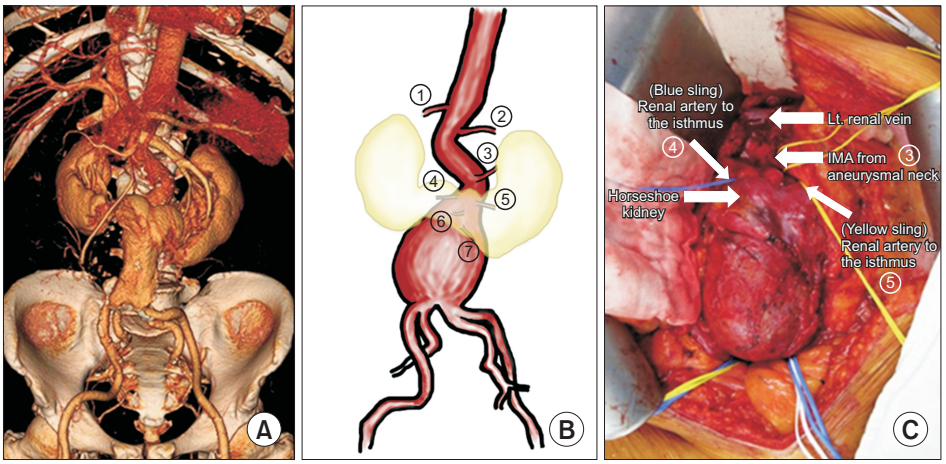

Fig. 1. Preoperative computed tomography angiogram (A) and schematic drawing (B) showing an infrarenal aortic aneurysm with multiple accessory renal arteries arising from the aorta (①, ②) and the aneurysm sac (④, ⑤, ⑥, ⑦). Two accessory renal arteries (④, ⑤) larger than 2 mm were isolated for revascularization (C). Inferior mesenteric artery (③, IMA) arising from the aneurysm neck was ligated.

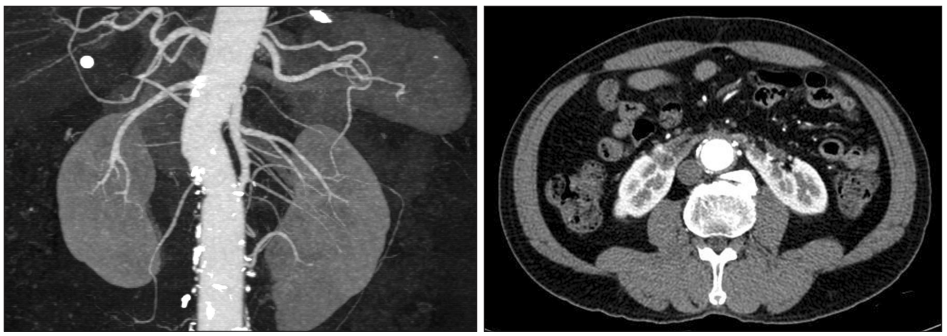

Fig. 2. Patent left accessory renal artery, occluded right accessory renal artery, and infarction of the isthmus on computed tomographic angiograms obtained at 18 months postoperatively.

Treitz ligament revealed the aneurysm with its upper third being shielded by the isthmus of the HSK. The infrarenal aorta, external and internal iliac arteries were dissected for clamping and accessory renal arteries were carefully isolated (Fig. 1C). The aneurysm sac was opened and a Y-shaped Dacron graft (18-9 mm, Hemashield; Maquet Corporation, Rastatt, Germany) was placed under the isthmus for reconstruction. Both common iliac arteries were spared from aneurysmal change, but were heavily calcified and short, and thus, distal anastomoses were performed to the right iliac bifurcation, and to the left external iliac artery. The larger two accessory renal arteries were reimplanted to the graft with aortic patches. The accessory renal arteries were clamped for 30 and 50 minutes, respectively. One hundred mL of 15% mannitol and 10 mg of furosemide were infused before clamping for renal protection. The other two small arteries were ligated. The operation took 6 hours and 10 minutes. Estimated amount of blood loss was 2,100 mL and 4 pints of blood was transfused during the operation. After 1 day of intensive care unit stay, he was moved to the general ward. He was discharged at postoperative 7th day.

Although occlusion of one of the implanted arteries with infarction of the isthmus was noticed on CT taken at 6 days postoperatively, renal function was stable with a serum creatinine level of 0.90 mg/dL. CT angiography at 18 months postoperatively showed the renal infarct had remained unchanged without any progression, and that both the aortic graft and left accessory renal artery were patent (Fig. 2). Currently, the patient is clinically well at 29 months postoperatively.

DISCUSSION

The technical difficulty associated with managing AAA with coexistent HSK is primarily due to two factors, that is, their close spatial relationship and the frequent arterial variation that accompanies HSK.

Because the isthmus usually lies in front of the aneurysm, the optimal method of access remains an issue of continued debate. Historically, the transperitoneal approach has been more commonly used, but the retroperitoneal approach provides good visualization of both the AAA and the aberrant arteries arising from the aneurysm regardless of the presence of the isthmus [3]. Both approaches seem to be acceptable, as three-dimensional CT angiography nowadays provides detailed information about the aberrant arteries, which aids secure separation of the HSK and the aorta. Therefore, as in cases without HSK, the decision regarding surgical approach can be made based

http://dx.doi.org/10.5758/vsi.2015.31.2.54

on the anatomical characteristics of the AAA, such as, the involvement of the iliac arteries and the proximal extent of the aneurysm, and the preference of the vascular surgeon.

Division of the isthmus is sometimes necessary during the transperitoneal approach, which raises concerns of procedure-related complications, such as, bleeding, urinary fistula, and delayed graft infection. However, the actual incidence appears to be low, as only one such complication occurred among 31 reported cases of isthmus division during AAA operations conducted from 1956 and 1999 [4]. However, safe and secure division of the isthmus can still be difficult, especially when the isthmus is thick and parenchymatous. As in laparoscopic heminephrectomy of HSK, division may be aided by the use of staplers and energy devices [5]. Chihara et al. [6] recently reported the use of a harmonic scalpel to divide the isthmus during AAA surgery.

One or more variations of the renal artery were observed in up to 60% of concomitant HSK-AAA cases, and multiplicity was the most common [2]. Early in 1993, O'Hara et al. [7] noticed a high prevalence of renal ischemia after repair of AAA coexisting with HSK, and recommended reconstruction of accessory renal arteries larger than 2 mm. We also adopted the same policy and reconstructed two larger accessory arteries, but the anastomoses required are technically demanding, because the isthmus hinders access to the accessory renal arteries, which are usually short. In the described patient, one of the reimplanted arteries thrombosed during the early postoperative period and led to partial renal infarction, although fortunately, this was not clinically significant in terms of renal function.

Similar clinically tolerable renal infarctions have been observed in endovascular aneurysm repair (EVAR) cases, and as a result a more liberal standard for revascularization has been proposed. Kaplan et al. [8] based on their experiences of 17 renal artery exclusions during EVAR AAA with HSK, suggested a cut off value of 3 mm in patients with no preexisting renal insufficiency. Moreover, in a recent review of 5 papers on EVAR with covered accessory renal arteries, it was concluded that although coverage may result in segmental renal infarction in a considerable number of patients, this it is not associated with renal impairment [9]. However, this latter study was not limited to cases of AAA with HSK, and sizes of renal arteries were not specified.

Selection of treatment modality, open repair or EVAR, in AAA with HSK is not simple, and the benefits should be carefully weighed against the risks. Several reports have shown that intentional coverage of accessory renal arteries during EVAR did not cause deterioration of renal function, in spite of renal infarction in some patients. EVAR-enthusiasts advocate the expansion of size criteria, from 2 mm to 3 mm, and even to 4 mm, but yet the supporting studies are mostly retrospective and small sized. Moreover, we could not find any reports providing details about cases requiring occlusion of multiple accessory renal arteries (EVAR in the present case would have had to sacrifice 4 accessory renal arteries, including two with 2.5 mm and 3.1 mm size.). Simple size criteria cannot be applied in such cases, as there may be additive effects on the extent of the infarct. Assessment of the renal mass supplied by the accessory renal artery with spiral CT during angiography [10] or by using renal scintigraphy [11] has been suggested. Although it was not performed in our patient, these methods may aid in deciding which renal arteries can be sacrificed safely, by providing more accurate estimates of the possible infarct size.

To sum up, larger accessory renal arteries may be sacrificed safely during repair of AAA with HSK, but in our opinion there is not enough evidence regarding the sacrifice of accessory renal arteries, and thus, we recommend revascularization of accessory arteries greater than 2 mm until more data is available.

REFERENCES

1) Natsis K, Piagkou M, Skotsimara A, Protogerou V, Tsitouridis I, Skandalakis P. Horseshoe kidney: a review of anatomy and pathology. Surg Radiol Anat 2014;36:517-526.
2) Connelly TL, McKinnon W, Smith RB 3rd, Perdue GD. Abdominal aortic surgery and horseshoe kidney. Arch Surg 1980;115:1459-1463.
3) McIlhenny C, Scott RN. Abdominal aortic aneurysm in association with horseshoe kidney. Eur J Vasc Endovasc Surg 2002;23:556-558.
4) Stroosma OB, Kootstra G, Schurink GW. Management of aortic aneurysm in the presence of a horseshoe kidney. Br J Surg 2001;88:500-509.
5) Khan A, Myatt A, Palit V, Biyani CS, Urol D. Laparoscopic heminephrectomy of a horseshoe kidney. JSLS 2011;15:415-420.
6) Chihara S, Fujino T, Matsuo H, Hidaka A. Surgical treatment of abdominal aortic aneurysm associated with horseshoe kidney: symphysiotomy using harmonic focus. Ann Thorac Cardiovasc Surg 2014;20(Suppl):922-925.

7) O'Hara PJ, Hakaim AG, Hertzer NR, Krajewski LP, Cox GS, Beven EG. Surgical management of aortic aneurysm and coexistent horseshoe kidney: review of a 31-year experience. J Vasc Surg 1993;17:940-947.
8) Kaplan DB, Kwon CC, Marin ML, Hollier LH. Endovascular repair of abdominal aortic aneurysms in patients with congenital renal vascular anomalies. J Vasc Surg 1999;30:407-415.
9) Antoniou GA, Karkos CD, Antoniou SA, Georgiadis GS. Can an accessory renal artery be safely covered during endovascular aortic aneurysm repair? Interact Cardiovasc Thorac Surg 2013; 17:1025-1027.
10) Dorffner R, Thurnher S, Prokesch R, Youssefzadeh S, Hölzenbein T, Lammer J. Spiral CT during selective accessory renal artery angiography: assessment of vascular territory before aortic stent-grafting. Cardiovasc Intervent Radiol 1998;21:179-182.
11) Dzieciuchowicz L, Espinosa G, Diaz CV, Lavilla Roya FJ, Lostao JA. Renal function in patients treated with abdominal aortic stentgraft implantation with an intentional occlusion of accessory renal artery. Ann Vasc Surg 2012;26:299-305.

http://dx.doi.org/10.5758/vsi.2015.31.2.54