Endovascular aneurysm repair: Treatment of choice for abdominal aortic aneurysm coincident with horseshoe kidney? Three case reports and review of literature

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There is still controversy as to which surgical method is the most suitable for repair of abdominal aortic aneurysm with concomitant horseshoe kidney (AAA-HSK). We report three cases of AAA-HSK treated with endovascular aneurysm repair. In one of these patients we sacrificed the accessory renal artery by applying coils before the operation. Renal infarction, hypertension, or elevated serum creatinine level was not observed in any of our patients. If the blood supply to the kidneys is taken into consideration, endovascular aneurysm repair is our preferred surgical method for repair of AAA-HSK when anatomic conditions are suitable for stent-graft application and kidney function is normal. (J Vasc Surg 2004;40:367-70.)

Horseshoe kidney (HSK) usually is associated with normal renal function, inasmuch as it is asymptomatic in most patients. HSK comprises a range of possible arterial, venous, and renal malformations that impede aortic surgery.[1] Only .12% of patients requiring aneurysm repair have HSK.[2]

Various classifications exist for variable arterial blood supply in HSK. We prefer that proposed by Eisendrath et al[3]; the frequency distribution derives from Faris and Buxton[4] (Fig 1).

The isthmus of HSK may consist of fibrotic tissue or of well-vascularized parenchyma, which is seen much more frequently.[5]

In the rare combination of HSK with abdominal aortic aneurysm (AAA), we believe endovascular aneurysm repair (EVAR) is a valuable alternative when technically feasible. The technical problems are probably associated with increased morbidity and mortality, but can be averted with EVAR. We present the results of EVAR at 2 centers, and discuss them in conjunction with a review of the literature.

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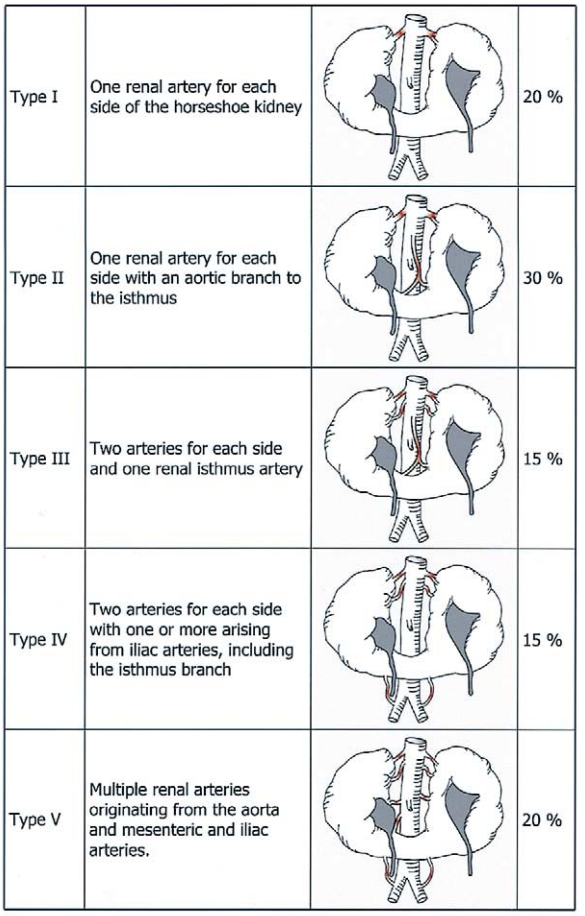

Fig 1. Arterial blood supply to horseshoe kidney. Classification of five kinds of arterial blood supply, according to Eisendrath et al.[3]

Literature review of horseshoe kidney treated with endovascular aneurysm repair

	Author				
	Ferko et al[15]	*Dorffner et al*[16]	*Loftus et al*[17]	*Loftus et al*[17]	*Kaplan et al*[18]
Year	1997	1998	1998	1998	1999
Gender	Male	Male	Male	Male	ND
Age (y)	86	ND	59	73	ND
Aneurysm diameter (cm)	ND	ND	59	63	61
Neck length (mm)	5	ND	ND	ND	ND
Type of stent graft	Tapered aortomonoiliac PTFE prosthesis	Stentor	Tapered aortomonoiliac PTFE prosthesis	Tapered aortomonoiliac PTFE prosthesis	ND
Renal arteries	2 + 2	ND	2 + 1	2	3 + 4
Elsendrath classification	II	ND	II	I	IV
Occlusion of renal arteries	1	1	0	2	ND
Renal infarction	One fifth of right side	One third of HSK	No	No	ND
Hypertension	No	No	No	No	No
Elevation of creatinine level	No	No	No	No	No
Special features					

PTFE, Polytetrafluoroethylene; *HSK*, horseshoe kidney; *ND*, not determined.

CASE REPORTS

In 2 hospitals that participated in this study, EVAR was used in 3 patients (35% of treated patients) with coincident AAA and HSK (AAA-HSK).

A MEDLINE and Current Contents search using the terms "horse shoe," "horseshoe," "kidney," "aneurysm," "endovascular," and "EVAR" identified the 8 cases described in the literature in which EVAR was used to treat AAA-HSK. The individual cases, including our own, were investigated for important variables (Table).

Case 1. A 70-year-old man had diabetes mellitus, arterial hypertension, coronary heart disease, and high-grade carotid stenosis (preoperative American Society of Anesthesiologists [ASA] classification III). Computed tomography (CT) scans demonstrated an AAA 58 mm in diameter with an infrarenal neck 25 mm in diameter. The HSK was supplied by a normal renal artery on each side and one accessory renal artery. Renal retention values were in the normal range. The aneurysm was repaired with a 24 × 14 × 14-mm Zenith stent graft (Cook). The accessory renal artery, which originated ventrally, was covered with the stent graft. The patient was discharged on day 5 after the operation.

Case 2. A 70-year-old man had arterial hypertension and coronary heart disease (preoperative ASA III). CT scans revealed an AAA limited to the aorta with a diameter of 58 mm; the length of the neck was 15 mm. The HSK was supplied with blood by two normal renal arteries, of which the left was dominant. Renal retention values were moderately elevated (creatinine concentration, 2.2 mg/dL). The aneurysm was repaired with a 26-mm × 18-mm × 18-mm Zenith stent graft (Cook). The patient was discharged on day 4 after the operation.

Case 3. A 69-year-old man had HSK and an AAA with maximum diameter of 6.5 cm, as demonstrated on CT scans. Normal and selective angiography revealed that the renal artery was normal bilaterally, and there was a single left-sided accessory renal artery (Fig 2, online only; Fig 3).

Functional scintigraphy of the kidney carried out separately on each side showed that the left kidney was functionally predominant (63%). Clinical laboratory results revealed renal retention values in the normal range (creatinine, 1.2 mg/dL; urea, 10 mg/dL).

We decided to use endovascular therapy. Since we accepted a partial segment renal infarction with deliberate stenting over of the accessory renal artery, that artery was occluded with coil embolization to avert a type II endoleak, as described by White et al.[6] After the intervention, the creatinine concentration rose to 1.4 mg/dL. An aortobiilial stent prosthesis (Ancure; Guidant) was implanted. The patient was discharged on postoperative day 6, and recovery was uncomplicated.

In all three patients there was no postoperative (14 days and 12 months after procedure) elevation of kidney retention values (creatinine, urea) or deterioration of arterial hypertension.

CT angiography performed postoperatively and after 12 months did not reveal any indications of renal infarction or endoleak.

DISCUSSION

The technical difficulty in performing surgery on infrarenal AAA with concomitant HSK consists in finding a suitable access route and on the uncommon manifestation of an accessory renal artery.[1,7] Presence of an accessory renal artery influences the choice of access route in accord with the Eisendrath classification. In anatomic terms, accessory renal arteries are regarded as functional end arteries, but collateral flow has been noted clinically.[8-10]

(Table continued)

Lee et al[19]	*Toursarkissian et al*[20]	*Teljink et al*[21]	*Ruppert et al*		
			Case 1	*Case 2*	*Case 3*
2001	2001	2003	2003	2003	2003
Male	Male	Male	Male	Male	Male
78	70	78	70	70	69
52	50	72	58	58	65
ND	11	30	25	15	40
AneuRx (Medtronic)	AneuRx (Medtronic)	Talent (Medtronic)	Zenith (Cook)	Zenith (Cook)	Ancure (Guidant)
2 + 1	2 + 4	2	2 + 1	2	2 + 1
II	IV	I	II	I	II
0	2	0	1	0	1
No	No	No	No	No	No
No	No	No	Unchanged	Unchanged	Unchanged
No	Transient	No	No	No	No
Additional hypogastric artery aneurysm (diameter, 62 mm)	Isthmus mass	Ruptured abdominal aortic aneurysm			Coil application for closure of accessory renal artery

There are two conventional surgical approaches to dealing with accessory renal artery during aneurysm repair. The first consists of reimplanting all relevant accessory renal arteries.[11,12] The second is ligation of accessory renal arteries, and small renal infarcts are anticipated as a matter of course. This approach has the advantage of enabling a major reduction in operation time and lowering of surgical risk.[13,14]

Since 1991 the EVAR method has been described 8 times in treatment of AAA-HSK.[15-21] Our cases are considered in conjunction with a synoptic review of the outcome after EVAR (Table).

Renal arteries were sacrificed in 6 patients. Two patients had demonstrable infarction of the kidneys. A transient elevation in renal retention values occurred in 1 patient. Deterioration of existing or new hypertension was not observed in any patients.

The question of conventional surgical procedure may be elucidated on the basis of the observations made when applying EVAR in renovascular anomalies. Aquino et al[22] have shown that, apart from small segmental infarcts in 21% of patients, transient hypertension occurred in only 1 of 24 patients who underwent treatment of an AAA with EVAR by stenting over the accessory renal artery. Kaplan et al[18] reported similar results. In addition to the requirement that the main trunk arteries not be significantly stenosed, Kaplan et al[18] stipulate that their candidates for EVAR have accessory renal arteries with diameter less than 3 mm and that there is no pre-existing renal failure.

Our results and review of literature also document that the importance of accessory renal arteries appears to have been overestimated early on. In view of the rarity of AAA-HSK, the 11 cases reported justify a recommendation for diagnosis and EVAR therapy. In their detailed review of 176 patients, Stroosma et al[7] also conclude that EVAR is preferred over the open method in HSK.

This discussion of accessory renal artery leads us to conclude that in the presence of blood supply type I and II,according to Eisendrath, EVAR is preferable to open aneurysm repair in any patient in whom EVAR is technically feasible, if renal retention values are normal. Nonpredominant accessory renal artery less than 3 mm in diameter providing the isthmus with blood can be covered without any problems. In the case of dominant accessory renal artery greater than 3 mm in diameter, we recommend diagnostic use of selective angiography to determine what proportion of the HSK and how much parenchyma is supplied by the accessory renal artery. In the case of blood supply types III and IV it must be decided on the basis of each case whether EVAR is feasible. In our view, Type V cannot be repaired with EVAR.

Large accessory renal arteries may lead to type II endoleak. As reported by White et al,[6] they also entail risk for rupture. Hence we embolized the artery with coils before EVAR in our third case, because angiography revealed evidence of minimal collateral flow to the accessory renal artery via renal capsule arteries.

CONCLUSION

If the prerequisites of anatomic suitability and normal renal function are fulfilled, we recommend that EVAR be considered the method of first choice in the presence of AAA-HSK in patients with arterial blood supply types I to IV (non-dominant accessory renal artery <3 mm), according to Eisendrath, because these patients benefit particularly from less severe access trauma.

Fig 3. Selective angiogram shows that the left accessory renal artery (diameter, 3.5 mm) supplies blood to parts of the isthmus and the left half of the kidney.

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