Horseshoe Kidney Complicating The Repair Of An Abdominal Aortic Aneurysm

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Abstract

A 63-year-old male who presented with an abdominal aortic aneurysm and an incidental finding of a horseshoe kidney intraoperatively is described. Operative approach was transabdominal. The isthmus of the horseshoe kidney which was over the inferior border of the aneurysm was lifted upwards to give better exposure to the aneurysm. In addition to one renal artery for each side, there were accessory arteries to each side taking off from the aneurysm supplying the lower poles of the kidney and isthmus. These were reimplanted individually into the graft. Postoperatively renal function remained normal without any need for dialysis. A horseshoe kidney coexistent with an abdominal aortic aneurysm poses two problems to the surgeon: exposure of the aneurysm, and identification of anomalous blood supply to the kidneys and their subsequent reimplantation to the graft. In this case, technical difficulty did not compromise the repair of the aneurysm and the outcome of the operation.

THE INCIDENCE of horseshoe kidneys is 1 to 4 in 1000 cases[1]. Horseshoe kidneys occurring with aortic aneurysms are rarer, with less than a hundred cases reported worldwide[2,3]. This paper adds another case to the growing number of reports, with the aim of increasing the awareness of surgeons who manage abdominal aortic aneurysms, that such a condition may exist. Although infrequent, this presents a technical challenge because of the abnormal anatomic relationship between aorta and kidney, and because of the possible anomalies in renal blood supply, which may be involved in the aneurysmal wall. Consequently, the approach to the repair of the aneurysm would have to be modified.

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Case Report

This is a 63-year-old male who had epigastric pains and feeling of heaviness at the lower back for about a year. On consultation, he was noted to have a pulsating abdominal mass at the periumbilical area. Abdominal ultrasonography showed a fusiform dilatation of the distal abdominal aorta measuring 4.2 cm at its widest transverse diameter with circumferential thrombus formation. The kidneys were described to be normal in size and echotexture. No further imaging studies were done for the kidneys. Although the urinalysis showed microscopic hematuria (8 to 12 per high power field), the serum creatinine was normal (0.8 mg/dL).

The aneurysm was approached transperitoneally. A 4 cm fusiform dilatation of the aorta below the renal vessels was seen. Initial dissection was carried out in the usual manner. However, a firm to doughy elongated structure was noted to cross the main body of the aneurysm. Further dissection revealed this to be the isthmus of a conjoined or "horseshoe" kidney. The associated anomalous arterial supply was also identified. The technique for resection of the aneurysm was subsequently modified. The isthmus was further

mobilized and lifted upwards to expose the lateral side of the aneurysm with the take-off of the accesory renal arteries, one to each side. The inferior mesenteric artery was also identified (Figure 1).

Figure 1. The isthmus of the horseshoe kidney (arrow) bridging over the main body of the aneurysm.

After proximal and distal controls, repair was carried out according to the concept of endoaneurysmorrhaphy using a size 16 Dacron graft. The graft was drawn beneath the horseshoe kidney. The accessory renal arteries were reimplanted individually end-to-side to the graft using a Carrel patch. The occluded inferior mesenteric artery was subsequently ligated. The retained part of the aneurysmal sac was closed over the aortic graft (Figure 2).

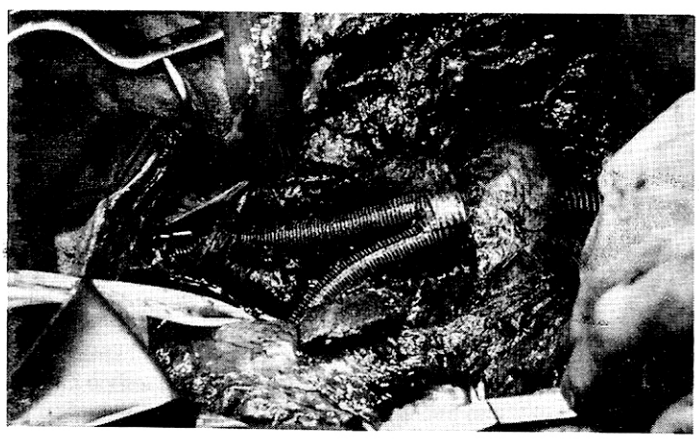

Figure 2. The aortic graft in place under the isthmus of the horseshoe kidney.

The postoperative course of the patient was uneventful. His renal function remained normal. The patient was discharged asymptomatic on the tenth postoperative day.

Discussion

Horseshoe kidneys have a 0.25% incidence.[1] Its association with an abdominal aortic aneurysm is an even rarer occurrence. Bietz reviewed 32 cases reported until 1974.[2] Literature search from 1977 until 1993 showed 22 case reports and series involving a total of 64 patients, including a 31-year review (1960 to 1991) from the Cleveland Clinic which reported 19 patients.[3]

Despite this rarity, the occurrence of horseshoe kidneys, or any other anatomic anomaly for that matter, must be anticipated by the surgeon who manages an abdominal aortic aneurysm, as this can create technical difficulties in its repair.

There are two major problems encountered during the repair of an abdominal aortic aneurysm in the presence of a horseshoe kidney: exposure of the aorta and preservation of the renal arteries.[4]

Horseshoe kidneys present several anatomic anomalies that compromise good exposure during aneurysmal repair. Normal kidneys complete their ascent and medial rotation by the eighth embryologic week while fusion of the metanephric blastema results in horseshoe kidneys. These are linked at the lower poles in 95% by the isthmus, which is usually of bulky parenchymatous tissue with its own blood supply; others may be just a flimsy midline structure made up of fibrous tissue.[1] Ascent is arrested when the isthmus reaches the inferior mesenteric artery. Thus the isthmus normally lies opposite the fourth lumbar interspace anterior to the common iliac vessels. The pelves are also directed anteriorly since medial rotation is prevented. Lastly, the ureters overlie the isthmus,[5] which could be injured during dissection. This typical presentation of horseshoe kidneys was found in this patient.

In 60 to 80% of cases, blood supply, in addition to renal arteries, is via multiple and aberrant segmental vessels.[6,7,8] This can be classified as follows, with almost equal incidence:[8]

1. one renal artery for each kidney
2. one renal artery for each kidney with an aortic branch to the isthmus (slightly more common)
3. two arteries for each kidney with one renal isthmus artery
4. two arteries for each kidney with one or more arising from the iliac arteries, including the isthmus branch
5. multiple renal arteries, sometimes too numerous to count, originating from the aorta and mesenteric and iliac arteries.[9]

In this case, in addition to one renal artery to each

kidney, there were two accessory arteries arising from the aorta which supplied each kidney, one on each side. There was no artery to the isthmus.

Venous abnormalities are less extensive and usually do not impede exposure of the aorta.

The diagnosis of horseshoe kidneys may be arrived at through the following:

1. symptoms and signs - 30% are asymptomatic and may just present as an abdominal mass,[1] but because of its predilection to infection, stones and hydronephrosis, it may produce periumbilical or flank pain, urinary tract infection, irritative voiding symptoms, or hematuria.[5] Such symptoms were absent in this patient except for the microscopic hematuria which was detected preoperatively.
2. ultrasound or CT scan - these significantly improve the chances of detection,[10] but the ultrasonogram done in this case did not help in the diagnosis. A postoperative reevaluation done could not also delineate the horseshoe kidney.
3. magnetic resonance imaging[4]
4. duplex scanning[4]
5. radionuclide renal scan - the isthmus may be seen but this is not likely to be performed unless the diagnosis is already suspected.[10]
6. excretory urograms - diagnostic in only one-half of cases.[11]
7. aortography - this is not performed routinely for aortic aneurysms in many centers.[11]

If diagnosed preoperatively, aortography and selective renal arteriography must be performed to delineate the blood supply[12] which is anomalous in 60 to 80%. If the arteries are multiple, selective cannulation of the aortic branch arteries may be useful both for intraoperative localization of arteries and identification of safe planes through which to operate.[4]

If the horseshoe kidneys are found intraoperatively, on-table arteriography to identify accessory renal arteries coming off the aneurysm may be done.[13] This is done by injecting 40 ml of contrast agent into the temporarily-occluded aorta proximal to the aneurysm. The surgeon did not find this necessary as the renal and accessory arteries were identified easily.

The surgical approach may either be thoracoabdominal[14] or transabdominal.[9] The transabdominal approach was more than sufficient in this case; the exposure was further increased with the horseshoe kidney reflected upward with a loop around the isthmus. Alternatively, the isthmus may be divided.[9] Urine leakage from the transected edges of the renal isthmus is rare if the raw surface is covered and sealed with tough renal capsule.

Critical renal arteries may be reimplanted individually if they arise from the aneurysmal aorta[14] and if they are of sufficient size. Multiple renal arteries may be reimplanted using a Carrel patch.[9]

References

1. Bauer SB, Perlmutter AD, Retik AB. Anomalies of the upper urinary tract. In: Campbell's Urology, sixth edition. PC Walsh, AB Retik, TA Stamey, ED Vaughan (Editors). Philadelphia: W.B. Saunders Co. vol. 2, sect. X, chapt. 34, pp. 1376-1381, 1992.
2. Bietz DS, Merendino KA. Abdominal aortic aneurysm and horseshoe kidneys: A review. Ann Surg 1975; 181:333.
3. O'Hara PJ, Hakaim AG, Hertzer NR, et al. J Vasc Surg 1993; 17(5):940-947.
4. Svensson LG, Crawford ES. Aortic dissection and aortic aneurysm surgery: clinical observations, experimental investigations and statistical analysis (Part III). Curr Prob Surg 1993; 30(1): 87-88.
5. Elder JS. Operations for anomalies of renal fusion. In: Mastery of Surgery (urologic surgery). JE Fowler (editor) New York: Little, Brown and Co. 1992; 75-84.
6. Connelley TL, McKinnon W, Smith RB, Perdue GL. Abdominal aortic surgery and horseshoe kidney. Arch Surg 1980; 115:1459.
7. Hohenfellner M, Schultz-Lampel D, Lampel A, et al. Tumor in the horseshoe kidney: clinical implications and review of embryogenesis. J Urol 1992; 147:1098-1102.
8. Eisendrath DN, Phifer LA, Culver HB. Horseshoe kidney. Ann Surg 1925; 82:735-764.
9. Svensson LG, Persson LA, Cohen PM, et al. Successful management of ruptured septic aortic aneurysm and horseshoe kidney with multiple renal arteries: a case report. Smith Afr J Surg 1987; 25:161-163.
10. Rutherford RB. Infrarenal aortic aneurysms. In: R B Rutherford (ed). Vascular Surgery, second edition. Philadelphia: W.B. Saunders Co. 1984; 766-767.
11. Sigler L, Geary JE. Abdominal aortic aneurysm and unexpected horseshoe kidneys. J Cardiovasc Surg 1963; 10:320.
12. Davis JT, Hardin WT, Hardy JD, Neely WA. Abdominal aortic aneurysm and horseshoe kidney. South Med J 1975; 64:75.
13. Minken SL, Rob CG. Aortic aneurysm and horseshoe kidney: a case report and collective review. Surgery 1967; 61:719.
14. Crawford ES, Coseli JS, Safi HJ et al. The impact of renal fusion and ectopia on aortic surgery. J Vasc Surg 1988; 8:357-383.