Surgical Treatment of Abdominal Aortic Aneurysm Associated with Horseshoe Kidney: Symphysiotomy Using Harmonic Focus

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Coexistence of horseshoe kidney and abdominal aortic aneurysm (AAA) is a rare entity that presents a technical challenge to vascular surgeons. How to approach such an AAA with horseshoe kidney and whether to divide the renal isthmus remains a controversial issue. We report here the successful surgical repair of an AAA with horseshoe kidney via the transperitoneal approach with division of the renal isthmus by Harmonic Focus, which allowed easy division of the isthmus without bleeding. Harmonic Focus, a hand-held type of harmonic scalpel, was thus useful in symphysiotomy of the horseshoe kidney.

Keywords: abdominal aortic aneurysm, horseshoe kidney, Harmonic Focus

Introduction

Horseshoe kidney is a common urologic anomaly, occurring in approximately 0.25% of the population.1) Despite this relatively high incidence, the occurrence of abdominal aortic aneurysm (AAA) associated with horseshoe kidney is rare. Surgical treatment of AAA associated with horseshoe kidney requires special consideration because of the abnormal anatomy. The isthmus of the horseshoe kidney almost always lies over the aneurysm, which renders its exposure rather difficult. Accurate preoperative diagnosis and well-designed surgical strategies are required for good outcomes. We report here a case of successful surgical AAA repair via a transperitoneal approach with division of the renal isthmus using a Harmonic Focus, a hand-held ultrasonic dissector, in the presence of a horseshoe kidney.

Case Report

A 58-year-old Japanese man referred for hemorrhagic gastric ulcer presented with a huge pulsatile tumor on abdominal physical examination. Computed tomography (CT) demonstrated an infrarenal AAA measuring 73 mm in diameter, associated with a horseshoe kidney, with the isthmus lying anterior to the aneurysm. The isthmus was 3 mm in thickness, and did not show any evidence of a collecting system (Fig. 1A). The AAA extended to the bilateral common iliac arteries. The presence of two accessory renal arteries was confirmed by CT and 3-D CT, with one originating from the anterior surface of the aneurysm and leading to the right side and isthmus of the horseshoe kidney (Fig. 1B–1D).

The surgical repair procedure for the AAA was performed through a median laparotomy. The isthmus of the horseshoe kidney was observed to lie over the aneurysm, and the inferior mesenteric artery was observed coursing down in front of the isthmus. The isthmus measured 5 cm longitudinally, with a thickness of 4 mm. Both the ureters
were identified and protected within the operative field. Although dissection of the proximal aorta, bilateral external iliac arteries, and bilateral internal iliac arteries was easy, the right accessory renal artery was rather short in length, originating behind the isthmus of the horseshoe kidney. Since it was difficult to identify this right accessory renal artery and it was evident that a collecting system was not present in the isthmus, we performed symphysiotomy. Although the isthmus was thicker than anticipated, we could divide it easily without bleeding by using a Harmonic Focus (Ethicon Endo-Surgery, Inc., Cincinnati, Ohio, USA) (Fig. 2). After symphysiotomy, the accessory renal artery was clearly observed, and the aorta could then be repaired according to standard procedure. The abdominal aorta was clamped under the left and right main renal arteries. Because the accessory artery measured 5 mm in diameter, after the accessory artery orifice was identified, cold Ringer’s solution (4°C) was continuously infused into the accessory artery. During the perfusion, the lower one-third of the right kidney was noted to be pale. We inserted a 16-mm × 8-mm, bifurcated Dacron graft into the aorta. Each leg was anastomosed to the terminal end

de Fig. 1  (A) Computed tomography (CT) demonstrated an abdominal aortic aneurysm associated with horseshoe kidney.  (B–D) Two accessory renal arteries were confirmed by CT and 3-D CT, with one (arrow) originating from the anterior surface of the aneurysm and leading to the right side and the isthmus of the horseshoe kidney.

Fig. 2  The isthmus was divided easily without bleeding by using a Harmonic Focus.
aneurysm, and the patency of the reconstructed accessory renal artery was confirmed. No signs of renal infarction were observed.

Discussion

Horseshoe kidney is the most common urologic anomaly, occurring in approximately 0.25% of the population. It represents a fusion anomaly, mainly at the lower poles, occurring between the 4th and 6th weeks of gestation. A 2:1 male-to-female predominance has been noted for this abnormality. Despite this relatively high incidence, AAA associated with horseshoe kidney is rare.

Since the isthmus of the horseshoe kidney almost always lies over an AAA, surgical treatment of such an aneurysm is complicated due to the abnormal anatomy, difficulties in exposing the aneurysm, and a variable blood supply to the isthmus and lower poles of the horseshoe kidney. Therefore, accurate preoperative diagnosis and well-designed surgical strategies are required for optimal management of such cases.

The optimal approach to the abdominal aorta in patients with a horseshoe kidney remains controversial. The left extraperitoneal approach appears, to date, to be well tolerated and is recommended in patients with a horseshoe kidney since it avoids interference with the renal isthmus, the urinary tract, and the renal vessels. However, reaching the right iliac vessels via this approach is not easy. The transperitoneal approach assures the best exposure of the kidney, the ureters, the aneurysm, and both iliac vessels; however, the renal isthmus can pose a problem in reimplanting aberrant renal arteries. We therefore used a median laparotomy as the surgical approach since it easily exposes both the iliac axes.

Abnormalities in renal blood supply have been reported in 60%–74% of patients with horseshoe kidneys. Anatomically, the blood supply to the horseshoe kidney is controlled segmentally by the accessory arteries, and the collateral blood flow between the segments is minimal. Therefore, ligation of the accessory arteries may result in ischemia of the renal isthmus. Canova, et al. reported that anomalous renal arteries <2 mm in diameter can be sacrificed without a real risk of renal ischemia. However, accessory renal arteries of significant size should be preserved to prevent renal infarctions.

The isthmus that connects the lower renal poles in horseshoe kidney may either be a fibrous band or contain functional parenchymal tissue. Successful surgical repair of the abdominal aorta, with or without division of the renal isthmus, has been previously reported. Because of the risks of retroperitoneal urinary leaks, infection, bleeding, and renal ischemia, some surgeons consider it prudent to not divide the isthmus. However, Connelly, et al. reported the results of symphysiotomy performed in 24 of the cases reviewed and added their cases, with no complications observed related to the division of the isthmus. They divided the isthmus and oversewed the stumps. They observed that if the arterial blood supply was preserved, postoperative renal necrosis and urine leaks would not occur. Although Connelly, et al. did not recommend routine symphysiotomy, they advised the division of the isthmus when it would facilitate the surgical repair of AAA. In our case, since the accessory artery was rather short and originated behind the relatively thin isthmus, we performed symphysiotomy with reconstruction of the accessory artery. Although the isthmus was thicker than anticipated, we divided it easily without bleeding by using a Harmonic Focus.

The microwave tissue coagulator, which has been used for controlling parenchymal bleeding in solid vascular organs, such as the liver, has been successfully applied in partial renal resection. The harmonic scalpel is a titanium blade that vibrates at a rate of 55500 Hz, allowing simultaneous tissue cutting and coagulation with minimal damage to surrounding tissues. This effect is achieved by the disruption of hydrogen bonds in tissue proteins, thus forming...
a hemostatic coagulum that seals both blood vessels and the urinary collecting system. Harmonic Focus is a handheld type of harmonic scalpel that allows lymphatics to be sealed without the utilization of clips or ties. This device has been available since October 2007 and is designed for open procedures. It feels similar to conventional surgical instrumentation, and can be used to precisely grasp, dissect, cut, and coagulate. When the isthmus is too thick for Harmonic Focus to grasp, a hook blade or the curved blade of the harmonic scalpel can also be substituted. Noguchi, et al. reported the successful repair of an AAA in the presence of horseshoe kidney and a coagulopathy, via division of the renal isthmus using a harmonic scalpel and additional suturing in 2004. In our case, additional sutures were unnecessary, and the patient’s renal function showed no deterioration postoperatively.

Conclusions

The Harmonic Focus facilitated the division of the isthmus without bleeding. When performing abdominal aortic surgery in a patient with a horseshoe kidney, consideration should be given to concurrent symphysiotomy using the harmonic scalpel like, as it is safe and provides a clear view of the operative field.

Disclosure Statement

All authors have no conflict of interest.

References