

## Two-stage off-pump coronary artery bypass grafting and abdominal aortic aneurysm repair in a patient with horseshoe kidney

*At nalı böbrekli bir hastada abdominal aort anevrizması ve koroner arter hastalığının iki aşamalı cerrahi tedavisi*

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Coronary artery bypass grafting and abdominal aortic aneurysm (AAA) repair were performed in a 59-year-old male patient with horseshoe kidney (HSK). An abdominal mass was detected on physical examination. Ultrasonography revealed a partially thrombosed AAA with a length of 14 cm and a diameter of 6.5 cm. Computed tomography showed a coexistent HSK and the infrarenal location of the AAA ending at the aortic bifurcation. On magnetic resonance angiography, the renal veins were patent and the presence, size, and location of the aneurysm were confirmed. Coronary angiography revealed severe lesions in the left anterior descending artery and the right coronary artery. Renal functions were within normal limits. He was operated on for coronary artery disease with the off-pump technique, followed by a subsequent operation for AAA repair through a median incision. The renal isthmus was preserved and mobilized, providing good access to the aneurysm. A tubular graft was implanted and wrapped by the native aorta. The patient was discharged with no postoperative complications.

**Key words:** Aortic aneurysm, abdominal/surgery; coronary artery bypass/methods; kidney/abnormalities; renal artery/abnormalities/surgery.

Horseshoe kidney (HSK), a rare complex congenital malformation caused by the fusion of renal parenchyma, is reported to occur in 0.15% to 0.33% of the population, with a two-fold frequency in males.<sup>[1,2]</sup> Vascular anomalies occur in 60% to 80% of reported cases.<sup>[1]</sup> The coexistence of HSK and an abdominal aortic aneurysm (AAA) is very rare, being reported in 1 of 710 autopsy patients.<sup>[3]</sup> The number of cases reported to have this association is relatively few (176 cases by 2001).<sup>[4]</sup> Anatomic features related to the renal isthmus or arterial anomalies pose technical difficulties for AAA repairs.

At nalı böbrek saptanan 59 yaşında bir erkek hastada koroner arter bypass cerrahisi ve abdominal aort anevrizması (AAA) onarımı yapıldı. Fizik muayenede abdominal kitle saptanan hastanın ultrasonografisinde 14 cm uzunluğunda, 6.5 cm çapında, kısmen tromboze olmuş AAA izlendi. Bilgisayarlı tomografide, at nalı böbrek ile birlikte aort bifurkasyonunda sonlanan infrarenal yerleşimli AAA görüldü. Manyetik rezonans anjiyografide anevrizmanın varlığı, büyüklüğü ve yerleşimi doğrulandı ve renal venlerin açık olduğu görüldü. Koroner anjiyografide, sol ön inen arterde ve sağ koroner arterde ciddi lezyolar izlendi. Hastanın renal fonksiyonları normal sınırlardaydı. Hastaya önce koroner arter hastalığı için atan kalpte koroner bypass ameliyatı uygulandı; daha sonra ikinci bir ameliyatla median insizyon ile anevrizma onarımı yapıldı. Anevrizmaya ulaşım, renal istmus korunup mobilize edilerek sağlandı. Tübüler greft implantasyonundan sonra, greft nativ aort ile sarıldı. Hasta herhangi bir komplikasyon gelişmeksizin taburcu edildi.

**Anahtar sözcükler:** Aort anevrizması, abdominal/cerrahi; koroner bypass/yöntem; böbrek/anormallik; renal arter/anormallik/cerrahi.

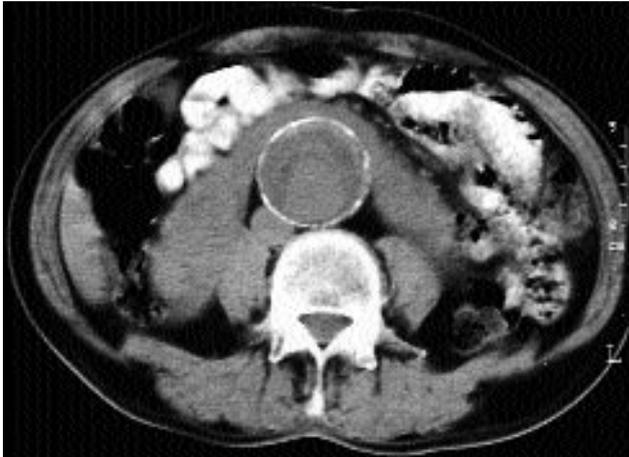
This article presents a patient with HSK who underwent AAA repair and coronary artery bypass grafting (CABG).

### CASE REPORT

A 59-year-old, hypertensive male patient presented with chest pain graded as class III according to the Canadian Cardiovascular Society Classification. An abdominal mass was detected on physical examination. Ultrasonography revealed a partially thrombosed AAA with a length of 14 cm and a diameter of 6.5 cm. Computed tomography (CT) showed a coexistent HSK

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**Fig. 1.** Magnetic resonance angiography confirmed the presence and size of the aneurysm and gave information about its location at the infrarenal level.

with a lower pole fusion. It also confirmed the presence of the AAA in the infrarenal location. The aneurysm ended at the aortic bifurcation. Magnetic resonance angiography confirmed the presence, size, and location of the aneurysm (Fig. 1). The renal veins were patent. Coronary angiography revealed severe lesions in the left anterior descending (LAD) artery and the right coronary artery (RCA). Renal functions were within normal limits.

The patient was first operated on for coronary artery disease. Revascularization was performed with the off-pump CABG technique using grafts from the left internal mammary artery and saphenous vein for the LAD and RCA, respectively. The patient was monitored carefully to avoid hypertensive episodes.

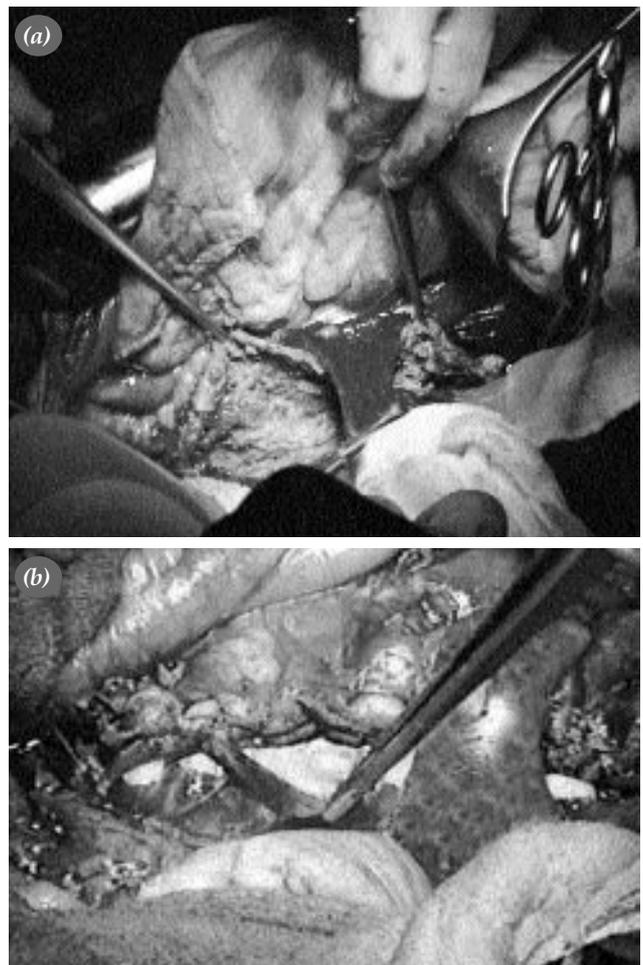
The second stage of the operation was the AAA repair through a median laparotomy. The aneurysm was seen at the infrarenal level, with a length of 14 cm and an approximate diameter of 6.5 cm, ending before the aortic bifurcation. An HSK was identified, with its lower pole located anterior to the aneurysmal sac. The renal arteries above the aneurysm were normal. The renal isthmus was preserved, mobilized, and a good access to the aneurysm was achieved. The infrarenal abdominal aorta and iliac arteries were cross-clamped and the aneurysmal sac was opened (Fig. 2a). The thrombosed material inside the aneurysm was removed. A tubular graft was implanted and wrapped by the native aorta (Fig. 2b). The patient was discharged on the postoperative sixth day without any complication.

## DISCUSSION

Patients with AAA often have concomitant coronary artery disease. It is still controversial whether a simul-

taneous operation or two-stage operation should be chosen for these patients.<sup>[5]</sup> One-stage operation is thought to be an attractive option in selected patients with an aneurysm exceeding 7 cm in diameter.<sup>[6]</sup> In a previous study from our clinic, a series of patients with AAA and concomitant coronary artery disease were treated with one-stage operations for aneurysms with a mean diameter of 8.25 cm and critical coronary artery disease.<sup>[7]</sup>

In our patient, we performed a two-stage operation with off-pump CABG. The rationale for this choice was based on both the clinical condition of the patient, that is his chief complaints were due to coronary artery disease and the aneurysm diameter was less than 7 cm, and the presence of HSK. The existence of HSK would prolong the operation time, which would increase postoperative morbidity and the risk for mor-



**Fig. 2.** (a) An operative view of the horseshoe kidney and the abdominal aortic aneurysm. The technique of hanging the isthmus without division enabled good access to the aneurysmal sac. (b) The view of the tubular graft after implantation and the horseshoe kidney.

tality (especially in those associated with renal insufficiency).

Nearly 15% to 30% of patients with HSK are reported to have asymptomatic, ascending urinary tract infections caused usually by intestinal gram-negative organisms, making the patient prone to infections.<sup>[8]</sup> Since the risk for an infection would be amplified in the more traumatic one-stage approach, AAA repair was reserved for a subsequent operation.

We used the off-pump technique for CABG in our patient to avoid hemorrhagic, cerebral, and pulmonary side effects and related mortality in cardiopulmonary bypass surgery.<sup>[7,9]</sup>

Identification of an HSK preoperatively will allow the surgeon to prepare for the operation.<sup>[10]</sup> Detection of this abnormality may also be made at surgery, but this will prolong the operation and significantly increase the risk for injury to the isthmus. In our patient, the diagnosis of HSK was made before surgery.

Computed tomography is reported to give the most detailed information regarding the HSK morphology and the anatomic features and relations of the kidney, its vessels, and the aneurysm in 90% of the cases. Intravenous pyelogram reveals anomalies of the urinary tract, with an 88% sensitivity in visualization of an HSK. The success rate of angiography (performed in posteroanterior and lateral projections) to visualize an HSK is 67%, while it is only 38% by ultrasound scanning.<sup>[10]</sup> Hence, to date CT has been the gold standard in the visualization of HSKs and their anatomic relation with aneurysms.

During surgery for HSKs, the most important consideration is the surgical approach to the aorta, avoiding the renal isthmus and identifying the anomalous renal arteries. Median laparotomy enables to completely explore the peritoneal cavity; therefore, both iliac vessels can be checked and any coexistent anomaly detected. However, in the case of an HSK, the renal isthmus would hinder approach to the aorta and the reimplantation of any anomalous renal vessel would be difficult.<sup>[10,11]</sup> If arterial disease is limited to the aorta, the retroperitoneal approach would not cause problems for the dissection of anomalous renal structures;<sup>[10,12]</sup> thus, making it an alternative approach.<sup>[11]</sup> In our patient, we preferred a median laparotomy for better visualization.

Although resection of the renal isthmus facilitates the approach to the aorta,<sup>[13]</sup> it is associated with complications such as bleeding, ischemia, retroperitoneal urinary filtration, and graft sepsis.<sup>[14]</sup> Therefore, this practice is giving way to not performing isthmic resection.<sup>[14]</sup> In our patient, the renal isthmus was preserved.

When clamping of the infrarenal aorta is not feasible, suprarenal clamping or intraaortic occlusion should be considered, in which circumstance renal protection emerges as the main problem. This requires that the cross clamping period of the aorta be minimized and cold perfusion be performed to renal arteries.

Preoperative evaluation of renal functions is important in determining the prognosis of patients with HSK, as early postoperative mortality rates are reported to be higher for patients requiring hemodialysis (67% vs 6.3%).<sup>[10]</sup> Our patient had normal renal functions and no complications developed postoperatively.

It can be concluded that the presence of an HSK is not a contraindication to surgical treatment of AAA, though it may somewhat make the surgical repair technically difficult. In case AAA is associated with coronary artery disease, a two-stage operation should be chosen with CABG on the beating heart to minimize the adverse effects of cardiopulmonary bypass. Separation of the renal isthmus should be avoided while repairing the AAA. Mobilization of the isthmus obviates its division and provides good access to the aneurysm.

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