CASE REPORTS
PRIKAZI SLUČAJEVA

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OPEN SURGICAL REPAIR OF ABDOMINAL AORTIC ANEURYSM IN ASSOCIATION WITH HORSESHOE KIDNEY – CASE REPORT

OTVORENO HIRURŠKO LEČENJE ANEURIZME ABDOMINALNE AORTE UDRUŽENE SA POTKOVIČASTIM BUBREGOM – PRIKAZ SLUČAJA

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Summary

Introduction. Horseshoe kidney is a congenital anomaly in which both kidneys are fused across the midline. An aneurysm is a permanent, irreversible localized dilatation of a blood vessel, at least 1.5 times its normal diameter. The concomitant occurrence of an abdominal aortic aneurysm and a horseshoe kidney is rare, appearing in only 0.12% of patients with a previously diagnosed abdominal aortic aneurysm. The management of an abdominal aortic aneurysm in the presence of a horseshoe kidney poses a unique challenge for surgeons due to the close proximity of the kidneys and the variations in the vascularization of the horseshoe kidney. **Case Report.** We present two cases of abdominal aortic aneurysm in patients with a horseshoe kidney, with vascularization types I and II, successfully treated using a transperitoneal surgical approach without sectioning the isthmus. **Conclusion.** Given the variability in treatment options for these conditions, every case must be evaluated individually to determine the best therapeutic approach for the patient.

Key words: Aortic Aneurysm, Abdominal; Fused Kidney; Surgical Procedures, Operative; Risk Factors; Treatment Outcome

Sažetak

Uvod. Potkovičast bubreg podrazumeva anomaliju fuzije bubrega, kod koje su bubrezi međusobno spojeni. Aneurizma predstavlja trajno, ireverzibilno i lokalizovano proširenje krvnog suda, gde je dijametar krvnog suda uvećan bar za 50% u odnosu na normalan dijametar. Konkomitanto prisustvo aneurizme abdominalne aorte i potkovičastog bubrega pojavljuje se u oko 0,12% pacijenata sa prethodno dijagnostikovanom abdominalnom aneurizmom. Zbog bliskih prostornih odnosa između aneurizme abdominalne aorte i potkovičastog bubrega, kao i varijabilne vaskularizacije, operacija istih predstavlja poseban izazov za hirurge. **Prikaz slučaja.** Predstavljamo 2 slučaja pacijenata sa istovremenim prisustvom aneurizme abdominalne aorte i potkovičastog bubrega, sa vaskualrizacijom tip I i II, koji su bili uspešno tretirani operativnim lečenjem, transperitonelanim pristupom, bez sekcije istmusa. **Zaključak.** S obzirom na različite opcije u terapijskom pristupu pacijentima sa gore navedenim dijagnozama, svaki slučaj mora biti evaluiran ponaosob kako bi se najbolja opcija odbarala za svakog pacijenta.

Ključne reči: aneurizma abdominalne aorte; potkovičasti bubreg; operativne hirurške procedure; faktori rizika; ishod lečenja

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Introduction

Horseshoe kidney (HSK) is the most common congenital fusion defect of the kidney, occurring in approximately 0.25% of the population [1]. HSK involves the fusion of both kidneys across the midline, joined by an isthmus composed of either renal parenchyma or fibrous tissue [2]. An aneurysm is a permanent, irreversible localized dilatation of a vessel, with its diameter being at least 1.5 times larger than the expected normal diameter [3]. The concomitant presence of an abdominal aortic aneurysm (AAA) and HSK is rare, occurring in only 0.12% of patients with a previously diagnosed AAA [4]. The management of AAA associated with HSK presents a unique challenge for surgeons due to the close proximity of the kidneys and the variations in the vascularization of the HSK [5]. We present two patients with the coexistence of AAA and HSK treated by open surgical repair using a transperitoneal approach without sectioning the isthmus.

Case Report

First case: A 69-year-old man with a history of hypertension and hyperlipidemia was referred to our clinic for an asymptomatic AAA. The patient had no

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Abbreviations

HSK – Horseshoe kidney
AAA – abdominal aortic aneurysm
COPD – chronic obstructive pulmonary disease
CKD – chronic kidney disease
CTA – computed tomography angiography
ICU – intensive care unit

family history of aneurysm or renal malformations. Computed tomography angiography (CTA) revealed a 69 mm infrarenal AAA associated to a HSK, with an isthmus lying anterior to the aneurysm. Two main renal arteries were detected, as well as one isthmic branch arising directly from the aorta, classified as Type 2 of HSK **(Figure 1)**. The preoperative serum creatinine level was 75 μmol/L. The surgery was performed through a xyphopubic laparotomy. Transperitoneal dissection revealed the aortic aneurysm with its upper third shielded by the isthmus of the HSK. The infrarenal aorta, isthmus of HSK, common iliac arteries, and two renal arteries, as well as isthmic branch, were dissected. The two renal arteries and the isthmus were controlled by silastic vessel loops. After systemic heparinization, an aortic clamp was placed below both renal arteries, yet proximal to the isthmus of the HSK and the isthmic branch. The aneurysm sac was opened longitudinally, and a 16 mm Dacron graft was sutured. The proximal anastomosis was made right below the HSK, and the isthmus was gently pulled upward with a vessel loop. The proximal anastomosis was placed below the isthmic branch, so no reimplantation was needed. The operation took approximately two hours. The estimated amount of blood collected in the Cell Saver was 950 mL, of which 633 ml were autotransfused during the operation. On the third postoperative day, the patient was transferred from the ICU to the vascular surgery department. He was discharged on the fifth postoperative day without any intraoperative or postoperative complications. The postoperative serum creatinine level was 78 μmol/L.

Second case: A 67-year-old man with a history of hypertension, COPD, mitral, pulmonary, and tricuspid valve insufficiency, as well as CKD stage 2 and right hydronephrosis, was referred to our clinic for an asymptomatic AAA. CTA revealed a 54 mm

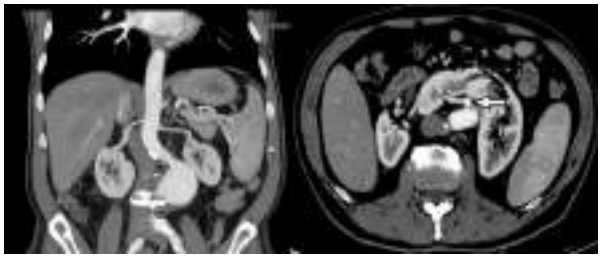

Figure 1. Computed tomography angiography depicting two renal arteries and an abdominal aortic aneurysm. White arrow indicates the isthmic branch.
Slika 1. *Kompjuterizovana tomografska angiografija sa prikazom aneurizme abdominalne aorte i obe renalne arterije. Bela strelica pokazuje istmičnu granu.*

Figure 2. Computed tomography angiography depicting horseshoe kidney and abdominal aortic aneurysm. White arrow indicates the isthmus.
Slika 2. *Kompjuterizovana tomografska angiografija prikazuje potkovičast bubreg i aneurizmu abdominalne aorte. Bela strelica pokazuje istmus potkovičastog bubrega.*

AAA and a 29 mm aneurysm of left common iliac artery. The CTA also showed a horseshoe kidney with the isthmus extended over the AAA, as well as right renal hydronephrosis and a ureteral calculus **(Figure 2)**. Two renal arteries were found, classified as Type I. The initial creatinine level was 95 μmol/L. The patient had no family history of aneurysm or renal malformations. The surgery was performed through a xyphopubic laparotomy. Transperitoneal dissection revealed the aortic aneurysm with the isthmus of the HSK lying over it. The infrarenal aorta, isthmus of the HSK, and common iliac arteries were dissected. After systemic heparinization, an aortic clamp was placed interrenally, with the right renal artery beneath the clamp and the left one above. The proximal part of the aneurysm sac, proximal to the HSK, was opened longitudinally, and a 16x8 mm Dacron bifurcation graft was sutured proximally. The clamp was then transferred to the graft, and the right renal ischemia lasted for 18 minutes. Then graft was placed under the isthmus, and an aneurysmectomy was performed on the lower part of aneurysm sac. Regarding the left common lilac artery aneurysm, distal anastomoses were performed on both common iliac arteries **(Figure 3)**. The operation took approximately three hours and twenty minutes. The estimated amount of blood collected in the Cell Saver was 900 mL, with 350 ml autotransfused during the operation. On the third postoperative day, the patient was transferred from the ICU to the vascular surgery department. He was discharged on the fifth postoperative day without any intraoperative or postoperative complications. The postoperative serum creatinine level was 93 μmol/L.

Discussion

When treating a patient with concomitant AAA and Horseshoe kidney, three main decisions must be made: the type of abdominal exposure to reach the aneurysm, whether to preserve or divide the renal

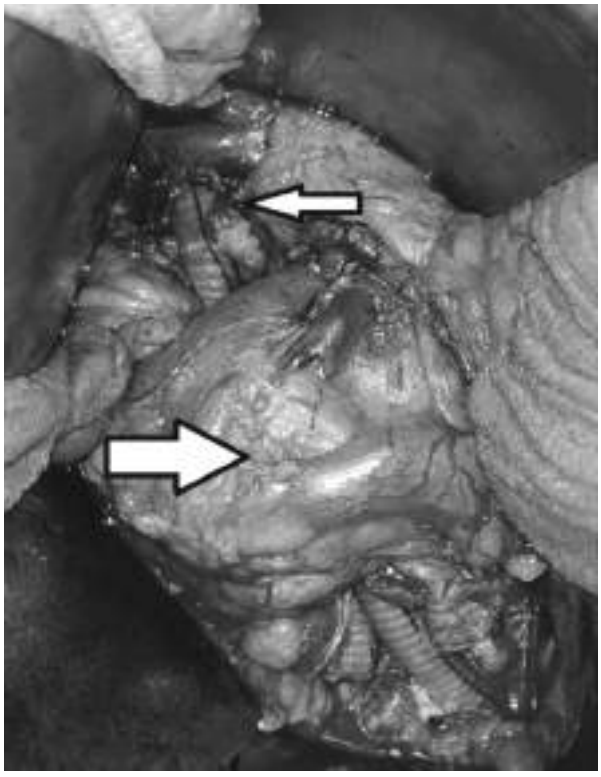

Figure 3. Y-shaped Dacron graft placed under the isthmus (upper white arrow). Horseshoe kidney (lower white arrow).
Slika 3. *Dakron bufurkaciona proteza pozicionirana ispod istmusa potkovičastog bubrega (prva bela strelica). Potkovičast bubreg (druga bela strelica).*

isthmus, and whether to ligate or salvage accessory renal arteries. HSK vascularization is prone to variations, simplified by the classification system proposed by Eisendrath et al. in 1925, which includes five types. Type I refers to the presence of one renal artery on each side of the HSK. Type II demonstrates an auxiliary aortic branch to the renal isthmus in addition to type I. Type III adds one more renal artery to each side of Type II. Type IV refers to the presence of two renal arteries on each side, with one or more originating from iliac arteries or the isthmus branch. Type V refers to the presence of multiple renal arteries arising from the aorta, mesenteric arteries, and iliac arteries [6]. One of our patients belonged to type I, with no auxiliary arteries found on CTA or intraoperatively. The other patient was type II, where an auxiliary isthmic branch was seen on CTA and intraoperatively. Since the proximal anastomosis was made right below the isthmic branch, no reimplantation was needed, and the isthmic branch was preserved. Minimal collateralization between renal segments and asymmetric blood supply mean that ligation of one or more aberrant or accessory renal arteries can result in ischemic necrosis of the kidney [7]. In some cases, accessory renal arteries supplying up to 32% of the total parenchyma can be occluded in patients with normal renal function during EVAR [8]. During open surgery, accessory renal arteries larger than 3 mm in diameter should be preserved or reimplanted [9, 10]. When deciding between open or endovascular aneurysm repair, the pros and cons of each approach must be considered. We chose the open technique in both cases due to inadequate anatomy for EVAR. The advantages of the transperitoneal approach include better exposure, access to aneurysm sac, renal isthmus, ureters, and both iliac arteries. The disadvantages include a higher risk of iatrogenic injury to the isthmus. While the retroperitoneal approach avoids contact with urinary tract and renal isthmus, it often provides inadequate exposure to iliac arteries, especially the right one. However, it offers better exposure to auxiliary renal arteries and easier reimplantation when needed. In both cases, we chose the transperitoneal approach. In the first case, the isthmic branch arose from the anterior surface of abdominal aorta, making the transperitoneal approach satisfactory. The isthmic branch did not need reimplantation. In the second case, there were no supplementary renal arteries that required reimplantation, and better exposure to the iliac arteries was needed due to their aneurysmatic degeneration, making the transperitoneal approach favorable [6]. The section of the isthmus was avoided in both cases to prevent complications such as urinary tract injury, retroperitoneal infection, bleeding, and renal ischemia [11]. Although there are cases in the literature where the isthmus was divided for better exposure and then sutured, resulting in uncomplicated outcomes, the risk of complications remains [9, 12].

Conclusion

Abdominal aortic aneurysm with concomitant horseshoe kidney remains a challenge for vascular surgeons. In both cases, we chose transperitoneal approach without sectioning the isthmus or reimplanting auxiliary renal arteries. In one cases, an auxiliary renal artery was preserved. Given the variability in treating these conditions, each case must be evaluated individually to determine the best therapeutic options for each patient.

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