

Laparoscopic nephron-sparing surgery for a tumor near the isthmus of a horseshoe kidney with a complicated blood supply

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Abstract

A horseshoe kidney is a congenital kidney malformation commonly associated with complications such as hydronephrosis, renal calculi, and infections of the renal pelvis. Renal cell carcinoma is extremely rare in a horseshoe kidney; once it occurs, however, it is intractable because of vascular abnormalities. This is especially true in laparoscopic nephron-sparing surgery, even for tumors of <4 cm in diameter. We herein report a case involving an asymptomatic 65-year-old man with an incidental finding of a 4-cm solid mass near the isthmus of a horseshoe kidney on B-mode ultrasonography. Preoperative computed tomography of the renal artery revealed six arterial vessels supplying the affected kidney. Laparoscopic partial nephrectomy was performed. The outcome of this case suggests that laparoscopic nephron-sparing surgery might be a successful treatment method for a horseshoe kidney but that preoperative vessel evaluation and experienced laparoscopic skills are needed.

Keywords

Horseshoe kidney, laparoscopic nephron-sparing surgery, partial nephrectomy, renal cell carcinoma, isthmus, ultrasonography, computed tomography

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Introduction

Compared with radical nephrectomy, partial nephrectomy (PN) has comparable oncological outcomes and provides better postoperative renal function and quality of life.^{1,2} Hence, several guidelines recommend PN as a reference standard for T1 tumors.^{3,4} Laparoscopic PN (LPN) has similar oncologic outcomes as open PN, but it results in quicker recovery and fewer postoperative complications and has gained popularity as a minimally invasive surgery.⁵ Technological advancements and increased surgical expertise have allowed the treatment of larger and anatomically more complex renal tumors using LPN. However, specific tumors can increase the difficulty of LPN. A tumor in a horseshoe kidney is considered one of the most challenging circumstances, even in experienced hands.⁶ We herein present a case of renal cell carcinoma (RCC) within a horseshoe kidney near the isthmus with a complicated blood supply treated by LPN. According to our online literature review, few such cases have been reported to date.⁷⁻¹⁴

Case report

A 65-year-old asymptomatic man underwent B-mode ultrasonography and was found to have a horseshoe kidney with parenchymal fusion of the lower poles and a low-echo mass near the isthmus of the left kidney. The tumor measured $40 \times 35 \text{ mm}^2$ and exhibited a blood flow signal, and no hydronephrosis was detected. Subsequent computed tomography confirmed these results (Figure 1). Preoperative computed tomography of the renal artery revealed six arterial branches supplying the left kidney, and the fifth and sixth branches mainly supplied the tumor (Figure 2). LPN was performed under general anesthesia. The transperitoneal approach was adopted, and all ports were displaced



Figure 1. Computed tomography demonstrates parenchymal fusion of the lower poles and a tumor near the isthmus of the left kidney.

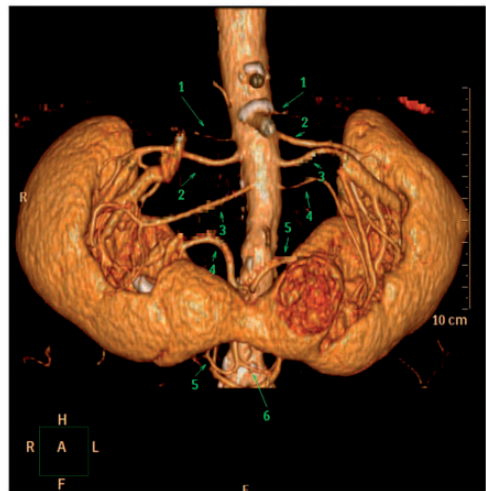


Figure 2. Preoperative computed tomography of the renal artery reveals six artery branches for the left kidney. The fifth and sixth branches are the main supply for the tumor.

about 3 cm medially and ventrally to account for the horseshoe aberrancy and tumor position (Figure 3). The isthmus was 2 cm wide and 1 cm thick. The tumor was close to the isthmus and extended to the left renal hilum, and the left ureter lay on the anterior and lateral aspects of the tumor. The fifth and sixth left renal artery

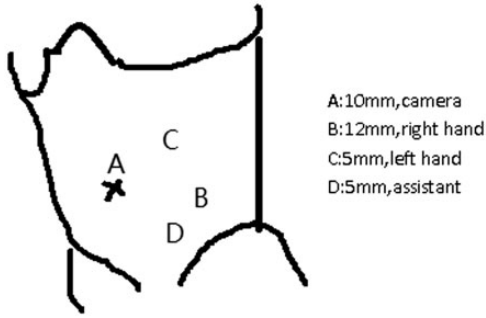


Figure 3. Laparoscopic ports. The ports are lower and closer to the centerline than routinely positioned ports.

branches were clipped off with Hem-o-lok clips (Teleflex, Wayne, PA, USA), and the third and fourth branches were blocked with bulldog clamps. The renal mass was completely removed with no apparent damage to the vascular or collecting system. The basal aspect of the wound was sutured with a 3-0 absorbable thread, and the edge of the renal parenchyma was sutured continuously with a 1-0 absorbable unidirectional barbed suture (Quill PDO suture, 36-mm 1/2 circle needle; Surgical Specialties Corporation, Westwood, MA, USA).

The operation time was 210 minutes, and the ischemia time was 30 minutes. The intraoperative blood loss volume was about 800 mL, and 430 mL of preoperative autologous concentrated red blood cells were transfused. The postoperative recovery was smooth, and no perioperative complications occurred. The postoperative serum creatinine concentration was 78.4 mmol/L, and ultrasound showed no obvious hydronephrosis on postoperative day 4. The pathological results were grade II renal clear cell carcinoma in the left kidney with hemorrhagic cystic change; the size of the tumor was about $3.9 \times 3.5 \times 2.4 \text{ cm}^3$. The tumor did not involve the membrane, and no tumor was found

in the margin. The immunohistochemical markers were as follows: CK(+), Vim(++), RCC(-), CD10(+), Pax2(-), Pax-8(-), VEGFR-1(-), VEGFR-2(+), VEGFR-3(-), CD117(-), PDGFR- α (++), PDGFR- β (-), and Ki-67 (<1%+). The patient remained tumor-free after 24 months of follow-up.

Discussion

The horseshoe kidney is the most common renal fusion anomaly with an incidence rate of 1 in 400 and male:female ratio of 2:1. Individuals with chromosomal aneuploidies (trisomies and Turner syndrome) have a predilection for horseshoe kidneys.⁹ Because of fusion of the inferior portion of the metanephric blastema that forms the isthmus, horseshoe kidneys commonly present with complications such as hydronephrosis, renal calculi, and infections of the renal pelvis. RCC is extremely rare in a horseshoe kidney; but once it occurs, however, it is intractable, especially by laparoscopic nephron-sparing surgery and even for tumors of <4 cm in diameter. The surgery is challenging mainly because of the anomalous anatomy and vasculature of the horseshoe kidney. Consequently, adequate preoperative imaging is important to define the atypical vascular supply and anatomical abnormalities. Multiple renal arteries are always found in horseshoe kidneys. In the present case, preoperative computed tomography of the renal artery revealed six arterial branches supplying the left kidney, with the fifth and sixth branches mainly supplying the tumor. The fifth and sixth left renal artery branches were clipped off with Hem-o-lok clips, and the third and fourth branches were blocked with bulldog clamps before removing the tumor; however, the intraoperative bleeding was heavy because of insufficient blocking of the branches. Had the second branch been blocked, the blood loss might have

been reduced. Another disadvantage in this case was the absence of intravenous urography or computed tomography urography before surgery to determine the ureteral course. Additionally, we had not placed a ureteral catheter before the surgery. The intraoperative search for the ureter took nearly 60 minutes, which partially explains the long operative time. Finally, the left ureter was found to lie on the anterior and lateral aspects of the tumor, not just anterior to the isthmus.

Declaration of conflicting interest

The authors declare that there is no conflict of interest.

Ethics and consent

The Fourth Medical Center of PLA General Hospital ethics committee approved this study, and the patient provided informed consent for publication.

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