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Robot-assisted partial nephrectomy for renal cell carcinoma in the isthmus of horseshoe kidney

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ABSTRACT

The anatomic features of a horseshoe kidney are unique—the kidney is fixed and poorly mobile, with many arterial and venous blood supplies, thereby complicating minimally invasive surgery for renal cancer in this setting. Several reports have described robot-assisted partial nephrectomy (RAPN) to treat renal cancer in a horseshoe kidney, but no reports of RAPN for renal cancer in the isthmus of a horseshoe kidney have been published to date. This case report describes the technique and usefulness of RAPN for treatment of renal cancer located in the isthmus of a horseshoe kidney.

1. Introduction

Horseshoe kidney is a congenital fusion anomaly with a complex blood supply. Therefore, minimally invasive surgery for renal cell carcinoma (RCC) in a horseshoe kidney is technically difficult.[1,2] We describe the case of a patient with RCC in the isthmus of a horseshoe kidney treated with robot-assisted partial nephrectomy (RAPN).

2. Case presentation

A 79-year-old woman with chronic low back pain underwent plain computed tomography (CT), which revealed a renal tumor near the isthmus of the horseshoe kidney as an incidental finding (Fig. 1A). The patient was subsequently referred to our department. On presentation, her performance status was 1. Because renal dysfunction (serum creatinine, 1.86 mg/dL and estimated glomerular filtration rate, 20.8 mL/min) was noted, enhanced CT could not be performed. A definitive diagnosis of RCC was made by magnetic resonance imaging, which revealed a 45-mm tumor on the right side of the isthmus (Fig. 1B). In addition, a left-sided inferior vena cava (left IVC) was observed, with many arteries and veins flowing intricately into the horseshoe kidney (Fig. 1C and D). Based on these findings, the patient was diagnosed with right RCC in the isthmus area of the horseshoe kidney. The tumor stage was determined to be cT1bN0M0, and the RENAL nephrometry score was 7×. A three-dimensional image of the kidney, tumor, ureters, and vessels is shown in Fig. 1E. The patient had low renal function, making the present case a so-called "imperative case." Hence, open partial nephrectomy with cold ischemia was a potential treatment option, provided that the protection of residual renal function could be prioritized. However, considering that the patient was an older adult with a performance status of 1, we chose the transperitoneal approach for RAPN and isthmus transection because of its low invasiveness.

Bilateral ureteral stents were placed before performing RAPN. A magic bed was used to change the patient position from the standard flank to semilateral position with the head down. The da Vinci Xi surgical system (Intuitive Surgical, Sunnyvale, CA, USA) with a seven-port approach was used with two assistant ports (Fig. 2A). First, with the patient in the standard flank position, the positions of the camera and robotic arms were set (Fig. 2B), and RAPN was initiated. Compared with normal RAPN, renal artery exposure required more time because the kidney was less mobile and the intricately draining venules bled easily. The tumor in the isthmus was identified, but its caudal and dorsal sides were not visible in the set camera position. Therefore, the patient's position was changed to semilateral with the head down, and the positions of the camera and robotic arms were switched (Fig. 2C). The dorsal side was clearly visible, and arteries and veins from this side were safely cut. After exposing the tumor and isthmus, the isthmus was transected using a vessel sealer, which did not open the urinary tract. The separation of the isthmus created mobility in the lower side of the kidney; thus, the patient's position was returned back to the standard flank position and the positions of the camera and robotic arms were switched (Fig. 2D). Hereafter, the standard approach of RAPN could be performed. The renal artery was clamped, and the tumor was subsequently

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Abbreviations

CT	Computed tomography
RAPN	Robot-assisted partial nephrectomy
RCC	Renal cell carcinoma
left IVC	left-sided inferior vena cava

3. Discussion

Typically, in RAPN, the perinephric area is dissected to provide mobility and create an adequate surgical view for various tumor locations.[3] However, this approach is not feasible for a horseshoe kidney because of its anatomic features, including reduced fixation artefacts in the isthmus. Previous studies have reported the use of RAPN to treat a horseshoe kidney; however, in all cases, the tumor was not located near the isthmus but in the middle or lower pole, for which the typical approach of RAPN can be used.[2,4,5] Although one report presented a hybrid technique using laparoscopic surgery, in the present case report, RAPN and isthmus transection were simultaneously performed for the first time via pure robotic surgery.

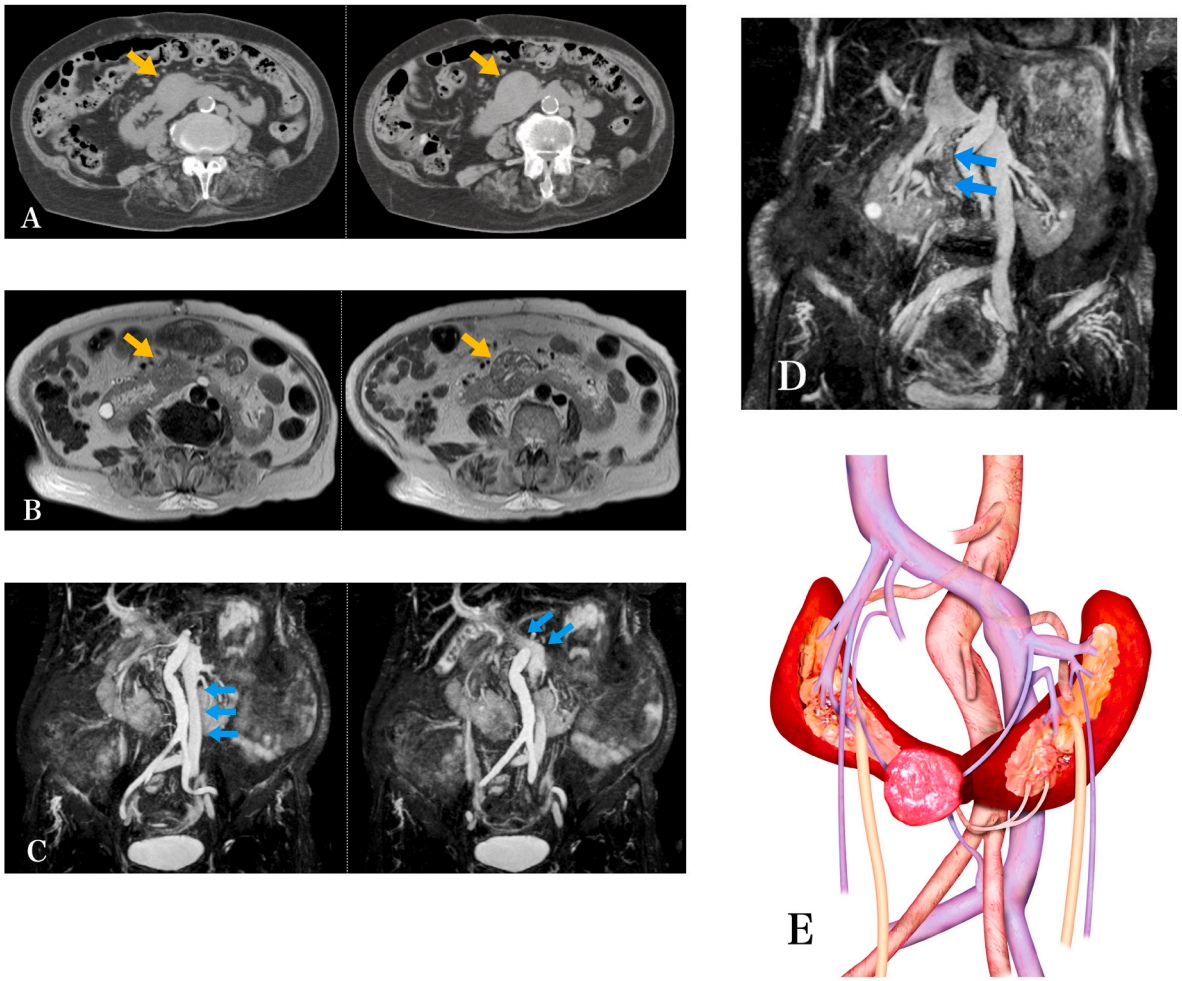

Fig. 1. AAxial computed tomography of the isthmus and tumor in a horseshoe kidney.
Fig. 1B. Axial magnetic resonance imaging of the isthmus and tumor in a horseshoe kidney. The tumor was heterogeneous, and renal cell carcinoma was suspected.
Fig. 1C. Coronal magnetic resonance imaging of the left inferior vena cava (IVC) and complex blood supply. IVC runs on the left side of the aorta and crosses it at the proximal portion of the left renal vein.
Fig. 1D. Coronal magnetic resonance imaging of intricately draining veins.
Fig. 1E. Three-dimensional image of the kidney, tumor, ureters, and vessels.

resected. Because the renal pelvis was opened, a central suture and renorrhaphy were performed before releasing the renal artery clamping.

The total operative time was 362 min, console time was 271 min, warm ischemia time was 19 min, and the estimated blood loss was 90 mL. The postoperative course was uneventful. Pathologic examination revealed clear cell RCC (pT1b, Fuhrman grade 2) with negative surgical margins (Fig. 3). At the 1-month follow-up, the serum creatinine level was 1.96 mg/dL and estimated glomerular filtration rate was 19.7 mL/min. At the 12-month follow-up, no local recurrence or metastasis was detected on CT.

The most difficult part in our case was to create and maintain an appropriate and safe surgical view. The flank position and the usual camera position are the best approach for the renal artery and partial nephrectomy because they provide the most familiar surgical view. However, with this camera and body positions, it was dangerous in this case to dissect the dorsal side of the isthmus, which was rarely visible because of the presence of the 45-mm tumor. Severe vascular malformations were present, including left IVC and many small veins

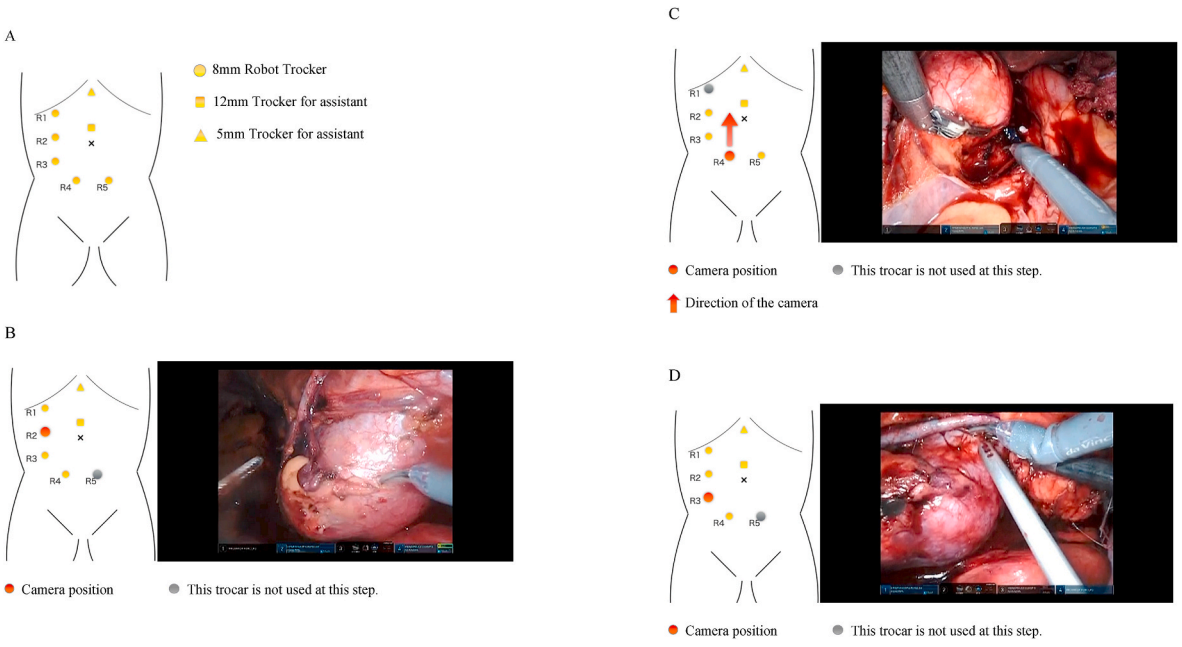

Fig. 2. APosition of the trocar for robotic partial nephrectomy, showing five robotic ports and two assistant ports.
Fig. 2B. Position of the trocar at the start of the operation and actual surgical view.
Fig. 2C. Position of the trocar and actual surgical view when the dorsal side of the isthmus was dissected.
Fig. 2D. Position of the trocar and actual surgical view when the tumor was resected.

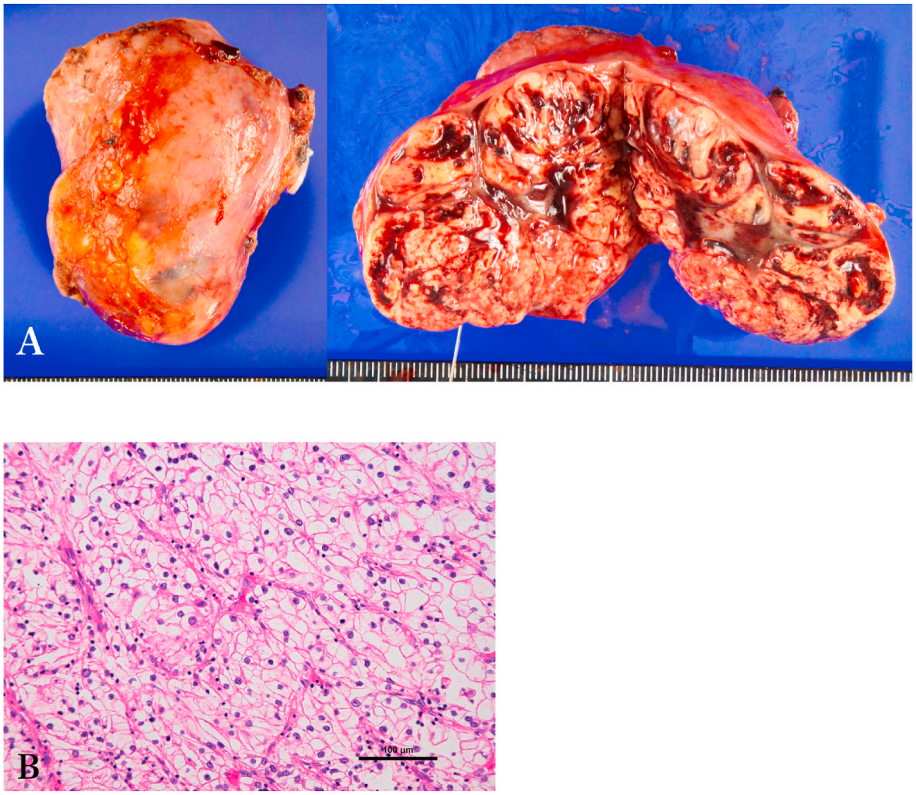

Fig. 3. AMacroscopic image of resected renal cell carcinoma with negative surgical margins.
Fig. 3B. Pathological examination of the resected specimen revealed clear cell renal cell carcinoma.

intricately flowing into the kidney, leading to easy bleeding, even after careful dissection. Taking the advantage of the da Vinci Xi feature that allows the insertion of the camera from any robot trocar, we moved the camera to the lower abdominal port, allowing dorsal vessels and the isthmus to be safely transected. We believe this flexibility was a major factor in the success of this operation. With this approach, RAPN could be performed safely on the RCC near the isthmus by dynamically changing the camera and body positions depending on the operative

site.

4. Conclusion

This report presents the case of a patient with RCC located in the isthmus of the horseshoe kidney, which was successfully treated by RAPN.

Consent

Informed consent was obtained from the patient for the publication of this report.

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Declarations of competing interest

None.

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References

1. Molina WR, Gill IS. Laparoscopic partial nephrectomy in a horseshoe kidney. *J Endourol*. 2003;17:905–906.
2. Raman A, Kuusk T, Hyde ER, et al. Robotic-assisted laparoscopic partial nephrectomy in a horseshoe kidney. A case report and review of the literature. *Urology*. 2018;114:e3–e5.
3. Harris KT, Ball MW, Gorin MA, et al. Transperitoneal robot-assisted partial nephrectomy: a comparison of posterior and anterior renal masses. *J Endourol*. 2014;28:655–659.
4. Yamamichi G, Nakata W, Tsujimura G, et al. Renal cell carcinoma in a horseshoe kidney treated with robot-assisted partial nephrectomy. *Urol Case Rep*. 2019;25,100902.
5. Uketa S, Shimizu Y, Kanamaru S, et al. Robot-assisted partial nephrectomy via retroperitoneal approach in a patient with horseshoe kidney. *IJU Case Rep*. 2021;4:239–242.