LAPAROSCOPIC RESECTION OF THE HORSESHOE KIDNEY FOR RENAL CELL CARCINOMA

Muradyan AG[1,4]✉, Vorobyev NV[2], Kostin AA[3,4], Tolkachev AO[2], Volchenko NN[5], Popov SV[4], Mamontova IS[6]

[1] Department of Urology and Surgical Nephrology, Medical College, Peoples' Friendship University of Russia, Moscow, Russia

[2] Oncourology Department, Hertzen Moscow Cancer Research Institute, a branch of the Medical Radiological Research Centre, Moscow, Russia

[3] Department of Urology, Oncology and Radiology, Faculty of advanced training for health workers, Peoples' Friendship University of Russia, Moscow, Russia

[4] Medical Radiological Research Centre, Moscow, Russia

[5] Department of Oncourology, Hertzen Moscow Cancer Research Institute, a branch of the Medical Radiological Research Centre, Moscow, Russia

[6] Department of radiology, Hertzen Moscow Cancer Research Institute, a branch of the Medical Radiological Research Centre, Moscow, Russia

Renal fusion is one of the most common kidney anomalies. The most frequent is horseshoe kidney, characterized by a fusion of the poles (typically the lower poles) of the kidneys. We described a clinical case of a malignant tumor in the right half of the horseshoe kidney (stage 1 cancer, CT1aN0M0) in a man aged 65 years, who underwent laparoscopic resection. It was shown that laparoscopy is no less efficient than open surgery. However, in planning the operation, it is necessary to use spiral computed tomography for three-dimensional reconstruction of the organ and identification of its anatomical features caused by aberrant blood supply to horseshoe kidney.

Keywords: horseshoe kidney, renal cell carcinoma, laparoscopic resection, laparoscopy

✉ **Correspondence should be addressed:** Avetik Muradyan
ul. Miklukho-Maklaya, d. 8, Moscow, Russia, 117997; mdmuradyan@gmail.com

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ЛАПАРОСКОПИЧЕСКАЯ РЕЗЕКЦИЯ ПОДКОВООБРАЗНОЙ ПОЧКИ ПО ПОВОДУ ПОЧЕЧНОКЛЕТОЧНОГО РАКА

А. Г. Мурадян[1,4]✉, Н. В. Воробьев[2], А .А. Костин[3,4], А. О. Толкачев[2], Н. Н. Волченко[5], С. В. Попов[4], И. С. Мамонтова[6]

[1] Кафедра урологии и оперативной нефрологии, медицинский институт, Российский университет дружбы народов, Москва

[2] Отделение онкоурологии, Московский научно-исследовательский онкологический институт имени П. А. Герцена – филиал Национального медицинского исследовательского радиологического центра, Москва

[3] Кафедра урологии, онкологии, радиологии, факультет повышения квалификации медицинских работников, Российский университет дружбы народов, Москва

[4] Национальный медицинский исследовательский радиологический центр, Москва

[5] Отделение онкоцитологии, Московский научно-исследовательский онкологический институт имени П. А. Герцена – филиал Национального медицинского исследовательского радиологического центра, Москва

[6] Отделение рентгенодиагностики, Московский научно-исследовательский онкологический институт имени П. А. Герцена – филиал Национального медицинского исследовательского радиологического центра, Москва

Сращение почек — одна из наиболее распространенных почечных аномалий. Чаще всего встречается подковообразная почка, которая характеризуется сращением полюсов органа, как правило — нижних. Нами описан клинический случай злокачественной опухоли в правой половине подковообразной почки (рак I стадии cT1aN0M0) у мужчины 65 лет, которому была выполнена лапароскопическая резекция. Было показано, что лапароскопия является не менее эффективным методом, чем открытое хирургическое вмешательство. Однако при планировании операции необходимо использовать спиральную компьютерную томографию для трехмерной реконструкции органа и выявления его анатомических особенностей, вызванных аберрантным кровоснабжением подковообразной почки.

Ключевые слова: подковообразная почка, почечноклеточный рак, лапароскопическая резекция, лапароскопия

✉ **Для корреспонденции:** Аветик Гагикович Мурадян
117997, г. Москва, ул. Миклухо-Маклая, д. 8; mdmuradyan@gmail.com

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The incidence of renal cell cancer has been rising over the decades. In Russia, kidney cancer (most commonly renal cell carcinoma, RCC) accounts for 3.9 % of all malignant tumors. The country recorded 8,430 deaths from the disease in 2014 and 22,234 new kidney cancer patients were revealed [1]. If RCC is diagnosed at clinical stage T1 [2], then partial nephrectomy — the gold standard of treatment for renal tumors smaller than 4 cm in diameter — can be effectively performed. It should be noted that recent years have witnessed an increase in the number of laparoscopic and robotic surgeries in this group of patients in recent years.

Congenital anomalies of the kidney and urinary tract are common in about 3.3–11 % of the population [3]. According to autopsy data, renal fusion accounts for 16.5 % of all kidney anomalies — 1 in every 425–700 people. The number of men with such anomalies is twice higher than women. The most common and clinically significant type of renal fusion is the horseshoe kidney, which is characterized by the fusion of the lower poles (in about 90 % of cases) and rarely of the upper poles, causing the joined kidneys to take a U-shape form, resembling a horseshoe. In addition, each kidney has its own ureter emptying into the bladder and supply vessels [4].

Diagnosing renal anomalies of shape at the present stage is not difficult since ultrasound imaging can identify the presence and type of abnormal fusion. Intravenous contrast-enhanced computed tomography scan provides more complete information about the state of the renal parenchyma, blood supply, urinary tract, and relationship with neighboring organs. So, according to studies, horseshoe kidney has abnormal blood flow in 70–84.3 % of cases [5].

Description of clinical case

Patient V., 65 years old, came to the Hertzen Moscow Cancer Research Institute (HMCRS) with previously identified space-occupying lesions of the right kidney.

From the patient's history, it was known that the patient had been feeling sick since August 2015 when he experienced increased body temperature of up to 38.5–40 °C and was hospitalized at the infectious department of a medical unit in Chelyabinsk. Ultrasound imaging was used to examine the abdominal cavity, which identified a tumor in the right kidney. Afterwards, the patient decided to visit HMCRS for treatment.

The patient has a hereditary burden: the father suffered from lung cancer. Among the comorbidities are stage II hypertension, type 2 diabetes (decompensation stage), cirrhosis of the liver caused by toxins (class B according to Child-Pugh score), portal hypertension, esophageal varices complicated by bleeding for which endoscopic ligation was performed in 2014.

A tumor of 34 x 35 x 35 mm in size without any signs of invasion into the pyelocaliceal system was found through ultrasound imaging and spiral computed tomography scan of the abdomen and retroperitoneal space at the border of the upper and lower third of the right kidney on the front surface. Besides, renal fusion in the lower pole region was identified. The defect detected was a medical finding since it had no clinical manifestations in the patient. The RENAL nephrometry score was 4a (fig. 1, 2).

No regional and distant metastasis were found by assessment of the prevalence of tumoral process. Diagnosis: tumor in the right half of horseshoe kidney, stage I, cT1aN0M0.

Laparoscopic resection of the right half of the horseshoe kidney was performed in October 19, 2015. After pneumoperitoneum was created using a Veress needle, three trocars were inserted by a standard technique [6]. During inspection on the border of the upper and middle third of the right half of the horseshoe kidney along the lateral surface, a tumor mass, 4 cm maximum size, was identified. The renal hilum was mobilized, and a clamp was imposed on it through a counteropening. A cold scissors was used to resect the tumor within healthy tissues. Kidney wound was cut down by atraumatic suture using non-absorbable clips Absolok (Ethicon, Belgium, USA) (fig. 3). During the operation, we used tools and devices from endoscope manufacturer Karl Storz (Germany).

The surgery lasted for 160 minutes, anoxia period lasted for 20 minutes, and there was 400 ml of blood lost. The postoperative period was uneventful. Glomerular filtration rate at the preoperative stage was 87 mL/min, at the 4th day — 59 mL/min, and 8th day — 67 mL/min. The patient was discharged on the 9th day in a satisfactory condition.

Morphological study revealed a clear-cell renal cell carcinoma G1, without extension to the perirenal fat and with no tumor cells on the resection edge (R0) (fig. 4).

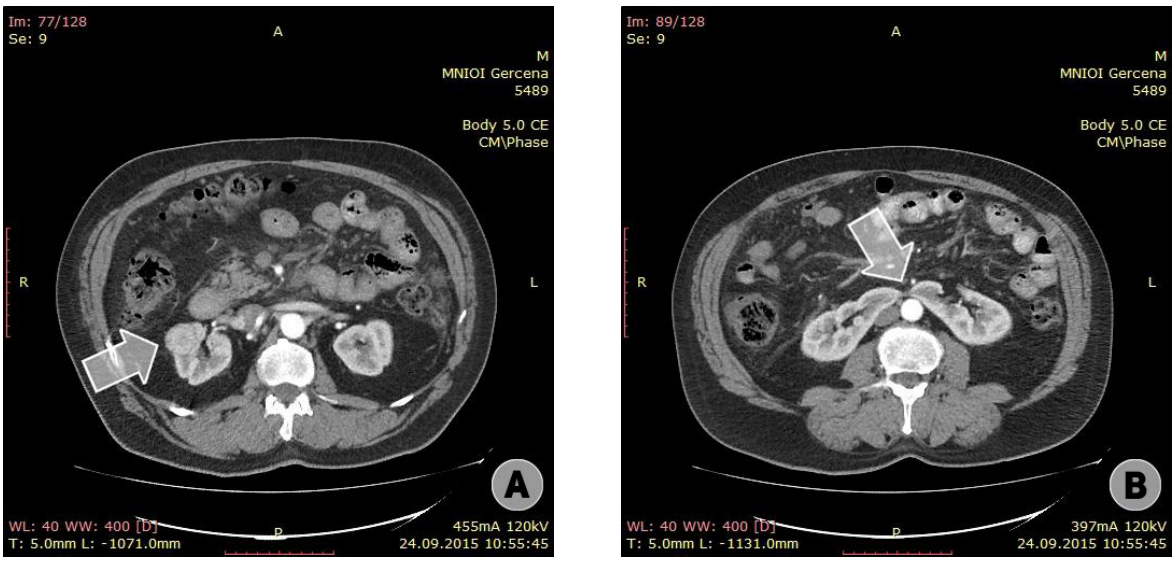

Fig. 1. Sections of the arterial phase of spiral CT scan of the abdominal cavity. **(A)** Tumor in the right half of the horseshoe kidney (arrow) on the border between the upper and middle third. **(B)** Isthmus of the horseshoe kidney (arrow) at L_{II} level

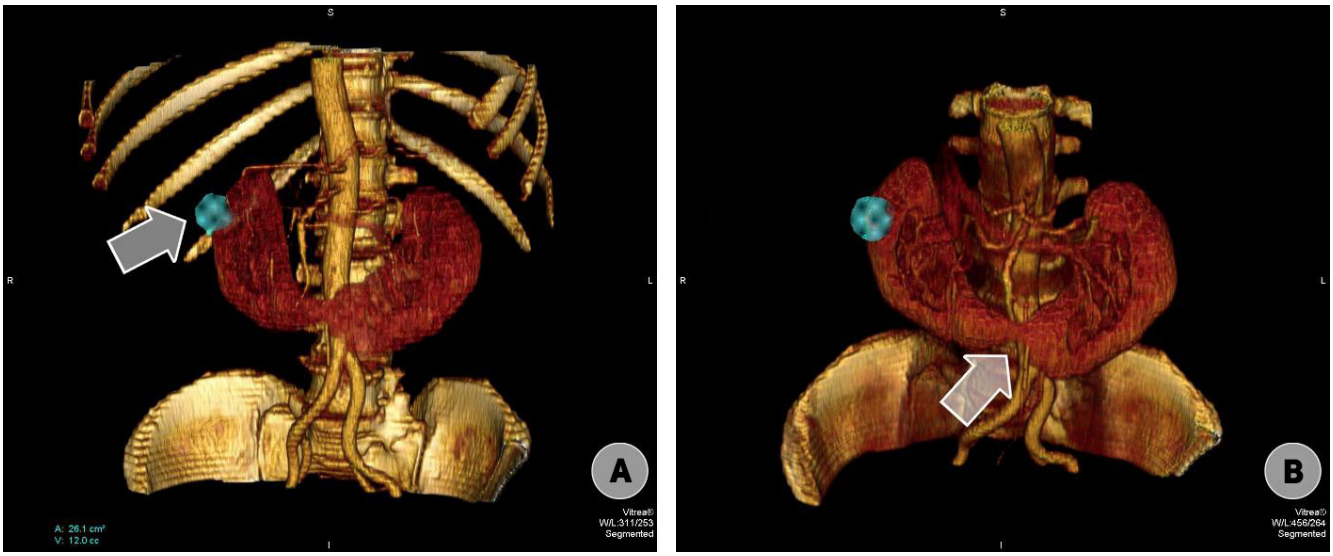

Fig. 2. Three-dimensional reconstruction of the kidneys and great vessels using spiral computed tomography scan. **(A)** Tumor in the right half of the horseshoe kidney (arrow). **(B)** Isthmus of the horseshoe kidney (arrow)

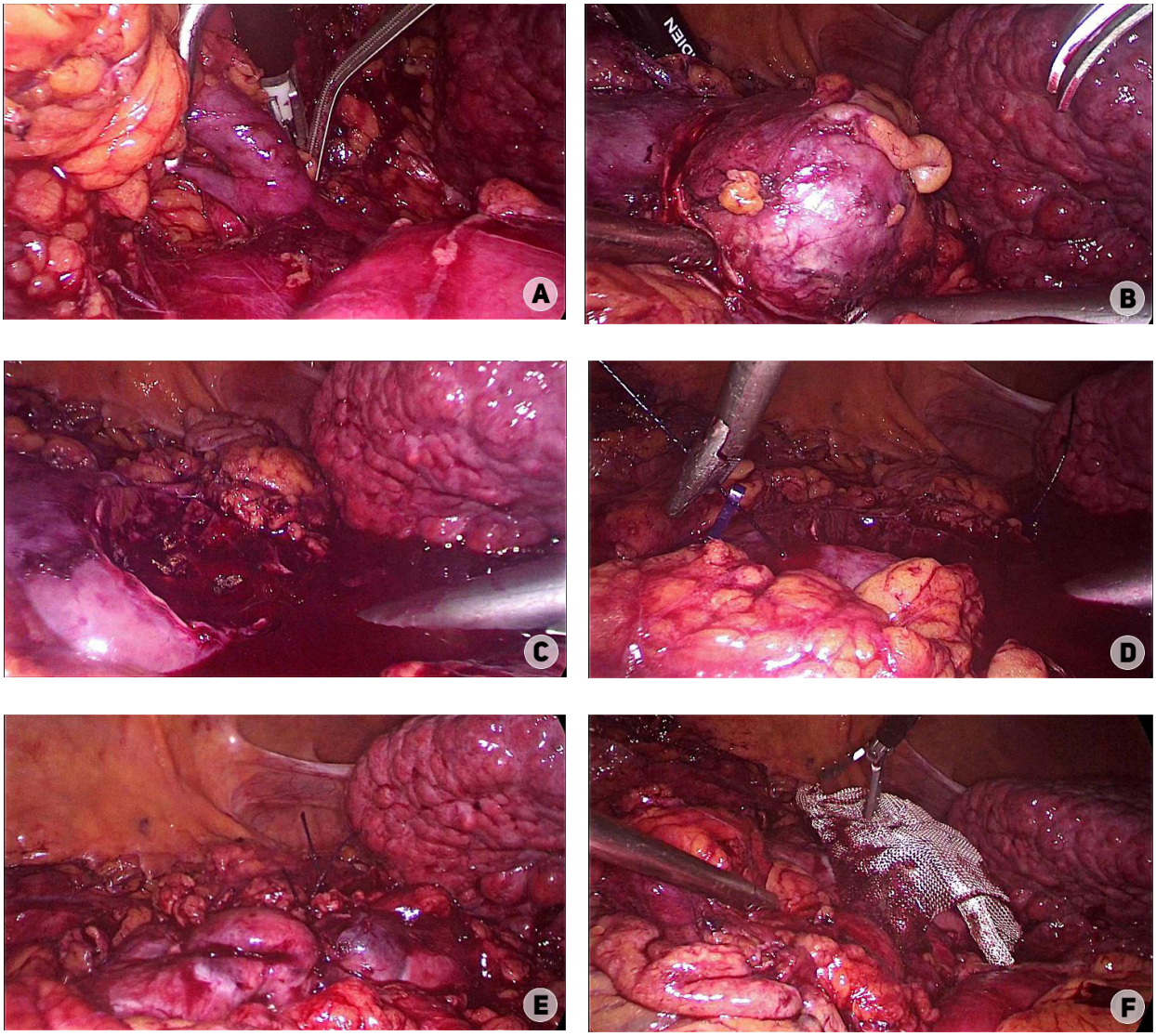

Fig. 3. Surgery stages. **(A)** Imposition of clamp in the renal blood vessels. **(B)** Tumor in the right half of the horseshoe kidney. **(C)** Site of the removed tumor. **(D)** Sealing of kidney injury. **(E)** Appearance of resected kidney. **(F)** Covering of the kidney injury with hemostatic mesh

Discussion of clinical case

Horseshoe kidney was first described by da Carpi in 1522 and in more details by Morgagni in 1761 [7]. Despite the fact that such abnormality often has no clinical manifestations, in some cases it goes with UPJ strictures and urolithiasis [8, 9]. Horseshoe kidney is found in 20 % of Down's syndrome cases and 60 % of Turner syndrome cases, as well as in Patau, Gardner and Edwards syndromes [10, 11]. According to Glenn, horseshoe kidney is found in 78.9 % of stillborn fetuses, 28.5 % of newborns and 3.5 % of adult patients [12].

Surgical treatment of horseshoe kidney tumor is based on the same principles as those applied in non-tumor surgical procedures. Wells first reported the feasibility of partial nephrectomy in 1884, while Vermooten in 1950 described and substantiated indications for organ operations in renal cell carcinoma [13, 14].

Transperitoneal laparoscopic approach is the most commonly used method for separation of the isthmus (isthmotomy), for pyeloplasty, for resection or heminephrectomy. Currently, it has been ascertained that laparoscopic surgery for tumor in a horseshoe kidney is as effective as open surgery [15]. However, open surgery is often necessary when complex vasculature and rotation are involved [16]. Due to aberrant blood supply during surgery planning, especially concerning tumor formations, it is necessary to use a CT scan to determine the vascular architectonics and exact location of the pelvicalyceal system [17–19].

It should be noted that laparoscopic surgery for tumor in a horseshoe kidney is still rare and we were able to find descriptions of only three cases of laparoscopic resection of a horseshoe kidney [7, 13, 20]. The details are presented in the table.

CONCLUSIONS

Laparoscopic partial nephrectomy in patients with renal tumors smaller than 4 cm in diameter is the standard surgical treatment. Nevertheless, in view of aberrant blood supply to the horseshoe kidney, it requires special diagnostic approach to manage patients with this anomaly. From our experience, contrast-enhanced spiral CT scan allows to assess the anatomical features of the patient's kidneys and consequently apply modern minimally invasive surgery procedures. Laparoscopic approach for conservation treatment of renal cell carcinoma in a horseshoe kidney can be an alternative treatment for this abnormality.

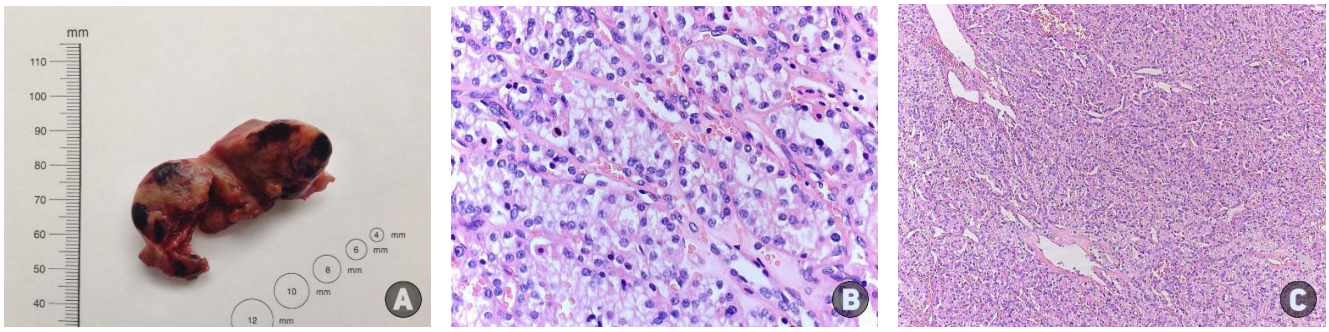

Fig. 4. **(A)** Macropreparation on a section. **(B)** Micropreparation with hematoxylin staining, x10. **(C)** Micropreparation with eosin staining, x40

Brief description of clinical cases of laparoscopic resection of a horseshoe kidney for renal cell carcinoma (according to scholarly literature)

Research	Age/sex	Side	Tumor location	Tumor size, mm	Surgery	Surgery duration, min	Warm ischemia duration	Blood loss	Morphological diagnosis
Tsivian et al., 2006 [20]	62/F	Right	Lower front surface of the right side of the isthmus	20	Laparoscopic	210	–	70	RCC
Tkocz et al.,2012 [13]	72/F	–	Lower pole	40	Retroperitoneoscopic	–	–	–	RCC, G3
Benidir et al., 2014 [7]	58/M	Right	Upper pole	40	Laparoscopic	180	25	200	RCC, G1

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