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# A 27-Year-Old Primigravida with a Right Renal Cell Carcinoma Removed at 30 Weeks of Gestation by Robot-Assisted Retroperitoneoscopic Partial Nephrectomy

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Data Collection B  
Statistical Analysis C  
Data Interpretation D  
Manuscript Preparation E  
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**Conflict of interest:** None declared

**Patient:** Female, 27-year-old  
**Final Diagnosis:** Renal cell carcinoma  
**Symptoms:** Asymptomatic  
**Medication:** —  
**Clinical Procedure:** —  
**Specialty:** Oncology • Urology

**Objective:** Rare disease

**Background:** Large renal tumors during pregnancy are rare findings (0.07-0.1%). Current guidelines recommend surgical removal. This surgery should be carefully planned in an interdisciplinary team and involves special risks for mother and fetus. This report describes a case of a 27-year-old primigravida woman with a right renal cell carcinoma involving the lower pole of the kidney, which was removed at 30 weeks of gestation by robot-assisted retroperitoneoscopic partial nephrectomy (RARPn).

**Case Report:** The patient was referred by the treating obstetrician with a newly diagnosed right lower pole renal mass of 6×4 cm in greatest diameter extending deeply into the parenchyma. No metastasis or enlarged lymph nodes were described in subsequent magnetic resonance tomography. Clinical and laboratory examinations documented a healthy mother and fetus. A right-sided RARPn was advised and planned by an interdisciplinary team of treating physicians (gynecologists, oncologists, and urologists). The surgery was conducted under general anesthesia with an obstetrician on stand-by. Surgery was performed without any complications (operation time 95 min, renal-ischemia time 15 min, and negligible blood loss) and histopathology confirmed the diagnosis of a chromophobe renal cell carcinoma. Further follow-up consultations showed regular wound healing and normal progression of pregnancy, and the patient gave birth to a healthy child at term. Follow-up examinations of the patient were uneventful.

**Conclusions:** This case shows that RARPn can be a safe and effective surgical procedure for partial nephrectomy during pregnancy, where surgery is performed in a specialist center and by an interdisciplinary experienced surgical team. It seems to offer advantages and better risk profile over the laparoscopic approach.

**Keywords:** Carcinoma, Renal Cell • Laparoscopy • Pregnancy Trimester, Second • Robotics

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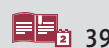
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## Background

The incidence of cancer during pregnancy is low and rates of newly diagnosed malignancy are reported to be around 0.07-0.1% of all pregnancies [1-3]. Potentially malignant masses of the kidney during pregnancy are rare findings and only around 100 cases are described in the literature to date [4-7]. Possibly triggered by hormonal and consecutive paracrine effects, 50% of renal masses during pregnancy are malignant lesions; in 23%, angiomyolipomas are revealed, while oncocytomas occur in only 3-7% of cases [7-9]. To date, it remains unclear whether hormonal changes during pregnancy may promote the formation of malignant cells within the kidney [10-12].

Renal cell carcinoma is mostly an incidental finding (eg, on abdominal ultrasound), but symptoms in advanced cases may include a palpable mass, followed by pain and hematuria [4,13]. The usual diagnostics for renal masses, besides sonography and basic blood work-up, is multi-phasic contrast-enhanced abdominal and chest computer tomography (CT). Alternatively, magnetic resonance imaging (MRI) can replace abdominal CT, especially during pregnancy, as recommended by the current EAU guidelines [14].

Small renal masses can undergo surveillance, and the indication for a surgical approach in pregnant women can only be confirmed by an interdisciplinary team. Furthermore, possible consequences for the mother and unborn child in terms of surgical complications or possible targeted therapy have to be considered [9,15].

Presumably, the first laparoscopic nephrectomy in a pregnant patient was successfully carried out by O'Connor and colleagues in 2004 [2,16]. In the current era of robot-assisted surgery, the partial nephrectomy techniques were revolutionized. This was followed by the robot-assisted experience with partial nephrectomy during pregnancy [18-20]. The retroperitoneoscopic approach to the kidney was first described by Gaur et al 1993. This approach has advantages compared with transperitoneal laparoscopic approaches; although the retroperitoneoscopic approach is limited by a smaller working space, different anatomic landmarks, and possible risk of vascular injury, which requires more surgical skill, it minimizes the risk of bowel injury when performed by experienced surgeons [21].

Recent studies found that RARPN has acceptable morbidity and oncologic outcomes in comparison to laparoscopic and open approach, despite intersurgeon variation in renal warm ischemia time (WIT) and complications. Greater surgeon experience is associated with shorter WIT [22,23].

This report describes a case of a 27-year-old primigravida woman with a right renal cell carcinoma involving the lower pole of

the kidney, which was removed at 30 weeks of gestation by robot-assisted retroperitoneoscopic partial nephrectomy (RARPN).

## Case Report

A 27-year-old primigravida woman who presented at 30 weeks of gestation was referred by the treating obstetrician due to a newly diagnosed suspicious renal mass, 6×4 cm in greatest diameter, on abdominal ultrasound (US). The tumor was located on the lower pole of the right kidney, extending deeply in its parenchyma, and was classified as highly suspicious for malignancy (Figures 1, 2).

Complete physical and laboratory examinations were done at first consultation. The fetal weight was estimated at around 1827 g, without any noticed fetal abnormalities. Concomitant medical conditions were a monoclonal gammopathy diagnosed at the beginning of the pregnancy and a possible hereditary thrombophilia with a history of 3 sisters who had thrombosis during pregnancy. The baseline creatinine level was 0.6 mg/dl with a GFR (MDRD) of about 101 ml/min/1.73 m<sup>2</sup>. At baseline, leukocytes were slightly elevated at 12.4×10<sup>3</sup>/μl and the blood count showed a slight anemia with a lower hemoglobin level than normal (11.4 g/dl).

A consecutive abdominal-MRI was performed. The formal report confirmed the suspicious lesion and confirmed a localized disease without any signs for a distant metastasis or enlarged lymph nodes. Possible treatment alternatives, including ablative techniques and surveillance with a delay of the surgery, were discussed with the patient and her partner, who refused. After an interdisciplinary discussion of the case with the Anesthesiology, Oncology, Obstetrics, Neonatal, and Urology Departments, the patient was scheduled for surgical removal of the renal mass. The patient refused a simultaneous caesarian section. The retroperitoneoscopic approach was favored as a novel approach to avoid intraabdominal manipulations.

## Surgical Procedure

A right-sided RARPN was performed using the da Vinci robot system (Intuitive Surgical, Sunnyvale, CA, USA), which was performed uneventfully under general anesthesia. The patient was placed in left lateral extended position. A small incision was made caudal to the tip of the 12<sup>th</sup> right rib. The retroperitoneal space was bluntly dissected by a balloon dissector followed by insertion of a single da Vinci port (Intuitive Surgical, Sunnyvale, CA, USA) for the camera, and the retroperitoneal space was established by carbon dioxide insufflation. Another da Vinci port was placed 8 cm posteriorly in the same line with a camera trocar. The peritoneum was dissected from the anterior abdominal wall using a laparoscopic forceps through this



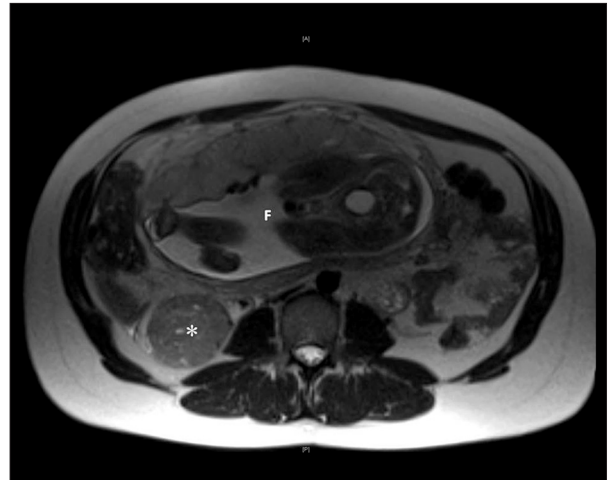
**Figure 1.** Magnetic resonance image (MRI) axial section of the abdomen in a 27-year-old woman at 30 weeks of gestation. MRI shows a 6×4 cm tumor in the lower pole of the right kidney. \* – tumor; K – kidney; S – spleen; L – liver.

trocar to place a 12-mm Versaport (Covidien, Mansfield, MA, USA) for the assistant and 2 *da Vinci* ports 9 cm apart.

The renal hilum was meticulously dissected with identification of the renal artery and renal vein. Subsequently, the tumor at the right lower renal pole was identified after removal of perirenal tissue. After determination of the resection margins, a clamp was placed on the renal artery. The tumor was dissected with monopolar scissors and put into an endobag for safe removal, followed by a reconstruction of the renal calyx system, hemostatic sutures for open blood vessels and a consecutive renorrhaphy. Total ischemia time was 15 min (total operative time was 95 min.). A drain was placed and removed on the 2<sup>nd</sup> postoperative day. The tumor was a bluish, hard in consistency, well capsulated, and clearly delineated mass from the renal parenchyma.

Constant monitoring and sonography for fetal heart sounds according to the current SAGES (Society of American Gastrointestinal and Endoscopic Surgeons) guidelines [15] were evaluated every 10 min, without any abnormal findings during the whole surgery. The postoperative recovery was uneventful, without any relevant change in hemoglobin level (10.5 g/dl, postoperatively).

After urological and obstetric consultation, the patient was discharged at the 8<sup>th</sup> postoperative day in good general condition and after sonographic control of the fetus.



**Figure 2.** Magnetic resonance image (MRI) of the abdomen in a 27-year-old woman at 30 weeks of gestation. MRI-sagittal section shows a 6×4 cm tumor in the lower pole of the right kidney. \* – tumor; F – fetus.

The final pathology report revealed a 109-g partial nephrectomy specimen with a subcapsular lesion of 6.4 cm in greatest diameter. The renal resection margins were clear. In further pathological analysis, the diagnosis of a chromophobe renal cell carcinoma was confirmed. TNM classification revealed pT1b (6.4 cm), pNx (regional lymph nodes cannot be assessed), LO (no invasion into lymphatic vessel or vein), Pn0 (no perineural invasion), and R0 (free resection margins, <0.1 cm of normal tissue).

Further follow-up consultations showed regular wound healing and normal progression of the pregnancy with uncomplicated full term spontaneous vaginal delivery afterwards. The patient was referred to the Oncology Department for further follow-up examinations according to the current EAU guidelines.

## Discussion

RARP of a newly diagnosed suspicious renal mass on routine ultrasound during pregnancy by the treating obstetrician is a novel and safe procedure for both mother and fetus due its advantages over open and laparoscopic approaches. Histopathology confirmed a chromophobe renal cell carcinoma. Although the retroperitoneoscopic approach may be surgically challenging, it has many advantages over the usually applied transperitoneal techniques for laparoscopic or robotic surgery.

Current guidelines recommend the surgical removal of large renal masses. A preoperative biopsy is not regularly recommended but should be initiated if a focal ablative approach is planned [14]. Offering a biopsy for accessible large renal masses could be accompanied by complications. The incidence of

benign renal tumors is low, especially when MRI results indicate malignancy. Despite the fact that many biopsies are carried out under radiation, the main counterarguments against a renal biopsy were the low but considerable risk of biopsy itself and the limited diagnostic accuracy (a 14% rate of non-diagnostic outcomes, an upgrade of pathology to a higher risk category after surgery in about 16%, and a 37% false-negative rate). Furthermore, current guidelines do not recommend renal biopsy in case of pregnancy [1]. In summary, a renal biopsy may give an interesting preoperative result in this current situation but without any impact on further management.

Surgery during the 1<sup>st</sup> and 3<sup>rd</sup> trimester of pregnancy may be associated with greater risks due to an assumed risk of spontaneous abortion and preterm labor, respectively. Therefore, several authors suggest performing surgery during the 2<sup>nd</sup> trimester, preferably between the 26<sup>th</sup> and 28<sup>th</sup> weeks [15].

A 1995 review by Loughlin et al concluded that surgery for a solid renal mass during pregnancy should be carried out in the 1<sup>st</sup> trimester if diagnosed early, despite the risk of spontaneous abortion or congenital abnormalities [2]. Second trimester pregnancies should be continued until 28 weeks of gestation when the fetal respiratory system is better established and the risk of premature labor is decreased [2].

Other authors propose that if renal mass is discovered during the 3<sup>rd</sup> trimester of pregnancy, delaying surgery after birth or synchronous surgery during term delivery should be considered to reduce the risk of a miscarriage [1,17]. Despite these reports, none of these recommendations mentioned above are supported by good-quality evidence.

Therefore, according to the current SAGES (Society of American Gastrointestinal and Endoscopic Surgeons) guidelines for the use of laparoscopy during pregnancy [15], laparoscopic surgery, including renal procedures, may be performed during any trimester of pregnancy despite the possible risk of triggering uterine contractions, thus causing fetal distress or even spontaneous abortion due to surgical manipulation [18-20].

From the uro-oncological point of view, in contrast to small renal masses (usually a maximum of 4 cm in diameter), studies showed a positive correlation of tumor diameter with metastatic spread. Every additional centimeter of tumor diameter added an additional risk of 25% for distant metastasis [36]. Additionally, postponing necessary operations until after parturition might increase the risk of perioperative or even late complications for both mother and the fetus [15]. For example, local tumor progression could lead to complications not only for the mother in terms of hematuria, internal bleeding/Tumor rupture, thrombosis or ureteral compression, but also the fetus could suffer from any kind of external compression

by a bulky tumor [19]. In addition, despite an estimated doubling time of renal cell carcinoma of 300-500 days, delaying surgery could possibly shift a potentially curable disease into a palliative situation [7]. Furthermore, it is difficult to accurately define an operation time in pregnant women due to possible complicated or delayed delivery, postnatal convalescence time, and possible higher blood loss with prognostic consequences.

Several reports show the feasibility of a laparoscopic nephrectomy during pregnancy, without any outstanding complications [1,2,9,16,17,21-23]. Even robotic surgeries have already been performed without any specific complications [24,25].

Importantly, there is no clear evidence for an increased risk of preterm labor or perioperative complications for mother and child. Further studies suggest that both laparoscopic cholecystectomy and appendectomy can also successfully be performed late during the 3<sup>rd</sup> trimester [15,23,26-31].

Only a few case reports and several animal studies have shown a decreased uterine blood flow secondary to pneumoperitoneum and fetal hypotension, as well as fetal acidosis with associated tachycardia, hypertension, and hypercapnia as a result of carbon dioxide insufflation [2,15,33]. To reduce the risk of complications, the carbon dioxide insufflation should be minimized, and intraperitoneal pressure should be kept below 15 mmHg while routine capnography is obtained. Use of the retroperitoneoscopic approach abolishes this problem, with minimized intraperitoneal pressure.

In terms of benefits of laparoscopic surgery versus open surgery, the literature reveals the advantages of a lower risk of wound complications, decreased risk of thromboembolic events, and diminished postoperative maternal hypoventilation, as well as fewer postoperative ileus problems, faster postoperative recovery time, and a lower level of pain with consecutively decreased fetal respiratory depression [1,2,15,22,33,10]. The advantages of a laparoscopic approach can apply for both the trans- or the retroperitoneal approach.

While the transperitoneal procedures offers a larger working space and a better visibility of important surgical landmarks, retroperitoneal procedures, in contrast, enable the surgeon to control the renal hilum at an early stage and to lower the rate of bowel manipulation, thus minimizing uterine irritation [1,2,18,22,10,34].

The present report describes a case of RARPN during pregnancy. Combining the advantages of robotic surgery, we assume the superiority of this retroperitoneal access in this case, referring to the specific advantages of an extraperitoneal approach without pneumoperitoneum and bowel manipulations providing early control of the renal artery, and direct approach to the

kidney, as well as better control of unexpected bleeding due to the limited volume of the retroperitoneal space. In summary, a RARP is a precise surgical technique. Furthermore, with only partial removal of the kidney, renal function can be preserved.

All results of the present surgery were comparable with the published series of RARP in the literature. The blood loss and short WIT in this case may be, as stated in the literature, a reflection of our experience with this approach. The short-term follow-up outcomes were also comparable with published literature reviews [22,23].

Lastly, these rare, complex cases require close interdisciplinary discussion and cooperation between an experienced and conscientious surgical team as well as a professional team to prepare, monitor, treat, and follow up the mother and child. Otherwise, a critical oncological surgery in a pregnant patient should be delayed until parturition, if justifiable.

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## Conclusions

This case report shows that RARP is a safe and effective surgical procedure for partial nephrectomy during pregnancy, if surgery can be performed in a specialist center and by an experienced surgical team. The retroperitoneoscopic approach seems to offer some distinct benefits in this indication over a laparoscopic or open approach.

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## Conflicts of Interest

None.

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