JBUON 2018; 23(4): 872-876
ISSN: 1107-0625, online ISSN: 2241-6293 • www.jbuon.com
E-mail: editorial_office@jbuon.com

REVIEW ARTICLE

Literature review on the feasibility of laparoscopic partial nephrectomy for renal cancer during pregnancy: a propos of a case

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Introduction

Of all adult malignancies, documented renal cell carcinoma accounts for 3% of all adult malignancies [1-3] and, specifically, during pregnancy, it is rare [1,4]. Furthermore, renal cell carcinoma is rarely considered as a diagnosis for the doctors due to its rarity and due to the overlap in symptoms between pregnancy and urological malignancies (hypertension, microscopic hematuria, palpitations, weight gain or hyperglycemia [1].

Partial nephrectomy is the gold standard treatment of small renal masses [5], and minimally invasive treatment, like the laparoscopic approach, has already proven its feasibility in non-pregnant patients. Nevertheless, there has been little published data regarding laparoscopic partial nephrectomy during pregnancy with only one case reported [6].

The main objective of this article was to assess the feasibility and safety of a laparoscopic partial nephrectomy for a pregnant patient with renal cell carcinoma.

Key words: *laparoscopy, minimally invasive, nephrectomy, pregnancy, renal cancer*

Case presentation

The case presented herein concerned a 31-year-old pregnant patient with a left kidney tumor of 6x6x4 cm and over 50% exophytic, situated on the anterior aspect of the kidney. Due to lack of symptoms, it was discovered incidentally during the first trimester obstetric examination. Due to pregnancy the physicians could not recommend a CT scan. Furthermore, an MRI was suggested to the patient to attain an improved diagnosis, but the patient refused claiming claustrophobia and fear of exposure to radio wave energy. Therefore it was decided that the data obtained from the Doppler abdominal ultrasound was sufficient (Figure 1).

The pathology report revealed a chromophobe renal cell carcinoma with eosinophilic cells and negative surgical margins pT1bNxMx.

The medical history revealed 3 term deliveries (2 by caesarean section) and one ectopic pregnancy for which she underwent open salpingectomy.

We explained the patient her treatment options: active surveillance until term, or organ-sparing surgery during pregnancy. She decided not to wait, fearing aggressive tumor growth or metastasis, and expressed her wish for a minimal invasive approach.

When she presented herself to our clinic the pregnancy was in the first trimester (8 weeks). The obstetrician's and anesthesiologist's recommenda-

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Received: 17/01/2018; Accepted: 25/02/2018

tions were to defer any surgical procedure until the 2nd trimester, where on the one hand the risks of a spontaneous abortion would be significantly reduced while on the other the effect of general anesthesia would be less harmful for the fetus.

We would like to highlight the particularities of this case: pregnant patient, surgical history with possible adhesions and a left sided tumor (the required lateral flank position increasing pressure on the vena cava).

The 2nd trimester scan revealed a viable fetus with no visible malformations. Progestin treatment was recommended by the obstetrician 1 week before surgery and 1 week after to aid the relaxation of the uterus and no tocolytic prophylactic administration.

A trans-peritoneal laparoscopic partial nephrectomy, using 3 trocars was performed in the 16th week of pregnancy. Figure 2 was taken during the operation; the pregnant uterus and the left ovary can be distinguished. Figure 3 shows how a vascular Satinsky clamp was introduced directly through the abdominal wall and used to clamp the renal pedicle.

Results

The duration of the procedure was 102 min, with 21 min of warm ischemia and a blood loss of 350 ml. For the renorraphy a sliding-clip technique was perfomed, using polyglactin suture, 10mm Hem-O-Lock clips and a haemostatic bolt. The set up for the renorraphy can be seen in Figure 4. The postoperative recovery was uneventful. The CO_2 pressure did not exceed 12 mmHg, to prevent any worsening of the pulmonary physiology of our patient or fetal acidosis.

The patient was mobilized 8 hrs after surgery. Beside early ambulation for deep venous thrombosis prophylaxis, we administered low molecular weight heparin and we used an intermittent pneumatic compression device. The patient was dis-

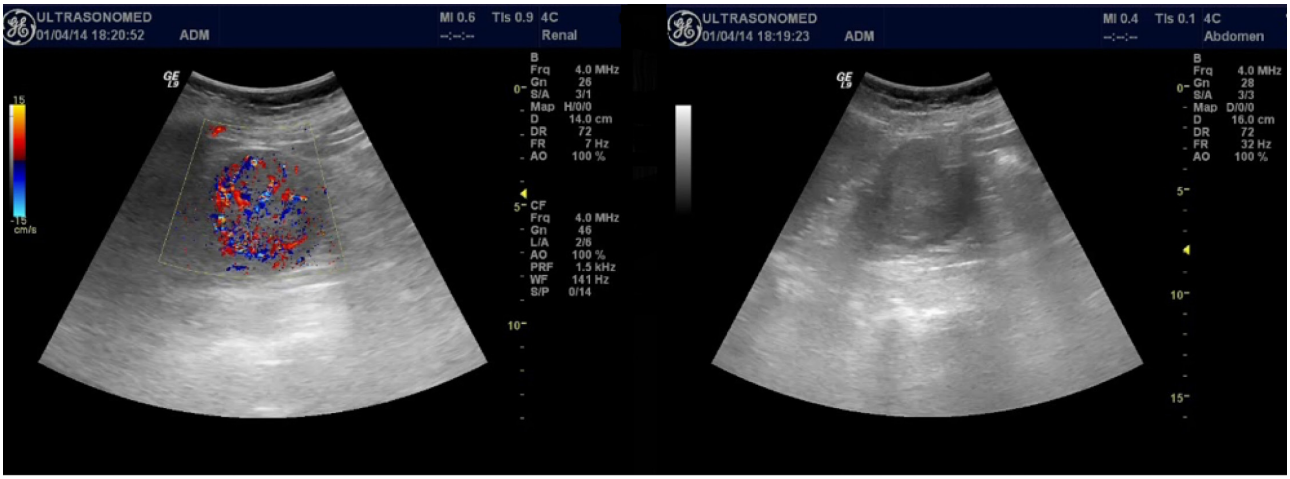

Figure 1. Ultrasound examination of the renal tumor, showing Doppler signal specific for renal carcinoma.

Figure 2. Intraoperative aspect of the pregnant uterus and left ovary.

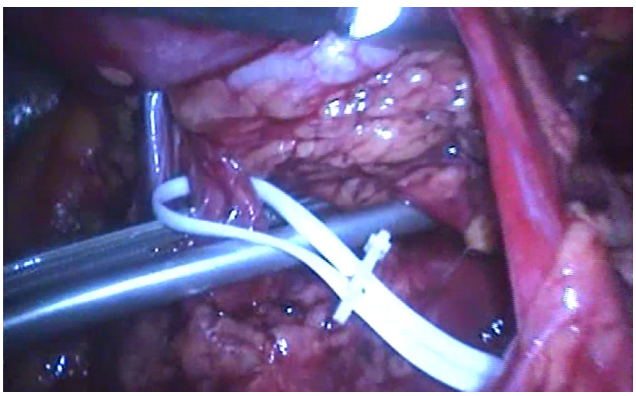

Figure 3. Vascular clamp is set-up on the prepared renal artery. The ureter is prepared and visible on the right side of the image.

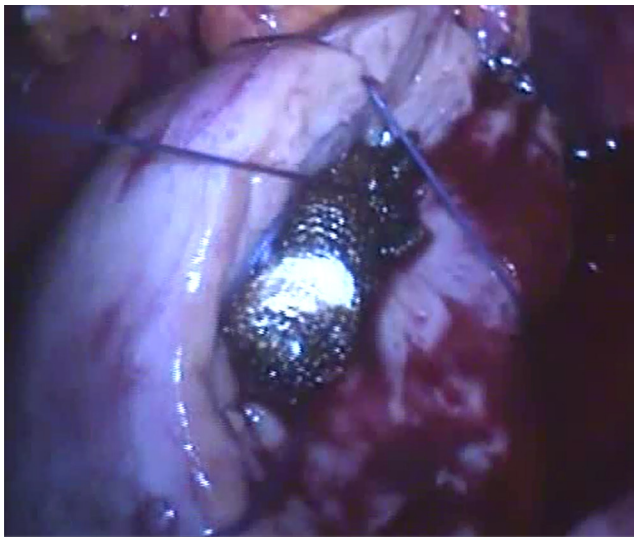

Figure 4. Intraoperative aspect of the kidney suturing using polyglactin and a haemostatic bolt.

charged on the 4th postoperative day. The mother and fetus's well-being was closely observed during and after surgery by an obstetrician.

The patient delivered at term- a 2750 g boy, APGAR score 9. During the 36 months follow-up the CT and ultrasonography scan did not reveal any tumor recurrence.

Discussion

One of the first links found between pregnancy and renal cancer was that there are estrogen and progesterone receptors on normal and cancer renal cells [7]. It was proposed that it could be possible pregnancy-associated hormone levels, like high estrogen, promote renal cell proliferation directly or via growth factors [2,7]. The failure of hormone treatments has led to the assumption that there is a relation between the hormones and renal cell carcinoma development but the underlying mechanism is not known [2,8]. A second correlation could be that the active functional immune system tolerates both pregnancy and renal cell carcinoma. The condition of immunosuppression allows for the maternal tolerance of the fetus by decreasing cellular immunity through the release of serologic blocking factors and hormones [9]. This immunosuppression is specific to the fetal antigens, which would protect the fetus from immune rejection [1]. However, pregnancy and cancer reflect biological conditions in which antigenic tissue is tolerated by the immune system [10,11]; therefore, the immunosuppressive effects caused during pregnancy could mask the cancer. In 2008, Pomara et al. proposed that this could happen by stimulating the growth of mutated p53 cells while the immune system selects for clones of the wildtype p53 tumor cells. Lastly, there does appear to be a correlation between the number of births and an increased incidence risk of renal cell carcinoma; specifically, the risk of this cancer is twice as high in pluriparous women than in nulliparous women [9,12]. However, some researchers argue that this increased risk of cancer during pregnancy can be attributed to the older age of the mothers [1,13]. In conclusion, there is no clear evidence indicating that pregnancy influences the clinical progression of cancer but rather that there is an increasing risk of renal malignancies with every additional pregnancy.

It is important to remember that renal cell carcinoma is still rare in both fertile women and even rarer during pregnancy [9,12]. By 2014 the accumulation of English literature found there have been a total of 102 documented cases of all renal malignancies during pregnancy including 21 reported cases of renal cell carcinomas [2]. Before the technology was available for laparoscopic surgery, radical nephrectomy was considered to be the standard surgical treatment for pregnant patients with renal cell carcinoma [2]. The first time a successful laparoscopic radical nephrectomy was performed during pregnancy was in 2004 by O'Connor and his colleagues. More recently (2010), in patients with T2 tumors and renal masses not treatable by nephron-sparing surgery, Ljungberg et al. on behalf of the EAU recommended laparoscopic radical nephrectomy as the new standard. Thus, the relative little amount of data published on pregnant patients and renal tumor gets to even fewer cases in which nephron-sparing surgical treatment has been applied.

Specifically regarding the open technique there were two cases in the literature: a classic partial nephrectomy at 16 weeks of gestation for a cystic renal cell carcinoma [14] and the other one where the caesarean section was performed simultaneously [15].

We found only one more case of laparoscopic partial nephrectomy reported during pregnancy in the literature for a right-sided renal tumor. Early unclamping technique was preferred. Renorraphy was completed with a barbed suture, application of Floseal and completed with a glyconate suture. They also placed a double J catheter. The pregnancy, delivery and oncological follow-up is declared as uneventful and with no tumor recurrence or metastasis at 22 months after surgery [6].

There is evidence reported in the accumulated literature that demonstrates the successful implementation of robotic-assisted laparoscopic partial nephrectomies [16-18]. There was even one case of

robot-assisted partial nephrectomy in 2008 done during pregnancy and without complications reported during or after the surgery [19]. This supports the notion that the laparoscopic partial nephrectomy technique is a safe and feasible option during pregnancy.

We chose to offer the patient surgical treatment during pregnancy after reviewing the literature on published case reports. One case presented similar conditions, particularly that the renal tumor mass was discovered in the 2nd trimester, in which the active surveillance until delivery was not the best solution as the patient underwent radical nephrectomy only after delivery. Meanwhile, she developed metastases and unfortunately died 12 months postoperatively [20]. In another case, the patient was metastatic four months after spontaneous delivery [21]. Surgery during the 2nd trimester is considered the safest, compared to 1st trimester where spontaneous abortions or congenital abnormalities could arise or in the the 3rd trimester which could induce premature labor [1,2,19].

The majority of the experience accumulated in urology for laparoscopic operations during pregnancy originates from cholecystectomies and appendectomies. All of these studies reported no increased in risk to the mother or fetus when performing a laparoscopic surgery during pregnancy [22-29]. Furthermore, there are many advantages of the aforementioned minimally invasive laparoscopic approach that can be beneficial for a pregnant patient: a lower risk of wound complications, diminished postoperative narcotic requirements, decreased probability of maternal pulmonary and fetal depression [26], reduced postoperative morbidity, decreased pain, faster return of bowel function and, as a result, a shorter hospital stay [2].

The improved visualization in laparoscopy may reduce the risk of uterine irritability by lesser uterine manipulation [30], whilst decreased uterine irritability results in lower rates of spontaneous abortion and preterm delivery [31]. Furthermore, laparoscopic radical nephrectomy has been shown in long-term outcome studies to have equivalent cancer-free survival rates to those of the traditional utilized open radical nephrectomy [5,32]. Without the corresponding literature, we can only deduce based on laparoscopic radical nephrectomy cancer-free survival rates that a similar long-term outcome can occur for laparoscopic partial nephrectomy.

There are some risks associated with laparoscopic surgery that should be taken into consideration and include: injury to pregnant uterus; technical difficulties due to the increasing size of the gravid uterus; pneumoperitoneum resulting in higher intra-abdominal pressure; and, lastly, decreased uterine blood flow by lower maternal venous return or cardiac output [2,33].

Conclusion

Partial nephrectomy has become the standard treatment for small renal tumors and laparoscopy has already been proven feasible for non-pregnant patients. The safest time period to perform the surgery was reasoned to be the 2nd trimester (weeks 13-28). A minimally invasive surgery for the pregnant patient was achieved through the use of laparoscopy to perform a partial nephrectomy. Furthermore, there was successful removal of the renal cell carcinoma tumor of the left kidney with the partial nephrectomy and follow-up scans reported no tumor recurrence. There were no complications during birth and the patient delivered a boy at term. In this case, laparoscopic partial nephrectomy was feasible and safe during pregnancy for the removal of renal cell carcinoma tumor.

Ethics considerations

The ethics committee of the Oncology Institute "Prof. Dr. Ion Chiricuța" gave the approval for the laparoscopic partial nephrectomy technique specific to a pregnant patient with renal cancer. The reference number for this case report given by the ethical committee is 5003/20.05.2014.

Written informed consent was obtained from the patient for publication of her case and any accompanying images. PDF scans of the original consent have been uploaded as supplementary material.

Authors' contributions

Dr. Bogdan Petrut, Dr. Maximillian Hogea, Dr. Tiberiu Tat and Dr. Vlad Schitcu performed the laparoscopic partial nephrectomy procedure. Dr. Bogdan Petrut is the lead doctor that organized the design of the study. Mihail Buse: writer/editor of the paper, guided by dr. Vlad Schitcu. Prof. Zeno Sparchez conducted the medical and imaging procedure during the treatment of the patient.

Conflict of interests

The authors declare no conflict of interests.

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