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Indications and the Role of Laparoscopic Partial Nephrectomy

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Article info

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Abstract

Context: Most renal cell carcinomas today are diagnosed incidentally at an early stage as small renal masses. Partial nephrectomy (PN) has become an established curative treatment in these indications and is mainly performed through open surgery.
Objective: Laparoscopic PN (LPN) is an attractive alternative to open PN (OPN). In this article are reviewed the indications, the surgical specificities, and different options for standardisation and optimisation of LPN.
Evidence acquisition: LPN should duplicate the principles of open surgery to get the same oncologic and complication outcomes. This is the case in experienced hands.
Evidence synthesis: The role of LPN is, to date, restricted to high-volume laparoscopic centres. Indications should be adapted to each surgeon experience, keeping in mind that the goal of LPN is to safely remove a tumour with the lowest renal and surgical complications in a limited operative time to keep the warm ischemia time to <30 min. Surgical improvements and robot-assisted laparoscopy are two major aspects of the future development of LPN.
Conclusions: LPN is a demanding surgical procedure and is so far limited to some specialised centres. New developments will potentially allow a wider use of this minimally invasive procedure.

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1. Introduction

Renal cell carcinoma (RCC) has been increasing in the United States and Europe by nearly 3–4% per year in recent decades [1,2]. In the United States, there were an estimated 51 190 new cases and 12 890 deaths in 2007 [3]. The majority of RCCs are, nowadays, incidentally detected as small renal masses (SRMs) by abdominal imaging in asymptomatic patients.

As specified in the 2007 European Association of Urology (EAU) recommendations, nephron-sparing surgery (NSS) is an established curative approach for the treatment of RCC in selected SRMs. NSS for tumours >4–7 cm maximum diameter (T1b tumours) can be performed in centres with expertise in selected patients, and open partial nephrectomy (OPN) currently remains the standard of care, as it yields the same oncologic outcomes as radical nephrectomy (RN) but preserves better renal function and quality of life (QoL) [4–8].

Laparoscopic surgical skills, applied to partial nephrectomy (PN), could offer the advantages of a minimally invasive but efficient surgical procedure. Laparoscopic PN (LPN) aims to duplicate the surgical principles of OPN in terms of oncologic outcomes, renal function preservation, and complication limitation. LPN is a less invasive procedure than OPN and has potential advantages, such as shortening the hospital stay and patient recovery, for increasing postoperative patient QoL and limiting

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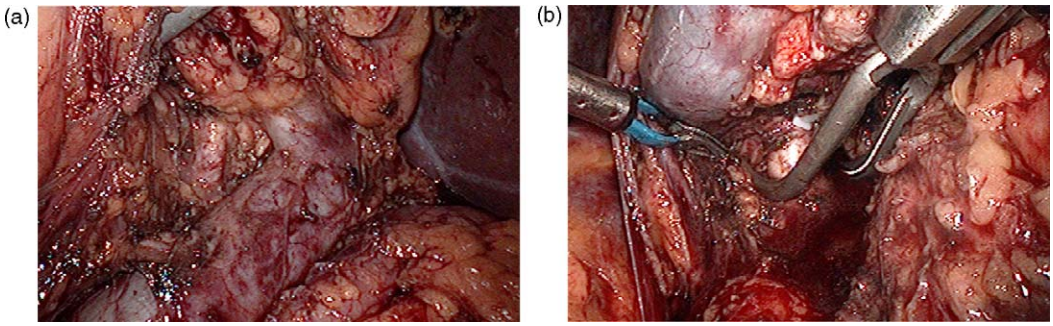

Fig. 1 – (a) Complete renal hilum dissection; (b) bulldog clamp applied to the renal artery.

long-term wound complications (eg, abdominal eventration, flank pain).

However, NSS is still underused (9.6% of RCC in the United States [9]) and mainly performed as OPN. LPN is a very demanding procedure, limited to few experienced centres [10]. In this article, the role, surgical specificities, and actual indications of LPN in the management of RCC are analysed.

2. Laparoscopic partial nephrectomy: Specific surgical procedure

The choice of transperitoneal or retroperitoneal approach depends on the surgeon's preference and/or on tumour location within the kidney as defined on the preoperative computed tomography scan. Anterior and lateral tumours are more easily approached transperitoneally, whereas posterior tumours could be approached retroperitoneally [11–14].

The transperitoneal approach (mainly performed as laparoscopic approach) is conducted the same way as laparoscopic RN: after colonic mobilisation, the kidney, ureter, and spermatic vessels are identified. Renal hilum dissection should isolate the artery and vein in order to perform, in a safe way, arterial or total hilum clamping and unclamping (Fig. 1). Temporary arterial (or hilum) clamping is mandatory during LPN, as manual parenchyma compression for haemostasis control is not feasible under laparoscopy (although a few recent publications have shown that parenchymal compression without hilum clamping is feasible in selected cases during LPN [15]). During the so-called "warm ischemia time" (WIT; from arterial clamping to unclamping), the surgeon has a very limited timing to excise precisely and totally the tumour with a safe control margin, repair the caliceal opening if needed by placing a suture on the collecting system, and perform a renorraphy for parenchymal haemostasis control. The duration of WIT has to be <30 min, a safe upper time limit accepted before renal function impairment [16]. Thus, WIT is the real challenge of LPN and explains why this procedure is restricted to centres experienced with laparoscopy.

After the hilum is dissected and before applying the clamp, the kidney is mobilised and dissected out of the perirenal fat. The surrounding fat tissue is excised with the tumour. The surgical field should be perfectly exposed and every surgical tool and material ready for excision and renal repair before clamping the vessels in order to optimise WIT. If needed for localisation of a central or medullar small tumour, intraoperative ultrasonography can be performed with a laparoscopic probe.

Renal hilum clamping is generally performed using a Satinsky clamp (through a trocar), a bulldog clamp (intracorporeally), or Rumel tourniquet tape depending on the surgeon's preference [13,17–19] (Fig. 1). A selective clamping of the only artery is generally favoured, because bleeding control is often sufficient and retrograde kidney perfusion may minimise the risk of acute tubular necrosis postoperatively [20]. Renal hypothermia has been rarely performed during LPN [21–23] but can be obtained with ice slush cooling introduced in a bag placed around the kidney [21], by renal intra-arterial cooling through continuous perfusion of cold Ringer's lactate [22], or by retrograde saline perfusion through the ureter [23].

Following vascular clamping, the tumour and a safe renal parenchymal margin are properly excised, using cold scissors to avoid cautery artefacts of the excision limits [13,24] (Fig. 2). The tumour is elevated using a forceps applied on the peritumoural fat, and the operative field is maintained dry using suction cannula. The tumour is then placed in a bag and left out of the surgical field until the end of the procedure. Collecting system entry can be identified with or without the use of a ureteral catheter, according to the surgeon's experience [25].

The reconstruction of the excision bed in the renal parenchyma should be performed as precisely and quickly as possible to reduce complications and WIT. Several technical procedures have been described for these

Fig. 2 – Cold scissor tumour excision with a safe parenchymal margin.