

Laparoscopic Nephrectomy and Partial Nephrectomy

Intraperitoneal, Retroperitoneal, Single Site



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KEYWORDS

• Laparoscopy • Nephrectomy • Partial nephrectomy • Retroperitoneal • Single site

KEY POINTS

- Laparoscopy has become a mainstay approach in the management of pediatric renal maladies.
- Transperitoneal and retroperitoneal laparoscopic approaches are safe and effective.
- Advancing technologies, such as single-site surgery and robotics, are becoming increasingly common in the management of pediatric patients.

 **Videos of umbilical incision, trocar incision, colon mobilization, transperitoneal nephrectomy, and prone nephrectomy accompany this article at <http://www.urologic.theclinics.com/>**

INTRODUCTION

The indications for simple laparoscopic nephrectomy range from mitigation of renin-mediated hypertension and severe proteinuria, to removal of infected, poorly functioning renal units, or severely hydronephrotic kidneys. The use of minimally invasive surgery (MIS) further extended to malignant pathologies, hence radical laparoscopic nephrectomy is frequently offered for pediatric renal malignancies, such as Wilms tumor or renal cell carcinoma. On the other hand, although partial nephrectomy is traditionally used for management of renal malignancies in adults, its role in the pediatric population is more commonly limited to duplex kidneys with or without ureteroceles.

Historically, laparoscopic nephrectomies in pediatric and infant patients were initially described by Ehrlich and colleagues¹ (pediatric) and Koyle and colleagues² (infant) in the early 1990s. In both cases they removed a multicystic dysplastic kidney. Since that time, the general principles of

transperitoneal laparoscopic nephrectomy have largely remained the same.

Although pediatric laparoscopy was hindered at first by the size of the access ports and the length of the instrumentation, advances in technology and development of dedicated pediatric instruments have led to fast adoption and dissemination of this surgical approach. Today, there are 3-mm to 5-mm instruments with respective optics widely available, and technical advances by some companies (eg, GIMMI [GIMMI GmbH, Tuttlingen, Germany]; **Fig. 1**) have allowed even further miniaturization to 2.7-mm instruments and optics.

Laparoscopy in children is a unique procedure when compared with adults, and the nuances of this approach in the pediatric population are not only related to size of the patients or instruments, but also pertain to the physiology. For instance, the relative distance between the access point and any intra-abdominal structures has the potential to cause significant damage as instruments are

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Fig. 1. GIMMI instruments. (Courtesy of GIMMI GmbH, Tuttlingen, Germany; with permission.)

advanced into the abdominal or retroperitoneal cavity. In addition, there can be more significant physiologic effects of pneumoperitoneum on the respiratory, cardiovascular, renal, and gastrointestinal tracts, particularly at higher pressures. Surgeons embarking on incorporating laparoscopy in their practice are advised to have a clear and deep understanding of the evolving technology and the physiology of children.

NEPHRECTOMY

Equipment

The array of laparoscopic equipment available in the market today is immense, although still far less so in the pediatric market as compared with the adult market. In general, we prefer to have a standard set up for all laparoscopic renal cases (Table 1), with additional specialized equipment available on standby to be used as needed. Standardization of equipment placement and organization of the various cables and tubes is essential for safety and efficiency during the case. For instance, we recommend using a dedicated Mayo stand to keep the basic equipment in a predictable location and easily within reach.

General Positioning

Like any surgical procedure, one of the first, and most critical, steps in a laparoscopic nephrectomy is patient positioning, padding, and retention to the table. We recommend that positioning be done as a joint effort among the surgeon, anesthesiologist, and nursing staff to ensure that all aspects and potential implications of the patient position are accounted for. When performing

simple nephrectomy, positioning can vary from supine to partial flank to full flank, depending on multiple factors, such as body habitus, operative side, kidney size, planned port placement, and anticipated exposure needs. In any of the positions, the break point in the bed and/or kidney rest may be used to help widen the angle between the lower ribs and pelvic brim, effectively increasing the operative space. In general, however, the benefit of the kidney rest and/or bed break is fairly limited in pediatric patients because of their small size. When a partial or full-flank position is used, the positioning of the arms and legs are critical to ensure there is no strain on the respective joints. Once positioning is established, the focus shifts toward appropriately padding pressure points. Once positioned and padded, the patient needs to be secured to the bed with sturdy tape (2–3-inch cloth tape) to provide complete security and allow the bed to be maximally deflected in any direction without risking significant shifting of the patient on the bed. Furthermore, key points that need to be secured with tape include upper and lower legs, hips, chest and shoulders, arms, and head. If simple bed movement is planned, such as mild Trendelenberg, then it is often necessary to tape only the legs and chest/shoulders. Any degree of side-to-side bed adjustment should mandate taping around the hips, arms, and head as well.

TRANSPERITONEAL SIMPLE NEPHRECTOMY

Access

When performing a transabdominal approach, we recommend open access to the peritoneal cavity via the umbilical region, with the point of entry at the fusion of the fascial layers to form the linea alba. We find this anatomic landmark to be the most predictable point of entry into the abdomen.

Once the umbilicus is everted, the lateral aspects are grasped with Allis clamps and skin is incised in a vertical transumbilical fashion using a #11 blade (Fig. 2). The open umbilicus is

Table 1
General and specialized laparoscopic equipment

Case	General Equipment	Special Equipment
Nephrectomy or partial nephrectomy	30° scope (3, 5, or 10 mm depending on the procedure to be performed); scissor with cautery, Maryland, bowel, and right-angle graspers; hook;	Laparoscopic stapler, specialized coagulation device (eg, Harmonic, Enseal, LigaSure, Thunderbeat)
Retroperitoneal nephrectomy or partial nephrectomy	suction irrigator; clip applicator; specimen-retrieval bag	In addition to above, narrow S-retractor or right-angle retractor

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