6 Difficulties in Laparoscopic Simple Nephrectomy

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The first transperitoneal laparoscopic nephrectomy was performed by Clayman et al. in 1990 [1]. Since then, this surgery has been performed for various benign renal diseases. In 1992, Gaur et al. developed the balloon dissection technique for creation of the retroperitoneal space [2]. Since that time, retroperitoneoscopic nephrectomy has been demonstrated to be safe and effective for benign nonfunctioning kidneys [3, 4]. Refinements such as entrapment bags and tissue morcellators have improved both the efficiency of specimen removal and the minimally invasive nature of the procedure. Laparoscopic nephrectomy offers less postoperative pain, shorter hospital stay and convalescence, and an optimal cosmetic result compared with traditional open surgery [5, 6].

Indications

Laparoscopic nephrectomy has become a routine procedure at specialized centers. It can be performed for all age groups, in obese patients and nearly all benign pathological conditions of the kidney [7–10].

Removal of a nonfunctioning or poorly functioning kidney is indicated when it causes symptoms such as pain, urinary tract infection, or hypertension. It is also indicated in patients with chronic renal failure for removal of the left kidney before renal transplantation [4, 6, 9, 11–14]. Laparoscopic nephrectomy was reported for the following benign pathologies:

- Hydronephrosis
- Chronic pyelonephritis
- Renovascular hypertension
- Reflux nephropathy

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- Autosomal dominant polycystic kidney disease
- Renal dysplasia
- Post-traumatic atrophy of the kidney

Contraindications

Absolute contraindications to laparoscopic simple nephrectomy include active peritonitis, bowel obstruction, uncorrected coagulopathy, and severe cardiopulmonary insufficiency [4, 6, 11, 13]. Relative contraindications include morbid obesity, severe inflammatory conditions affecting the kidney, such as xanthogranulomatous pyelonephritis (XGP), and renal tuberculosis.

Techniques of Laparoscopic Simple Nephrectomy

Transperitoneal Laparoscopic Nephrectomy

The patient is initially positioned supine for intravenous access, induction of general anesthesia, bladder catheterization, and nasogastric tube placement. The patient is then positioned in a modified lateral decubitus [6, 15] or a standard lateral kidney position [11, 13]. The table can be flexed as needed and padding is used to support all pressure areas (Fig. 6.1). The room setup is shown in (Fig. 6.2). During the skin preparation and towel placement, the entire flank and abdomen are included in case conversion to an open procedure is required.

Access to the abdomen is obtained either with a Veress needle or with a Hasson canula. The needle is introduced at the lateral border of rectus muscle, at the level of the umbilicus [11]. Although the umbilicus is not the preferred site for needle placement during laparoscopic nephrectomy, it carries many advantages as the underlying peritoneum is fused to the overlying fascia, and it is the shortest distance

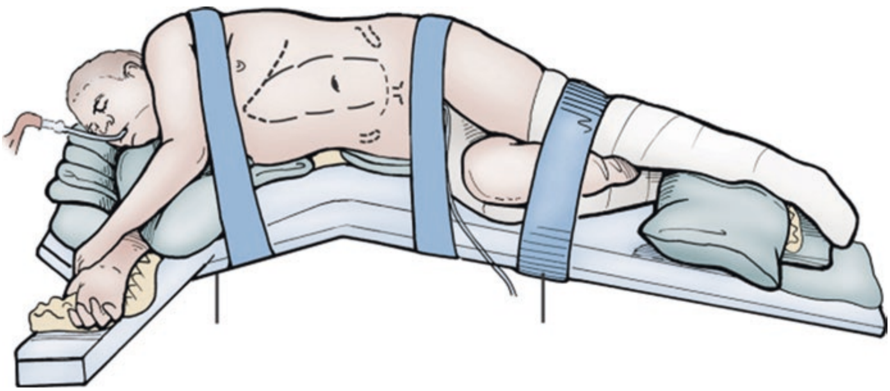

Fig. 6.1 Patient positioning for transperitoneal laparoscopic nephrectomy

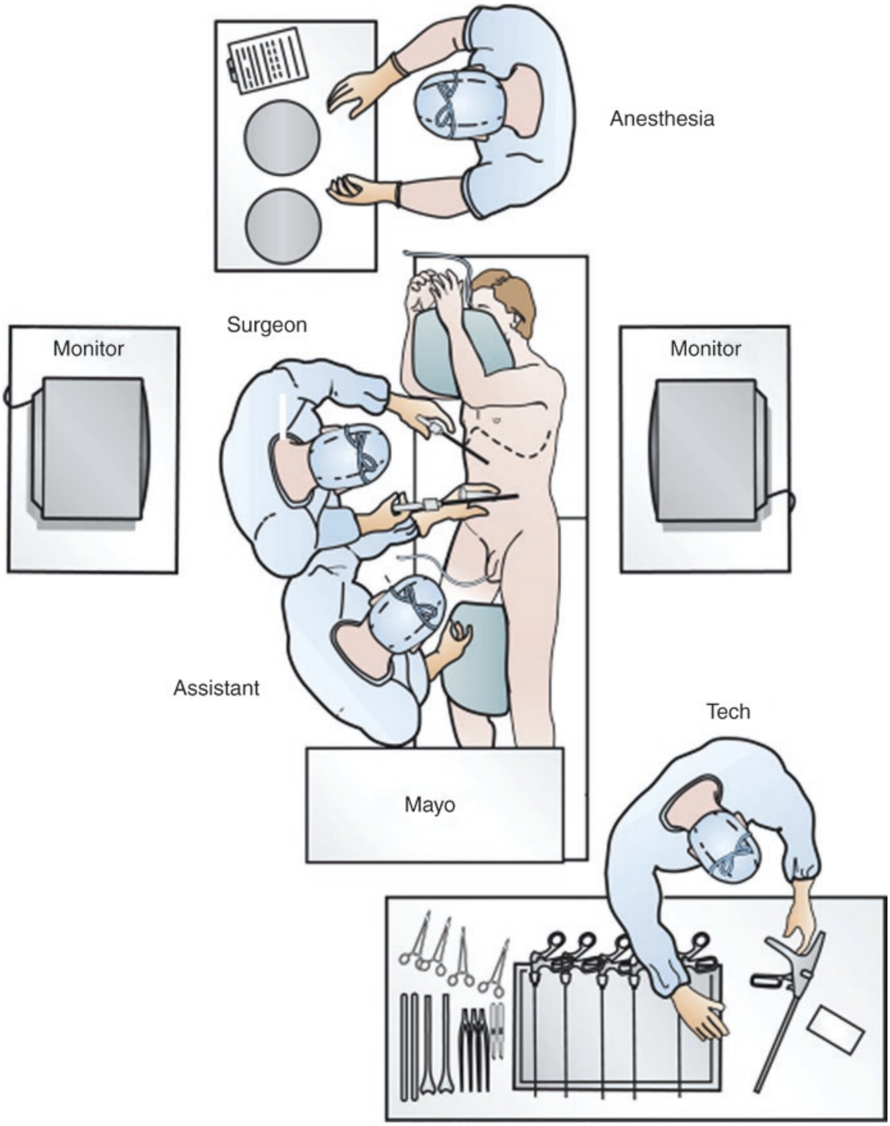

Fig. 6.2 Room setup for transperitoneal laparoscopic nephrectomy (From Bishoff and Kavoussi [46]. Copyright Elsevier 2007)

between the skin and the peritoneum [16]. The intraperitoneal position of the tip of the needle can be ensured by the visual and tactile verification of release of the needle spring by the hanging drop test, and by injection of 2 mL of saline with failure of its retrieval upon suction. Patients with a history of multiple abdominal operations may have underlying adhesions and laparoscopic access is best established

Fig. 6.3 Port distribution for transperitoneal laparoscopic left nephrectomy

by the open technique. The site of access is preferably via a small infra-umbilical or para-umbilical incision [17].

Insufflation is started slowly, at a rate of 1 L/min until generalized resonance is achieved. The peritoneal cavity usually requires 3–6 L of CO_2 in adults and 1.5–3 L in children to be completely inflated. Then the flow is increased to maintain intraperitoneal pressure at 15 mmHg in adults and less than 12 in children using an automatic insufflator [11].

Four ports are used (Fig. 6.3). The first port (10 mm) is fixed at the site of the Veress needle. This port is used to introduce the laparoscope (10 mm, 0° lens). Under endoscopic guidance, the second port (12 mm) is fixed midway between the first port and the anterior superior iliac spine. This port is used to introduce dissecting electro-scissors, vascular stapler (to control the renal vasculature), and the endoscopic pouch (to entrap the kidney at the end of operation). The third port (10 mm) is inserted below the costal margin at the midclavicular line and is used to introduce the grasping forceps for tissue manipulation. The fourth port (5 or 10 mm) is inserted in the midaxillary line and is used for retraction of liver or spleen using a fan retractor.

Thorough inspection of the abdominal cavity is essential to exclude any inadvertent trauma, especially to the colon or blood vessels. The colon passes anterior to the kidney and the ureter. The peritoneum lateral to the colon (line of Toldt) is incised using diathermy scissors and extends from the level of the iliac vessels distally to above the colic flexures proximally (Fig. 6.4). A safety distance (about 1 cm) lateral to the colon should be respected to avoid diathermy injury of the colon. Using a combination of blunt and sharp dissection posterior to the colon, the colon is freed from the posterior abdominal wall and is reflected medially by the effect of gravity.

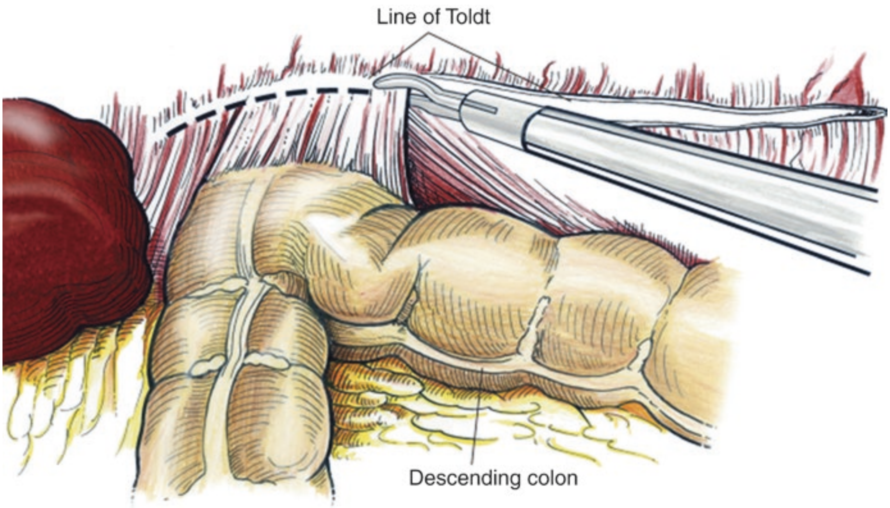

Fig. 6.4 Incision of the line of Toldt during left nephrectomy (From Bishoff and Kavoussi [46]. Copyright Elsevier 2007)

The kidney becomes visible after reflection of the colon. The ureter passes anteromedial to the psoas muscle until it reaches the renal pelvis.

The upper ureter is easily identified and dissected with cephalad traction on the lower pole of the kidney. Using electrosurgical scissors, the periureteral fascia is dissected and the ureter is freed until it reaches the renal pelvis. Usually the ureter is divided at its lumbar level, about 5 cm below the level of the lower pole of the kidney. If its caliber is normal, it is divided between endoscopic clips. Otherwise, it can be ligated with endoscopic ligatures or clamped and incised with the endoscopic stapler.

Proximal dissection of the ureter leads to the medial side of the renal pelvis where the renal artery and vein can be safely dissected. The renal vein is anteroinferior to the renal artery. In some cases, exposure of the vena cava in right-sided nephrectomy allows better visualization of the renal vein, whereas on the left side, the aorta is the landmark for the left renal artery. Exposure of the pedicle stump allows better and earlier control and avoids dealing with multiple branches and tributaries.

A toothed forceps (5 mm) is used to grasp the proximal end of the divided ureter. With caudal and lateral traction on the proximal end of the ureter, the anterior surface and medial border of the renal pelvis are dissected to expose the renal vessels. Using the endoscopic forceps, lateral traction along the medial aspect of the anterior surface of the kidney helps stretch the renal hilum to free it further, especially the upper, lower, and posterior sides. The renal vein appears first, followed by the renal artery posterosuperiorly.

Control of the Renal Pedicle

The renal artery is secured between endoscopic clips and cut, leaving two to three clips toward the stump side. In most cases the vein is too wide, so an endoscopic stapler is most useful. The stapler is used for simultaneous stapling and division of the vein. Another method to control the renal vein is to shrivel it using a ligature followed by clipping with a Hem-o-lok® (Teleflex Medical, Research Triangle Park, NC). This step combines advantages of suture ligation and clips with a locking mechanism and is important to shrivel a vein of any diameter to allow safe application of clips [18]. The main argument against the routine use of clips to ligate the pedicle is the relative ease with which clips may be dislodged. This drawback is overcome by using clips with a locking mechanism at the tip, such as the Hem-o-lok®, Laparo-clip (Tyco Healthcare, Mansfield, MA) and Absolok Plus (Ethicon Endo-Surgery, Cincinnati, OH). In addition, clip length is usually not adequate to occlude a large vein completely [18].

Sometimes the vessels are surrounded by a dense fibrous reaction and an attempt to separate the artery from the vein seems difficult and hazardous. In this situation, division of the renal pedicle en mass using the endoscopic stapler may be accomplished. Although en bloc ligation of the renal pedicle has been potentially implicated in the postoperative development of arteriovenous fistula (AVF), [19] the possibility of its development is remote due to the presence of dense, intervening tissue between the vessels. This has been supported by other reports that have studied the possibility of AVF development after en bloc ligation of the renal hilum [19–21].

In some cases, the gonadal vein is identified either crossing the right ureter anteriorly or lying medially alongside the upper left ureter. Both can be dissected and clamped with a 9-mm endoscopic clip and incised when necessary, but this must be done 2 cm away from the renal vein to avoid future problems with the applying the endoscopic stapler to the renal pedicle.

Gerota's fascia is identified by its orange yellow color and is incised to expose the renal surface. The plane between the fascia and the kidney is easily dissected with a combination of blunt and sharp dissection. One should avoid dissecting along the lateral border of the kidney initially, as early division of these attachments allows the kidney to drop medially and may hinder hilar dissection. To facilitate dissection of the upper pole, a fan-shaped retractor is passed to elevate the liver on the right side or the spleen on the left side.

After complete dissection of the kidney, a folded laparoscopic retrieval bag is introduced through the 12-mm port. The bag is folded around the 5-mm forceps in a clockwise direction. After introduction of the sac in the peritoneal cavity, it is unfolded in a counterclockwise direction. The mouth of the bag is kept open using two pairs of toothed forceps. Using a strong claw forceps, the kidney is thrown inside the sac. The mouth of the sac is closed by applying traction on the nylon thread, and it is pulled to the outside through the 12-mm port site. To extract the kidney, a combination of strong forceps and blunt-ended scissors is used to fragment the renal tissue. The kidney may be placed in an organ sack and retrieved intact through an extended skin incision [6, 13].

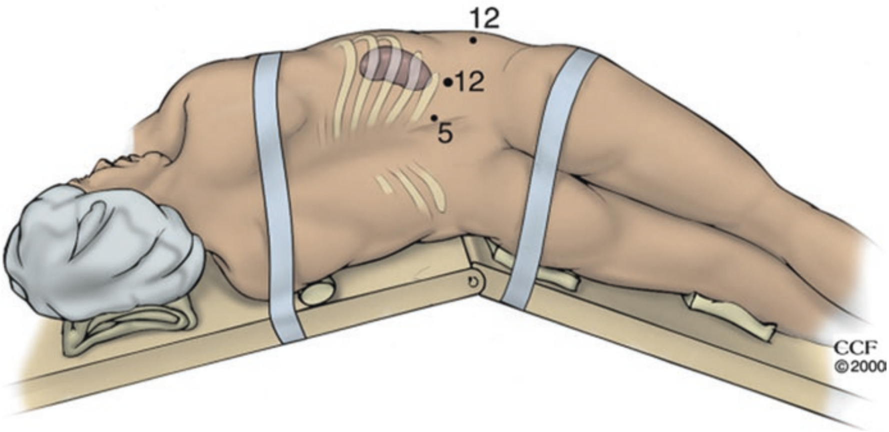

Fig. 6.5 Patient positioning for retroperitoneal laparoscopic nephrectomy (From Bishoff and Kavoussi [46]. Copyright Elsevier 2007)

After the specimen retrieval is completed, a fingertip can be placed into the port through which the kidney was removed. Pneumoperitoneum is reestablished, and a final inspection of the intra-abdominal contents is performed. One must remember to decrease the intra-abdominal pressure to 7 mmHg to confirm hemostasis prior to exiting the abdomen. Fixation of an 18 F tube drain is done through the site of the most lateral port. The 5-mm ports are then removed under direct vision, and the remaining 10-mm port withdrawn with the laparoscope within it to observe the edges of the port during removal. All 12-mm ports should have fascial closure.

Advantages of the transperitoneal approach include more space to perform the surgery and easily identifiable anatomical landmarks. Therefore, the learning curve for the procedure is shorter and large kidneys are easier to manipulate in the large peritoneal space**.** However, there are some disadvantages, such as formation of intra-abdominal adhesions, contamination of the peritoneal cavity by urine, risk of injury to the intra-abdominal organs, and increased risk for bowel herniation compared to the retroperitoneal approach [4, 17].

Retroperitoneal Laparoscopic Nephrectomy

The same positioning steps in the transperitoneal approach are applicable for the retroperitoneal approach. The patient is placed in a lateral position (Fig. 6.5).

Creation of the Retroperitoneal Space

Gaur described the first technique for creation of the retroperitoneal space. The dissecting balloon is made with a number 8 red rubber catheter and a number 7 surgeon glove, where one end of the catheter is fed into the glove (which then becomes the balloon) while the other end is attached to the pneumatic pump of a blood pressure apparatus. A 2-cm skin incision is made just above the iliac crest in

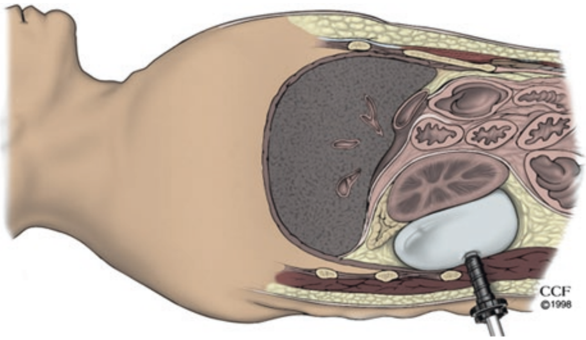

Fig. 6.6 Creation of the retroperitoneal space using a balloon (From Hsu et al. [47]. Reprinted with permission from Mary Ann Liebert, Inc.)

the midaxillary line. Blunt dissection is done down to the retroperitoneal space using artery forceps and occasionally, a finger. A curved artery forceps grasps the tip of the balloon and places it in the retroperitoneal space. The balloon is inflated using a pneumatic pump until a bulge appears in the abdomen. During this procedure, the balloon pressure is intermittently increased to 110 mmHg then decreased to 40–50 mmHg. The balloon is left inflated for 5 min to achieve hemostasis, then deflated and removed [2].

Rassweiler et al. described another technique where a 15–18 mm skin incision is made in the lumbar (Petit's) triangle between the 12th rib and the iliac crest. A tunnel is created down to the retroperitoneal space using blunt dissection. Three methods were described to dissect the retroperitoneum: The first method uses a latex balloon formed from the middle finger of surgical glove on an 18 F catheter. The second method uses a balloon trocar system that consists of a latex balloon ligated to an 11-mm metal trocar sheath (Fig. 6.6). The third method uses the index finger exclusively to dissect the retroperitoneal space (Fig. 6.7) [4, 22].

Gill et al. made a 1.5–2 cm incision immediately anterior to the tip of the 12th rib. The posterior lumbodorsal fascia is incised between stay sutures, muscle layers are bluntly separated and the anterior fascia is incised under vision. A fingertip is then inserted through the incision, the lower pole of the kidney is palpated, and a retroperitoneal space is created [23].

El-Kappany et al. made a 2-cm subcostal incision one fingerbreadth below the tip of the last rib. The incision is deepened by cutting or splitting the muscle until the white, glistening lumbar fascia is identified. The fascia is sharply incised to reach the retroperitoneum. Using the index finger for blunt dissection, a small retroperitoneal space is created to facilitate placement of the dissection balloon. A simple toy balloon of 1.5 L capacity is connected to an 18-F Nelaton catheter using double ligatures of number 0 silk sutures. The balloon is introduced into the retroperitoneum and inflated using sterile saline. It is kept inflated for 5–10 min to allow for more dissection and hemostasis of the retroperitoneum [24].

El-Ghoneimi et al. published their experience in infants. They made an incision 1.5-cm long and at 1 cm from the tip of the twelfth rib. Gerota's fascia is approached by a muscle-splitting incision with blunt dissection, and then opened under direct vision. The first trocar (5 or 10 mm) is introduced directly inside the opened Gerota's

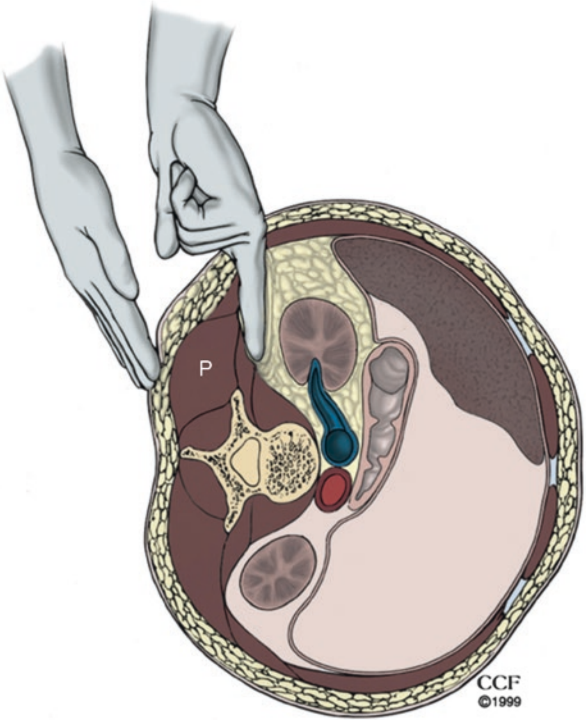

Fig. 6.7 Creation of the retroperitoneal space using a finger (From Hsu et al. [47]. Reprinted with permission from Mary Ann Liebert, Inc.)

fascia. A working space is created by gas insufflation dissection and the first trocar is fixed with a purse-string suture applied around the deep fasciato to ensure an airtight seal [25].

Port Distribution

A 10-mm blunt trocar is fixed at the site of the first incision. To prevent gas leakage, the muscles around the port must be closed using simple sutures, and two mattress sutures (number 1 silk) must be used to close the skin incision and fix the port in place. CO_2 insufflation is initiated through this port to maintain the pressure in the retroperitoneal space between 10 and 15 mmHg. The laparoscope is introduced through this port to facilitate fixation of another two ports under direct vision. The second port (12 mm) is fixed anterior to the first port at the same subcostal line. The third port (10 mm) is fixed one fingerbreadth above the anterior superior iliac spine. The third port is used for the laparoscope, and the first and second ports are used for dissection and manipulation (Fig. 6.8).

Operative Steps

The main landmark for orientation is the psoas muscle. This marks the posterior boundary of dissection, which is the first area to be tackled. A fibrous outer layer of Gerota's fascia is incised near the medial border of the psoas muscle to expose the perirenal fat. The incision is extended upward to expose the kidney, and downward to expose the

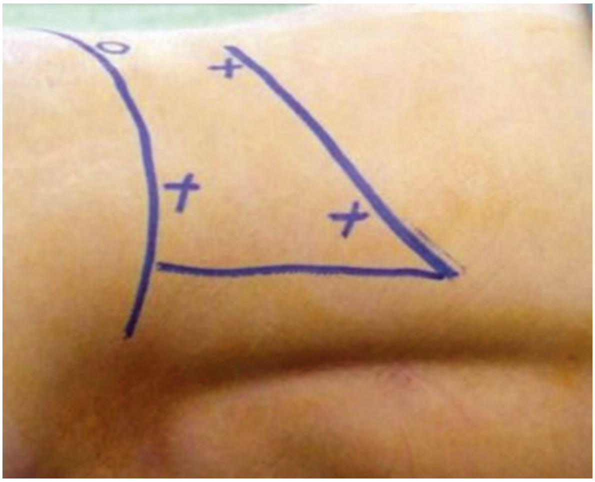

Fig. 6.8 Port distribution for retroperitoneal laparoscopic nephrectomy (From El-Kappany et al. [24]. With kind permission of Springer Science + Business Media)

ureter. The ureter appears as a white band anteromedial to the psoas muscle, with its surrounding vascular supply. The ureter is divided between endoscopic clips. If the ureter is followed up to the kidney (with dissection of the perirenal fat), the renal pelvis will be exposed. Here, the renal artery appears first and is posterosuperior to the renal vein. The gonadal vessel appears clearly on the left side of this vein. On both right and left sides, gonadal veins appear medial to the ureter when they reach the renal hilum. Then the procedure is completed as outlined in the transperitoneal technique.

The kidney is usually extracted without fragmentation from the initial subcostal incision in view of its small size. With average- or large-sized kidneys, entrapment and extraction are performed in a manner similar to the transperitoneal approach. Specimen extraction can be done by placing it in a laparoscopic retrieval bag or an organ entrapment bag, or intact removal of the specimen by enlarging the primary port or connecting two ports to make a large incision.

The retroperitoneal approach has many advantages. Since the peritoneal cavity is not entered, there is no risk of forming postoperative adhesions. There is also no risk of contamination of the peritoneal cavity with the contents of the urinary tract. There is a decreased risk of injury to the intraperitoneal organs and there is no need for retraction of the intra-abdominal viscera. As there is no need to mobilize the gut to expose the urinary tract, there is no postoperative ileus and hence a shorter convalescence [26]. Access to the site of lesion is direct as the kidney is a retroperitoneal structure. Less trocar punctures are needed as there are fewer requirements for retraction. The approach is safe even in patients with history of intraperitoneal surgery. There is less incidence of bowel herniation than with the transperitoneal approach [3, 4, 17, 27]. Disadvantages include a smaller working space, and more difficult identification and exposure of some anatomical structures. More experience and a longer learning curve are needed for this approach as there are few landmarks in the retroperitoneum. This space is sometimes obliterated in patients with inflammatory pathologies such as pyelonephritis [3, 4, 17].

Difficulties in Laparoscopic Nephrectomy

Laparoscopic Nephrectomy for Inflammatory Renal Conditions

Although the term “simple” is associated with nephrectomies that are performed for benign indications, this description continues to be one of the great misnomers in the field of urologic surgery. Inflammation, fibrosis, and scarring often affect the involved kidney, making the process of dissection much more difficult than that of the typical radical nephrectomy. When present, these factors make the laparoscopic approach to the simple nephrectomy a challenge for even the most experienced laparoscopic surgeons.

Perirenal and perihilar fibrosis is a common finding in infectious and inflammatory renal conditions such as pyonephrosis, tuberculosis, and XGP, making laparoscopic dissection challenging [4, 13]. The theoretical advantages of the laparoscopic approach for inflammatory renal diseases have been questioned and were considered a relative contraindication to laparoscopy [28].

The best laparoscopic approach for inflammatory renal conditions remains controversial. Whereas the retroperitoneal approach has been advocated for managing renal tuberculosis and other inflammatory renal conditions [29, 30], in many cases the transperitoneal approach provides superior exposure and more working space for difficult dissection. Thus, the transperitoneal approach has been advocated for XGP. A theoretical advantage of the retroperitoneal approach is the lack of intraperitoneal contamination with infectious material, as in pyonephrosis and tuberculous kidney. In previous series, two cases of spillage of tuberculous material were reported, although at follow up no disseminated or systemic disease was identified [28, 31]. However, no difference was noted in the transperitoneal and retroperitoneal approaches for tuberculous kidneys [30, 31].

Technical Considerations in Laparoscopic Nephrectomy for Inflammatory Renal Diseases

1. Open access placement using the Hasson technique via the periumbilical or primary retroperitoneal approach has been recommended for tuberculous kidney. Alternatively, initial subcostal access may be achieved to establish pneumoperitoneum [32].
2. Hydraulic distension using a balloon was found to be more effective than pneumatic distension during creation of the retroperitoneal space.
3. The hilum first approach is useful when dense perinephric adhesions are present as perihilar scarring makes dissection of the renal vessels difficult. A direct approach to the hilum without dissecting the kidney is crucial to minimize oozing [33]. The vessels are controlled outside the fascia just above the psoas muscle if it is not possible to identify the pedicle after incising the fascia. After controlling the pedicle, the kidney dissection continues inside the fascia. If adhesions make this impossible, the dissection is carried out outside the fascia as in radical nephrectomy.

4. En-bloc control of the renal hilum using the stapler can be performed. The hilum can be transected and secured with Endo-GIA staples without dissecting individual hilar structures [32].
5. Subcapsular nephrectomy can be used with severe adhesions around the kidney. Adhesions between the renal capsule and parenchyma are not as serious as those between the kidney and perirenal tissues. This operational style avoids perirenal adhesions that may be present in the subcapsular space. The renal fibrous membrane is cut along the renal hilum, and the fat and fibrous tissues are separated to decrease the size of the renal pedicle. The renal pedicle is then thin enough to be controlled with an endoscopic linear cutter. This maneuver solves the problem of a broad renal pedicle that cannot be cut off in a laparoscopic operation [34].
6. Dissection outside of Gerota's fascia has been reported to facilitate the procedure, especially in cases of chronic pyelonephritis with kidneys harboring stones. Intra-Gerotal dissection may be difficult. In such cases, dissection at the extra-Gerotal plane is better conducted to avoid the severe perirenal adhesions.
7. In patients with percutanous nephrostomy, after creation of the retroperitoneal space, division of the percutaneous nephrostomy tract in the retroperitoneum is helpful. This allows the kidney to be pushed forward and creates a larger retroperitoneal space [33].
8. Recently, laparoscopic nephrectomy was reported in most cases of inflammatory renal conditions. A higher conversion rate and longer operative time should be expected. Early conversion may be required due to failure to progress, but blood loss, hospital stay, and analgesia requirements are lower compared to the open approach [35].

Laparoscopic Nephrectomy in Patients with Previous Abdominal Surgery

Abdominal surgery promotes the formation of adhesions that may distort tissue planes, alter the position of anatomical landmarks and fix bowel to the anterior abdominal wall, making subsequent laparoscopic access and dissection more difficult. Therefore, it may be difficult to place the Veress needle due to abdominal wall adhesions. Abdominal scars may necessitate placing trocar sites at alternative suboptimal positions, potentially increasing the possibility of vascular injury while obtaining access, and hindering instrument manipulation during the procedure [36].

Dissection of adhesions may increase the risk of bleeding and bowel injury. In addition, the distortion of normal anatomy may decrease visibility during the procedure. Technical considerations such as these have prompted many initial reports in the general surgical literature to cite previous abdominal surgery as an exclusion criterion to laparoscopy [37].

Previous surgery at the same anatomical site is associated with longer operative time and increased hospital stay compared with patients with no history of surgery and surgery at a different location. Longer operative time was likely associated with the increased difficulty of laparoscopic surgery in an anatomical region previously subjected to operative dissection [38].

Patients with previous history of abdominal surgery were more likely to receive blood transfusions. This trend was likely related to increased age and higher degree of medical co-morbidity. However, there were no significant differences in operative blood loss, the rate of operative conversion, or the rate or operative complication. Therefore, previous abdominal surgery does not appear to adversely affect the performance or safety of subsequent urological laparoscopy [36].

In another report regarding transperitoneal laparoscopic simple nephrectomy in patients with history of previous abdominal surgery, there was no significant differences in operative time, estimated blood loss or overall complication rate. The only significant difference was a longer hospital stay in patients with previous abdominal surgery [39].

Technical Considerations in Patients with Previous Abdominal Surgery

1. The retroperitoneal approach to laparoscopic nephrectomy is preferred over the transperitoneal approach as there is no difference in regard to operative times, blood loss or hospital stays between patients with a history of abdominal surgery and those with no history of abdominal surgery [40].
2. The first port must be away from the scar of previous surgery.
3. Open insertion of the first port or using optical access trocars may prevent bowel injury.

Laparoscopic Nephrectomy for Giant Hydronephrosis

Giant hydronephrosis is defined as a kidney containing more than 1,000 mL fluid in the collecting system. Radiologically, these kidneys meet or cross the midline, occupy a hemi-abdomen or extend more than five vertebral lengths. The most common cause of giant hydronephrosis is ureteropelvic junction obstruction which is the etiology in about 80% of cases [41].

Initial operator disorientation occurs because of the large hydronephrotic sac that occupies the retroperitoneum, obscuring the standard landmarks for surgery. Thus reorientation is needed once preliminary dissection is completed and the kidney is deflated.

Technical Considerations in Laparoscopic Nephrectomy for Giant Hydronephrosis

1. The transperitoneal approach is more appropriate than the retroperitoneum approach because of the larger cavity of the peritoneum.
2. Percutaneous aspiration of the fluid inside the hugely dilated pelvicalyceal system is advised to help develop adequate working space. Aspiration can be performed prior to pneumoperitoneum by passing a long percutaneous needle through the renal angle. Alternatively, using a Veress needle is an efficient way

of achieving kidney decompression. In cases where the hydronephrotic kidney will not interfere with port placement, the kidney can be decompressed after initial dissection using laparoscopic suction because the tense hydronephrotic sac helps in the identification of the perirenal plane.

3. Adequate retraction of the collapsed renal sac is important to identify the renal pedicle. If further dissection cannot be achieved intracorporeally, bringing the sac out through an anterior port (extracorporeal retraction) aids in ease of retraction and hilar dissection. The port site needs to be enlarged to about 2–3 cm depending on the bulk of the kidney, since a large incision can lead to a gas leak. Once the kidney is fully mobilized and the vessels are clipped, it can be delivered through the same port by further enlarging the incision if needed. The laparoscopic retrieval bag is not needed in these cases as the collapsed kidney can be delivered after minimally enlarging the port site [42].

Laparoscopic Nephrectomy in Obese Patients

Obese patients have higher rates of postoperative complications, including nosocomial infections, wound infections and wound dehiscence**.** However, Matin et al. did not find an association between body mass index (BMI) and surgical or postoperative complications [43]. Doublet et al. also documented that laparoscopic nephrectomy is safe and effective in obese patients [44].

Technical Considerations in Laparoscopic Nephrectomy in Obese Patients

1. Extra care should be used in positioning obese patients.
2. Optimal ventilation is mandatory because pneumoperitoneum makes the already impaired respiratory movements in obese patients more difficult.
3. Adequate padding for pressure points is necessary.
4. Less bend is usually used in the operative table with obese patients.
5. Ports are inserted more laterally in patients with large abdominal girth [45].

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