Laparoscopic Urological Procedures

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INTRODUCTION

Laparoscopic urological surgery can be divided into three areas:

1. Diagnostic
2. Extirpative
3. Reconstructive

Because much of urologic surgery is reconstructive and radiologic imaging techniques continue to refine the accuracy of urologic diagnoses, the role of laparoscopy in urologic practice has decreased in the past few years. However, there are specific areas of urologic surgery in which laparoscopic applications have expanded. Laparoscopy is used extensively in pediatric urology for the diagnosis and operative correction of undescended testicles as well as the laparoscopic removal of obstructed or poorly functioning kidneys. Another major surgery is laparoscopic adrenalectomy for both benign and malignant conditions of the adrenal gland.

LAPAROSCOPIC VARICOCELECTOMY

Laparoscopic varicocele ligation has been performed by many urologists and reports from several medical centers have been published. The data suggest that laparoscopic varicocele ligation is therapeutically superior to open surgical and radiographic (embolization) techniques. Laparoscopic varicocelectomy appears to reduce postoperative morbidity. Whether it is necessary to identify and preserve the testicular artery during laparoscopic varicocelectomy, it remains controversial. Loughlin and Brooks reported on the use of a laparoscopic Doppler probe that they believe facilitates the identification and preservation of the testicular artery. Matsuda et al. claim that the testicular artery does not have to be preserved; they clip the testicular artery and veins en bloc. Further, multicenter experience is needed to resolve whether the testicular artery should be preserved during laparoscopic varicocele ligation. Because the testicular artery is preserved during open surgical repair or radiographic embolization procedures, we generally preserve the testicular artery during varicocelectomy.

Operative Technique

The technique of laparoscopic varicocele ligation is straightforward. The procedure is usually performed using general anesthesia. A urethral catheter is placed to empty the bladder and a Veress needle is placed at the umbilicus to inflate the peritoneal cavity with carbon dioxide. Alternatively, Hasson technique can be performed at the inferior margin of the umbilicus and the trocar can be placed into the peritoneum under direct vision. Three laparoscopic ports are placed for varicocelectomy according to baseball diamond concept.

The intra-abdominal vas deferens can be identified as structure joining the spermatic cord above the internal inguinal ring **(Fig. 1)**. The gonadal vessels are visualized easily in the retroperitoneum. The posterior peritoneum is excised with cautery, laser, or endoscopic scissors. The gonadal vessels are then mobilized; however, reliably identifying the spermatic artery and its branches is sometimes difficult through the laparoscope **(Figs. 2A and B)**. Therefore, many surgeons prefer to use the laparoscopic Doppler probe to facilitate identification of the spermatic artery during laparoscopic varicocele ligation.

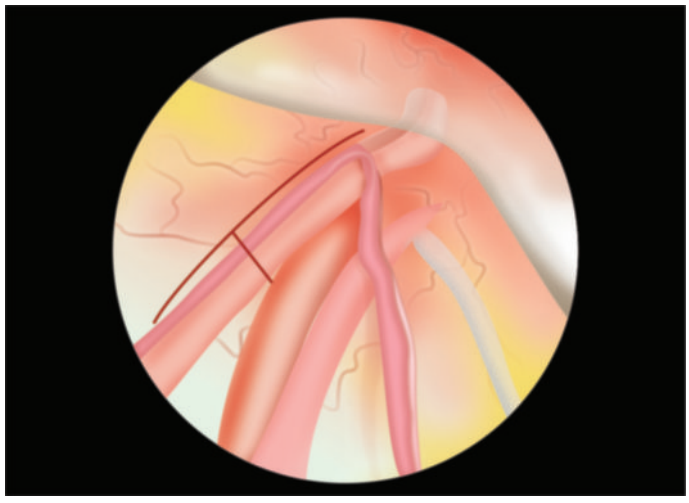
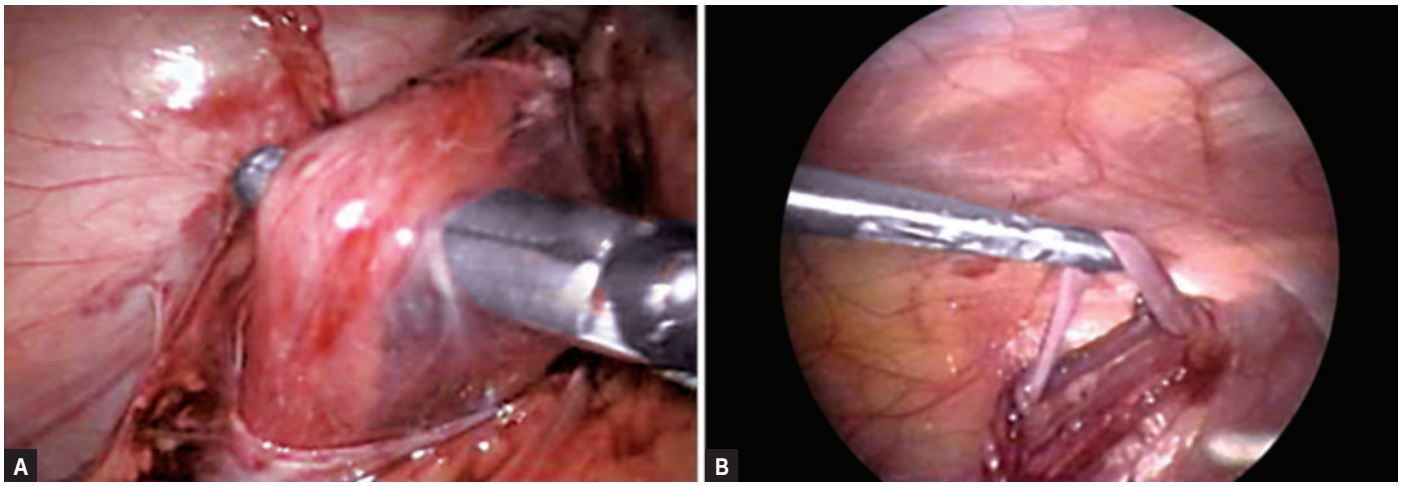


Fig. 1: Laparoscopic varicocelectomy.



Figs. 2A and B: The spermatic vein is identified.

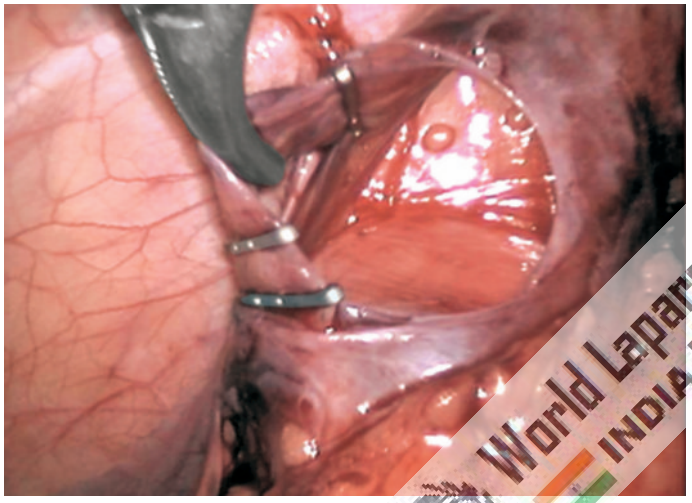


Fig. 3: Clips applied around spermatic vein.

The Doppler probe is 28.58 cm long and fits through a 5-mm laparoscopic port. After identifying the gonadal artery, the surgeon isolates the gonadal vein or veins using blunt dissection with atraumatic graspers.

Endoscopic clip applier is used to secure it or intracorporeal suturing is used to ligate the gonadal vein or veins while sparing the artery **(Fig. 3)**.

LAPAROSCOPIC RETROPERITONEAL NODE DISSECTION

The laparoscopic retroperitoneal node dissection in the management of testicular cancer is still not very frequently performed. Increased operating time is a consideration in applying laparoscopic techniques to a procedure. As with pelvic node dissection, the question has also been raised as to the completeness of the laparoscopic retroperitoneal node dissection. Laparoscopic dissection of the nodal tissue behind the aorta and vena cava is difficult laparoscopically.

Laparoscopic retroperitoneal node dissection appears, at least for now, best applied to patients without evidence of bulky disease in the retroperitoneum, who would otherwise be candidates for observation rather than surgical exploration. Although the laparoscopic procedure does not currently appear to be as through a dissection as the open node dissection, it offers the opportunity to have some pathologic documentation of nodal status in patients considered for observation. The technique for laparoscopic retroperitoneal node dissection has not been standardized and is still evolving; therefore, the reader is referred to the case reports for the author's individual techniques.

LAPAROSCOPIC MANAGEMENT OF LYMPHOCELES

Lymphoceles are not uncommon after renal transplantation; an incidence of 0.6–18% has been reported. It can also occur after pelvic lymphadenectomy and an incidence of 5.6% has been reported in these circumstances. Most of these patients are asymptomatic and do not require much aggressive treatment. When the lymphocele becomes symptomatic or is associated with fever and potential infection, however, drainage of the lymphocele is indicated. Several investigators have reported successful laparoscopic drainage of lymphoceles.

Operative Technique

The technique of lymphocele drainage is described as follows: After the induction of general endotracheal anesthesia, the surgeon places a urethral catheter to drain the bladder and a nasogastric tube is then inserted. A Veress needle is inserted into the peritoneal cavity in the left upper quadrant to avoid the transplant allograft. A pneumoperitoneum is achieved in the usual manner and 10 mm trocar sheath is inserted through the same site into the peritoneal cavity. The video endoscope is placed through this port and two additional 5 mm ports are inserted under direct vision in the periumbilical area in the right upper quadrant at the level of the midclavicular line.

The abdomen is carefully inspected and the renal transplant and associated lymphocele are visualized. They appear as two extrinsic bulges in the retroperitoneum. The lymphocele is distinguishable by its superolateral location to the graft and the soft consistency on probing. The lymphocele also transmits light readily when the light source is placed at its wall. The patient is placed in Trendelenburg position to allow the small bowel to fall cephalad and to facilitate the visibility of the lymphocele. The lymphocele is then entered using electrocautery. The peritoneum and its attached lymphocele wall are grasped and the incision is extended circumferentially using laparoscopic scissors. An ellipse of lymphocele wall is removed, thereby creating a window. After careful marsupialization of the edges of the window, the lymphocele is inspected and all internal loculations are lysed and excised to create a single cavity. At the end of surgery, the cavity is irrigated and inspected for adequate hemostasis prior to the usual completion of the laparoscopic procedure.

LAPAROSCOPIC URETEROLYSIS

Usually, the patient undergoes laparoscopic ureterolysis via a transperitoneal approach. An external ureteral stent should be placed to help identify the ureter as it is done with laparoscopic nephrectomy. The ureter is identified by a close-up vision of telescope and then successfully mobilized laparoscopically. Laparoscopic biopsy forceps should be used to obtain multiple biopsy specimens of the periureteral tissue. Laparoscopic ureterolysis is not a very frequently performed procedure. Additional experience will help determine how applicable laparoscopic ureterolysis will become in the future.

LAPAROSCOPIC ILEAL CONDUIT

In many centers, laparoscopic surgeons are performing laparoscopic ileal loop conduit. This procedure is commonly performed for palliation of obstruction in old man with fibrosarcoma of the prostate. The ileal loop itself is fashioned laparoscopically using endoscopic stapling devices. To perform the ureteral anastomosis, however, the distal ureters and a portion of the conduit have to be brought in through a trocar site and an extracorporeal and handsewn ureteroileal anastomosis is performed on each side.

The report emphasizes the limitations of laparoscopic instrumentation at this time. Laparoscopic suturing is cumbersome and the ureteroileal anastomosis could not have been completed easily laparoscopically. Until either tissue welding techniques or better suturing techniques are available, only limited applications are available for laparoscopic reconstructive surgery such as that outlined in this case report.

LAPAROSCOPIC PELVIC LYMPHADENECTOMY

Laparoscopic pelvic lymphadenectomy has the potential to aid in the staging of prostate cancer. Most urologists embrace the philosophy that if the pelvic lymph nodes are involved in prostate cancer, cure cannot be achieved with radical prostatectomy or radiation therapy and hormonal therapy is indicated in these patients for palliation.

Vascular injuries are most common complication during dissection. Adherence to good laparoscopic technique and familiarity with the anatomy are the most reliable ways to avoid complications.

Operative Technique

The pneumoperitoneum is established in the standard manner. Trocar placement is then performed. The size and location of trocar sites for the procedure vary with the surgeon's preference. Most use the diamond configuration. An alternative used by some surgeons is the so-called fan configuration for trocar placement. This configuration allows the surgeon and the surgical assistant to manipulate instruments with both hands during the dissection. It is also helpful in obese patients or in those with a prominent urachus. The size of the trocars used at each site may vary. A 10-mm port is usually placed in the umbilicus for the laparoscope. An additional 10 mm port is placed in at least one other site for tissue removal. Another 10 mm port is used for the endoscopic clip applier. Usually, 5 mm ports are used for the remaining trocar sites. After completion of trocar placement, the laparoscopic landmarks for pelvic node dissection are identified. These landmarks include the medial umbilical ligament (remnant of the obliterated umbilical artery), urachus, bladder, vas deferens, iliac vessels, spermatic vessels, and internal ring. The next maneuver is to incise the posterior peritoneum parallel and lateral to the medial umbilical ligament. Early identification of the ureter is important to avoid ureteral injury. The vas deferens is then divided to facilitate operative access to the obturator space. Using primarily blunt dissection, the iliac vein and artery are identified. The nodal tissue overlying the external iliac vein is then teased medially to expose the internal obturator muscle. A laparoscopic vein retractor can be used to retract the external iliac vein laterally and permit easier, more complete dissection of the nodal tissue beneath the vein. The dissection proceeds with removing tissue off the vein distally until Cooper's ligament and the pubic bone are identified.

Electrosurgery is used to fulgurate small vessels and lymphatics and the distal extent of the packet is freed from the pubic bone. The packet is pulled proximally and freed from the underside of the pubic bone. At this point, the obturator nerve is identified. Because nodal tissue can be

quite bulky and difficult to grasp, adequate forceps can ensure a more reliable grasp of the specimen. With blunt dissection, the obturator nerve is cleaned off proximally and endoscopic clips are used to divide the distal portion of the dissection. At the completion of the laparoscopic pelvic lymphadenectomy, the iliac artery, vein, pubic bone, and obturator nerve can be seen clearly. The field is checked for hemostasis and the dissection is performed in an identical manner on the opposite side. The trocars are removed and the puncture sites are closed in the usual manner.

LAPAROSCOPIC NEPHRECTOMY

Anterior Relation of Kidney (Fig. 4)

Right Kidney

- Inferior surface of liver (1)
- Second part of duodenum (2)
- Hepatic flexor of colon (3)

Left Kidney

- Inferior surface of spleen (5)
- Tail of pancreas (4)
- Splenic flexor of colon (6)

Posterior Relation of Kidney (Fig. 5)

- Psoas muscle (1)
- Quadratus lumborum muscle (2)

Several obstacles are preventing laparoscopic nephrectomy technique from being more widely embraced. The first is the time factor which is considerably longer than for an open nephrectomy. The second is the handling of the renal pedicle. Clayman et al. have used titanium clips to secure the renal artery and vein. Ehrlich et al. used an endoscopic linear stapler to secure the pedicle. Despite the fact that Clayman et al. group did not report any significant intraoperative or postoperative bleeding because of inadequate pedicle control, many urologists are uneasy with this aspect of the operation. The third and perhaps most serious concern is the applicability of this technique to cases of renal malignancy. Currently, the adrenal gland is not included in the laparoscopic radical nephrectomy; although this exclusion is probably more a theoretical concern in lower pole and midpole tumors, it would be a limiting factor in upper pole tumors.

Tumor spillage during any laparoscopic procedure is an obvious practical concern. Several reports documented tumor implantation during laparoscopy. Clayman et al. tried to solve this problem by developing an entrapment system for the kidney and the lymph nodes. These systems consist of impermeable bags inserted through the laparoscopic trocar. The surgical specimen is placed within the bag or pouch and a drawstring around the opening of the bag allows for closure and acts as a handle to remove the pouch from the abdominal cavity through the laparoscopic trocar. In nephrectomy, the renal specimen is fragmented and aspirated using an especially designed electrical tissue morcellator placed through the neck of the kidney sac. The development of this type of technology decreases, but does not eliminate the potential for tumor spillage. Undoubtedly, more work is needed to address the concern of tumor implantation, if this technique is to be applied to malignant renal tumors.

Operative Technique

The patient is kept nil by mouth for 8 hours. Initially, positioned the patient in supine for the anesthesia and placement of orogastric tube and 18 Fr Foley catheter. After this, patient is positioned in a modified lateral decubitus position with the umbilicus placed over the break in the operating table. Flexed the table as needed or put a balloon under the patient at the level of the umbilicus. Support the buttocks and the dorsum with padding and all the potential pressure points. The surgeon is positioned in the abdominal

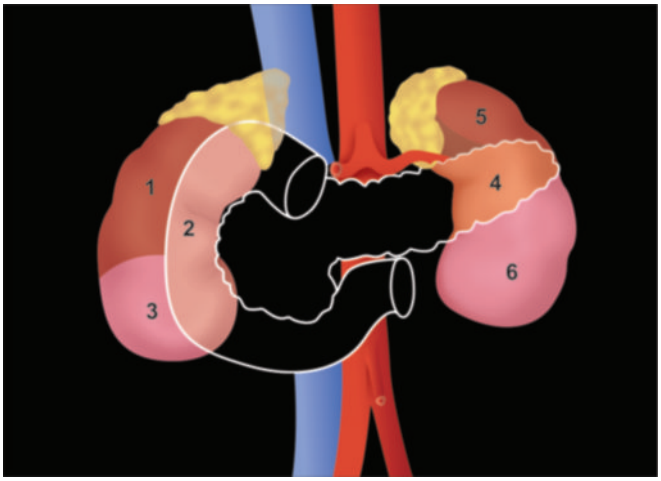


Fig. 4: Anterior relation of kidney.

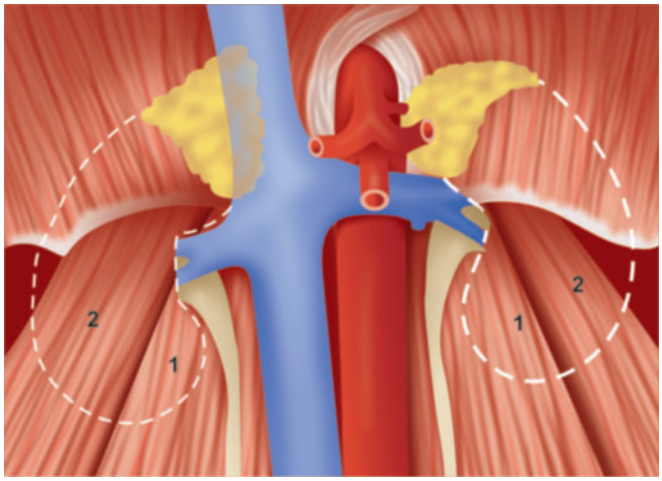
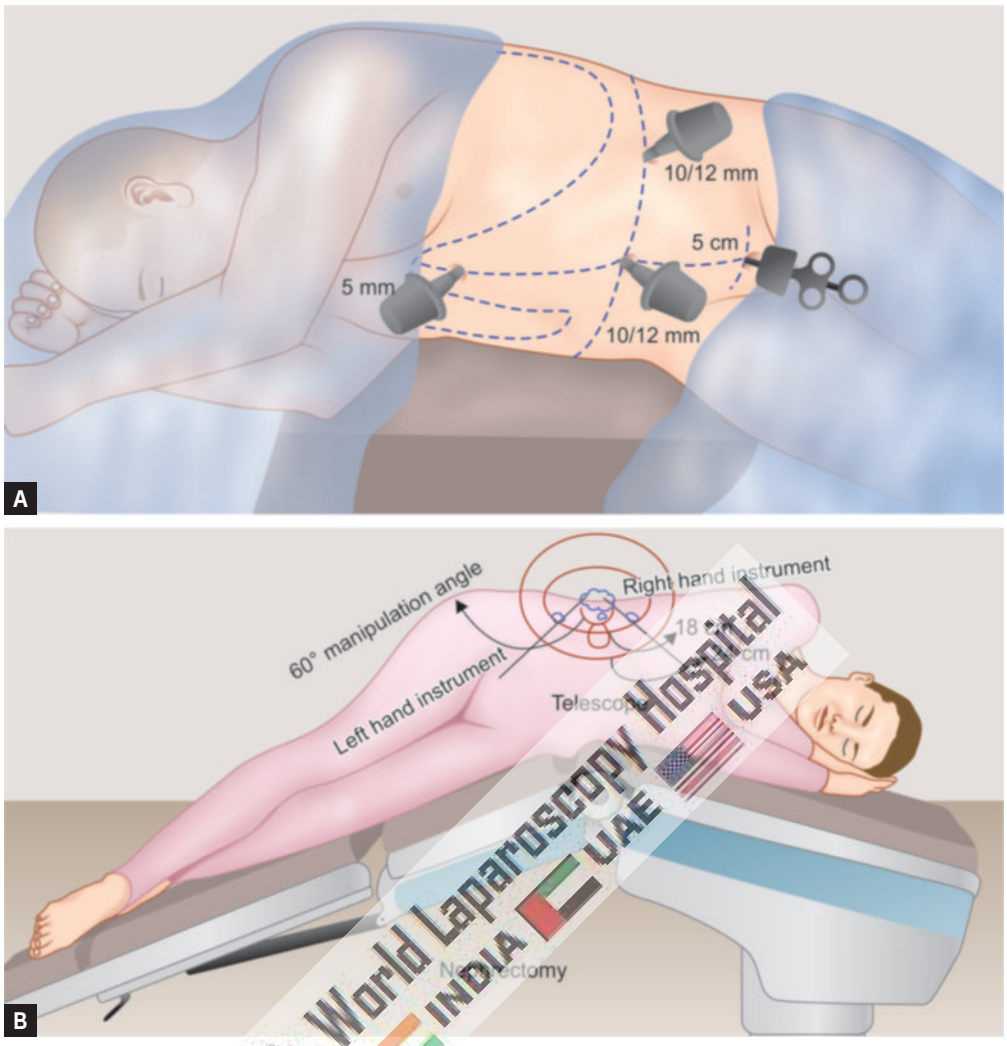


Fig. 5: Posterior relation of kidney.



Figs. 6A and B: Port position in laparoscopic nephrectomy.

side of the patient and the first assistant is placed caudally to the surgeon. The laparoscopic cart is positioned at the back of the patient's chest with the operative team facing the video monitor. The instrument table is positioned behind the operative team. A cutaneous incision is made two fingerbreadths below the costal margin arch at the level of the lateral border of the rectus muscle. The Veress needle is introduced through the incision and after that surgeon should establish the pneumoperitoneum. After 10-mm paraumbilical port, camera port for the 30° telescope and another 10-mm right hand working port are introduced in the epigastrium pararectally **(Figs. 6A and B)**. A 5-mm left hand working port is introduced in the hypogastric region pararectally. One or two 5-mm ports are placed as per requirement for bowel and liver retraction.

Laparoscopic radical nephrectomy is done medial to lateral through a transperitoneal approach. The retraction of the liver is required to improve the visualization of the renal hilum and this is done by atraumatic grasper placed through an extra 5-mm trocar below the ribs in the anterior axillary line. The dissection of peritoneum over the right renal vein (RRV) in relation to inferior vena cava (IVC) is done by using the Harmonic Ace or any similar energy source such as thunderbeat in transperitoneal approach **(Fig. 7)**.

Kocherization is done anterior and leftward mobilization of the second part (C loop) of the duodenum after incision of the parietal peritoneum on its right aspect; the IVC and left renal vein (LRV) are encountered posteriorly **(Fig. 8)**.

The RRV is dissected circumferentially with the blunt dissection. The right renal artery which lies inferior and posterior to the RRV is dissected and stapled **(Figs. 9A and B)**.

The tributaries of the renal vein are clipped with titanium clips doubly and divided. The renal artery is divided first with Harmonic Ace and all fibrofatty tissues with lymph nodes around the renal hilum are dissected upward toward the specimen. The kidney is mobilized with Gerota's fascia from surrounding structures. The separation of the kidney from the lateral abdominal wall is done at last, so that the specimen does not fall on the operative field.

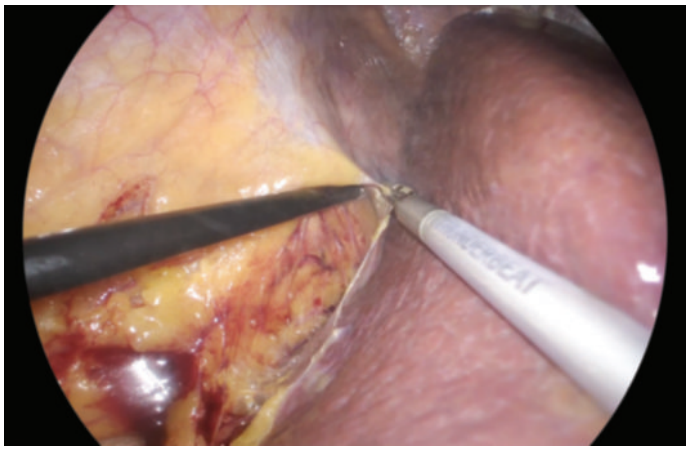


Fig. 7: Start of dissection in nephrectomy.

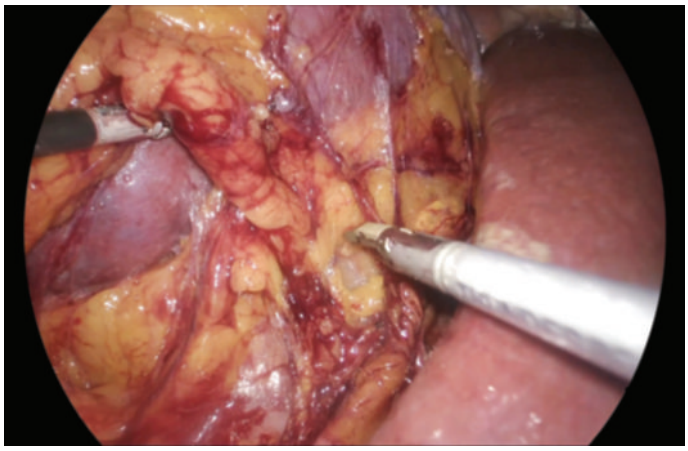
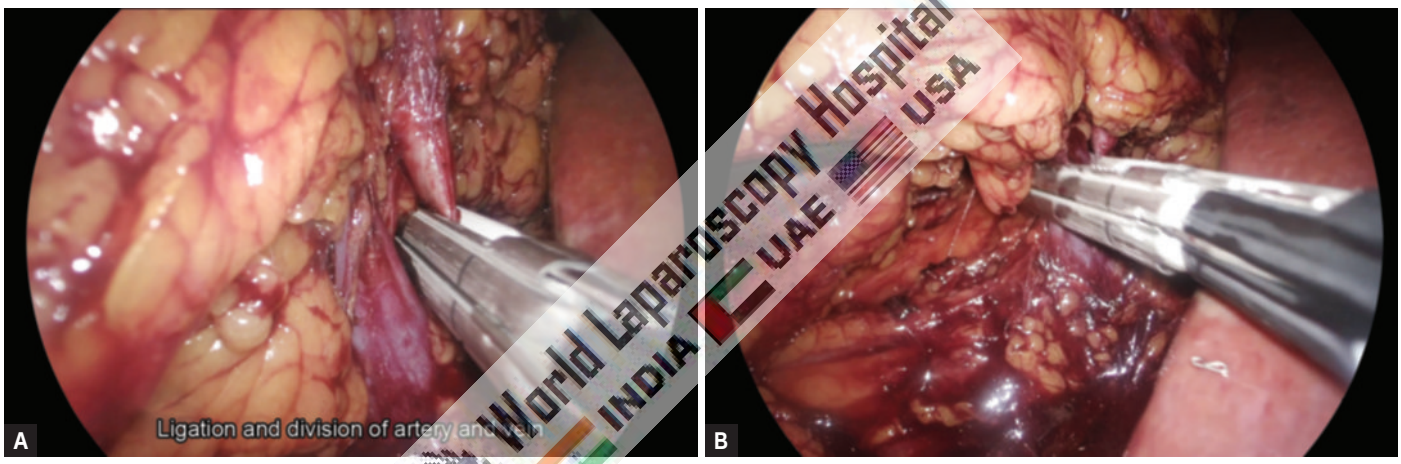


Fig. 8: Kocherization of duodenum and colon.



Figs. 9A and B: Stapling of renal artery and vein.

Dissection of the Ureter

The psoas tendon is a reliable landmark when searching for the gonadal vein and ureter. Once located, the ureter is elevated from the psoas muscle, clipped, and cut **(Figs. 10A to D)**. The gonadal vein may be visualized at an early stage during the dissection of Gerota's fascia, if the bowel is properly retracted medially. The hemostasis is checked with the irrigation of a normal saline solution and also by reducing CO_2 pressure to reduce the tamponade effect on bleeding veins. Number 32 French drain is kept at the renal hilum.

The specimen is kept in a large size Endobag to prevent port site metastasis and delivered through a small muscle-splitting incision in the right iliac fossa or through an incision between two trocars **(Fig. 11)**. All port sites are irrigated with betadine and closed with Vicryl.

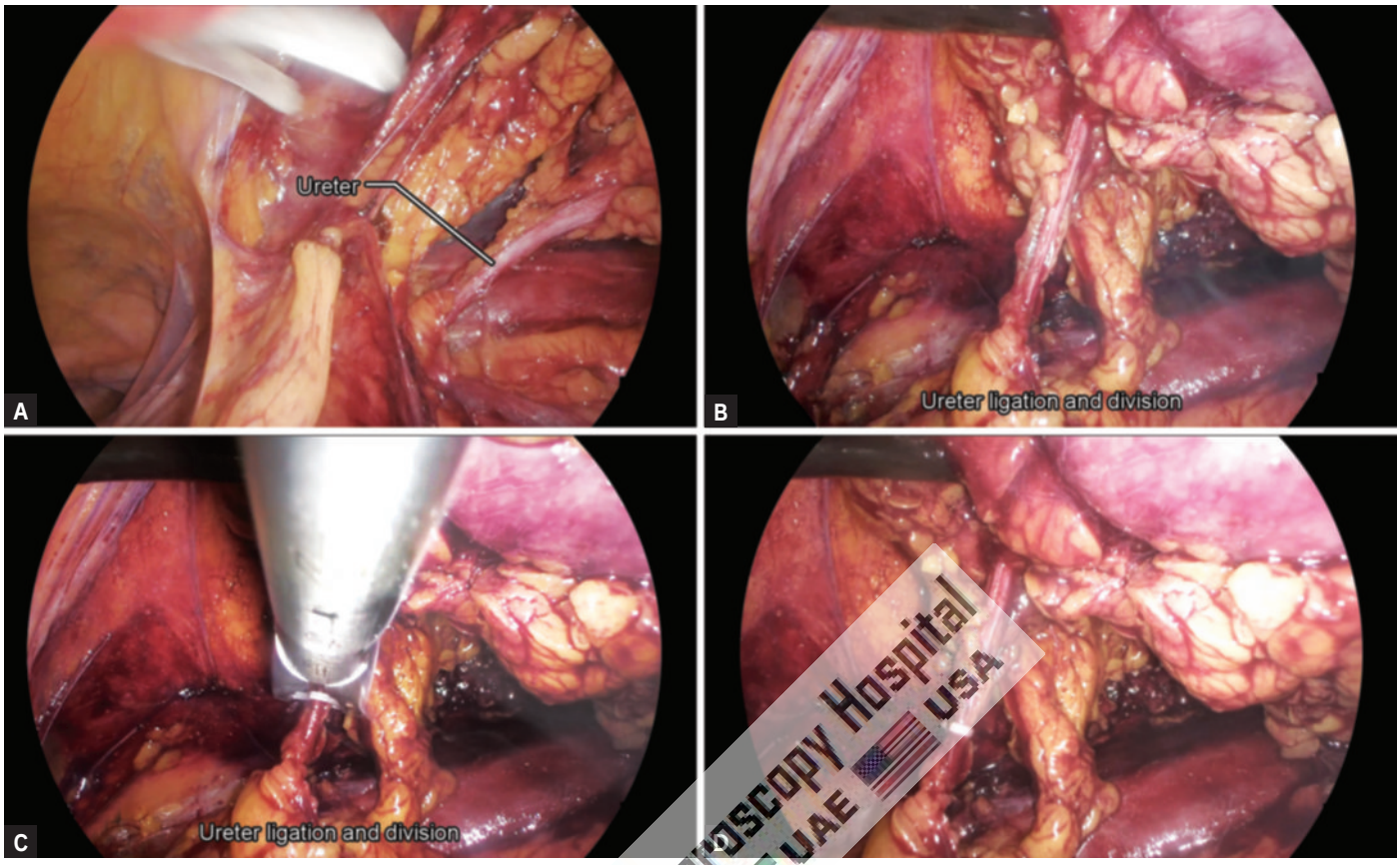
Complications of Laparoscopic Nephrectomy

The complication rate of laparoscopic transperitoneal nephrectomy is 5.64%.

The most frequent complications are:

- Bleeding (2.5%)
- Retroperitoneal hematoma (1.2%)
- Bowel injury (1%)

There were no statistically significant differences in complications rate by age, sex, or surgical access: transperitoneal versus retroperitoneal. The complications rate was similar for both the laparoscopic and hand-assisted technique. Laparoscopic nephrectomy has established its role as a standard of care for the management in a patient who required nephrectomy. Long-term follow-up has demonstrated that laparoscopic nephrectomy has shorter patient hospitalization time and effective outcome.



Figs. 10A to D: Clipping of ureter during nephrectomy.

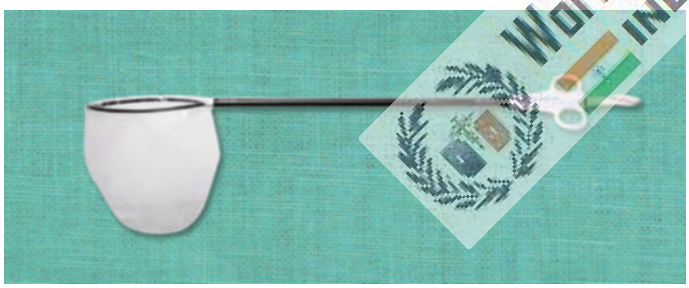


Fig. 11: Large size Endobag for kidney removal.

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