Laparoscopy in Urology.

Darshan Kumar Sharma, Anil Kumar Varshney

RG Stone Urology and Laparoscopy Hospital, East of Kailash, New Delhi, India

***Abstract**: Over the last decade laparoscopic surgery has been popularized and developed to such an extent that it can be considered gold standard for many types of procedures in urology. Currently; the majority of operations in urologic field can be performed laparoscopically. This is because it is as effective as open surgery, but associated with less postoperative pain, shorter hospital stay, faster recovery and is better cosmetic result. With advances in laparoscopic equipment and more experience, almost all urologic operations may be done with this technique, from most simple to most complex procedures. Although, the image of the surgical field is excellent because of the fidelity of existing optics and screen, laparoscopic equipment does not give equivalent tactile feedback and the same degree of freedom of movement the hands provide during open surgery. Thus, laparoscopic surgery requires special training and familiarity with technique per se and its specialized instruments. This article is an overview on laparoscopy in urology.*

INTRODUCTION

Only recently laparoscopy has become a practical and acceptable alternative to treat complex urologic surgical diseases. William Schuessler did first urologic laparoscopic procedure: the pelvic lymphadenectomy for patients with prostate cancer[1]. Shortly thereafter, the first laparoscopy nephrectomy performed in 1991 by clayman et al[2]. Laparoscopy has become a major domain of urological surgery and use of this approach has evolved to perform more extensive and complicated procedure. With the ongoing developments in this field, it would probably replace open surgical procedure one day.

HISTORICAL OVERVIEW

The current practice of laparoscopic renal surgery evolved slowly over a period of almost 200 years. In 1805, Bozzini developed the first reproducible device to illuminate dark cavities previously unseen in the living body[3].

The shift toward laparoscopy was initiated by Kelling[4], a surgeon who was the first to apply Nitze's cystoscope, introduced through a trocar, in a closed-cavity endoscopic examination of a living dog. In 1938 - J Veress[5], of Hungary, developed the spring-loaded needle[5]. Its current modifications makes the "Veress" needle a perfect tool to achieve pneumoperitoneum during laparoscopic surgery.

Open access to the peritoneal cavity before introduction of the first trocar, thereby reducing the incidence of potential complications. These Keyhole surgeries use images displayed on TV monitors for magnification of the surgical elements[6,7]. The key element in laparoscopic surgery is the use of a laparoscope. There are two types: (1) a telescopic rod lens system, that is usually connected to a video camera (single chip or three chip), or (2) a digital laparoscope where the charge-coupled device is placed at the end of the laparoscope, eliminating the rod lens system. Also attached is a fiber optic cable system connected to a 'cold' light source (halogen or xenon), to illuminate the operative field, inserted through a 5 mm or 10 mm cannula or trocar to view the operative field. The abdomen is insufflated, with carbon dioxide gas. This elevates the abdominal wall above the internal organs like a dome to create a working and viewing space. Carbon dioxide is used because it is common to the human body and can be absorbed by tissue and removed by the respiratory system. It is also non-flammable, which is important because electrosurgical devices are commonly used in laparoscopic procedures.

This work has paved the way for a variety of both extraperitoneal and reconstructive renal surgical procedures.

Comparisons between laparoscopy and traditional open surgery have consistently demonstrated advantage of laparoscopic approach.

The proven benefits of laparoscopic surgery, compared with open surgery, are now recognized in the treatment of various renal pathologies.

ADVANTAGES

There are a number of advantages to the patient with laparoscopic surgery versus an open procedure. These include:

* Reduced hemorrhage, which reduces the chance of needing a blood transfusion.
* Smaller incision, which reduces pain and shortens recovery time, as well as resulting in less post-operative scarring.
* Less pain, leading to less pain medication needed.
* Although procedure times are usually slightly longer, hospital stay is less, and often with a same day discharge which leads to a faster return to everyday living.
* Reduced exposure of internal organs to possible external contaminants thereby reduced risk of acquiring infections.

There are three basic laparoscopic approaches for urological surgeries : transperitoneal, retroperitoneal, and hand-assisted.

TRANSPERITONEAL APPROACH

The transperitoneal approach is the traditional method used to perform laparoscopic surgery. It also affords an optimal working space and facilitates orientation from readily identifiable anatomic landmarks.

Commonly performed laparoscopic procedures are

- Simple nephrectomy for non-functioning kidney
- Deroofing of simple renal cyst
- Ureterolithotomy
- Pyelolithotomy
- Radical nephrectomy for renal tumours
- Live donor nephrectomy
- Pyeloplasty
- Adrenalectomy for adrenal tumors
- Nephroureterectomy
- Orchidopexy

The procedures which being complex and done only in few major centers are

***Correspondence: Dr. Anil Varshney,** Medical Director & Chief Urologist, R.G. Stone Urology & Laparoscopy Hospital, F-12, East of Kailash, New Delhi-110065, India, Fax: 011-26218743 **e-mail:** drvarshney@rghospital.com*

- Partial nephrectomy
- Ureterolysis
- Ureteric reimplantation
- Radical prostatectomy
- Radical cystectomy
- Augmentation cystoplasty
- Vesicovaginal fistulas
- Ileal replacement of ureter
- Retroperitoneal lymph node dissection

RETROPERITONEAL APPROACH

The retroperitoneal approach mimics traditional open surgery in that the kidney is approached without entry into the peritoneal cavity. A potential space must be developed to allow adequate visualization of the surgical field. Even though urologists have conventionally approached the kidney through the retroperitoneum, the laparoscopic approach can appear unfamiliar owing to overlying adipose tissue and the limited working space. For the novice, this can cause difficulty with orientation, visualization, instrument manipulation, and organ entrapment.

Dr Durga D. gaur who opened the retroperitoneal and extraperitoneal routes to the urological surgeons . In 1992 Dr Gaur introduced the concept of balloon dilatation of retro peritoneum which enabled the urologist to rapidly dissect the fibro fatty tissue of retro peritoneum and thereby create a working space adequate for laparoscopic surgery[6].

There are patients in whom retroperitoneal access is preferred over the transperitoneal approach. Patients with a history of multiple abdominal surgical procedures or peritonitis may benefit from this approach. Initial retroperitoneal access can be achieved with subsequent opening of the peritoneum as indicated (Cadeddu etal, 1999)[7]. Also, patients with abnormalities on the posterior surface of the kidney (exophytic cyst or mass) may be better served through retroperitoneal access. Consequently, the laparoscopic surgeon should be familiar with both transperitoneal and retroperitoneal approaches.

HAND-ASSISTED APPROACH

To facilitate learning of laparoscopic techniques and to increase the availability of less invasive procedures, hand-assisted endoscopic techniques have been introduced. The first hand-assisted laparoscopic nephrectomy (HALN) was reported by Nakada and coworkers[8]. The hand-assisted devices offer a bridge between laparoscopic and open surgery and may help surgeons without advanced laparoscopic training gain the necessary experience. Hand-assisted laparoscopic surgery has the advantage of restoring tactile feedback and use of the hand to assist with dissection, retraction, extraction, and rapid control of bleeding if needed. An incision large enough to allow the surgeon or assistant to insert a hand must be created, and this site can be utilized for organ extraction. Hand-assisted dissection may be helpful in those patients whose pathologic condition makes laparoscopy more difficult, such as infectious processes or prior renal surgery.

The most challenging aspect of laparoscopy is reconstructive surgery. Urologists began to develop skills in this area and thus expanded the indications for laparoscopic surgery into other areas. By using laparoscopic techniques for suturing and intracorporeal knot tying, the following procedures were successfully completed laparoscopically: reimplantation of the ureter, ureteroureterostomy, pyeloplasty, bladder neck suspension, Fowler-Stephens orchidopexy, transperitoneal and extraperitoneal bladder autoaugmentation, and nephropexy.

INSTRUMENTATION

In advanced laparoscopic procedure; the entire operating team should be familiar with all equipment and the sequential operative steps. Advanced laparoscopic set includes a Veress needle, blunt-tip 5-mm and 10/12 mm ports, 10 mm laparoscope, atraumatic bowel graspers, J-hook electrocautery, laparoscopic scissors, Allis clamp, Maryland grasper, Metal clip applier, Hem-o-lok TM clips (10 mm) and applicator (Weck Closure System, NC, USA), 10-mm right-angle clamp, right-angle dissector, bulldog clamps. A suction system with suction cannula and irrigation handpiece, normal saline for irrigation allows robust suction/ irrigation and its smooth, blunt, reusable tip facilitates gentle, atraumatic dissection in the area of the renal hilum. Straight 5-mm needle drivers are easy to handle and allow strong, reliable grasping. A Satinsky vascular clamp allows efficient hilar clamping. Haemostatic agent Floseal delivered by a reusable metal laparoscopic applicator. The round Autosuture preperitoneal and retroperitoneal dilatation balloon allows the creation of an optimal working space for Trocars.

Piped supply of CO2, Monopolar and bipolar electrocautery with 5 mm handpiece, High flow insufflator, and Light source, Harmonic scalpel with 5 mm handpiece, 3CCD camera and 50 cm LCD monitor. Endocatch bags, defogging fluid and scope warmer and variety of other instruments required for specific procedures.

COMPLICATIONS OF LAPAROSCOPIC RENAL SURGERY

Complications are an unavoidable consequence of surgical practice. Even when the surgery is in the most experienced hands, factors related to the patient, operating room environment, and chaotic forces can lead to an untoward event. Thus, efforts at prevention and the patients' understanding should be maximized. Moreover, if complications occur, the consequences can often be minimized through early recognition and appropriate intervention.

Some of the risks are briefly described below:

- The most significant risks are from trocar injuries to either blood vessels or small or large bowel. The risk of such injuries is increased in patients who have below average body mass index or have a history of prior abdominal surgery. While these injuries are rare, significant complications can occur. Vascular injuries can result in haemorrhage that may be life threatening. Injuries to the bowel can cause a delayed peritonitis
- Some patients have sustained electrical burns unseen by surgeons who are working with electrodes that leak current into surrounding tissue. The resulting injuries can result in perforated organs and can also lead to peritonitis.
- There may be an increased risk of hypothermia and peritoneal trauma due to increased exposure to cold, dry gases during insufflation. The use of heated and humidified CO2 may reduce this risk.
- Many patients with existing pulmonary disorders may not tolerate pneumoperitoneum and may need conversion to open surgery after the initial attempt at laparoscopic approach.
- Coagulation disorders and dense adhesions from previous abdominal surgery may pose added risk for laparoscopic surgery and are considered relative contra-indications for this approach.

Life-threatening vascular injuries usually occur during dissection of the renal hilum.

Bleeding complications can be minimized by carefully inspecting the abdomen at the conclusion of surgery. Examination after lowering the intra-abdominal pressure can reveal bleeding veins tamponaded by the pneumoperitoneum. One also needs to carefully inspect the area of surgical dissection and the trocar sites for adequate hemostasis.

Common areas of postoperative intra-abdominal bleeding include the adrenal gland, renal hilum, mesentery, gonadal vessels, and ureteral stump.

Patients undergoing laparoscopic renal surgery can experience intravascular volume overload, because the laparoscopic approach is associated with far less insensible fluid loss compared with the open procedures.

There is also a vascular-mediated oliguria that should not be aggressively treated because diuresis is seen after release of the pneumoperitoneum.

CONCLUSION

Based on literature review and our own experience laparoscopy for urological procedures are well established and is still evolving technique in more complex procedures. In high volume centres with more experience in laparoscopy treating kidney diseases is viable option offers several advantage over open technique especially in terms of patient comfort, post-operative pain, shorter convalescence, less blood loss, lower complication rates without compromising the ultimate outcome. Laparoscopy is potentially becoming a new standard of care in kidney pathology. Laparoscopy will replace open surgical procedures in near future.

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