

Laparoscopic Era

Modern Status of Laparoscopic Surgery in the Urology of Iran and World

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First, we would like to introduce laparoscopic procedures conducted at Labbafinjad Medical Center, some of which were performed for the first time in Iran and some others were conducted for the first time worldwide, by which Iran has been known as a leading country among Mediterranean countries in laparoscopic urology.

1. Laparoscopic ileocystoplasty (to extend bladder by ileum with intestinal anastomosis) simultaneously with laparoscopic Malon to control stool incontinence (First case in the world) (9 cases)
2. Laparoscopic urethrocystoplasty (First case in the world) (2 cases)
3. Radical laparoscopic prostatectomy by an innovative technique with no suture (20 cases)
4. Laparoscopic antireflux in children by Lich method (40 cases)
5. Laparoscopic retroperitoneal and pelvic lymphadenectomy (6 cases)
6. Laparoscopic pyeloplasty (to repair pelvic obstruction) (50 cases)
7. Laparoscopic donor Nephrectomy (170 cases)
8. Laparoscopic Nephrectomy (65 cases)
9. Laparoscopic adrenalectomy (11 cases)
10. Laparoscopic adrenalectomy (15 cases)
11. Laparoscopic surgery of retrocaval ureter (1 cases)
12. Laparoscopic removal of ureteral and pelvic stones (140 cases)
13. Nephropexy (1 cases)
14. Varicocelectomy (102 cases)
15. Laparoscopic repair of hydrocele and hernia (28 cases)
16. Laparoscopic therapy of renal cyst (25 cases)
17. The detection and treatment of ectopic testis (247 cases)
18. Partial adrenalectomy (1 case)
19. Histrosalpingoanorectomy (1 case)

DEFINITION

Laparoscopy is to study peritoneum cavity via a camera entered abdominal cavity through
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abdominal wall following induced pneumoperitoneum. Ordinary surgery processes are performed during laparoscopic surgery but with less lesions and faster improvement comparing to

open surgery. The variety of mentioned procedures indicated that approximately all open abdominal urological surgeries could be conducted by laparoscopy, provided that there is due practice.

Laparoscopic urologic procedures have some advantages including:

1. They prevent large incisions in abdominal urologic surgeries, which are cosmetically important and prevent hernia and infection at the place of incision.
2. They reduce immediate and chronic postoperative incision pain (especially at flank position). In contrast to open surgeries, no pain or a very little pain is felt in laparoscopic procedures.
3. Faster return to the normal life and work due to less pain and immobility is possible, which leads to better economical outcome for families and society.

In general, modern surgery tends to decrease pain and invasion and laparoscopy has found its place among minimally invasive procedures as an approach, which replaces urological open surgeries in lots of cases.

INTRODUCTION AND HISTORY

The idea of minimal stress and invasion has been come in mind since a long time ago. The use of tube and speculum in medical sciences refers to ancient Greek civilizations. New endoscopy was innovated in 1805 by Bozzini who tried to observe urethra and vagina by the light of candle through a tube.⁽¹⁾ By the invention of cystoscope by Nitze in 1875, edoscopic surgery (to observe urethra and bladder and perform surgery by endoscope) was started and developed parallel to open surgery.⁽²⁾ In 1901 Von Ott reported first examination of abdominal cavity by light concentration provided by a mirror connected to speculum. One year later Killing reported a laparoscopic surgery performed on an alive dog by a cystoscope after blowing filtered air.⁽³⁾ The first human laparoscopy was conducted by Jacobeus in 1910 via a cystoscope⁴. In 1929, passing through two separate trocars was viable and in 1933, Co₂ was applied to produce

pneumoperitoneum. Consistent control of Co₂ pressure during laparoscopy was reported in 1944 by Palmer.⁽⁵⁾ Although modern laparoscopy was developed in Europe by gastroenterologists, obstetricians were the most beneficiaries of laparoscopy and were the pioneers. Though the first laparoscopy was performed via a cystoscope, its first practical urological application was reported in 1976 to detect cryptorchidism.⁽⁶⁾ Wickham extracted ureteral stone by laparoscopy in 1979.⁽⁷⁾ Eshghi used laparoscope to remove staghorn stone through skin in 1985.⁽⁸⁾ Animal urologic laparoscopies were conducted by Winfield in 1990 and Schuesster reported the first retroperitoneal lymphadenectomy to treat prostate cancer in 1991.^(9, 10) Performing laparoscopic varicocelelectomy by Donvan, Winfield, and Haywood and nephrectomy by Clayman were reported at the same year.^(11,12,13) Later on, several procedures (bladder diverticulitis, retroperitoneal lymphadenectomy, urethrolease, bladder neck suspension, renal cyst, pyeloplasty, radical nephrectomy, ileocystoplasty, radical cystectomy, radical prostatectomy, and antireflux) were performed and reported by urologists and researchers. Although there are many reports on laparoscopic urological surgeries, this method has not totally adapted in most centers, so it needs further developments to achieve its real position.

Undoubtedly, lots of laparoscopic technological aspects and instruments would be developed in future, so that applying this technique would be much easier and would be expanded to other procedures too. Furthermore, less dependency on instruments could lead to less expensive laparoscopy. For example, consistent metal instruments and trocars are used in our center instead of disposable ones.

PRINCIPALS OF LAPAROSCOPIC SURGICAL PROCEDURES

Proper selection of patients, knowledge of related complications, familiarity with laparoscopic techniques and availability of laparoscopic equipments and their directions are essential in laparoscopic procedures. In this article, we would like to review how to prepare a patient and select him for laparoscopic surgery.

PATIENT'S SELECTION AND PREPARATION

Precise physical examination and history taking are considered as important steps at the beginning of the work. A history of sever cardiac or respiratory disease is a limited factor for the procedure. Sever adhesion by previous abdominal or pelvic surgeries is relatively considered as a contraindication in laparoscopic surgeries, though not always (especially for skilled surgeons). A history of generalized peritonitis, sever obesity, large hiatal hernia and incarcerated hernia are contraindications as well. Congenital and acquisitioneal umbilical disorders (hernia, urachal cyst, purulent discharge) should be studied, so that in case of presence, trocars should not be inserted around umbilicus. In the cases of aortic aneurism, it is better not to insert the needle and trocar in the midline. They should be inserted with direct vision. Mainly it is preferable to insert the first trocar with direct vision in order to prevent entrance complications. In a report a comparison was made in more than 12000 laparoscopic surgeries between the method of blind insertion of Veress trocar needle and the method of inserting the first trocar openly, it was found that the complications were much less (50%) in the second method.⁽²²⁾ Definite contraindications for laparoscopy are as follows:

1. Generalized peritonitis
2. Infection of abdominal wall
3. Intestinal obstruction
4. Uncorrected coagulation disorders

Patient should be aware of this procedure and should be asked for permission for any open surgery if needed. Intestinal preparation is needed and it is preferred to use liquid diet 48 hours postoperatively in addition to 300gr MgOH in order to repair primarily any intestinal complication. In the cases of intestinal segment surgeries Neomicine 2gr and oral Metromidazole 2gr should be administered in 2 doses a night before surgery with an interval of 4 hours (a survey is being conducted in this center on the necessity of preoperative intestinal preparation if ileum is going to be involved). Any drug that disturbs blood coagulation (like aspirin and anti inflammatory drugs) should be stopped provided that coagulation time becomes normal. Routine tests

are available and depending on the type of procedure and its extension, transfusion may be requested. IV antibiotic is administered 30 minutes before surgery and continued for 2 days or more depending on the type of procedure. Open surgery instruments should be always prepared to be used for a laparoscopic patient who may need open surgery during the procedure.

PREPARATION FOR PROCEDURE

Foly catheter and NG tube should be applied to empty bladder and gastric cavities during laparoscopy. Patient's legs should be tied by elastic bandage or pneumatic socks should be used to prevent postoperative emboli. Penis and scrotum should be bandaged separately to prevent any pneumomoscrotum and pneumofalus. Liquid should be received through the vessels of neck as much as possible to let the hands be free, for the use of arm boards impedes the movement of surgeon and his assistants. Like other abdominal surgeries, abdominal and genital parts are prepped with iodine. Some researchers believe that in case of long procedures 5000 units SC Heparin should be injected 6 hours preoperatively and 12 hours postoperatively till the patient resumes his movement.

Usually, the surgeon and scrub nurse are positioned near the patient in contrast to pathology and assistant surgeon positioned next to the patient at pathology side. Laparoscopic instruments (TV and Co2 blower) are positioned near the patient's feet and above his both sides, it is better to use 2 TVs, so that the surgeon and his assistant could easily observe the surgery field and the level of abdominal Co2 pressure. Before beginning the procedure, all needed instruments should be controlled to assure their accurate working, It is essential to control the following instruments:

1. Co2 blower
2. Indicator system (camera, endoscope, TV, light source)
3. Suction and washing unit
4. Cuter

IMPORTANT POINTS IN ANESTHESIA AND LAPAROSCOPY

Analgesia, amnesia and muscle relaxation are important factors in laparoscopy. Though epidural anesthesia is preferred by some surgeons and patients for some short-term surgeries such as tubal ligation general anesthesia is considered as the preferable method for laparoscopy.

Since there is a risk of vomiting and aspiration due to increased abdominal pressure and Trendelenburg position, intubation of the trachea is recommended. Important anesthetic complications are not so common in laparoscopy. However, less important complications such as headache, vomiting, muscles pain, shoulder pain and dizziness may be occurred which is due to the used drugs. N₂O is not preferred by surgeons, because it causes intestinal expansion and consequently difficulty during the procedure (applying N₂O for 2 hours leads to 100% increase in intestinal gas volume in 70% of cases). N₂O also causes postoperative vomiting and pneumothorax if pleura is opened. Patient should be totally relaxed because the smallest improper movements could lead to insertion of trocar in intestines or large vessels. The administration of anti-H₂-receptor (Cimetidine) and Metoclopramide in patients who are at high risk of aspiration (those with excess body fat, hiatal hernia and diabetes) could prevent this complication and minimize aspiration of gastric acidic contents. The neck veins are preferred for water, electrolytes, and blood transfusion.

It is essential to monitor blood O₂ saturation to prevent hypoxia...

THE INSERTION OF ESPECIAL LAPAROSCOPIC NEEDLE (VERESS NEEDLE)

Veress needle is inserted to fill peritoneum cavity with Co₂ in order to insert the first trocar. The needle could be disposable or durable. Needle No.14 has a diameter of 1.2 mm and a length of 70 to 120 mm. The needle has an outer cover with a sharp tip and an axis with a blunt tip. The central or inner margin of the needle is pushed on the handle of scalpel to assure that by pushing central and blunt part, the needle would be retracted and by omitting the pressure, it would be quickly returned to its place.

Patient is positioned at 10 to 20 degrees in a way that the head would be at a lower level than the pelvis. The place of inserting needle should be exactly above or under umbilicus which is bilaterally retracted upwards by 2 grasping pencils in a way that the abdominal wall would be kept away from inner organs, then a small curved incision is incised on the skin by a scalpel, through which, the needle is inserted vertically toward peritoneum. The insertion of needle through fascia and peritoneum is sensible and to assure it, a syringe of 5 mm N.S is connected to the needle. Then the syringe is aspirated to assure the lack of blood or intestinal contents (yellowish liquid) outflow. Next, N.S is injected and aspirated. If the fluid was injected in peritoneum cavity, it could not be aspirated. When syringe is disconnected from the needle particularly if abdominal wall is retracted upward, needle's remaining drops would rapidly enter the peritoneum.

Afterwards, the blower of Co₂ is connected to the needle and the gas is blown by an amount of 1 lit/min. Abdominal pressure should be lower than 10 mmHg before the flow of Co₂. If the pressure is higher and no Co₂ flow is seen (flow=0) or if the pressure rapidly reaches 15 mmHg (with an amount of one lit/min), the surgeon should retract the needle back a little. If the pressure is high again, needle should be pulled out before gas blow reaches 200 mm and the surgeon should try the needle once again.

It should be confirmed that the needle is inserted in peritoneum and the gas is flowed, even if the needle was inserted for several times. One sign of inserting Veress in abdominal cavity is that natural dullness of liver would be omitted in percussion during gas flow and the abdomen is gradually extended. The abdomen is filled with gas till the pressure reaches 15 mmHg and then the trocar is inserted.

THE INSERTION OF THE FIRST TROCAR

Regarding the fact that inserting the first trocar, which is performed blindly like Veress, is of great importance, a small incision (1 cm) is made above or below umbilicus and then an incision is cautiously made in fascia. The surgeon holds a 10 mm trocar in his right hand and his assistant bilaterally retracts the umbilicus upwards and

lifts abdominal wall so that when the surgeon pushes the trocar inside the peritoneum, umbilical wall is kept away from inner organs by two grasping pencils. The insertion of the trocar is associated with a special sound. To insert the trocar more inside the abdomen, it should be pushed toward an imaginary line started from umbilicus toward a point between promontorium and bladder. Before the insertion, Co₂ pressure could be temporary increased to 20 mmHg and maximally to 25 mmHg, so that a maximum distance between abdominal wall and inner organs is obtained.

Following the first trocar insertion, other trocars are inserted in a proper place according to the type of procedure and by observing the system.

THE INSERTION OF THE FIRST TROCAR BY DIRECT OBSERVATION AND WITHOUT THE USE OF VERESS

A 1 cm incision is usually made above umbilicus. Fascia is incised a little by a scalpel. Peritoneum is opened 1 cm or less while abdominal wall is kept away from the inner organs. Then 1 mm trocar is inserted by direct observation (without scalpel). To prevent Co₂ leakage from the place of the first trocar entrance, fascia incision should be a little smaller than trocar diameter and a spiral plug should be seen at the surface of trocar (new trocars are mostly grooved).

Then the lense and other trocars are inserted by a direct observation. This method excludes the blindly performed processes and their complications in laparoscopy and facilitates teaching urology to assistants and fellowships. The following method is used in case of Veress insertion.

Considering practical laparoscopic experiments performed at UNRC, the use of Veress has been omitted and the first trocar is always inserted in abdomen with a direct observation, which leads to 2 important advantages:

1. It prevents blindly insertion of Veress to omentum, intestines and great vessels particularly in children, besides it precludes the detachment of peritoneum from fascia and gas leakage in peritoneum.
2. The abdomen is filled with gas by trocar much

faster than Veress; thus, applying trocar is time-saving.

TROCAR EXTRACTION

By the end of laparoscopy and before the extraction of trocars, the field of procedure is examined with low pressure (5 mmHg) for any hemorrhage, and then it is washed by 200 to 500 ml N.S and 500mg Cephazoline.

The drain of any brown-yellowish material or blood (a sign of intestinal injury) should be noticed very carefully. If none of them were observed, the liquid would be sucked. Some surgeons do not extract this liquid to decrease adhesion of intestines to the passage of trocars and to decline infection. The small trocar is extracted first, the place of which is observed by laparoscope to detect any hemorrhage. The largest trocar is extracted finally and its place is covered by the finger till the gas is emptied, then the margins of fascia are joined together by an 8 like suture, remember that before fastening the suture the gas should be completely emptied. Skin passage of trocars should be sutured by 4.0 chromic or 5.0 vicryl subcutaneously and then the incision is covered by a light piece of gauze.

POSTOPERATIVE CARES

Postoperative cares are dependent on the type of procedures as in small procedures like varicocele or laparoscopic diagnosis of UDT performed at outpatient departments, liquid diet is administered in the afternoon and normal diet is given a day after. The patient could start walking 6 hours later. In the case of large procedures and suspected hemorrhage the repetition of Hb, Na, and K tests seems to be essential.

If the patient suffers from severe pain, a narcotic drug would be administered every 6 hours; however, Acetaminophen could be helpful on next day. If abdominal pain lasted or increased after 24 hours, intestinal perforation should be carefully suspected and studied. If shoulder pain which is particularly felt after large procedures (due to remaining abdominal gas and diaphragm stimulation), is continued specially in adults, patient should be examined by ECG and chest scan for any cardiac complication or pulmonary emboli. Antibiotics are usually administered for

2 days or occasionally more, depending on the type of procedure. If the patient suffers from delayed abdominal pain, hernia or infection of the region of surgery should be doubted. Echymosis of abdominal wall particularly in lower parts after vast pelvic operations are common and improved spontaneously. In case of increased echymosis and decreased blood Hb, abdominal CT scan should be ordered for the detection of any hematoma. Hydrocele is observed after long procedures due to the gathering of washing liquid. This would be improved spontaneously and by tight fastening of testis bandage and resting for one to two weeks.

LAPAROSCOPIC COMPLICATIONS

Performing laparoscopy by skilled surgeons is not associated with considerable complications, though at learning stage more complications may occur, which are gradually decreased. Complications are reported to be about 4% and mortality rate to be 0.03%. Laparoscopic complications have several major parts: those which have occurred during inserting Veress and inserting trocar and in pneumoperitoneum stage, as well as vascular complications which are developed by applying some surgical instruments, and those complications occurred at the stage of trocar extraction which include vascular complications (the most common), gaseous emboli, hypotension, cardiac rhythmic disorders, hypoxia, hypercapnia, acidosis, aspiration, pneumothorax, pneumomediastinum, pneumopericardium, subcutaneous emphysema, visceral injuries, peripheral nerve injuries, intestinal complications, and the rise of creatinine. The familiarity with the technique and accurate consideration to preventive measures are the best ways of preventing complications and decreasing them in laparoscopic procedures (as in open surgeries). Even though if any complication occurs, timely diagnosis and treatment would be of great importance. The elimination of Veress, blind insertion of first trocar and the insertion of first trocar with direct vision could omit most essential complications especially for surgeons use laparoscopy newly.

LAPAROSCOPY APPLICATIONS IN UROLOGY

By traditional use of cystoscope for diagnosis and treatment and through endoscope, surgical urology entered the new world of surgical endoscopy. Moreover, by performing bladder tumor and prostate TUR, the attitude of urologists toward treating diseases was changed and finally by the progress of technology, urethral entrance and ultimately renal entrance became practical via precise instruments, through which renal and urethral tumors and stones were treated. In 1976 a new gate was opened toward modern world of treating urologic diseases, that was by performing laparoscopy to detect UDT. Gradually, the practice of different laparoscopic techniques was confirmed as a surgical fact. In 1991, Schuessler reported the first surgical laparoscopy through which pelvic lymphadenectomy was conducted in a patient with prostate cancer. Radical nephrectomy for renal cancer was carried out by Clayman, who broke off the kidney by merciliter and extracted it./ Consequently performing large procedures through some small openings became a reality.^(10, 13) This procedure was appreciated by many urologists; however, some others opposed it because it lasted for 9 hours. Yet, the time of radical nephrectomy was gradually reduced to reach the time of open surgery or a little more. It was indicated that laparoscopy could be an actual rival and an appropriate replacement for open surgery. In accordance with different reports on laparoscopic nephrectomy outcomes, this procedure has been introduced as a substitution for open surgery, for it prevents large and painful flank incision which leads to hernia and postoperative severe pain. To date, nephrectomy is routinely conducted in lots of centers and it has replaced large procedures in big centers as a standard of care.

One thousand cases of laparoscopic radical prostatectomy have been recently reported in Europe. Schuessler was the first in the USA to perform this procedure; however, he concluded that it was incomparable to open surgery. One year later, following a report of 300 cases of laparoscopic radical prostatectomy by Vacnsine from France, the procedure was once again carried out by Gill from the USA, which was lasted for 3-4 hours and urethral catheter was removed



FIG. 1. Aberrant vessels in a patient with UPJ



FIG. 3. Postoperative photo of a patient who underwent RPLND laparoscopic retroperitoneal lymphadenectomy with 3 trocars. The scar of previous open orchidectomy is observed underneath.



FIG. 2. Laparoscopic lymphadenectomy for testicular tumor; lymph nodes between aorta and vena cava has been totally removed.



FIG. 4. Renal cyst in a 2-year child who underwent laparoscopy

after 2-5 days.⁽¹⁴⁾ Twenty cases of laparoscopic radical prostatectomy were conducted in Iran at Labbafinejad Medical Center during the last year. Postoperative urine control and stenosis of anastomosis were the same as open surgery, but with lower hemorrhage and sooner return to normal life. Laparoscopic repairing procedures are also common. First laparoscopic surgery and pyeloplasty was performed in 1993. It outran endopyelotomy in a way that its outcomes were similar to those of open surgery. Fifty cases of pyeloplasty have been already conducted in this center (fig. 1) with satisfied outcomes. The first case of laparoscopic cystoplasty was reported by Gill in 2000.⁽¹⁶⁾ The first laparoscopic

cystoplasty was carried out in this center in 2002. Nine cases of ileocystoplasty and one ureterocystoplasty have been already conducted. The most complicated procedures were performed by Gill et al at Cliolind Clinic which included radical cystectomy and ileal conduit, 11 cases of which were conducted in 2001, followed by 5 cases of radical cystectomy and orthotopic patch. Gill et al were introduced as a unique group in laparoscopic surgery field and were awarded best prize in laparoscopy at the urology congress.⁽¹⁷⁾ Nephrectomy due to benign lesions was carried out for the first time by Clayman in 1991. In 1993 laparoscopy was performed in Iran at Labbafinejad Medical Center to diagnose and

treat UDT and varicocele.⁽¹⁸⁾ Although, learning how to conduct laparoscopy is more difficult and time-consuming, it is practical by obtaining more skill. This center is an obvious example which initiated its laparoscopic activities by a limited experience with diagnostic laparoscopy. Larger procedures such as adrenalectomy, RPLND (fig. 2, 3), urethral stone and renal cyst (fig. 4) were conducted by gradual obtaining of experience at the first 4 years. Laparoscopic progresses were such fast that lots of mentioned surgeries were performed routinely during the last 2 years and some others such as ureteroplasty and ileocystoplasty with intra-abdominal anastomosis and appendix diversion toward abdominal wall were also carried out for the first time worldwide which were accepted at USA Urologic Congress for the first time from Iran and were represented in April 2003.^(20,19)

To date, all international journals of urology are filled with successful reports of laparoscopic procedures, which indicates the increasing progress in urology. It could be claimed that laparoscopy is now the first surgical alternative. It is believed that all those who are familiar with surgical principals are able to practice laparoscopy as well.

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