LAPAROSCOPY

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HISTORY

Laparoscopy also known as peritoneoscopy or celioscopy has seen lot of advancement since the latter part of the twentieth century.

Earlier between 1910 and 1940, laproscopy was mainly done by physicians.

In 1910 Jacobeus of Sweden induced a pneumoperitoneum and introduced a Nitze cystoscope into the peritoneal cavity. In the early 1930s, Kalk of Germany was principally responsible for developing laparoscopy into an effective diagnostic and surgical procedure.

In 1947, Raoul Palmer of France used the lithotomy position & created gaseous distension. He also used a uterine cannula to elevate the uterus.

Breakthroughs in endoscopy came by introduction of the “cold light” concept by Fourestier, Gladu and Valmiere and “fibreoptics” by Kampany and Hopkins.

The works and writings of Palmer (1962), Semm of Germany (1974), Gomel (1977) attested to the successful use of laparoscopy as a diagnostic and surgical procedure.

INTRODUCTION

Laproscopy is a minimal access procedure allowing peritoneal visualization, performed through a range of endoscopes to minimize the anatomical and physiological trauma to the patient.
The advantages of laparoscopy from an open surgery are-small incision, excellent visualization of operative site, reduced postoperative pain, shorter hospital stay, early return to full activity, cosmetic advantages, less wound complications.

The disadvantages are-difficulty in stopping bleeding, longer operative time, danger of visceral and vascular injury, expensive, specialized equipment, technically difficult and special training required.

INSTRUMENTS

LAPAROSCOPES

The two types of laparoscopes available are –diagnostic and operative. They come in variety of sizes from small (5-7mm) to large (8-11mm)

Diagnostic laparoscopes are available with different angles of view, either straight-forward or fore-oblique (45°), the selection being the surgeon’s choice but straight forward requires less adjustment.

The degree of magnification varies with the distance of the laparoscope from the object.

PNEUMOPERITONEAL NEEDLE AND TROCAR

Pneumoperitoneal needle allows the passage of carbon dioxide after it has pierced the abdominal wall. The two needles available are –Touhy and Veress needle, the latter one being commonly used.

Veress needle was designed to reduce the chances of accidental puncture. It has a spring that allows retraction of the blunt inner point as it traverses the abdominal wall but springs out to protect the intra-abdominal structures when it encounters the decreased pressure of the abdominal cavity.
Trocar is available in two models-flapper valve-allowing insertion of laparoscope and other instruments without loss of gas and trumpet valve-the more traditional one.
The trocar tip maybe pyramidal or cone shaped, but its important that it should be sharp. Trocar can be inserted after pneumoperitoneum is created or without insufflation. The latter requires great expertise and should be carried out by only skilled and trained surgeons.

**GAS INSUFFLATORS**
A gas insufflator is used to produce controlled pneumoperitoneum. The low flow produce is 0.5 to 1.0 L/min. Laparoscopic procedures are possible only if adequate pneumoperitoneum is maintained despite multiple instrument changes, multiple puncture site and irrigation. Therefore its imperative for a high flow insufflator which produces at least 4 to 5 L/min or more. The intraperitoneal pressure is 15-20mmHg not more than 25 mmHg

**GAS**
Carbon dioxide is the commonly used gas as it is absorbed by the blood stream and excreted by the lungs. The safe absorption rate is 100ml/min but if it exceeds can develop cardiac arrhythmias.

Nitrous oxide can also be used as it causes less peritoneal irritation and is well absorbed but the disadvantage is supports combustion in the presence of methane gas, which escapes if the bowel is breached.
LIGHTING

Adequate visualization depends on the quality and power of light delivered.

The beam of light used is xenon which is transmitted through fibreoptic cables.

ANCILLARY INSTRUMENTS

Probes

Simplest and commonly used is the blunt probe for visualization and manipulation of the structures. It’s also used to stabilize the structures atraumatically.

Forceps

Atraumatic grasping tongs and forceps

Large spoon forceps

Large claw or toothed forceps

Punch biopsy forceps

Scissors

Scissors are commonly used and come in many designs that include toothed, serrated, micro and hooked.

Hook scissors are typically used for large tissue dissection, micro scissors for fine dissection. Serrated scissors are not used, as they tend to chew through tissues.

Aspirators/irrigators

Aspiration can be regulated mechanically by suction devices or manually with a large syringe.

Combined aspiration/irrigation units are available which make the procedure simple and quick especially in cases of ectopic pregnancies.
Morcellators

Morcellation is commonly performed during myomectomy, oophorectomy, salpingectomy and removal of gestational tissue following conservative endoscopic surgery for ectopic pregnancy. Pieces of tissue too large to be removed intact from the pelvis may be cut into smaller pieces and removed through the Laparoscopic sleeve.

HEMOSTATIC INSTRUMENTS

The ability to achieve hemostasis depends on instrument availability, type of proposed surgical procedure and physician preference

Electrocoagulation

The modern generators are low voltage, high frequency, and solid-state units with insulated circuitry. Both unipolar and bipolar modes are available.

In a unipolar system, the current passes from the generator through the instrument to a ground plate and then back to the generator. Many instruments can be combined with unipolar electrocautery-scissors, scalpels, point coagulators. There is a lateral spread of the current resulting in tissue necrosis at a distant site. Tissue damage can be seen 3 to 4 cm away from the area of coagulation.

The bipolar system uses the two insulated jaws of the instrument to carry the current to and from the generator. The tissue between the jaw completes the circuit and the tissue is heated (coagulated) by passage of the current. Bipolar can be dispensed in both a cutting and coagulating mode. Peripheral damage with bipolar is less extensive than with unipolar. Nevertheless, there is approximately 1 to 2 cm of coagulation damage around the point coagulated.
**Thermo coagulation**

The system coagulates tissue by increasing the temperature through heat convection. Electricity is used to heat the metal inside the instrument that delivers the heat. Hemostasis is achieved by heating the tissue to 100 to 120°C. as the temperature in the tissue rises slowly; a color change to white is seen. It is thought that the denaturing of proteins and desiccation cause coagulation. Penetrating injury is not possible but superficial damage is possible.

**Laser**

The laser is a device that produces and amplifies light, creating intense, coherent electromagnetic energy. The major types of lasers used are CO2, argon, 532-nm potassium-titanyl-phosphate-garnet (Nd: YAG) laser. The power density determines the laser’s ability to vaporize, excise and coagulate various tissues. The ability of the target tissue to absorb the beam determines the area of destruction. This restricts the damage to healthy tissue in the vicinity of the impact by limiting the time of exposure of the beam. CO2 laser is the most commonly used. The CO2 has the ability to seal off blood flow in vessels upto 0.5 to 2.0 mm.

**Suture**

Suturing has added a new dimension to operative laparoscopy. Roeder loop is used. Suturing can also be performed with a straight needle. A 3 or 5 mm needle holder with a spring to keep needle in place is used.
Staples

Staples may be used for large vessel hemostasis. They may be either applied as single clips, which are usually mounted in a clip applicator, which has a stack of 20 clips available. It's necessary to skeletonise the vessels before using these clips. There are also available laparoscopic staplers which place rows of titanium staples and simultaneously divide the clamped tissue.

ANAESTHESIA

The patient is anaesthetised using muscle relaxant, endotracheal intubation and positive respiration. General anaesthesia is used.

TECHNIQUE

Patient is placed in a modified lithotomy position with her legs flexed to 45 degree and a Trendelenburg tilt of 15 degree. A steeper tilt may be necessary if loops of bowel prevent easy access of the pelvis. Surgeon cleans abdomen with antiseptic solution. The assistant cleans the vulva and vagina, bladder is emptied and a cervical tenaculum is applied to manipulate uterus and give surgeon an adequate view.

The veress needle is inserted through umbilicus, because at this point the thickness of abdomen wall is minimal and peritoneum is closely adherent to the underlying tissue. Its inserted into the skin at almost right angles for about a centimeter before changing the direction to about 45° towards the anterior part of the pelvis. The position of needle within the abdominal cavity is checked by aspiration test. Normal saline is injected through the needle and then aspirated. If the needle lies in the peritoneal cavity, no fluid is withdrawn. If the needle lies in the abdominal wall clear fluid is withdrawn, but if it is in bowel or a blood vessel the aspirate will be stained brown or red the surgeon must then
decide whether or not to proceed with laparoscopy. With experience the free side to side mobility of the end of the needle in the peritoneal cavity is quite characteristic.

Pneumoperitoneum is produced by insufflating 1-2 litres of CO2/min. When the gas is flowing freely and intra abdominal pressure is normal (<25mmHg), the rate of flow can be increased to 4-5 litres/min.

An incision of 5-1.0 cm in length, depending upon the diameter of laparoscope, is made downwards from the deepest point of the umbilicus and trocar is inserted using zigzag path to prevent herniation of omentum. The abdominal wall is held with the other hand to avoid damage to bowel by trocar.

A telescope is now inserted and abdominal cavity is inspected. Second port is made under direct vision, the second trocar is inserted. Most commonly used instruments are 5 or 7 mm in diameters. Supra pubic sites of access are the corner stones of accurate visualization and precise surgery. The Trocars are inserted on left and right side abdominal wall.

At the end of the procedure as much gas as possible is expelled through the cannula by pressure on the abdomen and clips or sutures are applied to the puncture wounds.

**INDICATIONS**

The indications of laparoscopy may be considered as either Diagnostic or Operative.

**Diagnostic laparoscopy**

**Infertility**

Laparoscopy can reveal peritubal adhesions not detected by HSG. Chromotubation is a part of diagnostic laparoscopy for infertility evaluation to determine tubal patency.
Endometriosis

Laparoscopy helps to identify the degree or extent of endometriosis allowing selection of the treatment and also pelvic adhesions.

Ovulation

Presence of corpus luteum in the ovary during mid cycle confirms ovulation

Chronic pelvic pain

In patients complaining of chronic pelvic pain not responding to therapeutic measures laparoscopy is indicated. Often unsuspected pathologies get revealed like adhesions, tubal hydrosalpinx, endometriosis, and pelvic congestion. Even negative finding is valuable to reassure that there is no pelvic pathology.

Ovarian disorders

Most reproductive endocrine disorders do not need laparoscopy. How ever polycystic ovarian disease not responding to conservative treatment, laparoscopy may be useful to confirm diagnosis. The operation of ovarian drilling is performed for improving ovulation induction and other symptoms of PCODs

Suspected adnexal masses

Suspected ectopic pregnancy

In a patient with abdominal pain and a positive pregnancy test, a laparoscope can detect tubal pregnancy even before it has ruptured.

Pelvic inflammatory disease and tuberculosis

In case of PID diagnosis can be confirmed on laparoscopy in most of cases. Peritoneal fluid or pus can be obtained for culture.
**Missing IUD**

A missing IUD which escapes into the peritoneal cavity, can be often retrieved successfully at laparoscopy.

**Pelvic malignancy**

In case of pelvic malignancies like ovarian malignancy, a laparoscopy is useful in staging and a biopsy from an effected area to confirm the type of tumour. **Second look laparoscopy** is helpful the presence of residual tumour.

**Uterine abnormalities**

Laparoscopy reveals uterine abnormalities like:

- The presence of mullerian anomalies like absent uterus, bicornuate uterus or presence of rudimentary horn.
- An enlarged uterus due to fibromyomas or adenomyosis.
- Adhesions to uterus and its retroverted fixity.

**Inspection of pouch of Douglas**

Often endometriosis is present in this site, so also adhesions to the rectum present. **POD** can be the site of pelvic abscess.

**Biopsies**

**Operative laparoscopy**

**Adhesiolysis**

Adhesiolysis is sometimes used to obtain correct diagnosis and help to free out the pelvic organs to correct the anatomy.
**Laparoscopic myomectomy**

Myomectomy is best planned for the younger women desirous of preserving their Reproductive function.

**Laparoscopic assisted vaginal hysterectomy (LAVH)**

LAVH is performed in benign conditions (myomas, adenomyosis, and chronic menstrorrhagia and DUB, insitu cancer of cervix)

**Laparoscopic sterilization**

Laparoscopic sterilization is the most frequently performed endoscopic procedure. Coagulation: In this method the tubes are identified, and different types of electrocoagulation methods are used like monopolar, bipolar or thermo coagulation. The electricity or heat is passed through the tube until it bubbles and collapse. It can then be divided by advancing the sheath of forceps so that the cutting edge transects the tube or it can be cut with hook scissors. Mechanical blockage: In this method the tubes are clamped with different types of clips or rings. The most commonly used is fallope ring. Ligation: Sterilization may be achieved by laparoscopic ligation of tube, a slipknot applied on the tube. This operation involves a three-puncture technique to allow application of forceps, loop and scissors and therefore is not widely practiced.
Other indication are

- Genital prolapse.
- Stress urinary incontinence.
- Pelvic floor repair.
- Dysmenorrhoea

Second look laparoscopy

Second look Laparoscopy helps us to know about the effect of treatment given for pelvic malignancies and other pathologies. Second look is the ideal to complete reconstruction of various abnormalities.

CONTRAINDICATIONS

Absolute-

- Bowel obstruction, ileus, peritonitis, intraperitoneal haemorrhage, diaphragmatic hernia and severe cardiovascular disease.

Relative –

- extremes of body weight, inflammatory bowel disease, the presence of a large abdominal mass and advanced intrauterine pregnancy.
COMPLICATIONS

For a long time, laparoscopy was considered a dangerous procedure.

Complications can be divided into few major categories

- Anesthesia related
- Trocar related
- Procedure related
- Instrument Related
- Positioning related.

Anesthesia related complication

Possible intoxication from absorption of CO2 gas. Extreme Trendelenburg and increasing intra abdominal pressure during laparoscopy may compromise patient.

Trocar related injuries

The most common of all the complications in laparoscopy, has been responsible for more deaths and injuries than any other category. Injury to major vessels is a real risk at the insertion of access instruments like veress needle and trocars. Types on injuries caused by trocar insertion is as follows

Unrecognized bowel injury.

Aorta, Inferior vena cava, mesenteric vessel, iliac artery and vein, Gastro duodenal artery, Hypogastric artery, Omentum vessel, Portal vein
**Procedure related**

Injuries during the surgical Maneuvers are also common.

The bladder could be injured during the dissection from the pubocervical fascia. Previous Cesarean section and endometriosis could increase likelihood of this complication. Injury of small bowel, colonic laceration may occur during dissection of adhesions. Furthermore, electrosurgery or laser may create unrecognized thermal lesion which become apparent after 48-72 hours with peritonitis. When frank bowel perforation is present, laparotomy is indicated.

**Instrument related**

Improper use of electrosurgery during a procedure, unfamiliarity with equipment, and the use of incompatible components contributes to the many injuries. Accidental burns of bowel and bladder.

**Patient related**

Obesity, chronic obstructive pulmonary disease, Diabetes, hypertension, history of deep vein thrombosis, peripheral artery disease all complicate surgical and recovery process. Patient may develop atelectasis, pulmonary embolism and cardiac compromise following prolonged laparoscopic surgery. Anemic patient may go into hypovolemic shock. Diabetic patient may develop fulminant infections. Careful selection of patients is advised.

**Positioning related**

Prolonged trendelenburg position with increased intra abdominal pressure may cause CO2 intoxication and acidosis. Pressure points may cause to develop neuropathy e.g.

It is essential that stockings be used with prolonged laparoscopy.

**Other complications**

Other complications include Surgical emphysema, haematoma formation and ureteric injuries, burns, accidental ligation, puncture injuries of stomach. Hernia at the site of incision, omentum prolapse at the site of umbilical incision and fistula formation.

Like all surgical procedures, it is important to observe strict aseptic techniques, postoperative sepsis and infection are known to occur. Uterine perforation with intrauterine manipulators are known complication.