Diagnostic Laparoscopy

An Essay
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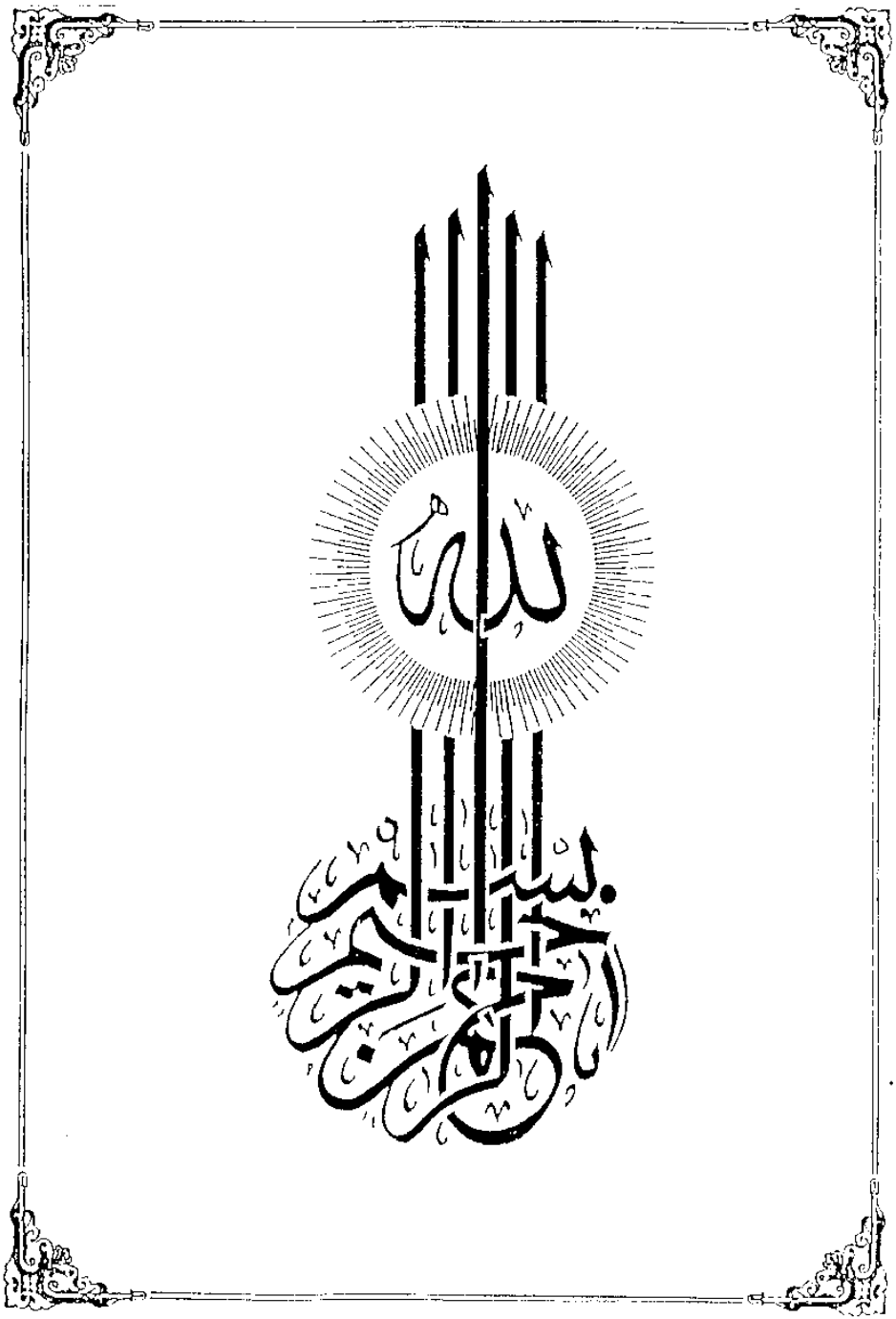


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This essay includes

- Principles of laparoscopic surgery
- Elective Diagnostic laparoscopy
- Emergency Diagnostic laparoscopy
- The way ahead.
- Summary and conclusions
- References
- Arabic Summary

PRINCIPLES OF LAPAROSCOPIC SURGERY

Principles of Laparoscopic

Surgery

Historical Notes

The evolution of operative endoscopy would be incomplete without due credit to the development of endoscopes , which make it all possible . Man's innate curosity to view the inside of body cavities or canals dates back to the time of Hippocrates II (460-375 B.C.) (*Semm, 1977*) who mentions examination of the rectum by looking with a rectal speculum to see where the rectum is affected. Abulkasim (1012-1013 A.D.), an Arab, used a glass mirror to refelect light into the vaginal cavity. He was thus the first to use reflected light for the purpose of illuminating and observation of the interior of a body orifice. The first endoscopic light should be credited to Tulio Caesare Aranzi who in 1585 wrote of using solar rays to visualize the nasal cavity (*Semm, 1977*).

Bozzani (1805 A.D.) of Frankfurt was the first to visualize the interior of the urethra, which he visualized in a human by using candle light and a cumbersome tube as an endoscope. (*Belt and Charnock, 1936*). Desormeaux (1835) is credited with being the father of cystoscopy when he developed the first serviceable urethroscope and cystoscope by using mirrors to reflect light of a kerosene lamp. Nitze (1877) added a lens system to the endoscopic tube that magnified the area being illuminated.

Newman (1889) describes an instrument using the incandescent lamp as a light source after Edison (1880) invented the incandescent lamp.

Ott, a famous gynecologist, was the first to introduce endoscopic inspection of the abdominal cavity using a head mirror and a speculum introduced through a small anterior abdominal wall incision. That was at the close of the 19th century (*Wittman, 1966*).

In 1903 at the 73 rd congress of German Nationalists and Physicians, Kelling, a surgeon from Dresden, demonstrated its use on a living dog into whose abdomen he had inserted a cystoscope to examine the viscera. Using a separate needle to produce a pneumo peritoneum with filtered air. In 1910 Jacobaues of Stockholm published human visceral exploration one abdominal and one thorocic, using no separate pneumoperitoneum needles but introduced air by means of the trocar used for introduction of the cyctoscope. The credit of using Trendelenburg position with an inflated abdominal cavity belongs to Nordentoft and his brother of Copenhagen in 1912. In 1914 Roccavilla of Italy described a modified method of Kelling and Jacobaeus. He designed an instrument that permitted the source of light to remain outside the abdomen : a strong beam of light was directed by reflection into the trocar tube (*Cohen, 1970*).

Kalk of Germany devised a new system of lenses that produced a foroblique (135 degrees) viewing system. His brilliant instrument led to the widespread adoption of the method in many countries. He can probably be referred to as the father of modern laparoscopy, and it is to his credit that it bacame possible to study and to make an accurate pathologic diagnosis of internal organs. Probably the first operative procedure to be performed by utilizing endoscopic visualization and the first to utilize a second puncture should be credited to Kalk (*Witman, 1966*).

Operative procedures combined with endoscopy was reported in 1933 by Fervers who burned abdominal adhesion and excised biospy tissue under direct visualization.

In 1952 a new apparatus developed by Fourestier, Gladu and Valmiere revolutionalized endoscopic techniques. They developed a method of transmitting an intense light along a quartz rod from the proximal to the distal end of the telescope. This immediately removed the dangers of accidents due to electrical faults and heat and allowed

allowed intense light to be centered so that photographs could be taken. Endoscopic color films were produced, and in 1959 a closed-circuit television program was first produced (*Steptoe , 1967*).

Kurt Semm described techniques most commonly associated with operative laparoscopy. His endocoagulator allowed a safe means of controlling blood loss. His loop-ligation and morcellation forceps enabled him to describe techniques for laparoscopic surgery. Semm (1983) performed the first laparoscopic appendectomy (*Semm, 1983*). The first cholecystectomy was described in 1989 (*Dubois, 1990*).

What has been witnessed has been a remarkable advancement of laparoscopic surgical techniques in recent years. What once were considered primarily open abdominal procedures are being performed partially or exclusively through the laparoscope. There are many advocates of these advances in laparoscopic technology. the patient avoids a large abdominal incision, and the hospital stay is shortened, as is postoperative convalescence, which decreases medical cost. However, these techniques are time-consuming and require a longer expenditure of time and money for equipment and training. What is evident is that laparoscopic procedures are here to stay, but it is doubtful whether the laparoscope will ever completely replace the scapel.

Facilities , Instrumentation , and Equipment

The popularity of laparoscpy for diagnosis and therapeutic procedures is due mainly to technological advances made over the last few decades (*Epstien, 1980*). Much like a craftsman in any endeavor, the surgeon must master the tools he utilizes. complete understanding of the advantages, limitations, and common pitfalls of each device may prove pivotal to successful outcome of any procedure . In a rapidly evolving and changing field, it is impertative that the surgeon consider adopting and modifying his practice as new technology is introduced to optimize patient gain and minimize inherent procedure risk .

Non Optical Equipment :-

These instruments include devices for induction of pneumoperitoneum , cannulas and trocars for introduction of the laparoscope and ancillary surgical instruments , hemostatic and dissection devices including lasers or electrocautery , and irrigation-aspiration systems to maintain a meticulous surgical field . In addition , surgical instruments that have been designed for specific functions should be carefully selected prior to each procedure (*Phillips, 1990*) .

Equipment for establishment of pneumoperitoneum :-

The separation of intracavitary organs from body wall by introduction of gas (this is called pneumoperitoneum) is fundamental for successful visualization of organs . A variety of gases (Carbon Dioxide , Nitrous Oxide , room air) and routes of insufflation (transabdominal , via the posterior vaginal fornix) have been advocated , each having specific advantages and liabilities (*Sharp et al, 1982*) .

Insufflation needles :-

Veress needle : The Veress needle was initially used for the induction of a pneumothorax in tuberculous lung (*Veress, 1938*). The Veress cannula is a clever double-barreled device consisting of an inner blunt-shaped spring-acting stylet and an outer sharply beveled needle . The outer needle perforates the fascial planes , and the blunt-ended inner stylet protrudes following advancement of the needle through resistant tissues to push aside any freely mobile intra-abdominal structures (e.g. bowel) . During passage of the Veress needle through the abdominal wall , two "pops" can generally be appreciated ; the first occurs as the abdominal wall fascia is traversed , and the second is produced by passage of the device through the peritoneum . Failure to enter the peritoneal cavity is usually caused by improper technique of needle insertion rather than inadequate needle length. It is important to carefully observe the abdomen during insufflation . Asymmetric distension or pressures above 15 mmHg suggest that the needle is not in the proper position . In these situations , the needle should be removed and reinserted (*Veress, 1938*). The Veress needle is manufactured in both reuseable and disposable forms in several diameters and lengths . Knowledge of the type of needle used is essential to enable accurate interpretation of the intra-abdominal pressure measured during gas insufflation.

Veress needles that have two ports (one for the introduction of gas and one for pressure recording) enable the operator to measure intraperitoneal pressures accurately during insufflation . (*Fig. 1*)

Foures-Kuss Needle :-

The device has a sharp-tipped removable inner core surrounded by an outer sleeve with lateral holes . Once the needles have been inserted into the peritoneal cavity , the

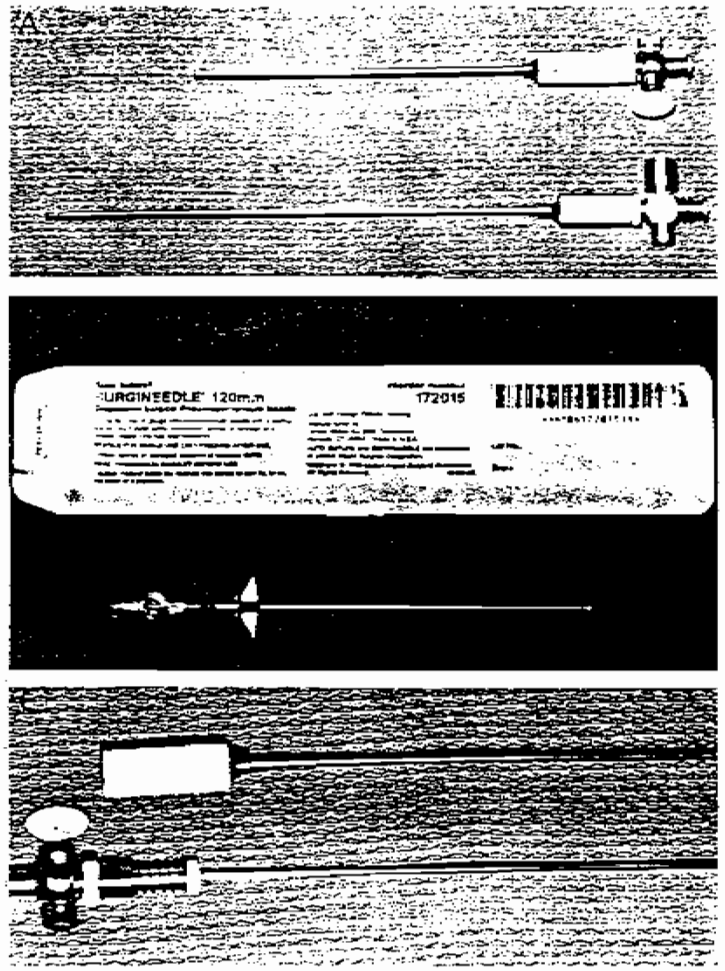

Fig. (1)

Veress needles are available in reusable (**A**) and disposable (**B**) formats. **C**, a disassembled unit reveals the inner spring-action stylet *(below)* and outer sleeve *(above)*. **D**, the Veress needle mechanism during tissue penetration.

inner core is retrieved , and the outer sleeve is connected to the insufflator . The advantages of this needle are its thin profile and the ability to insufflate through the lateral holes when the tip is impacted in tissue (i.e , the omentum) .

Insufflation Devices :-

Pneumoperitoneum was originally obtained by injecting room air by hand into the peritoneal cavity (*LoCicero et al, 1987*) . This procedure is now easily accomplished by using instruments that introduce the gas and simultaneously monitor the rate of flow , the volume delivered , and the intraabdominal pressure . These parameters are displayed on a panel to enable safe, expedient insufflation .

In accordance with current safety, gas should be instilled at no greater than 1 L / min. at a low flow rate . In order to perform endoscopic surgery , the insufflator should also be capable of delivering flows of 6 to 10 L / min. The high flow feature facilitates preservation of the surgical field during the exchange of surgical instruments and during aspiration of blood or irrigation fluid from the field (*Gadacz et al , 1990*) .

Cannulas and trocars :-

Following penetration of the body wall , the trocar is removed , and the cannula lumen may be used to introduce other surgical devices . Both cannulas and trocars are manufactured in reusable and disposable versions . disposable nonmetalic cannulas permit unobstructed intraoperative x - ray contrast studies such as cholangiography because they avert immages in the field produced by metalic devices . Cannulas also equipped with valves to prevent a loss of insufflation gas . They are fitted with a side luer-lock connector for attachment of gas tubing from the insufflator (*Rioux and Yuzpe, 1981*). (*Fig. 2*)

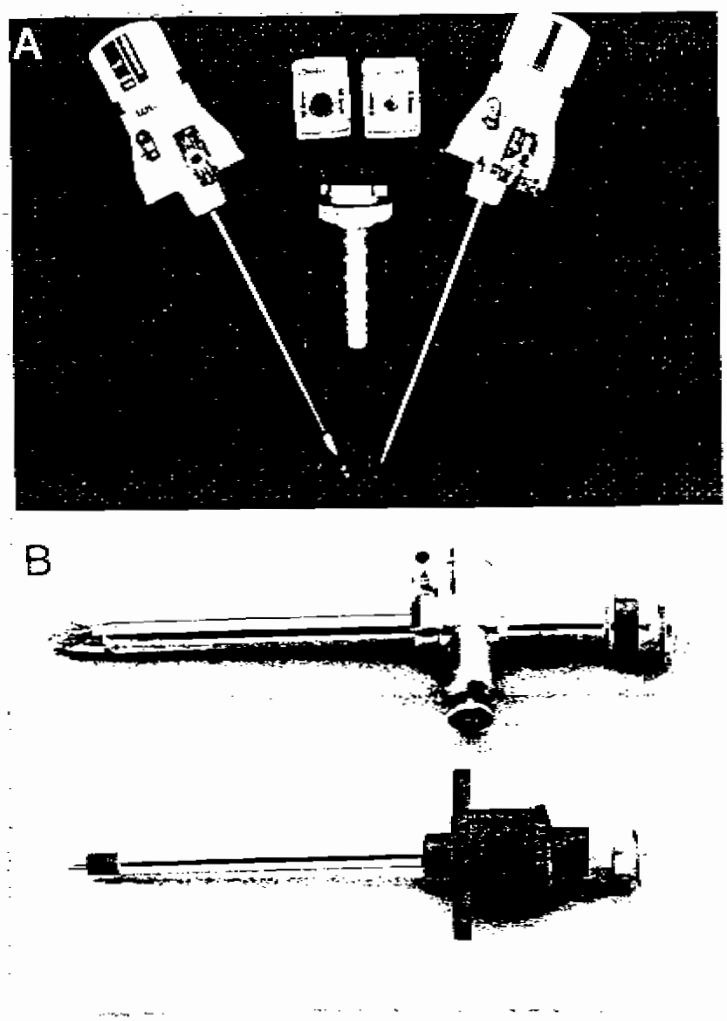

Fig. (2)

A. disposable Surgicon trocars and cannulas displayed with an abdominal wall fixator and reducers. **B.** reusable trocars and cannulas. (Note the Luer-lock gas line connector on the side of the cannulas for CO_2 insufflation.)

It is also possible to place a cannula by direct visualization of the peritoneal cavity i.e. the "open' technique . This requires special instrumentation (*Hasson, 1974*) . The Hasson cannula and trocar are designed to be inserted into the peritoneal cavity under direct vision . The indication for such an approach is usually in the setting of prior surgery when viscera might be adherent to the body wall and make a blind puncture hazardous . The major differences of the Hasson device from the standard cannula-trocar unit that has been described are a blunt obturator trocar, a cone-shaped sleeve , and a suture-holding component. The blunt obturator serves as atraumatic guide and pushes away intraperitoneal organs that contact the cannula . Because its insertion follows surgical incision of the abdominal wall , the risk of trauma is lessened . The main function of the sleeve is to obliterate the fascial openeing and thereby help maintain the pneumoperitoneum . Fascial sutures are wrapped around attachments on either side of the trocar sleeve under tension to hold the cannula firmly in place (*Hasson, 1974*). (*Fig. 3*)

Electrosurgery Units and Lasers :-

Electrosurgery units and / or lasers are an integral componenet of endoscopic surgical procedures , the surgeon must be thoroughly acquainted with the principles , risks, and safety features of each (*Hulka, 1985*) .

Electrosurgery Units :-

Two types of electrical methods are employed in modern electrosurgical units : unipolar and bipolar . In both types of units , the heat generated by the passage of current