PREVENTING ENTRY-RELATED GYNAECOLOGICAL LAPAROSCOPIC INJURIES

GREEN-TOP GUIDELINE NO. 49

INTRODUCTION

- Laparoscopic surgery has evolved over the past two decades to now be accepted as the method of first choice for tackling most gynecological problems.

INCIDENCE

- The incidence of complications depends on a number of factors. Firstly, it depends on whether the procedure is a diagnostic one, or whether a surgical procedure has been carried out.
- The rate of major complications was 1.4/1000 procedures comprising intestinal injuries, urological injuries and vascular injuries.
- Jansen *et al*. reported the results of a prospective multicenter study of 72 hospitals in the Netherlands in which there were 145 complications from 25,764 laparoscopies. There were two fatalities and 84 women required a laparotomy because of complications. There were 29 cases of gastrointestinal damage and 27 lesions of intra-abdominal vessels; 57% of the injuries were attributed to problems with laparoscopic entry. Women with a previous laparotomy were also found to be particularly at risk.

ADEQUATE PNEUMOPERITONEUM

- An intra-abdominal pressure of 20–25 mmHg should be used for gas insufflation before inserting the primary trocar.
- The distension pressure should be reduced to 12–15 mmHg once the insertion of the trocars is complete. This gives adequate distension for operative laparoscopy and allows the anesthetist to ventilate the patient safely and effectively.
- It is necessary to achieve a pressure of 20–25 mmHg before inserting the trocar, as this results in increased splinting and allows the trocar to be more easily inserted through the layers of the abdominal wall. The increased size of the ‘gas bubble’ and this splinting effect has been shown to be associated with a lower risk of major vessel injury.
- If a constant force of 3 kg is applied to the abdominal wall at the umbilicus to an abdominal cavity insufflated to a pressure of 10 mmHg, the depth under the ‘indented’ umbilicus is only 0.6 cm. When the same force is applied to an abdomen distended to 25 mmHg, the depth is 5.6 cm (range 4–8 cm).

- The mean volume of CO2 required to reach this pressure was 5.58 liters. No adverse effect on circulation or respiratory function was observed as long as the patient is lying flat.
- It is suggested that all gynecologists should consider using the pressure technique , insufflating the abdomen to 20–25 mmHg before inserting the primary trocar. Further evidence to support this practice is awaited from randomized controlled trials.

SECONDARY PORTS

- Secondary ports must be inserted under direct vision perpendicular to the skin, while maintaining the pneumoperitoneum at 20–25 mmHg.
- During insertion of secondary ports, the inferior epigastric vessels should be visualized laparoscopically to ensure the entry point is away from the vessels.
- During insertion of secondary ports, once the tip of the trocar has pierced the peritoneum it should be angled towards the anterior pelvis under careful visual control until the sharp tip has been removed.
- Secondary ports must be removed under direct vision to ensure that any hemorrhage can be observed and treated, if present.
- Any non-midline port over 7 mm and any midline port greater than 10 mm requires formal deep sheath closure to avoid the occurrence of port site hernia.

SUGGESTED STEPS FOR SAFE ENTRY

- **Veress needle safety tests:**

1. **Manometer test**: Involves connecting the gas tubing to the Veress needle and raising the abdominal wall to create negative pressure.

2. **Hissing sound test**: Involves turning the valve to the off position after it has been properly positioned. The abdomen is elevated and the valve opened, creating a hissing sound.

3. **Aspiration test**: Involves attaching a syringe filled with saline to the Veress needle and attempting to aspirate any material. If material is aspirated such as bowel contents or urine, the Veress needle should be removed. If blood is aspirated, the needle is left in place and preparation for exploratory laparotomy is made for a presumed vascular injury.

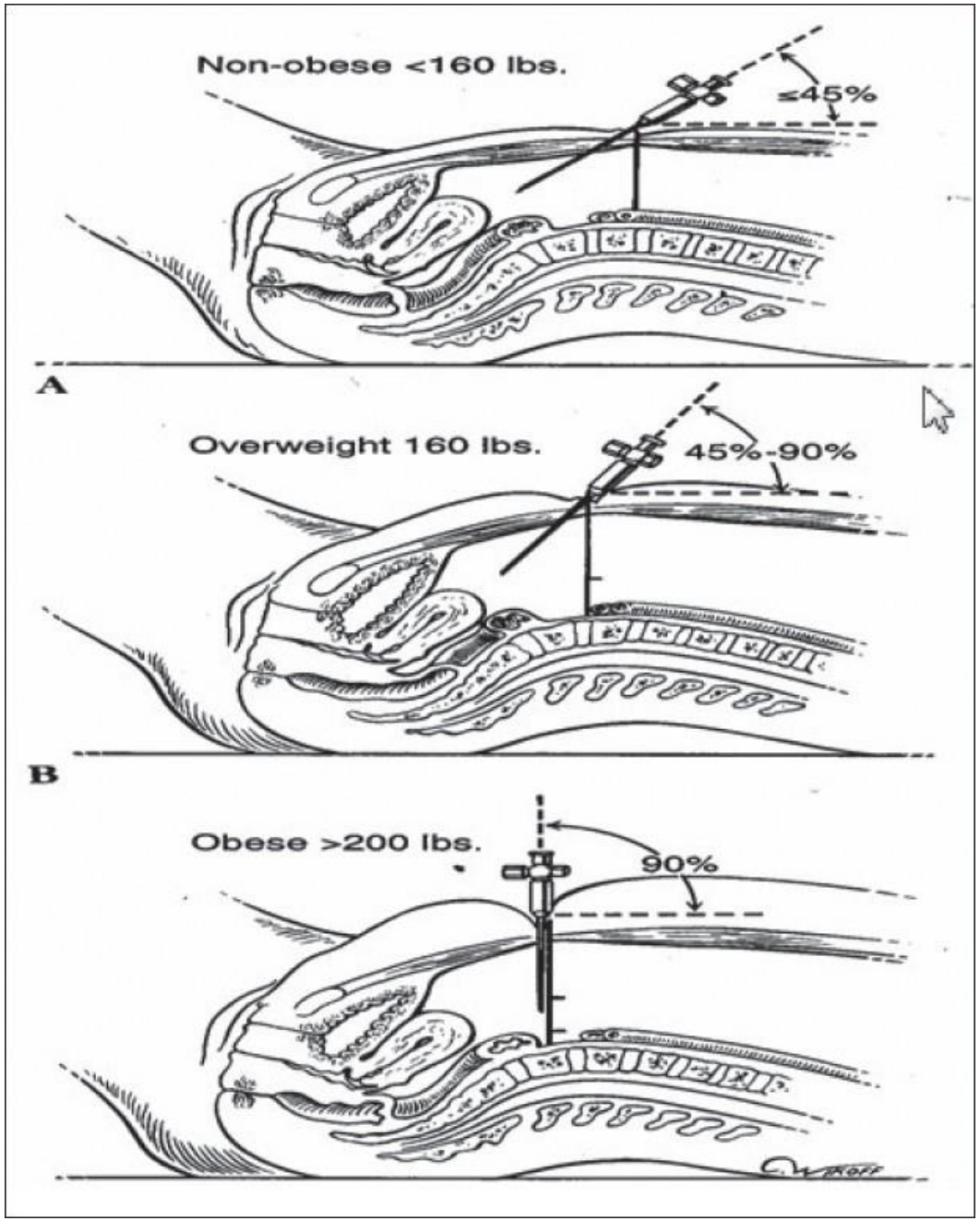
4. If no material is aspirated, 5 mL of saline is inserted and a reattempt to aspirate is made. If no fluid can be aspirated, entry into the peritoneal cavity is confirmed. If the saline is aspirated, an enclosed space was probably entered such as the preperitoneal space and the needle should be repositioned.

5. **Hanging drop test**: Involves placing a drop of water on the open end of the Veress needle and the abdominal wall is elevated. If the needle is correctly positioned, the water should disappear down the shaft. Until confirmation of proper position of the needle, insufflation should be low at a rate of 1 L/min.

6. Finally, the needle is attached to an insufflator that measures the pressure at the tip. The pressure will be low (5 mm Hg) if it is appropriately placed. Insufflation to 12-15 mm Hg with carbon dioxide gas follows.

Once this pressure is achieved, a 10 mm trocar with or without a safety shield is placed blindly into the abdomen. It must be emphasized that a full pneumoperitoneum should be established prior to insertion of the blind umbilical trocar. Once again, care must be taken to elevate and stabilize the abdominal wall and to ensure that the trocar is inserted in the midline safely.

- **Value of safety tests:** A recent retrospective study evaluating the double click sound test, aspiration test, hanging drop of saline test and the syringe test concluded that none of these tests is confirmatory for the intraperitoneal placement of the Veress needle and concluded that the most valuable test is to observe the actual insufflation pressure to be 8 mm or less and that the gas is flowing freely.
- **Angle of Veress needle insertion**: The position of the umbilicus was found, on average, 0.4 cm, 2.4 cm and 2.9 cm caudal to the aortic bifurcation in normal weight (BMI <25 kg/m2), overweight (BMI 25-30 kg/m2) and obese (BMI>30 kg/m2) women respectively. In all cases, the umbilicus was cephalad to where the left common iliac vein crossed the midline at the sacral promontory. Therefore, the angle of Veress needle insertion should vary accordingly from 45 degrees in non-obese women to 90 degrees in very obese women.



Angle of Veress needle insertion

- There are considerably fewer reports of bowel and major vascular injury in the literature using this technique than the Veress needle technique.
- Hasson presented his review of 5,284 women who had open laparoscopies and developed complications related to primary access. 21 had minor wound infections, four had minor hematomas, one developed an umbilical hernia that required surgery and one had an inadvertent injury to the small bowel that was repaired intraoperatively without adverse outcome. Access to the abdominal cavity was generally secured within three to ten minutes.
- The incidence of vascular injury rate in closed laparoscopy was 0.44% compared with 0% in open laparoscopy. The incidence of bowel injury was 0.7% compared with 0.5% respectively.

ALTERNATIVE VERESS NEEDLE INSERTION SITES

- **Left upper quadrant (LUQ, palmer's point):** In patients with a previous laparotomy, Palmer advocated insertion of the Veress needle three centimeters below the left subcostal border in the midclavicular line. This may be considered in the obese as well as in the very thin patient. The stomach should be emptied by nasogastric suction and the needle should be introduced perpendicular to the skin. Patients with previous splenic or gastric surgery, portal hypertension or significant gastropancreatic masses should be excluded.

ALTERNATIVE MEANS OF ENTRY

- **Open laparoscopy:** In general, trocar injuries to abdominal viscera occur **a)** when the viscera are unusually close to the point of trocar insertion or **b)** where the trocar penetrates too far into the abdominal cavity as it is inserted. The former can be anticipated when the patient has undergone a surgery previously. The best method of avoiding visceral injury in this case is to use the open Hasson technique or if the closed technique is used to place the first trocar at a site remote from the previous incision.
- The concept in the open technique is to create a tiny incision, directly incise the layers of the abdominal wall, directly cut the peritoneum and enter the abdomen. Since gas can escape around the incision, an olive is placed over the end of the trocar to occlude the incision and sutures are placed on the abdominal fascia and attached to the cannula.
- The proposed advantages for the open technique are avoidance of blind puncture with a needle and subsequent trocar, certainty of establishing a pneumoperitoneum and correct anatomical repair of the abdominal wall incision.
- Widespread use of this technique has been limited to women with previous lower abdominal surgery, pregnant women, children and very thin women where little space exists between the abdominal wall and the spine.
- Reasons for limiting the use of the open technique include greater time needed for performance, difficulty with the technique, obese patients and difficulty in maintenance of the pneumoperitoneum.

- **Direct trocar entry:** Dingfelder in 1978 was the first to advocate this technique in which where the abdomen is entered with a trocar without prior Veress needle entry and pneumo-insufflation.
- The advantages of this method are the avoidance of complications related to the use of the Veress needle: failed pneumoperitoneum, preperitoneal insufflation, intestinal insufflation and CO2 embolism.
- The direct entry method is faster than any other method of entry but is the least performed laparoscopic technique in clinical practice.

CHALLENGING SITUATIONS

- **Previous abdominal surgery:** This group of patients clearly represents a risk factor for adhesion formation. Patients with prior midline incisions had significantly more adhesions than those with Patients with prior midline incisions had significantly more adhesions than those with Pfannenstiel incisions suffered direct injury to the adherent omentum and bowel during the laparoscopic procedure.

A midline incision clearly presents a high risk for bowel adhesions under a planned umbilical trocar site; however, even scars away from the umbilicus can lead to adhesions at the umbilical site.

Alternative sites may be used for access with open or blind access techniques. One advantage of placing the first port in a site away from previous scars is the improved ability to see the abdominal cavity because vision is not obscured by adhesions. This allows for better assessment of location of remaining ports. Also, there is appropriate working distance necessary for manipulating the instruments.

- **Obesity:** The umbilicus is the thinnest area of the abdominal wall and needle insertion at this point is the easiest. The saline drop test and confirmation of an initial low intra-abdominal pressure are crucial in confirming proper intra-abdominal placement.

Another alternative is the use of the open insertion technique with a Hasson trocar. Large skin incision is necessary for Hasson trocar insertion in obese patients, leading to preoperative leakage of gas and to increased rates of wound infection postoperatively.

- **In very thin patients Hasson technique or insertion at Palmer's point is recommended.**

- **Large pelvic mass:** In this group of women, selecting an alternative supraumbilical site for primary entry will allow the greatest freedom of movement for manipulation of instruments as well as offer greater safety vis-à-vis damage to the pelvic mass e.g. fibroid, ovarian tumour or pregnancy.

CLASSIFICATION OF LAPAROSCOPIC ENTRY LESIONS

Type 1 injuries: Damage to major blood vessels or the bowel in a normal location, caused by entering with the Veress needle or the primary trocars.

Type 2 injuries: Damage to vessels in the abdominal wall and to the bowel adherent to the abdominal wall, both caused by the Veress needle or the primary trocar; type 2 lesions may occur regardless of whether the mode of access is laparotomy or laparoscopy.

COMPLICATIONS DURING LAPAROSCOPIC SURGERY

1. Gastro-Intestinal Tract injuries
2. Urinary tract injuries
3. Vascular injuries

GASTRO-INTESTINAL COMPLICATIONS

Risk factors:

- During the installation phase: Adhesions and anterior laparotomy are found in 68% of bowel
- Injury during the surgery procedure: 65% endometriosis
- The history of pelvic surgery X 10 risk of GIT lesion
- Mechanical injuries to the bowel are ten folds more frequent in patients who underwent PREVIOUS PELVIC SURGERY
- SEVERE ENDOMETRIOSIS is the main contributing factor for bowel injuries in patients with no previous surgery.
- Intestinal complications are responsible for most of morbidity and mortality during laparoscopic surgery
- Mortality in the bowel injury group was 21% when the diagnosis was delayed

Mechanism of GIT injuries:

- Direct trauma (instruments, forceps)
  - –Manipulation
  - –Adhesiolysis, enterolysis (bowel adhesions separation)
- Thermal trauma
  - –Bipolar
  - –Monopolar ++
  - –Ultracision, thermofusion, sealing methods

Late diagnosis:

- In average 4.0 + 5.4 (0-23) days after surgery
  - -Mechanical injuries: 1.3 days (0-4)
  - -Electro-thermal injuries: 10,4 days (0-38)

Prevention of gastrointestinal complications:

- Before surgery:
  - PV / PR examination
  - Trans Vaginal / Trans Rectal ultrasound
  - Imaging dynamic / spiral CTS / MRI
  - Bowel preparation?! In high risk cases such in severe endometriosis involving the colon and recto-vaginal space and patients with history of previous GIT operation
  - Nasogastric tube / mask ventilation (avoid stomach distention)
  - Vaginal packing / uterine manipulator
  - To opt for the lateral dissection
  - Attention to the electrical current used

URINARY TRACT COMPLICATIONS

1. Ureteral injuries
2. Bladder injuries
3. Fistulas
4. Bladder injuries are identified more often (87%) than ureteral injuries

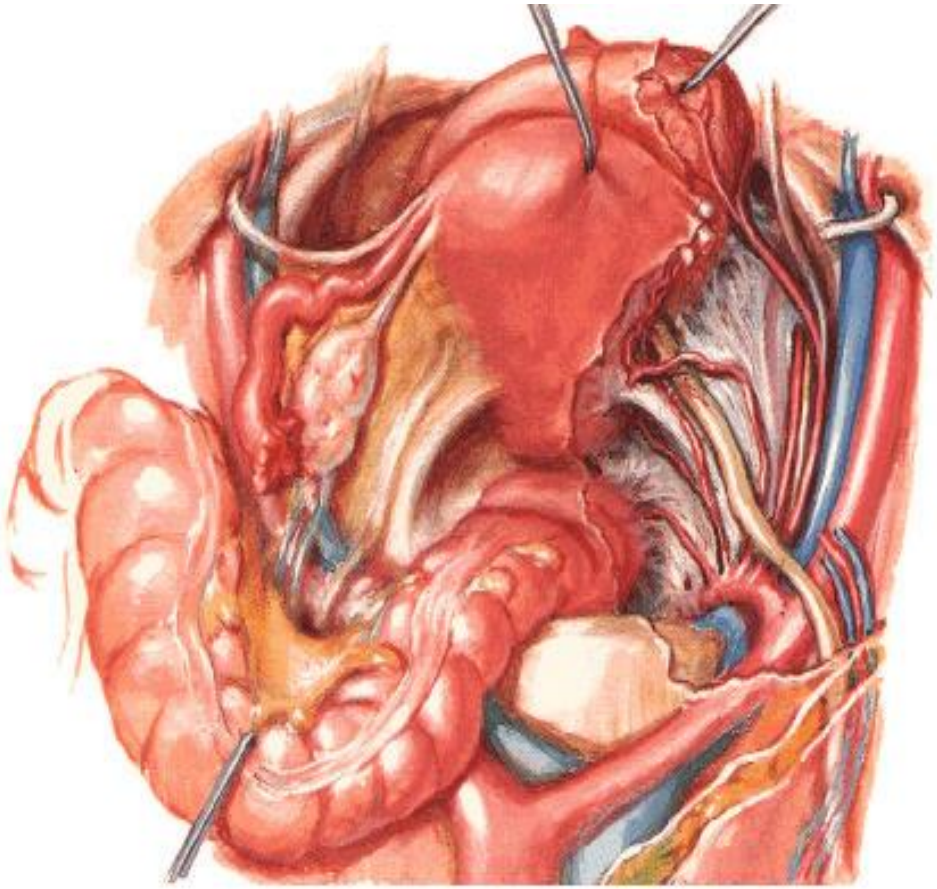
The rate increase with the difficulty of technique

- 0.027%
- 1.6% major laparoscopic procedures
- 3% hysterectomies

Ureteric lesions: sites

Ureter is vulnerable

- At the fossa ovarica
- At the uterine artery
- At the uterosacral/cardinal ligament
- At the infundibulo-pelvic ligament



High Risk Conditions

- pelvic endometriosis (65% of ureteric injuries)
- large uterus during hysterectomy
- Oophorectomy for a large ovarian /paraovarian cysts, residual or ovarian remnant syndrome
- cervical or intra-broad ligament myomas
- pelvic adhesions: due to previous pelvic inflammatory disease or surgeries
- congenital anomalies: pelvic kidney, ureteral duplication
- 50-75% of ureteral lesions occur during surgery of benign lesions, described as easy surgeries by the surgeon.

Postoperative ureteric injury symptoms:

- Clinical:
  - -Abdominal pain side
  - -(Flank) pain
  - -Distended abdomen
  - -Ileus
  - -Fever

IV ureterogram (IVP)

Retrograde ureterogram

Prevention:

- Ureter must be localized in all moments during the laparoscopy
  - -By identification under the peritoneum
  - -By dissection
  - -By pre-operative catherization (stenting), IVP, cystoscopy
- **Ureteral catheter:** systematic placement was abandoned because it does not prevent all lesions and has its own morbidity
- At the end of the surgery see ureter peristalsis and absence of dilatation

Bladder trauma:

- 1 to 2.3% in the advanced laparoscopy
- Mechanical or electro-thermal trauma

Mechanical trauma to Bladder occurs:

- During
  - -Adhesiolysis
  - -Resection of endometriosis implants
- The history of previous laparotomy increase the risk:
  - -Myomectomy
  - -Caesarean section

Diagnosis after Bladder injury:

•Pneumo sac – swollen bladder – entrapped CO2

•Hematuria

•Presence of urine in the abdominal pelvic cavity

•Post-operative anuria

Prevention:

• Bladder catheterisation

• Secondary trocars under vision

• Blunt dissection better than electrosurgery

VASCULAR INJURIES

1. Hypogastric vessels
2. External Iliac
3. Vena Cava
4. Aorta
5. Femoral aa/vv

- Usually happens during the installation phase and of course any injury may happens during surgery

Treatment of vascular injuries:

- Depends
  - -On the size
  - -On the vessel type

What to do ?

- Decision to stop the bleeding or sticking to the success of events
  - -Avoid to contaminate the optic
  - -Suction of the pneumoperitoneum
  - -Intestine returns in the pelvis
- To stop the bleeding with any instrument
- To identify the surrounding vulnerable organs
- To identify the type of the vessel
- To close the vessels
  - -Bipolar coagulation
  - -Clips
  - -Suture
  - -Laparotomy….

COMPLICATIONS OF LAPAROSCOPIC SURGERY

- **Early complications:** Early complications include bowel, vessel, bladder, or ureter lesions as well as anesthesia-related or general complications, such as pulmonary embolism, massive hemorrhage after major vessel injury or intravascular insufflation, and cardiac arrest.
- **Late complications:** these include secondary bowel lesions associated with peritonitis and massive intra-abdominal infection.
  - Small vascular lesions may remain unnoticed until a hematoma appears.
  - Some ureteral lesions remain unidentified until the development of an urinoma; this may occur several days after surgery.

THANK YOU