Safe Lap. Surgery

By

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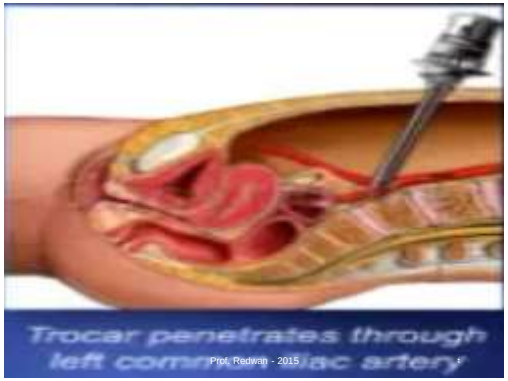
III - Vascular injuries (0.64%):

Anterior abdominal wall e.g, epig. vs.
Intra-abd.: liver, omental or mesenteric.
Major vessels: aorta, iliacs or I.V.C.

Aetiology:

Lack of relaxation. Small trocar wounds increased force. Blunt trocars.
Insufficient pneumo-peritoneum.
Bad direction of trocars.
Insufficient exposure of instruments tips.
Abnormal vessels: umbilical or urachal.



Caterpillar deformity

Trocar bleeding

see more on:

www.medtube.eu

Cystic artery bleeding

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Diagnosis:

Aspiration from veress needle.

Laparoscopic exploration.

Via drain.

May be missed:

Retroperitoneal

Barometric hemostasis.

(Low pressure lap. sugery)

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Treatment:

1- Abdominal wall:

-Transillumination. *- Avoid known vessels.*

- Diathermy . *- Vertical stitches.*

- Compression by foley's balloon.

2- Intra abdominal small vessels:

- Clipping. *- Coagulation.*

- Gauze compression. *- Stitches.*

- Cellulose, thrombine, or fibrine.

3- Large vs.

- Immediate laparotomy.

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Management of bleeding

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N.B.

Laparotomy Set Should Be Ready In Every Lap. Procedure.

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Major vascular injury : aorta ,IVC, Iliacs

- **Vascular injury** is a major cause of death from laparoscopy, with a reported mortality rate of .15%
- Major vascular injury: can occur:
  -Veress needle is inserted prior to insufflation.
  -or when a trocar is inserted after insufflation.

The reason for these injuries:

-is the close proximity of the anterior abdominal wall to the retroperitoneal vascular structures.

-In thin people, this distance can be as little as 2 cm. The distal aorta and right common iliac artery are particularly prone to injury.

-the take off of the right common iliac artery lies directly below the umbilicus

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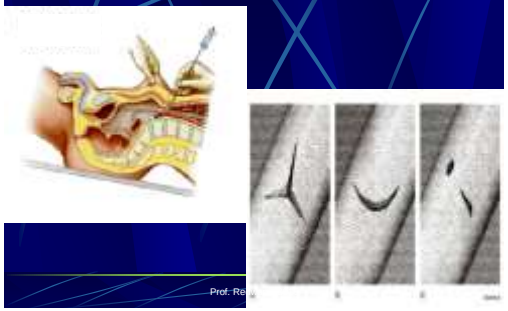
Vascular injuries

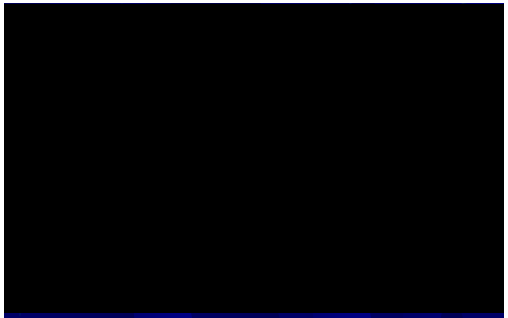


Massive bleeding from splenic art.

Massive bleeding from IVC

Minor vascular injuries

- the most common minor vascular injury is to the inferior epigastric vessels.
- reported to occur in up to 2.5% of laparoscopic hernia repairs.
- These injuries invariably occur during placement of secondary cannulas, which should be placed under direct vision and with prior transillumination of the abdominal wall.



Inferior epigastric artery bleeding

:Vascular&intestinal injuries

causes

- *A large survey of nearly 37,000* ***gynecologic laparoscopies in the US revealed:***
  - -a 0.16% incidence of bowel injury.
  - 39.8 % vascular and intestinal injuries were caused by the ***Veress needle.***
  - **37.9 %** by insertion of the ***primary trocar,*** and
  - 22% by the ***secondary trocar.***
  - -The remaining gastrointestinal injuries resulted during ***dissection, electrocoagulation, or grasping.***

Importantly, these investigators noted the ***experience of the surgeons was an important factor***

Site of insertion of Veress needle

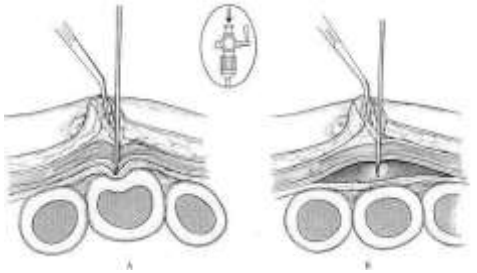
- **Superior or inferior crease of umbilicus**, in non obese patients (for abdominal procedures)
- **Trans-umbilical:** in obese patients.

Is umbilicus safe for ?access

- thinnest abdominal wall (easy access)
- cosmetically better.
- no significant blood vessels.
- Ergonomically better (centre point of abdomen).

- ***two fears regarding use of umbilicus:***
  - Infection.
  - Ventral hernia.

DURING INITIATION OF PNEUMOPERITONEUM



Insertion of the Veress needle

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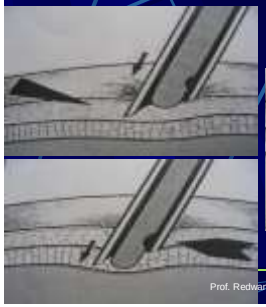


Insertion of the Veress :needle

Important precaussions:

1 Trendelenburg position.

2 Elevation of the abdominal wall.

3 direction of the needle at 45° to the spine and aimed toward the pelvis in the midline.

"Safety tests: "drop test

:Safety tests

- **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.

- **Irrigation test:**
  A 10 ml syringe / veress needle ⇒ inject at least 5 ml of normal saline through there will be free flow of saline otherwise.

  -If no fluid is removed, entry is confirmed.

  -If the saline is removed, an enclosed space (preperitoneal space) was probably entered ⇒ the needle should be repositioned.

:Safety tests

- **Manometer test-**-involves connecting the gas tubing to the Veress needle and raising the abdominal wall to create negative pressure.
- **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.
- the **needle is attached to an insufflator** that measures the pressure at the tip. The pressure will be low (5mmHg).

Formation of a cushion over the intestine

Choice of Gas for pneumoperitoneum

- *Carbon dioxide & N2O* are preferred because of increased risk of air embolism with room air.
- *CO2* is 200 times more diffusible than 02, is rapidly cleared from the body by the lungs and will not support combustion.
- *CO2* when come in contact with peritoneal fluid converts into carbonic acid ---- irritates diaphragm causing shoulder tip pain & discomfort in abdomen.
- Carbonic acid has one advantage also that it alters pH of peritoneal fluid (acidotic changes) and it is mild antiseptic.

-Insufflation of gas test, Quadro manometric test

1. Preset Insufflation pressure.
2. Actual Pressure.
3. Gas flow rate.
4. Volume of gas consumed.

PREVIOUS ABDOMINAL SURGERY

"a risk factor for adhesion formation"

- preoperative sonographic mapping of adhesions to help to determine a safe site for trocar insertion.
- placement of the needle at a site far from previous scars:
  -upper quadrants: Placement in the *midclavicular line* is safest in.
  - In the lower abdomen: the trocars are best placed *lateral to the epigastric vessels* but sufficiently medial to prevent colonic injury.

Previous abdominal surgery: Open "pneumoperitoneum "Hasson's technique

Optical trocar

- Vesiport.
- Optiview.
- Exel port.

Trocars

Ideal use of trocars without injury

:OBESITY

Problems: *the thickness of the abdominal wall and the preperitoneal fat.*

- The umbilicus is the thinnest area for the needle insertion.
- The use of the open insertion technique with a Hasson trocar.
- an extra long Veress needle may be reqired.

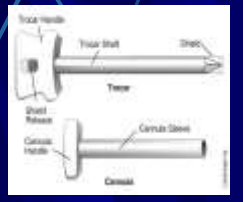
Trocar Components

- A trocar consists of:

1 Obturator
)Pyramidal/Conical/Blade
/Needle/Blunt(

2 Cannula (Sleeve(

3 Safety Shield (retractable)
Protects internal organs
against injury



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Trocar insertion

- *Holding* the trocar.
- *Angle of insertion:* perpendicular to the wall °70-60 ----after giving way.
- *Confirmation of Entry* of primary trocar:

-audible click
-whooshing sound.
-loss of resistance.

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Ideal axis for accessory instruments

IV - Nerve injuries:

- *Common in inguinal and sub-costal regions.*
- *Causalgia, hyposthesia ,or neuroma.*
- *Avoided by adequate knowledge of anatomy. e.g, no stapling of mesh below level of int. ring in herniorrhaphy.*

V - Thermal injuries:

-Revealed 4-10 days post operatively.
-Related to instrument used and surgeon's experience.

Monopolar diathermy:

-Patient is a part of the electric circuit.
-Current passes in the direction of least resistance → may affect un-targetted tissues specially if large grip of tissues.
-High heat radiation.
Electric spark → further injury.

Bipolar diathermy:

-Patient is not a part of the circuit.
-New instruments include scissors and hooks.
-High heat radiation.

Laser:

-Expensive.
-Needs special experience.
-Minimal tissue damage.

Argon beam coagulator:

-Spray surface coagulation e.g. suitable for G.B. bed. -Minimal penetration.
-Expensive. -May increase. I.A. pressure.

Endo coagulator:

-Very slow. -Very safe.
-Minimal damage.

Ultrasonic coagulation:

-No electric current. -No smoke.
-Minimal tissue destruction. -Expensive.
-Slower than electrocagulation

- The two most common methods of delivering RF electrosurgery are with monopolar and bipolar electrodes.
- **With monopolar electrosurgery:**
  -a **remote ground plate** on the patient's leg or back receives the flow of electrons that originate at a point source, the surgical electrode.
  -**A fine-tipped electrode** causes a high current density at the site of application and rapid tissue heating.
- Monopolar electrosurgery is inexpensive and easy to modulate to achieve different tissue effects.
- A short-duration, high-voltage discharge of current **(coagulation current)** provides extremely rapid tissue heating.
- Lower-voltage, higher-wattage current **(cutting current)** is better for tissue desiccation and vaporization.
- When the surgeon desires tissue division with the least amount of thermal injury and least coagulation necrosis, a cutting current is used.

- **With bipolar electrosurgery** the electrons flow between two adjacent electrodes.
- The tissue between the two electrodes is heated and desiccated.
- There is little opportunity for tissue cutting when bipolar current is used, but the ability to coapt the electrodes across a vessel provides the best method of small-vessel coagulation without thermal injury to adjacent tissues

Temperature & tissue Electrosurgery

- **At or above 44° C** --- tissue **necrosis** starts.
- **Between 50 & 80° C** --- **coagulation** occurs (collagen ⟶ glucose).
- **Between 80 & 100° C** ---- **dessication** (tissue become dehydrated).
- **Above 100° C** ----- **tissue turn to vapour**.
- **Above 200° C** ----- **carbonisation** begins (black eschar)

Temperature & tissue

Vaporization:

- - high current, low voltage
- - continuous waveform.

- Coagulation: 1- fulguration: *no contact*
  - -low current
  - -high voltage
  - - noncontinuous waveform
  - -much of energy is lost in air bet. electrode & the tissue

2-Dessication: *with contact*
the voltage-to-current is not important

Electrosurgery during :laparoscopy

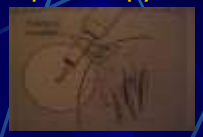
- **Potential hazards**:

A. access is obtained to the peritoneal cavity through trocars.

b. Laparoscope views only less than 10% of the electrosurgical probe.

c. Laparoscope is conductive (metal) & cannot be seen after it enters the trocar.

Electrosurgery during "laparoscopy: "cracks in insulation



- Active electrode has an insulated covering – 90% of which is out of the viewing range.
- Break in insulation in the shaft --- burns the organ touching the electrode.
(not noticed during surgery --- postop complications)

Electrosurgery during laparoscopy: "***capacitive*** "coupling

- Using monopolar electrosurgical energy when the active electrode touches the laparoscope accidentaly.

-metal trocars ---- ok.
-trocars with metal & plastic covering ---current may exit to the bowel or adj organ.

HOW TO AVOID THERMAL INJURIES :

1.Choose the most suitable tool for the procedure
2.Use the least possible coagulation power.
3.Cauterize the least amount of tissues at a time.
4.The whole un-insulated shaft of instrument should be under vision.
5.Multiple short repeated shots are better than a long one.
6.Proper connection & insulation of patient.

Late Complications Of Lap. :

1- Port site infection: depends on the procedure:
- 0.1% in diagnostic lap.
- 0.25 – 1% in lap. Chole.
- 2-3% in lap. Appendectomy.
- Can be reduced by retrieval bags.

2- Port site hernia: 0.1 – 0.3%:
- More with sharp instruments and big incisions i.e. > 10 mm.
- Avoided by closure of trocar sites 10 mm or more e.g by Maciol needles.

3- Port site malignant seedling
4- Intestinal obstruction:
- Adhesive: less than in open surgery.
- Incarceration in port hernia eg. Richter's type.

5- Ascitic fluid leak in liver cirrhosis and especially if a drain is left.

(Zigzag course, preplaced purse sutures, tissue adhesives, diuretics or ascites aspiration)

Proper training programs:

-Theoretical knowledge about laparoscopy, the instruments used, their mode of work & their problems.
-This should include technicians & nurses.
-Re orientation about the anatomy seen from a different angle.
-Aquaintance about practical handling of new instruments.

-Hand eye coordination with the help of pelvitrainers.
-The use of simulators e.g G.B., appendix, models for intracorporeal stitching and knotting.
-Full operations on animal models e.g pigs.
-Operating on human patients under strict supervision.
-Continuous training for advanced and new techniques.

Improvement of vision:

-Checking equipments before start.
-Checking connections e.g. a drop of cidex or saline between scope and camera or light cable can lead to failure of procedure.
-Proper placement of scope (not necessarily at the umbilical port).
-Minimize gas leak.
-The use of 3 chip camera improves colour definition.

-The use of 3D camera with special glasses improves the depth of picture.
-Higher resolution of camera and monitor improve quality of picture.
-Thermoflators and antifog solution reduce fogging on scope.
-Trained understanding camera man in a team is a must.
-Select the topography of ports to achieve the best angles of work.

How to avoid needle & trocar injuries:

1-Adequate relaxation.
2-Proper choice of site of 1st entry.
3-Lift abdominal wall up when introducing veress or blind trocar.
4-Direction towards pelvis or Lt. HC.
5-Evacuate bladder before op.
6-Do abdominal US before op.
7-Do not use blunt trocars.

8-Safety shield trocars are preferred.
9-The use of VISIPORT to penetrate under vision can help.
10-Open laparoscopy should be an alternative especially if previous laparotomy or distended gut is encountered
11-Force should come from wrist not from shoulder i.e. Avoid excess force.
12-Always test veress needle by aspiration + drop test before use.

GENERAL TIPS:

- The use of intra operative lap. Us probes can help differentiate vessels and ducts.
- The use of intraop. Endoscopy upper or lower can also add to the safety e.g in achalasia of cardia, or gastroplasty.
- Reusable instruments are better if autoclavable. Ethylene Oxide gas is an alternative though expensive

- Cidex sterilization is better avoided but if necessary it should be fresh and has sufficient time to work.
- Disposable instruments should not be reused.
- Patients should be fully monitored during operation and if necessary procedure should be turned into an open surgery
- LAPAROLIFT (gasless laparoscopy) can be an alternative to gas insufflations esp. in cardiac patients or those with history of D.V.T.

SAFETY MEANS

- PROPER TRAINING PROGRAMS.
- PROPER PT. MONITORING THROUGHOUT THE WHOLE PROCEDURE.
- PROPER STERILIZATION OF EQUIPMENTS & INSTRUMENTS.
- ACHIEVEMENT OF BEST POSSIBLE PICTURE, FIELD & VISION .
- AVOIDANCE OF ANY BLIND STEP.
- CONVERSION INTO AN OPEN SURGERY IS NOT A FAILURE.