

# In The Name Of God

# Complications RELATED TO ABDOMINAL ACCESS

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**FELLOWSHIP OF LAPAROSCOPY**

- ▶ **Up to one-half** of complications occur **at the time** of **abdominal access** for camera or port placement
- ▶ Complications can also arise from **abdominal insufflation**, **tissue dissection**, and **hemostasis**
- ▶ **Conversion to an open procedure** may be needed to manage complications that have been identified intraoperatively, while others may not be recognized until the postoperative period
- ▶ Severe complications such as **vascular injury** and **bowel perforation** can be **catastrophic** and are the main cause of procedure-specific **morbidity** and **mortality** related to laparoscopic surgery

- ▶ Complications related to **initial abdominal access** occur in **fewer than 1 percent** of patients
- ▶ Once abdominal access is **established**, complications during the course of the procedure are similarly **rare**

## type of organ injury during abdominal access

- ▶ Small bowel (25 percent)
- ▶ Iliac artery (19 percent)
- ▶ Colon (12 percent)
- ▶ Iliac or other retroperitoneal vein (9 percent)
- ▶ Secondary branches of a mesenteric vessel (7 percent)
- ▶ Aorta (6 percent)
- ▶ Inferior vena cava (4 percent)
- ▶ Abdominal wall vessels (4 percent)
- ▶ Bladder (3 percent)
- ▶ Liver (2 percent)
- ▶ Other (less than 2 percent)

# Risk factors

- ▶ **prior surgery** for intra-abdominal or pelvic disease (diverticulitis, pelvic inflammatory disease) have a **higher risk** of complications related to adhesions
- ▶ **extensive bowel distention**
- ▶ **very large abdominal or pelvic mass**
- ▶ **diaphragmatic hernia**
- ▶ patients with **poor cardiopulmonary reserve** may not be candidates for **abdominal insufflation** given the physiologic changes related to pneumoperitoneum
- ▶ For patients with risk factors for complications, the laparoscopic approach and approach to abdominal access need to be **carefully planned; an open approach may be preferred**
- ▶ The frequency of complications may be related **to surgeon experience** and the number of the specific procedures performed for some

# Vascular injury

- ▶ The overall reported rate of vascular injury (arterial or venous injury) ranges from **0.1 to 6.4 per 1000** laparoscopies
- ▶ **Most injuries** involve **minor vessels**
- ▶ **Vascular injury most commonly** occurs during **abdominal access** and is **second only** to **anesthesia** as a cause of **death** from laparoscopy
- ▶ Vascular injury **most commonly** occurs while placing a pneumoperitoneum **needle (Veress) or primary trocar**
- ▶ **Veress needle** is often implicated as the cause of **distal aortic or iliac vessel injury**, vascular injuries can occur with **any** of the available devices using open or closed techniques, during any laparoscopic procedure, including those in the upper abdomen

# Vascular injury

- ▶ Vascular injuries related to **abdominal access**

## **Major vascular :**

- ▶ Aorta
- ▶ inferior vena cava
- ▶ iliac vessels

## ▶ **minor vascular :**

- ▶ vessels of the abdominal wall
- ▶ mesentery
- ▶ other organs



# Minor vessels

- ▶ Vascular complications **most** commonly result from **laceration of minor vessels**
- ▶ these injuries are more **often** a **cause** for
  - ▶ **transfusion**
  - ▶ **conversion to an open procedure**
  - ▶ **reoperation**
- ▶ the site can be **coagulated or clipped**
- ▶ During **initial** abdominal access to establish pneumoperitoneum, **the omental and mesenteric vessels** are most commonly injured, particularly if there are **adhesions**

# Minor vessels

- ▶ The most common vascular **injury overall** is laceration of **the inferior epigastric artery** during placement of **lateral trocars** (usually as **secondary trocars**) in the lower abdomen
- ▶ Injury to **the inferior epigastric** vessels is **more common than** injury to the **superior epigastric vessels**, likely because the superior epigastric vessels in the upper abdominal wall often form a plexus of arteries
- ▶ **Partial lacerations** of the **inferior epigastric** artery vessels **may not spontaneously stop** bleeding, because the vessel is tethered and **cannot** retract and spasm

# Minor vessels

- ▶ Bleeding due to a vascular injury **at a port site** may **not** be observed with the port site cannulas in place and the abdomen insufflated due to tamponade
- ▶ **Delayed bleeding** can occur after the patient has been transferred from the operating room, typically within **one hour**
- ▶ **delayed abdominal wall hematomas** can present **two or three days** after surgery
- ▶ **Clinical manifestations** include:
  - **abdominal wall pain**
  - **abdominal wall or flank ecchymosis**
  - **external bleeding from a trocar site**
- ▶ Patients can also present initially with **hemodynamic instability** due to significant blood loss from a **port site** that **bleeds internally**

# Minor vessels

- ▶ Patients with an **abdominal wall hematoma** from laparoscopic access who are hemodynamically **stable** and with **no signs** of **hematoma expansion** can be managed **conservatively**
- ▶ The hematoma may **drain spontaneously** through **one or more port sites**
- ▶ **Intervention** is indicated if:
  - ▶ the hematoma expands
  - ▶ hemodynamically unstable
  - ▶ hematoma becomes infected
  - ▶ **rapidly** expanding hematomas leading to **hemodynamic instability** or **infected hematomas** are more effectively managed using **an open surgical** approach
  - ▶ **percutaneous embolization** of the bleeding vessel may be an option

# Major vessels

- ▶ injury to a **major retroperitoneal vessel** occurs, with incidences ranging from **0.1 to 1.0 percent**
- ▶ Injury to **major venous structures (inferior vena cava, iliac vein)** can also occur, and **massive air embolism** has also been reported due to unrecognized intravenous placement of a pneumoperitoneum needle and subsequent gas insufflation
- ▶ Injury to the **aorta or iliac vessels** during abdominal access can lead to rapid **exsanguination and death** unless prompt vascular control and repair are undertaken
- ▶ Major vascular injuries may be recognized **immediately** by observing **free blood** in the abdominal cavity

# Major vessels

- ▶ vascular injury **may not** be appreciated right away, due to bleeding into the **mesentery or retroperitoneum** rather than into the peritoneal cavity
- ▶ **Managing injury** to a **major vessel** requires subspecialty **expertise**, and consultation with a **surgeon experienced** with vascular procedures should be obtained without delay
- ▶ The **anesthesia team** should be immediately notified that there is a problem
- ▶ For patients in **lithotomy position** (gynecologic, rectal surgery), it is advisable to maintain the **extremities in an elevated position** to minimize hypotension
- ▶ For upper abdominal procedures for which the patient has been placed into **reverse Trendelenburg position**, the bed should be **flattened**, or placed **into Trendelenburg position**, as needed

# Major vessels

- ▶ If a vascular or trauma surgeon **is not immediately** available (community facility, ambulatory surgery center), we advocate a **damage control approach** as used in trauma surgery
- ▶ To minimize ongoing blood loss, the abdomen should be rapidly **opened with a midline incision**, **pressure** should be applied **directly** to the bleeding site for initial control, and the **abdominal cavity can be packed**, if needed
- ▶ These maneuvers allow for **fluid resuscitation** while awaiting the vascular or **trauma surgeon**, or arrangements for **immediate transfer** if subspecialty expertise is not available

# Conversion to an open procedure

The need to **convert to an open procedure** due to bleeding is determined :

- ▶ **rate of bleeding**
- ▶ the **amount of blood loss**
- ▶ the **clinical status of the patient** (tachycardia, hypotension, sepsis)
- ▶ **the presence (or lack) of a clearly defined source**
- ▶ the **comfort of the surgeon** with his or her ability **to see and control** the bleeding quickly using laparoscopic technique
- ▶ **Patient factors such as advanced age or poor functional status and comorbidities** (cardiopulmonary conditions, obesity, cirrhosis, clotting disorders)
- ▶ If **adequate visibility cannot be maintained**



# Conversion to an open procedure

- ▶ The decision to convert for bleeding is **justifiable and prudent**
- ▶ An **important source of patient morbidity results** from **the failure** to convert to an open procedure in a **timely** fashion when bleeding is encountered
- ▶ Laparoscopic hemostasis that is **partially effective or ineffective** can lead to **significant blood loss** and its associated clinical consequences
- ▶ It is important to be **vigilant** about the possibility of **injury to local anatomic** structures when attempting to control bleeding
- ▶ . **Extensive monopolar electrocautery** in this region can also result in a **thermal injury**

# Gastrointestinal puncture

- ▶ **Bowel injury** is **the third leading** cause of **death**, after anesthesia and major vascular injury
- ▶ most intestinal injuries during laparoscopy were incorrectly attributed to electrosurgery but were in actuality due to **pneumoperitoneum needle (Veress) or trocar placement**
- ▶ **Injury to the gastrointestinal** tract occurs in **0.03 to 0.18 percent** of patients undergoing laparoscopic surgery
- ▶ **Thirty to 50 percent** of inadvertent bowel injuries occur during **abdominal access**

# Gastrointestinal puncture

- ▶ The **small bowel** is the **most commonly** injured gastrointestinal structure during **abdominal access** for laparoscopic surgery, but **stomach, liver, and colon** injuries have been reported when subcostal access techniques are used
- ▶ **Decompressing the stomach** with an **orogastric or nasogastric** tube **prior** to upper abdominal access may minimize the potential for inadvertent stomach injury

# Gastrointestinal puncture

- ▶ **Many bowel injuries** go **unrecognized**, and, consequently, the patient can present postoperatively with or without **peritonitis**, often following discharge
- ▶ **The absence of peritoneal signs does not** rule out the possibility of bowel perforation and spillage of gastrointestinal contents within the peritoneal cavity
- ▶ **Delayed diagnosis** of an **access-related gastrointestinal injury** is a significant cause of **morbidity and mortality** and a **major** reason for legal action in the United States
- ▶ Nearly **one-half** of the injuries **were not** recognized at the time of the surgery
- ▶ **No patient** with bowel injury that was recognized **intraoperatively** sustained a postoperative adverse event, whereas patients with **unrecognized injury** and presenting in a **delayed fashion** required multiple procedures to manage the injury

# Gastrointestinal puncture

- ▶ reported a **higher incidence** of **bowel** injury with open compared with closed techniques. One large retrospective review reported an incidence of **0.4 percent** for **Veress** techniques and **1.1 percent** for the **open technique**
- ▶ A possible reason for a higher incidence may be a **selection bias** as some surgeons reserve open access techniques for patients anticipated to have complicated entry (adhesions)
- ▶ **Gastrointestinal injury** should be managed when recognized.

# Gastrointestinal puncture

- ▶ **Iatrogenic small and large bowel** injuries are managed as with other traumatic intestinal injuries, based upon **the grade of injury**
- ▶ Injuries due to the pneumoperitoneum needle (**Veress**) may be able to be managed **conservatively**
- ▶ Most **other trocar punctures** require **simple primary closure**, reapproximating the bowel wall with simple sutures in one or two layers
- ▶ For discrete large bowel injuries, colostomy is rarely needed
- ▶ If the operating surgeon is inexperienced or uncomfortable performing such a repair, we advise consultation with a **surgeon experienced** with bowel surgery

# Bladder puncture

- ▶ Bladder injury is a **rare** but reported injury during **abdominal access** for laparoscopy
- ▶ A history of **prior pelvic surgery** increases the risk of bladder injury
- ▶ Injury to the bladder **is more commonly** associated with **primary or secondary trocar insertion**, rather than related to **dissection** during the course of the operation
- ▶ **puncture** of the bladder results when a **midline, suprapubic trocar** is placed in a patient with an overdistended bladder

# Bladder puncture

- ▶ When anticipating port placement **below the level of the umbilicus**, a **Foley catheter** should be placed to **decompress** the bladder
- ▶ Although it is **common place** for patients to **void immediately** before the procedure, it is safer to drain the bladder with a catheter after the induction of anesthesia
- ▶ The catheter can also provide a means for **early recognition** of this complication
- ▶ Clinical signs of bladder injury include **gaseous distention** of the urinary drainage bag and **bloody urine**
- ▶ If a bladder injury is **suspected**, instillation of **indigo carmine or methylene blue** into the bladder may aid in identifying an injury



# Bladder puncture

- ▶ If the bladder is punctured with a pneumoperitoneum needle (**Veress**), **repair is generally not** needed
- ▶ **Small 3 to 5 mm punctures** in the **dome** of the bladder generally resolve **spontaneously** with bladder decompression for **7 to 10 days**
- ▶ **Larger or irregular defects** will require a **suture closure** with **absorbable** sutures using an open or laparoscopic approach
- ▶ The **Foley catheter** should be left in place for **4 to 10 days** depending on the size and location of the puncture or tear.
- ▶ If the operating surgeon is **unsure** of bladder management, **urology** consultation should be obtained

# Port-site hernia

- ▶ **Port-site hernia** following laparoscopic surgery is **less common** compared with **incisional hernia** occurring **after open surgery**
- ▶ **Trocar/port diameter** and **access technique** can affect the rate of hernia formation
- ▶ **Port-site hernia** appears to be related :
  - ▶ **more complex procedures** that require **multiple ancillary ports**
  - ▶ **larger-diameter ports** used for **specimen removal**
  - ▶ **stapling devices**
  - ▶ **single-site surgery**
  - ▶ **older age**
  - ▶ **higher body mass index**
  - ▶ **Increased operative times** and excess tissue manipulation (fascial weakening)

# Port-site hernia

- ▶ the risk of developing incisional hernia **is low** :
- ▶ use of **trocars  $\leq 12$  mm**
- ▶ **radially dilating trocars**
- ▶ **bladeless trocars**
- ▶ although uncommon, hernia has been reported for **5 mm trocar sites**
- ▶ Most authors **close fascial defects** if a **port  $> 12$  mm** is used, regardless of site or trocar/port type, and some advocate repairing **port sites  $\geq 10$  mm**

# Port-site hernia

- ▶ **port-site hernia** is identified following **laparoscopy**, the site **should be repaired** to prevent the development of intestinal **obstruction, strangulation**
- ▶ **Clinical manifestations** of port-site **dehiscence/hernia** include:
  - ▶ gross disruption of the wound with drainage
  - ▶ presence of a bulge with exertion or Valsalva
  - ▶ painful continuous bulge if bowel or omentum is incarcerated
  - ▶ clinical signs of bowel obstruction or infarction

# Surgical site infection

- ▶ **Wound infection** is **less common** following laparoscopic compared with open procedures; nonetheless, it can produce **significant morbidity**
- ▶ The presence of **significant peri-incisional erythema**, **wound drainage**, and **fever** may indicate the development of a **necrotizing fascial infection**
- ▶ Although the **umbilicus** is **more commonly** associated with **surgical site infection** than other trocar sites, this finding correlates with the use of the umbilicus as a **specimen extraction site**
- ▶ The incidence of wound infections can be **minimized** by appropriate administration of **prophylactic antibiotics**, **sterile technique**, and **use of bags during specimen extraction**
- ▶ surgical site infection **is treated** with **drainage**, **packing**, and **appropriate antibiotics**

# Complications **RELATED TO PNEUMOPERITONEUM**

- ▶ **subcutaneous emphysema** (improperly positioned pneumoperitoneum needle ( Veress) or port)
- ▶ **mediastinal emphysema** (improperly positioned pneumoperitoneum needle ( Veress) or port)
- ▶ **Pneumothorax** (physiologic effects of insufflation)
- ▶ **cardiac arrhythmia** (physiologic effects of insufflation)
- ▶ **carbon dioxide retention** (physiologic effects of insufflation)
- ▶ **postoperative pain related to retained intra-abdominal gas**( physiologic effects of insufflation)
- ▶ **air embolism due to venous injury**
- ▶ Patients who have **poor cardiopulmonary reserve** are not likely to be offered a laparoscopic procedure, and thus these complications are **uncommon**

# COVID-19 precautions

- ▶ **Open** and **minimally invasive surgery** can **both** produce **aerosolized particulate**
- ▶ The **severe acute respiratory syndrome coronavirus 2** (SARS-CoV-2), which is causing the COVID-19 pandemic, has been **identified in the blood and feces** of infected patients but **not yet in smoke/aerosol**
- ▶ Although some studies **failed to detect** the virus in **peritoneal fluid abdominal**, or **adipose tissue samples of patients with active COVID-19 infection**, at least one report has **detected**, the viral load in the peritoneal fluid was higher than that detected in the upper respiratory material from the same patient

# COVID-19 precautions

- ▶ In communities where SARS-CoV-2 infection is **prevalent**, for **laparoscopic surgeons** have suggested that:
  - ▶ **symptomatic patients be tested for SARS-CoV-2 infection**
  - ▶ **smoke plume generated by electrosurgery be minimized**
  - ▶ **devices be used to filter released carbon dioxide for aerosolized particles**
  - ▶ **personnel** attending laparoscopic procedures be **protected at minimum by N95 masks and face shields**, among other personal protective equipment
  - ▶ recommend that such patients **be treated medically and invasive procedures** be deferred until the SARS-CoV-2 infection has been **fully treated**



► **Thanks**