Abdominal access techniques used in laparoscopic surgery

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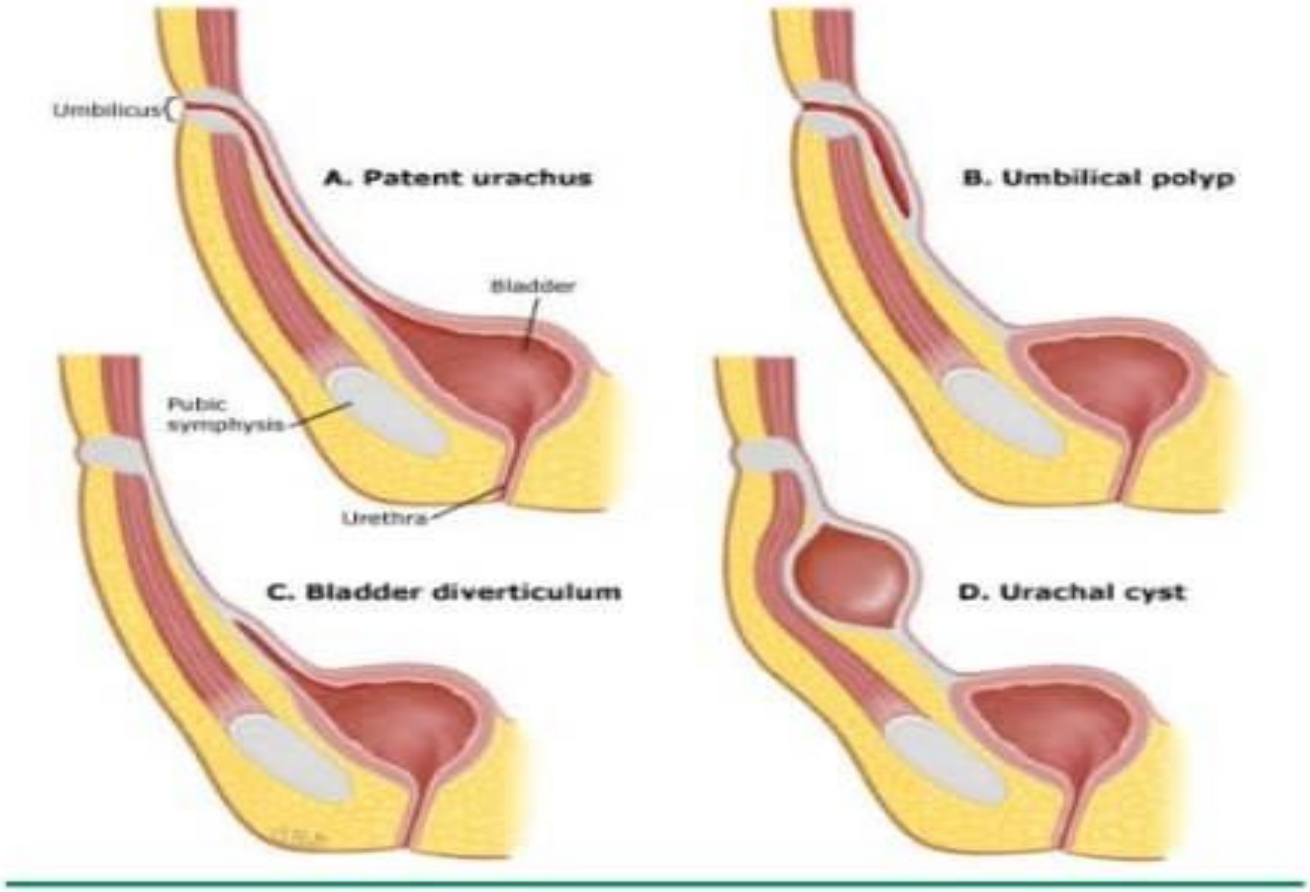
ABDOMINAL WALL ANATOMY

- **Midline abdomen**
- devoid of important vessels and nerves
- preferred initial access
- include skin, subcutaneous fat, and a fascial layer (the linea alba)
- The round ligament of the liver running within the falciform ligament attaches to the posterior aspect of the right rectus muscle in the upper midline abdominal wall as low down as the umbilicus.
- Previous midline abdominal incision can be associated with signiffcant underlying adhesions

ABDOMINAL WALL ANATOMY

- **Umbilicus**
- the most common location for access with a pneumoperitoneum
- fusion of fascial layers and is devoid of subcutaneous fat
- The median umbilical ligament (obliterated urachus) and paired medial umbilical ligaments (obliterated umbilical arteries) are peritoneal folds that join together at the inferior margin of the umbilicus,forming a tough layer.
- A defect in the umbilical fascia with or without the presence of a mass suggests an umbilical hernia
- Anomalies of the urachus may also exist

Anomalies of the urachus



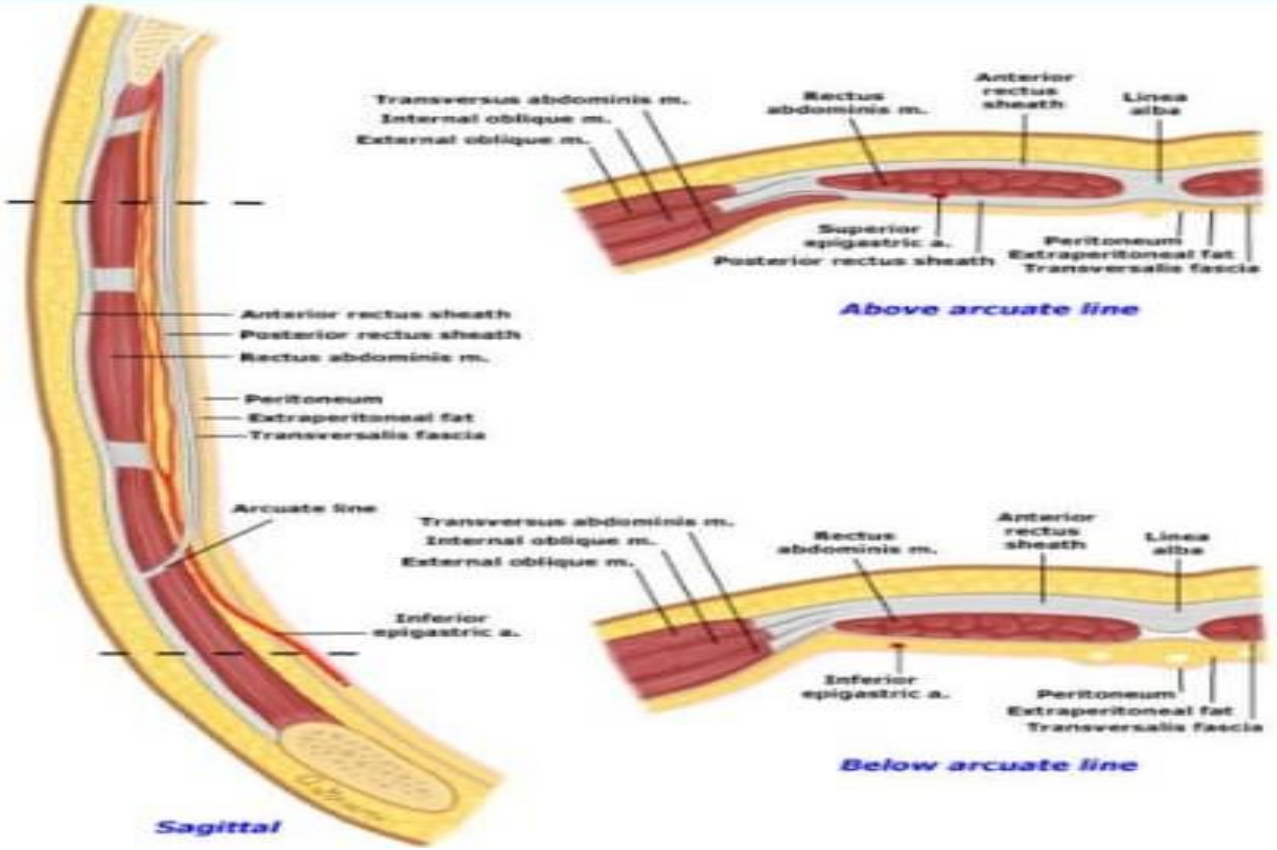
ABDOMINAL WALL ANATOMY

- **Medial costal margin**
- include the skin, subcutaneous fat, anterior rectus fascia, rectus muscle,posterior rectus fascia, transversalis fascia, transversus abdominis muscle, preperitoneal fat, and parietal peritoneum
- The superior epigastric artery runs along the underside of the rectus muscle in its midline
- The region where the external oblique, internal oblique, and

transversalis fascia fuse immediately lateral to the rectus muscle (linea semilunaris) contains no vessels

Sectional view of the abdominal wall musculature

Sectional view of the abdominal wall musculature



ABDOMINAL WALL ANATOMY

- **Lateral abdomen/flank**
- commonly used for the placement of retracting instruments
- Palmer's point is located 3 cm below the left costal margin, just lateral to the rectus muscle in the midclavicular line
- Palmer's point can also be used as a site for initial insufflation of the abdomen with a Veress needle when a transumbilical site cannot be used or is not preferred

- the layers of the abdominal wall include the skin, subcutaneous fat, fascia and muscle of the external oblique,internal oblique, and transversus abdominis (outward to inward), preperitoneal fat, and parietal peritoneumThe deep
- nerves and vessels of the abdominal wall run parallel to each other traveling along the posterior surface of the internal oblique

Sectional view of the abdominal wall musculature

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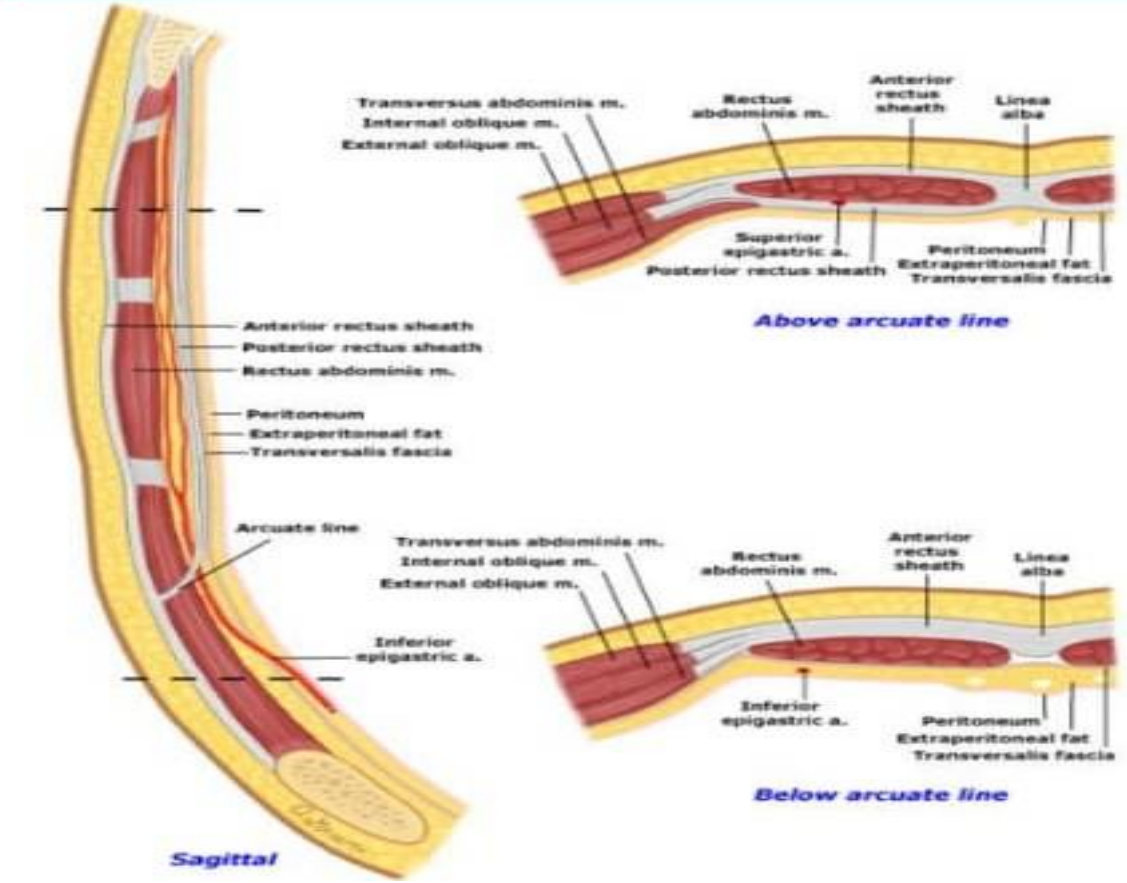

Blood vessels of the anterior abdominal wall

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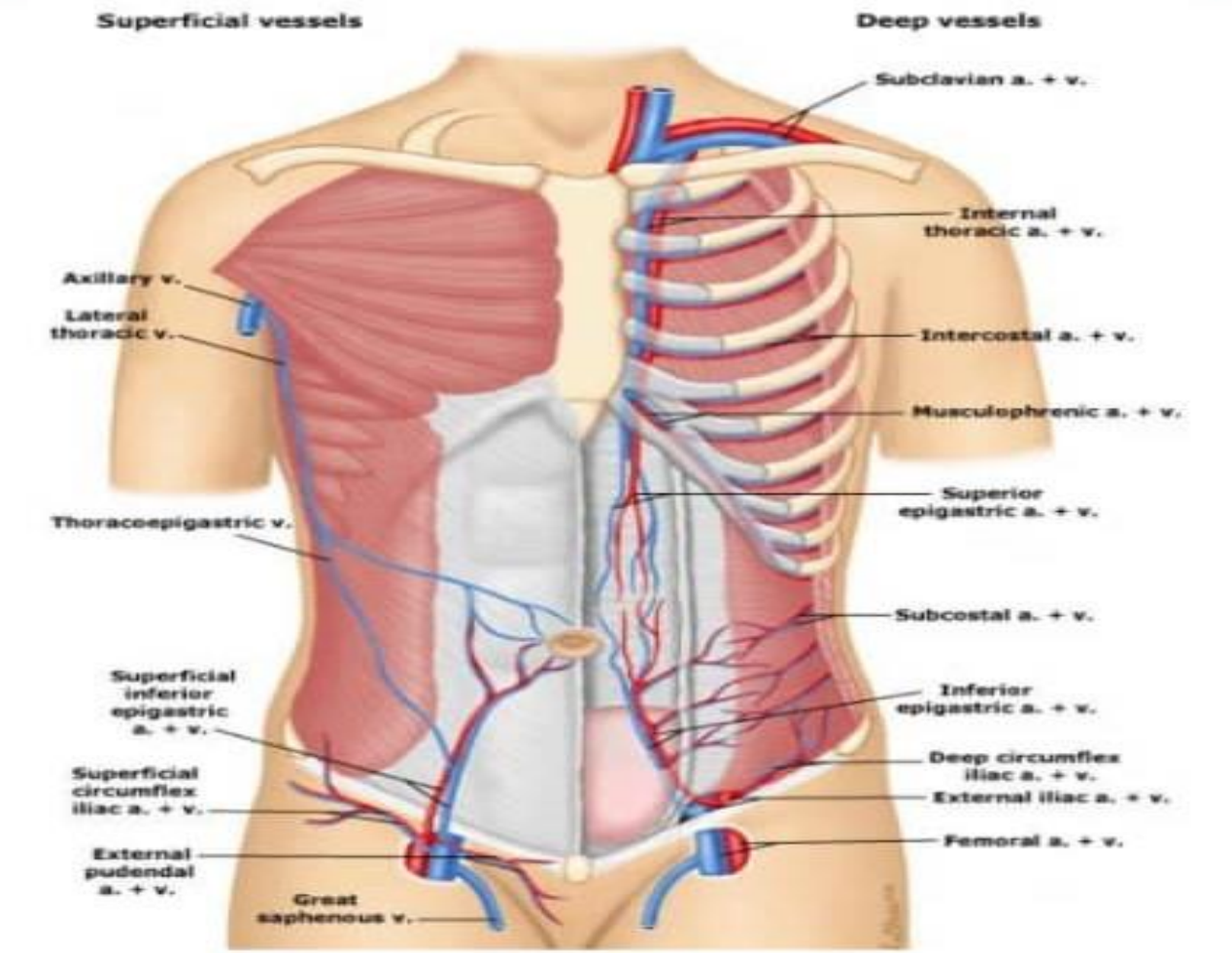


ABDOMINAL WALL ANATOMY

Ninth left intercostal space

- uncommon, site that is useful for primary insufflation of the abdomen when other sites are not available.
- The intercostal space is accessed in the anterior axillary line close to the superior margin of the tenth rib. This site approximates the inferior margin of the posterior spleen.
- The splenic flexure of the colon is also in proximity, making this access point more challenging than more medial sites.

ABDOMINAL WALL ANATOMY

- **Hypogastrium**
- used for laparoscopic surgery on pelvic structures
- the inferior and superffcial epigastric arteries,supeffcial and deep iliac circumflex arteries, and iliohypogastric and ilioinguinal nerves
- the vessels are not obvious prior to laparoscopic access, the laparoscope can be used to transilluminate the abdominal wall and identify the vessels.
- Access just medial and superior to the anterior superior iliac spine avoids these structures

PERITONEAL ACCESS

- open (Hasson)
- Closed

Prior to peritoneal access, we decompress the stomach and/or bladder to minimize the likelihood of bowel or bladder injury, depending on the point of entry

Open (Hasson)

- an incision (usually periumbilical) is made through the abdominal wall under direct vision
- adds to the length of the procedure
- most commonly used in the periumbilical region

Open Procedure

- Make an incision in the skin.
- Bluntly dissect the subcutaneous fat with a clamp (tonsil, Kelly).
- Cauterize, or ligate and divide, any vessels that are encountered.
- Place Kocher clamps on the fascia or umbilical stalk (if utilizing periumbilical region).
- Incise the fascia until a small amount of preperitoneal fat is identiffed. Place stay sutures in the fascial edges.
- The stay sutures aid with retraction of the abdominal wall and can be used to secure the port to the fascia, preventing its displacement during the surgery.

- B luntly dissect the preperitoneal fat, if present, and bring the peritoneum up into the wound with a hemostat. Open the peritoneum sharply, sweep the underside of the abdominal wall with the index finger to clear omentum or bowel, and confirm the absence of adhesions in the region of the incision.

- Place a blunt-ended trocar (ie, Hasson) through the incision, and secure it with the stay sutures or by inffating a balloon-tipped trocar, if used.

- Attach the gas (typically carbon dioxide) to the port and insuffate the abdomen.
- At the end of the procedure, remove the stay sutures, or, alternatively, use them to close the fascial defect.

Closed (Veress needle)

- a closed method in which the Veress needle (named for Janos Veres) is used
- a small-bore (2 mm) needle
- the clinician usually feels or hears protective sheath/obturator "click
- The most common insertion site for the Veress technique is the umbilicus
- quick entry
- a reduced risk for access site hernia with this technique

disadvantage of closed

- increased risk of major vascular complications
- The distance between the base of the umbilical stalk and the aorta is generally less than 4 cm and as little as 2 cm in thin individuals

Alternative sites

- other points in the midline
- the medial costal margin
- the ninth left intercostal space
- the lateral border of the rectus muscle 3 cm below the left costal margin(ie, Palmer's point)
- the lateral border of the rectus muscle at the level of the iliac crest.

Procedure

- Estimate the length of Veress needle needed to reach the peritoneal cavity.
- Make a 5 mm incision in the skin and the subcutaneous tissue
- Place the needle through the incision to the level of the fascia, mark the depth on the needle, then remove the needle
- Grasp the fascia (eg, manually, Kocher clamp) and elevate the abdominal wall, unless a subcostal site is used
- Grasp the Veress needle just above the previously marked site and insert it through the incision at a 45 degree angle toward the hollow of the pelvis, or away from fixed viscera, with care not to deviate in laterally
- Feel for two "pops.“
- displaced hub of the needle will "click" as the protective sheath recoils to cover the end of the needle

confirming Veress needle placement

- Saline aspiration and injection
- Hanging drop method
- Measurement of intraperitoneal pressure

Visual entry technique for primary and secondary port placement

- a specialized optical trocar/port that has a transparent tip
- Optiview, Kii optical access system, and Visiport

Advanced access techniques

- **Single-incision surgery**

- **Natural oriffce transluminal endoscopic surger**

  access to the peritoneum is obtained by traversing a "natural" oriffce

  a true "scarless"

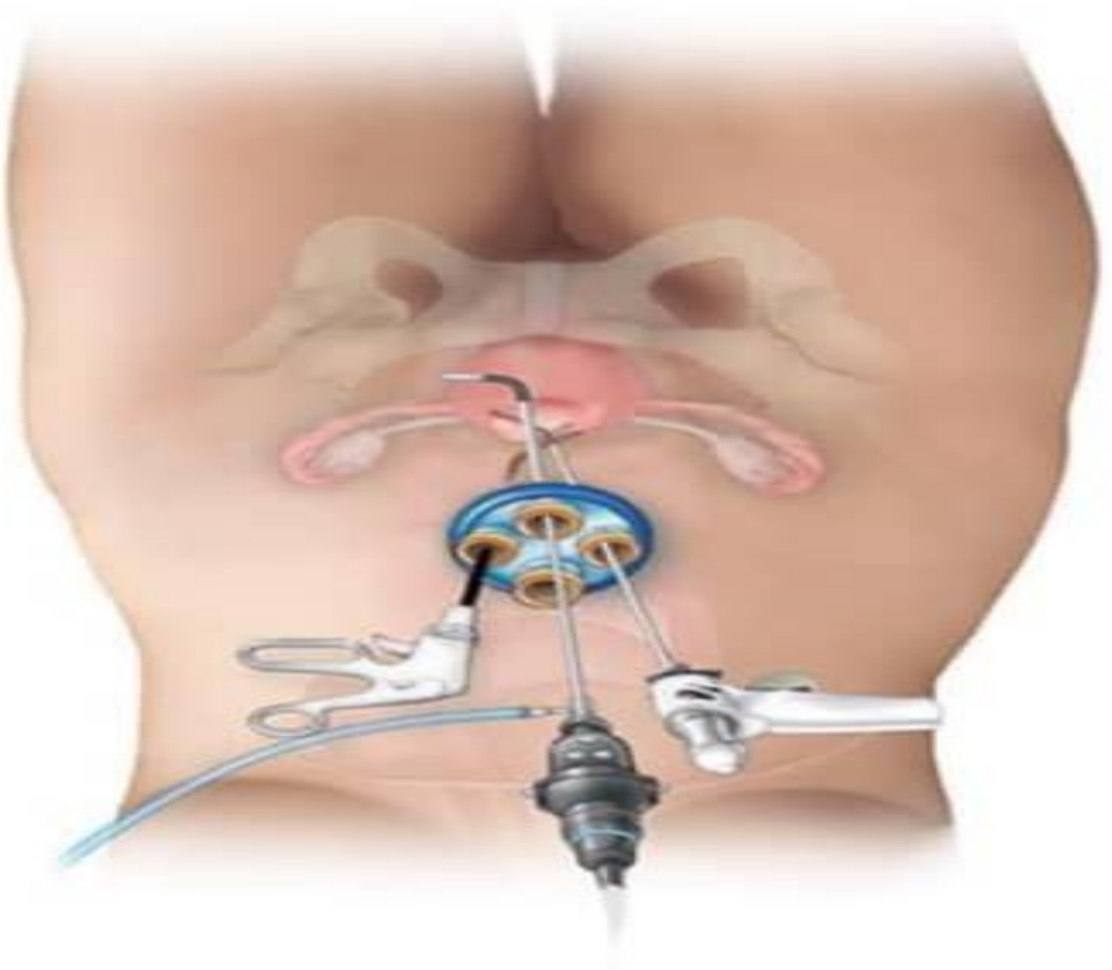
- **Alternative sites used in gynecologic laparoscopy**

  uterine fundus

  posterior vaginal fornix

instruments

Laparoendoscopic single-site surgery: Multichannel ports and instruments



Single incision laparoscopic surgery

Single incision laparoscopic surgery

Three instruments have been introduced through a single umbilical port.

Courtesy of Dr. Aurora Pryor.

Graphic 64522 Version 1.0

Establishing pneumoperitoneum

- carbon dioxide (CO_2) gas nitrous oxide and helium
- The pressure will initially be <10 mmHg but will slowly increase
- Intra-abdominal pressure of 12 to 15 mmHg
- If the pressure rapidly increases to 12 to 15 mmHg, then the needle/port may be displaced or occluded.
- the angle or rotating the trocar or Veress needle can also help free the opening
- During insuffation, increased intra-abdominal pressure stimulates the neurohumoral vasoactive systems, resulting in increased heart rate, mean arterial pressure, and systemic and pulmonary vascular resistance while decreasing vital capacity, venous return, preload, and cardiac output
- The CO_2 gas causes hypercapnia and respiratory acidosis due to absorption of the gas across the peritoneal surface.
- Monitoring end-tidal CO_2
- concentration is mandatory, and minute volume should be increased to maintain a normal CO_2 level
- Arrhythmias are a potentially serious consequence of hypercarbia.
- Renal parenchymal compression and decreased renal blood flow may result in temporary oliguria, which typically resolves upon release of pneumoperitoneum

Fascial closure

- If the open (Hasson) technique or a port ≥12 mm is used, the fascia should be closed
- Port sites established in a region of prior mesh should be closed with permanent suture.

Fascial reapproximation can be accomplished in a variety of ways:

- directly visualized with the aid of retractors
- A number of specialized instruments have been devised for port site fascial closure (Grice suture needle, Carter-Thomason needle-point suture passer, Endo Close instrument, Reverdin suture needle)

CHOICE OF TECHNIQUE

- **Access for insuffation**
- Surgeons should adhere to the technique with which they have the most experience but should be familiar with alternative techniques
- For access in the region of the umbilicus, either Hasson or Veress techniques can be used
- A third alternative of blind trocar access without insuffation has been described, but there are inadequate data to support its use.

Primary port placement

- the primary port can be placed either through the Veress needle track (except ninth rib approach) or elsewhere in the abdomen with either a simple (blind) trocar or visual entry trocar

Secondary port placement

- Secondary ports can be placed with either
  - nondisposable trocar
  - shielded disposable trocar
  - visual entry trocar
- with direct observation with the laparoscope of the trocar entering the abdomen
- Ports should be placed to facilitate operating in-line with the camera while maintaining triangulation and adequate spacing between the hands

Special considerations for access

- **Umbilical hernia**

access away from the umbilicus is suggested (subcostal location)

- **Prior abdominal surgery**

open access should be performed

- **Obesity**

longer trocars and Veress needlesopen technique

entry location should be based upon bony landmarks and not the location of the umbilicus since it can be displaced several centimeters inferiorly

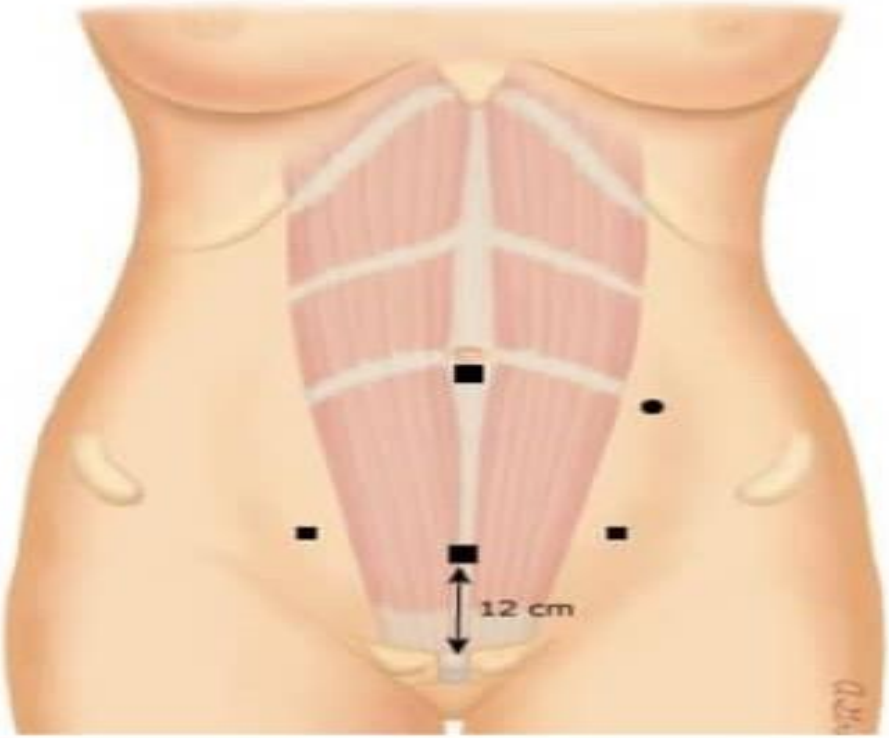
a 90 degree insertion angle is used

- **Pregnancy**

Open access

Port sites for laparoscopic hysterectomy

Port sites for laparoscopic hysterectomy



TROUBLESHOOTING ACCESS ISSUES

Failed entry

- If bile, enteric contents, or blood returns at placement of the Veress needle, the needle should be left in place and alternative access gained immediately
- Alternative access can be laparoscopic unless the bleeding is signiffcant, in which case open laparotomy is warranted

If entry fails but there is no complication, access can be reattempted at the same site

Leaking port

due to:

the fascial defect being too large

excess port angulation

- Balloon-tipped trocars can be helpful
- additional sutures
- the placement of a towel clamp to cinch the tissue
- Petrolatum-coated gauze

Loss of port position

- the port may need to be repositioned and/or secured with additional sutures
- Even ports not speciffcally designed to be sutured in place (no rings or suture stays) can be easily secured using a drain or "sandal"-type stitch
- use of longer or larger-diameter trocars or balloon/expandable-tip trocars may also be helpful

Bleeding port

- Bleeding from the abdominal wall may not become apparent until after the port is removed
- Bleeding points can usually be identiffed and managed with electrocautery
- On occasion, the skin incision may need to be enlarged to control the bleeding.
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- If persistent bleeding continues, a Foley catheter can also be inserted, inffated, and gentle traction applied to tamponade the site
- If this maneuver fails, U-stitches can be placed into the abdominal wall under direct laparoscopic visualization using a suture passer with absorbable braided suture.

Loss of pneumoperitoneum

- Under some circumstances, the established pneumoperitoneum may need to be temporarily released (eg, patient intolerance, hemodynamic instability, for portions of some surgical procedures) or is lost due to a leaking port or equipment malfunction.
- Most trocars have stopcock valves to easily release pneumoperitoneum if this is required.
- To reinstitute pneumoperitoneum, the stopcock can be turned back in line with the gas flow.
- To troubleshoot inadvertent loss of pressure, all potential loss sites should be assessed, including the gas supply, insuffation tubing, insuffator, valves, and port sites .

Extraperitoneal insufflation

- Subcutaneous
- preperitoneal
- omental insufflation
- direct access without insufflation minimizes the incidence
- if the device is inadvertently withdrawn out of the peritoneum, subcutaneous insufflation of CO2 gas will occur and insuffation pressure will quickly rise ≥15 mmHg.
- The abdominal wall distends but is not tympanitic, and crepitus instead will be noted in the subcutaneous tissues.
- Subcutaneous CO2 insufflation may increase the end-tidal CO2, and anesthesia personnel should be notiffed if extraperitoneal insufflation has occurred
- In the elderly, and patients with compromised tissue integrity (eg, collagen, vascular, or mixed connective tissue disorders), subcutaneous CO2 insu$ation can progress rapidly, quickly reaching the chest wall, neck, and face

Minimizing access-related pain

- Postoperative shoulder pain is not uncommon
- referred pain due to irritation of the diaphragm
- Pain from trocar placement
- reduce the initial insuffation rate and insuffation pressure
- warming and humidifying the CO2 gas
- removing residual CO2 gas at the end of the procedure
- The displacement of
- trapped CO2 gas may be improved with the instillation of normal saline, or by using pulmonary recruitment maneuvers, which involve multiple manual pulmonary inflations by the anesthesiologist (increases intra-abdominal pressure)

2019 Cochrane systematic review and meta-analysis of 32 studies found the following interventions to be associated with reduced shoulder pain after gynecological laparoscopic procedures

- A specific technique for releasing the pneumoperitoneum
- Intraperitoneal fluid instillation
- An intraperitoneal drain
- Local anesthetic applied to the peritoneal cavity (not subdiaphragmatic)

Subdiaphragmatic intraperitoneal local anesthetic and warmed and humidifed gas did not make a difference to shoulder pain. Gasless laparoscopic actually increased the severity of shoulder pain

Inadequate exposure

- If exposure or dissection is diffcult or unsafe:

additional trocars should be added to maintain patient safety.

- This is particularly important during single-site procedures, which should be abandoned in favor of a multiport technique if a good view of the operative field cannot be established.

Thanks