Laparoscopic Abdominal Access

EXCERPT FROM NEW TEXTBOOK
Prevention and Management of Laparoendoscopic Surgical Complications, 2nd Edition

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PATIENT PREPARATION AND POSITION

The anesthesiology team and circulating nurses coordinate the patient's transfer onto the operating table. The operative site is cleansed and shaved preoperatively. Operating tables must be designed to provide a 25-degree Trendelenburg position. After the induction of endotracheal anesthesia, an oral or nasogastric tube should be placed to deflate the stomach. Sequential compression devices are placed on the legs, which are then placed in padded stirrups to provide good support and proper position. Padding near the peroneal nerve is essential. To avoid nerve compression, no leg joint is extended more than 60 degrees for pelvic procedures. The buttocks must protrude a few centimeters from the edge of the table to allow uterine manipulation. The patient's arms are placed at the side, padded with foam troughs, and secured by a sheet. This allows the surgeon and assistants to stand unencumbered next to the patient. The anesthesiologist should have easy access to the patient's arm (**Figure 1**).

Once the patient is positioned, her abdomen, perineum, and vagina are prepared with a suitable bactericidal solution, and a Foley catheter is inserted. She is draped to expose the abdomen and perineum, and a pelvic examination is performed. Cystoscopy may be indicated for male or female patients and hysteroscopy may be indicated for female patients undergoing diagnostic and operative laparoscopy. After withdrawal of the hysteroscope, a uterine manipulator is inserted into the cervical os to manipulate the uterus and for chromopertubation. Rectal and vaginal probes can help separate the tissue planes of the cul-de-sac. The assistant can do a simultaneous rectal and vaginal examination for the same purposes. A sponge on a ring forceps is placed in the posterior fornix to outline the posterior cul-de-sac or anteriorly to identify the vesicouterine space. In patients who are suspected of having rectosigmoid endometriosis, a sigmoidoscopic examination is suggested. The rectum is insufflated to look for bubbles as they pass into the posterior cul-de-sac filled with irrigation fluid [1].

PLACEMENT OF THE VERESS NEEDLE

Insertion of the Veress needle, the primary trocar, and the secondary trocars is an important aspect of diagnostic and operative laparoscopy. Serious complications and injuries can occur during these procedures. The following factors increase the risk of injury:

1. Previous abdominal and pelvic operations

2. Body weight (whether patient is very obese or very thin)

3. A large uterus and the presence of a large pelvic mass

4. Failure to deflate the stomach with an oral or nasogastric tube

The optimal location for the Veress needle and primary trocar is intraumbilical because the skin is attached to the fascial layer and anterior parietal peritoneum with no intervening subcutaneous fat or muscle. The transumbilical approach accounts for the shortest distance between the skin and the peritoneal cavity even in obese patients. When a patient is morbidly obese, or her umbilicus exhibits poor hygiene, or a suspicion exists of an umbilical hernia, initial placement can be above or below the umbilicus. These sites sometimes are modified. The primary trocar is inserted above the umbilicus even subxiphoid in patients who have an enlarged uterus caused by a uterine leiomyoma, pregnancy, or sometimes for para-aortic lymph node dissection.

Before the needle is inserted, a transverse or vertical cutaneous incision is made large enough to accommodate the primary trocar. A vertical umbilical incision provides better cosmetic results.2 When one is incising the umbilicus, a skin hook is used to grasp and evert the base of the umbilicus, raising it from the abdominal structures. If needed, and especially in the case of morbidly obese patients, a Kocher clamp can be used to grasp the fascia, lift up, and further increase the distance between the fascia and underlying abdominal structures.

One should check the patency of the Veress needle before it is inserted. Traditionally, the angle of insertion is approximately 45 degrees for an intraumbilical placement while the patient is horizontal; a premature Trendelenburg position alters the usual landmarks (**Figure 3**). Transumbilical placement with a 90-degree angle of insertion is recommended after proper training with this technique. Palpating the abdominal aorta and the sacral promontory is performed first. The patient is completely flat, and the operating table is all the way down to maximize the surgeon's upper body control during insertion of the Veress needle. The Veress needle, held at the shaft, is directed toward the sacral promontory (**Figure 4**). The surgeon and assistant apply counter traction by grasping the skin and fat on each side of the umbilicus with a towel clamp [3]. In obese patients, a 90-degree angle is necessary initially to enter the peritoneal cavity. In thin individuals, vital structures are closer to the abdominal wall, so the surgeon makes certain that the abdominal wall is elevated and only a small portion of the needle is inserted into the abdominal cavity. That is rarely more than 2 cm to 3 cm of the Veress needle or trocar. A prospective study [4] involving 97 women undergoing operative laparoscopy showed that the position of the aortic bifurcation is more likely to be caudal to the umbilicus in the Trendelenburg position, compared with the supine position regardless of body mass index. Its presumed location can be misleading during Veress needle or primary trocar insertion. The physician must be careful to avoid major retroperitoneal vascular injury during this procedure.

VERIFICATION OF INTRAPERITONEAL LOCATION

Failure to achieve and maintain a suitable pneumoperitoneum predisposes the patient to complications.

“Hanging Drop” Method

Correct needle placement is verified by the “hanging drop” technique. A drop of saline is placed on the hub of the Veress needle after insertion through the abdominal wall.

Lifting the abdominal wall establishes negative pressure within the abdomen, drawing the drop of fluid into the needle. Absence of this sign indicates improper placement of the Veress needle.

Additional methods of verifying proper placement of the Veress needle are summarized in **Table 1**.

PLACEMENT OF THE PRIMARY TROCAR

The sharp primary trocar is aimed toward the sacral promontory. Dull trocars require increased force during insertion, multiple insertions, and excessive instrument manipulation. The insertion of a disposable-shielded trocar in the presence of a pneumoperitoneum requires half the force needed for the insertion of a reusable sharp trocar. The disposable trocar shield does not completely prevent injury [11]. Using these new devices can inflict injury because of the unexpected ease of their insertion. Numerous mesenteric, bowel, and vascular injuries have been reported with the use of disposable trocars.

A pneumoperitoneum reduces the proximity of the abdominal wall to the spine and the potential for damage to bowel and vessels [12]. Whether a pneumoperitoneum is associated with a lower incidence of trocar-related injuries is unproved.

Conventional Technique

The direction of trocar insertion is 90 degrees to the abdominal wall plane toward the sacral
promontory. Control of the laparoscopic trocar is essential as it penetrates each layer of the anterior abdominal wall. The trocar is inserted with the patient in a horizontal position because viscera tend to slide away from the advancing trocar. A premature Trendelenburg position does not prevent visceral injury even if significant adhesions are present. Altering the patient's position affects the surgeon's view of important landmarks, such as the sacral promontory and hollow of the sacrum. The major anatomic landmarks include the umbilicus located at the level of L3 and L4. The abdominal aorta bifurcates between L4 and L5.

In a program for laparoscopic sterilization, Soderstrom and Butler [13] revealed that the complication rate was reduced 10-fold when a consistent operating format was used. Successful insertion depends on an adequate skin incision; trocars in good working condition (disposable trocars should be checked to be sure they are not locked); proper orientation of the trocar, sheath, and surgeon's hand; and control over the instrument's force and depth of insertion.

With all trocar insertions, the surgeon must hold the instrument properly with the patient in a supine position at the height of the surgeon's waist or slightly below it. The trocar and its sleeve are held with the index finger extended to the level of the maximal planned penetration to prevent the sharp trocar tip from thrusting too deeply. The trocar is held in the palm of the dominant hand. It is rotated in a semicircular fashion with its long axis as controlled, firm downward pressure is applied (**Figure 8**). As the trocar is advanced, the operator senses when the fascia is traversed; the force is reduced as the trocar is advanced slowly to enter the peritoneum. Disposable pyramidal tip trocars are

preferable. Flat dilating tip trocars leave a smaller fascial defect, but require more force pressure with less control. A disposable-shielded trocar has the advantage of a sharp instrument for each operation.

Direct Insertion

Trocar insertion without creating a pneumoperitoneum initially reduces the number of preliminary procedures, saving operative time and preventing potential complications. Direct insertion is a safe alternative to initially creating a pneumoperitoneum [14-21]. Nezhat and associates [14] compared the ease and safety of creating a pneumoperitoneum with those of direct insertion of either a reusable trocar or a disposable shielded trocar in 200 patients in a randomized, prospectively controlled study (**Tables 2 and 3**).

The direct trocar technique as described by Nezhat [22] consists of placing the patient in the supine position with her legs in Direct OR stirrups after general anesthesia is induced. She is prepped and draped in the usual sterile fashion. A transurethral Foley catheter is placed for intraoperative bladder drainage. The stomach is decompressed with a nasogastric or orogastric tube. The operating table is lowered at or below the level of the surgeon's waist. After palpating the bifurcation of the aorta and sacral promontory, the umbilical skin is elevated with a skin hook and a 1-cm incision is made sharply with a scalpel. The anterior abdominal wall is then elevated by using 2 towel clamps placed on either side of the umbilicus. While elevating the anterior abdominal wall away from the underlying viscera, the surgeon holds a 10-mm trocar with his index finger positioned 3 cm away from the trocar tip to guard against sudden uncontrolled entry into the abdomen. The trocar is inserted at a 90-degree angle and advanced in a controlled fashion into the peritoneal cavity with a twisting semicircular motion. The laparoscope is then introduced, proper intraperitoneal placement ascertained, and pneumoperitoneum created with high-flow insufflation. The underlying structures are then carefully inspected for injury.

Open Laparoscopy

In 1971, Hasson [23] introduced the concept of open laparoscopy to eliminate the risks associated with insertion of the Veress needle and trocar. This technique involves direct trocar insertion through a small skin incision without prior pneumoperitoneum. Specially designed equipment consists of a cannula and trumpet valve fitted with a cone-shaped sleeve. A blunt obturator protrudes 1cm from the tip of the cannula. The cone sleeve seals the peritoneal and fascial gap.

A small transverse, curved, or vertical incision is made at the umbilicus. Two Allis clamps, a knife handle with a small blade, a straight scissors, a tissue forceps with teeth, a right-angle skin hook, 4 S-shaped retractors, a needle holder, 2 curved Kocher clamps, and 4 small curved hemostats are needed. As the incision is made, Allis clamps or a self-retaining retractor is used to provide adequate exposure. Once the fascia is cut, a 1-cm incision is made in the peritoneum. One suture of 0 polydioxanone (Ethicon) is passed through each peritoneal edge and fascia and tagged. The cannula carrying the blunt obturator is inserted through the opening into the peritoneal cavity. The obturator is withdrawn, and CO2 is insufflated through the cannula, which is inserted as deeply as required to prevent leakage. The previously placed sutures are used to fix the trocar

sleeve so that the laparoscope can move freely within the abdominal cavity. At the end of the procedure, the abdominal wall is closed, by using the previously placed sutures.

Open laparoscopy usually takes about 5 minutes to 10 minutes longer than closed laparoscopy performed by operators with comparable expertise. In more than 1000 consecutive operations done by Hasson [23], the frequency of minor wound infection was 0.6% and that of small bowel injury was 0.1%. In a review of the laparoscopic complications, the open techniques reduced the incidence of failed procedures, inappropriate gas insufflation, gas embolism, bladder and pelvic kidney punctures, major vessel injuries, and postoperative herniations [24].

In a survey conducted by Penfield [25], intestinal lacerations are the most serious complication of open laparoscopy, and most of those lacerations occurred during the early use of this technique. In 10,840 open laparoscopies attempted by 18 board certified obstetricians/gynecologists, 6 bowel lacerations were reported, 4 were recognized and repaired, and 2 were not suspected until several days postoperatively. To reduce the risk of bowel laceration, the surgeon should use a focus spotlight, work with an experienced assistant, make a vertical incision to facilitate exposure, grasp and elevate the fascia with small Kocher clamps, and cut between the clamps. A gynecologist who attempts open laparoscopy usually will find that the procedure is slow and cumbersome because of difficulty in exposing and identifying each layer of the abdominal wall.

ACCESSORY TROCARS

Additional cannulas are needed through which various instruments are inserted into the abdomen for manipulation and operative procedures. Placement sites depend on the patient's anatomy, the contemplated procedure, and the surgeon's preference. For diagnostic purposes, an incision generally is made 4 cm to 5 cm above the symphysis pubis in the midline. This area, delineated by the 2 umbilical ligaments and the bladder dome, is safe and usually avascular.

For operative laparoscopy, 2 accessory trocars (5 mm) are placed 4 cm to 5 cm above the symphysis pubis at the outer border of the rectus muscle, 3 cm to 4 cm below the iliac crest, 2 cm to 3 cm lateral to the deep inferior epigastric vessels. These trocars are inserted under direct vision to lessen the risk of intraabdominal visceral, uterine, and vascular injury and to provide free access to the posterior cul-de-sac. Vascularization of the lower abdomen is provided by 2 vessels: the deep inferior epigastric originating from the external iliac artery and the superficial epigastric, a branch of the femoral artery. Transillumination helps identify the superficial vessels, but they are difficult to see in obese patients. The deep inferior epigastric vessels run lateral to the umbilical ligaments and are seen intraperitoneally and identified easily. These vessels pass the round ligament, proceed to the anterior abdominal wall, and are seen above the peritoneum. To avoid injuring these vessels, the trocar is inserted medial or lateral to the umbilical ligaments by viewing the underside of the abdomen wall laparoscopically (**Figure 11**). Despite these precautions, aberrant vascular branches occasionally are traumatized, and the operator must be able to manage this type of injury.

To reduce the chance of trauma to the abdominal structures, the proposed site for the secondary puncture is indented by applying abdominal pressure with the index finger

and observing the peritoneal surface with the laparoscope. Next, mapping of the potential sites for accessory trocar placement is done by advancing the tip of an 18-gauge needle attached to a syringe transabdominally through the peritoneum, revealing the exact course and placement of the accessory trocar. This allows optimal placement. These maneuvers are important, particularly in a patient with evidence of abdominal wall adhesions, and help ensure safe access.

After the skin incision has been made, the trocar, held with the index finger extended on the sheath to control the depth of penetration, is inserted through the fat and fascia. Further advancement is controlled under laparoscopic view. The trocar is aimed toward the center of the abdomen and hollow of the sacrum. If it is aimed laterally, it can slide down the pelvic side wall without being seen through the laparoscope, resulting in injury to the iliac vessels. The accessory trocars are never inserted without laparoscopic observation of their indentation on the abdominal wall or before mapping the abdomen. When insertion of the trocars is viewed directly from the monitor, the surgeon should be sure the camera has not been rotated so that it shows the wrong view of the pelvis. Other sites of entry include the midpoint between the symphysis pubis and the umbilicus and McBurney's point.

Some accessory trocar sleeves are too long or too short to allow free access to the pelvic structures and tend to slip out of the peritoneal cavity. The presence of trap valves can interfere with efficient instrument exchange, prevent the introduction and removal of suture material, and prevent the removal of tissue. Several accessory trocar sleeves either screw in or have an umbrella to secure them to the abdominal wall. Radially expanding trocars may reduce laparoscopic complications, lessen a surgeon's exposure to liability, and improve patient outcomes [26]. Two hundred twelve women underwent various laparoscopic procedures involving the placement of 541 radially expanding access cannulas and no major complications occurred. One patient developed a postoperative mesenteric hematoma that was assumed to be secondary to a venous injury from the Veress needle. Despite the absence of fascial anchoring devices, only six (1%) cannulas slipped.

Figure 1. This patient is in a dorsolithotomy position, but the thighs are not flexed so that the suprapubic trocars may be maneuvered.

Figure 3. Angle of trocar insertion with operating table in flat (A) and Trendelenburg (B) positions.

Figure 4. Note the anatomic location of the umbilicus and abdominal aorta in nonobese (A), overweight (B), and obese (C) patients.

Figure 8. Countertraction is applied by grasping the lower abdomen; the surgeon inserts the trocar into the abdomen by palming it and using the index finger as a guard against sudden entry into the abdomen. Inset shows the position of the trocar and intestines.

Figure 11. Accessory trocars are placed under direct vision to avoid injury to the inferior epigastric vessels and any organs that may be adherent to the pelvic sidewall or the anterior abdominal wall. The trocar is inserted lateral to the left umbilical ligament. To avoid inferior epigastric vessels that are invariably lateral to umbilical ligaments.

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Use of other abdominal quadrants, like suprapubic access, have also been reported, especially in those procedures where a large specimen has to be removed, because the incision remains under the bikini line and it is cosmetically acceptable (27,28). Additionally, the availability of material for Single-Incision Laparoscopy and the overall learning curve for surgeons had to be considered (29).Â The role of single-incision laparoscopic surgery in abdominal and pelvic surgery: a systematic review. Surg Endosc 2011;25:378-96. Portal Location and Abdominal Access Most laparoscopic procedures are performed with the horse either (1) anesthetized in dorsal recumbency, via ventral or ventrolateral portals, or (2) sedated and standing, via one or both of the paralumbar fossae. Various portal locations can be used for ventral and paralumbar approaches; the location frequently depends on the procedure. Safe access and avoidance of injury to the underlying viscera (as well as adherence to the principles of triangulation andâ€¦ CONTINUE READING. Abdominal Access technique. â€œAccess is the Key of Successâ€. Prof. Dr. R. K. Mishra.Â Gasless Laparoscopic surgery. Rather than creating pneumoperitoneum mechanical lifting of abdominal wall is possible. Gasless laparoscopic surgery does not have any added advantage except in the patient of high risk of pneumoperitoneum or sometime when leak of gas can not be stopped due to colptomy in LAVH or sometime in difficult hand assisted laparoscopic surgery with gas leak. It has following disadvantages.

Technique of access is different for different minimal access surgical procedures. For thoracoscopy, retroperitoneoscopy, axilloscopy all have completely different way of access. In this chapter we will discuss the various abdominal access technique used in laparoscopy.Â In gynaecological or lower abdominal laparoscopic procedure it is not necessary to put nasogastric tube. In minimal access surgery shaving of skin is not must and if necessary it should be done on operation table it self by surgeon. Patient position Laparoscopic Access. Each type of surgeryâ€"intraluminal endoscopy, extraluminal endoscopy (ie, laparoscopy), and open surgeryâ€"is defined by the manner of accessing the operative site. Getting this part of the surgery right is fundamental to the success of the whole procedure.Â Finally, knowledge of the abdominal wall configuration provides confidence in the â€œfeelâ€ of initial entry and reduces the chance of abdominal wall vessel injury. Fig. 28.1 illustrates a cross section of the abdominal wall. Open access peer-reviewed chapter. Laparoscopic Access Techniques. By Mieszko Norbert Opilka, Zbigniew Lorenc and Jacek Starzewski.Â Many authors recommend then to lift the anterior abdominal wall (using Mikulicz forceps or Backhaus clamp), or stabilize it before the Veres needle is inserted. It is considered that only three attempts for successful pneumoperitoneum estabilishment are acceptable, fourth attempt should be made in an alternative site. Laparoscopic surgery includes operations within the abdominal or pelvic cavities, whereas keyhole surgery performed on the thoracic or chest cavity is called thoracoscopic surgery. Specific surgical instruments used in a laparoscopic surgery include obstetrical forceps, scissors, probes, dissectors, hooks, and retractors. Laparoscopic and thoracoscopic surgery belong to the broader field of endoscopy. The first laparoscopic procedure was performed by German surgeon Georg Kelling in 1901.