

Access, Pneumoperitoneum, and Complications

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Creating a pneumoperitoneum, the safe way is one of the first steps a surgeon should learn in doing laparoscopic surgeries. As with any procedure, there is risk of complications which might occur like bleeding, subcutaneous emphysema, vascular injuries, and bowel injuries in accessing the abdomen.

The purpose of this chapter is to discuss the four techniques in establishing pneumoperitoneum namely the Veress needle technique, direct trocar insertion, optical trocar insertion, and open (Hasson's) technique. The choice as to which technique to choose depends on the surgeon's preference, habitus of the patient, and anticipated previous postoperative conditions like adhesions.

Veress Needle Technique

The Veress needle (Fig. 1) was invented by Janos Veress in 1930 as a tool for treating patients with tuberculosis. It was only in 1947,

that Raoul Palmer introduced its use in establishing pneumoperitoneum for laparoscopy [1].

It has an outer cannula with a beveled needle and a spring-loaded inner stylet with a dull tip which retracts as the needle goes through the abdominal wall and pushes forward once it is inside the abdominal cavity to protect the underlying viscera. Its length ranges from 7 to 15 cm with a diameter of 2 mm.

Technique: A small incision is made superior or inferior to the umbilicus just enough for the veress needle to pass through. The patient is then placed in Trendelenburg's position and the abdominal wall is lifted using towel clamps at the sides of the umbilicus to create negative pressure. The needle is then inserted with the tip towards the pelvis to prevent injuries to bowels and vessels. A "give" will be felt once it enters the peri-



Fig. 1 Veress needle

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toneal cavity. Avoid moving side to side the needle as this may enlarge a bowel or vessel perforation.

Correct placement of the needle can be verified by injecting saline solution and there should be no resistance. It can also be checked by the sudden escape of air from the abdominal cavity and drop test.

Low flow insufflation of CO₂ is then started until the intraabdominal pressure reaches 13–15 mm Hg. The needle is then replaced with a sharp trocar and the scope is used immediately to verify the correct entry. The other trocars are then inserted under direct vision.

If midline adhesions are anticipated, another location to insert the Veress needle is at Palmer's point. This is located 3 cm below at left subcostal area at the midclavicular line [1]. This is recommended for obese and very thin patients.

Direct Trocar Insertion

Direct trocar insertion was first described by Dingfelder in 1978. Advocates of this technique prefer this because it excludes the use of a Veress needle thus avoiding double-blind puncture of the abdomen and is the fastest [2]. However, this must be carried out by experienced and skilled surgeons because it is a blind direct insertion. Prerequisites to this technique are adequate skin incision, sharp trocar, and a completely relaxed abdominal wall. The abdominal wall is lifted with towel clamps at the trocar and is inserted in a twisting motion. The trocar is held like a pen to avoid accidentally going too deep and inadvertently perforating bowels or vessels. The scope is then used, and an explorative laparoscopy is then done to check for injuries.

Optical Trocar Insertion

Optical trocars as seen in Fig. 2 have a hollow shaft with a transparent tip. An adequate skin incision is made then a zero-degree telescope is inserted through the trocar as the surgeon inserts the trocar through the abdominal wall in a rotat-



Fig. 2 Hollow trocar with transparent tip

ing movement. The transparent tip allows direct visualization and allows the user to see the different abdominal layers as the trocar goes through the abdomen until the peritoneal cavity is reached.

Open (Hasson) Technique

Open technique was first described by Hasson in 1971. This technique lessens the probability of visceral or vascular injuries which are more commonly encountered in blind techniques [3].

A 2 cm incision is made at the umbilicus or either superior or inferior to the umbilicus. The fascia and the peritoneum are incised, and the peritoneal cavity is entered under direct vision. Finger exploration around the periumbilical area is sometimes done to determine if there are abdominal adhesions. The Hasson's trocar (Fig. 3) is then inserted and anchored with stay sutures at the fascia. The scope is then inserted to verify correct position of the trocar and to look for any injuries. Insufflation of CO₂ is then initiated at low pressure. Rapid expansion of the diaphragm might lead to vagal stimulation and bradyarrhythmias. The open technique is recommended especially for patients with previous abdominal operations.



Fig. 3 Hasson's trocar

Pneumoperitoneum

Creation of the pneumoperitoneum and maintenance of it is essential in laparoscopic surgery. Otherwise, one will not have adequate working space. The ideal insufflating gas should be cheap, physiologically inert, colorless, have high blood solubility, and is nonexplosive. Some of the insufflating agents are carbon dioxide, nitrous oxide, helium, and argon. However, the most used one is carbon dioxide since it is cheap, has low toxicity, is easily reabsorbed, has a low risk of gas embolism, and is nonexplosive [4].

Insufflation is achieved by using an insufflator which delivers carbon dioxide at a flow rate of up to 20 L/min. The insufflator also has an alarm which sounds when the abdominal pressure exceeds the predetermined level, which is set at 12–15 mm Hg. Higher pressures may lead to hypercarbia, acidosis, and adverse hemodynamic and pulmonary effects.

Complications and Management

As in any procedure, there will always be a risk of complications, which ranges from 0.05 to 0.2%. However, this represents about 20–30% of the complications encountered in laparoscopic surgery. This may be namely bowel injury, vascular injury, and extraperitoneal gas insufflation. The most common is extraperitoneal gas insufflation, which can be prevented by inserting the Veress needle perpendicularly and making sure it is in place during the

creation of the pneumoperitoneum. One should suspect that the gas is going extraperitoneally if there is no obliteration of the liver dull sounds and the CO₂ pressure does not rise. Conversion to open (Hasson's) technique is advisable if there is difficulty in positioning the Veress needle safely.

Vascular injury has a low incidence rate of 0.04% however this is the most life-threatening [5]. Immediate surgical intervention is required and conversion to open laparotomy and subsequent vascular repair is done. The most common vessels injured during the blind entry of the first trocar are the following: abdominal aorta, iliac vessel at the level of the aortic bifurcation, and inferior vena cava. Vascular injuries usually occur during uncontrolled forced entry.

Another complication is visceral injury. It has a 0.13% incidence but the mortality rate can go as high as 3.6% [6]. Whenever this is suspected it is crucial to determine immediately the location. A complete bowel examination is mandatory, and the injury is sutured via open laparotomy, mini-laparotomy, or laparoscopy. This can be repaired based on its severity and the surgeon's choice.

References

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