

Comparison between Different Entry Techniques in Performing Pneumoperitoneum in Laparoscopic Gynecological Surgery

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ABSTRACT

Background: The main challenge facing the laparoscopic surgery is the primary abdominal access, as it is usually a blind procedure associated with vascular and visceral injuries. Laparoscopy is a very common procedure in gynecology. Complications associated with laparoscopy are often related to entry. The life-threatening complications include injury to the bowel, bladder, major abdominal vessels, and anterior abdominal-wall vessel. Other less serious complications can also occur, such as postoperative infection, subcutaneous emphysema and extraperitoneal insufflation. There is no clear consensus as to the optimal method of entry into the peritoneal cavity. It has been proved from studies that 50% of laparoscopic major complications occur prior to the commencement of the surgery. The surgeon must have adequate training and experience in laparoscopic surgery before intending to perform any procedure independently. He should be familiar with the equipment, instrument and energy source he intends to use.

Materials and methods: A Literature review was performed using PubMed, MedSpace, Springer Link and search engines like Google and Yahoo. Following search terms were used: trocar, laparoscopy, complications and pneumoperitoneum, entry technique. A total of 10,000 citations were found. Selected papers were screened for further references. Publications that featured illustrations and statistical methods of analysis are selected.

Results: Fifty-one articles were reviewed and the the operations included in our study were diagnostic laparoscopy for infertility and abdominal pathology, ovarian cyst, total laparoscopic hysterectomy, burch operation, myomectomy. The early complications recorded in our study are abdominal wall vascular injuries, visceral injuries, bradycardia, preperitoneal insufflations. The incidence of laparoscopic entry-related injuries in gynecological operations was 6.9%. Overall, there was no evidence of advantage using any single technique in terms of preventing major complications. However, there were two advantages with direct trocar entry when compared with Veress-needle entry, in terms of avoiding extraperitoneal insufflation and failed entry.

Conclusion: On the basis of evidence investigated in this review, there appears to be no evidence of benefit in terms of

safety of one technique over another. However, the included studies are small and cannot be used to confirm safety of any particular technique. No single technique or instrument has been proved to eliminate laparoscopic entry-associated injury. Proper evaluation of the patient, supported by good surgical skills and reasonably good knowledge of the technology of the instruments remain to be the cornerstone for safe access and success in minimal access surgery.

Keywords: Complications, Laparoscopy, Pnumoperitoneum, Trocar.

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INTRODUCTION

The word laparoscopy originated from the Greek word (Lapro—abdomen, scopion—to examine). Laparoscopy is the art of examining the abdominal cavity and its contents. This is achieved by sufficiently distending the abdominal cavity (pneumoperitoneum) and visualizing the abdominal contents using illuminated telescope. Over the past 50 years, rapid advancement in technology in terms of electronics, optical equipments and other ancillary instruments, combined with improved surgical proficiency and expertize, laparoscopic surgery rapidly advanced from a gynecological procedure for tubal sterilization to one used in performing most of the surgical procedures in all surgical and gynecological discipline for a variety of indications.

The main challenge facing the laparoscopic surgery is the primary abdominal access, as it is usually a blind procedure associated with vascular and visceral injuries. It has been proved from studies that 50% of laparoscopic major complications occur prior to the commencement of the surgery.^{1,2} If there is delay in diagnosis of visceral injuries or delay in reporting, the morbidity will increase and may lead to mortality.³

The surgeon must have adequate training and experience in laparoscopic surgery before intending to perform any procedure independently. He should be familiar with the equipment, instrument and energy source

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he intends to use. This indicates that in spite of the improvement in the technology and experience, primary access complications were decreased but not completely eliminated.

The included techniques (Veress needle pneumoperitoneum, trocar/cannula system). Open (Hasson) technique. Direct trocar insertion without prior pneumoperitoneum. The use of shielded disposable trocars. Optical Veress needle and optical trocar. Radically expanding trocar and the trocarless, reusable visual access cannula.⁴

MATERIALS AND METHODS

A Literature review was performed using PubMed, Med Space, Springer Link and search engines like Google and Yahoo. Following search terms were used: trocar, laparoscopy, complications and pneumoperitoneum, entry technique. Total of 10,000 citations were found. Selected papers were screened for further references. Publications that featured illustrations and statistical methods of analysis are selected.

Different Laparoscopic Entry or Access Techniques

Veress Needle and Pneumoperitoneum

Veress needle was first popularized by Roal Palmer of France 1947. The creation of pneumoperitoneum remains an essential step of successful laparoscopic surgery. Being a blind procedure, it is associated with injury to the vascular and visceral contents of the peritoneal cavity. It is the most popular technique used by most of the laparoscopic surgeons worldwide to achieve pneumoperitoneum. There are many sites for insertion for Veress needle to achieve pneumoperitoneum. In the usual circumstances in a patient with an average body mass index (BMI) and no history of previous or suspected intraperitoneal adhesions, the Veress needle is inserted through an incision at the base of the umbilicus. In obese patient with BMI > 30 or patient with history of previous midline incision, or failed pneumoperitoneum after three attempts alternative site for Veress needle insertion may be thought. The second common site for insertion of Veress needle is the Palmer's point which lies 3 cm below the left costal border in the midclavicular line.⁵ This technique is recommended for obese or very thin patient, patient with history of previous midline surgery or suspected intraperitoneal adhesions, or failure to achieve pneumoperitoneum after three attempts. It is essential to decompress the stomach using nasogastric tube suction. This technique should be avoided in patient known to have hepatosplenomegaly, history of previous gastric

or splenic surgery or palpable gastropancreatic mass.⁶ A 5 mm telescope can be introduced at the same site of Veress needle visualize the periumbilical adhesions, then a 10 mm trocar can be introduced under direct vision, followed by additional trocar/cannula system inserted under direct vision as required. Therefore, the angle of Veress needle insertion should vary accordingly from 45° in nonobese women to 90° in very obese women.⁷ Several tests have been recommended to ascertain correct placement of Veress needle in the peritoneal cavity.

These include:

- Double click sound of the Veress needle test
- Aspiration test
- Hanging drop of saline test
- Syringe test.⁸

A recent retrospective study evaluating these four tests reported that non of four tests proved confirmatory for the intraperitoneal placement of the Veress needle and concluded that the most valuable test is to observe actual insufflation pressure (intraperitoneal) to be 8 mm Hg or less, and the gas is flowing freely.⁹ It has been shown that achieving high intraperitoneal pressure (HIP) entry ranging from 20 to 25 mm Hg will increase the gas bubble and produce greater splinting of the anterior abdominal wall and increase the distance between the umbilicus and bifurcation of the aorta from 0.6 cm (at pressure of 12 mm Hg) to 5.9 cm. This will allow easy entry of the primary trocar and minimize the risk of vascular injury.¹⁰ The high pressure entry technique is recommended by the Royal College of Obstetricians and Gynaecologists (RCOG), London and The Society of Obstetricians and Gynaecologists of Canada (SOGC).^{11,12} New modifications to the Veress needle have been introduced to minimize Veress needle associated injury. These include pressure sensor equipped Veress needle, optical Veress needle. However, none of these new modifications has been proved to be superior to the classic Veress needle and eliminated Veress needle-related injury. Controlled randomized trials are recommended to ascertain their safety and justify their extra cost (Fig. 1).¹³

Hassons Method

Hasson (open) entry technique was first described by Harrith Hasson in 1971. When first reported his technique Hasson claimed that his technique avoids Veress needle pneumoperitoneum and its associated complications (gas embolism and vascular injury). This technique involves incising the fascial layer and holding its edges by two lateral stay sutures, these will be used to stabilize the cannula. This will seal the abdominal wall incision to the coned-shape sleeve. The telescope is introduced and

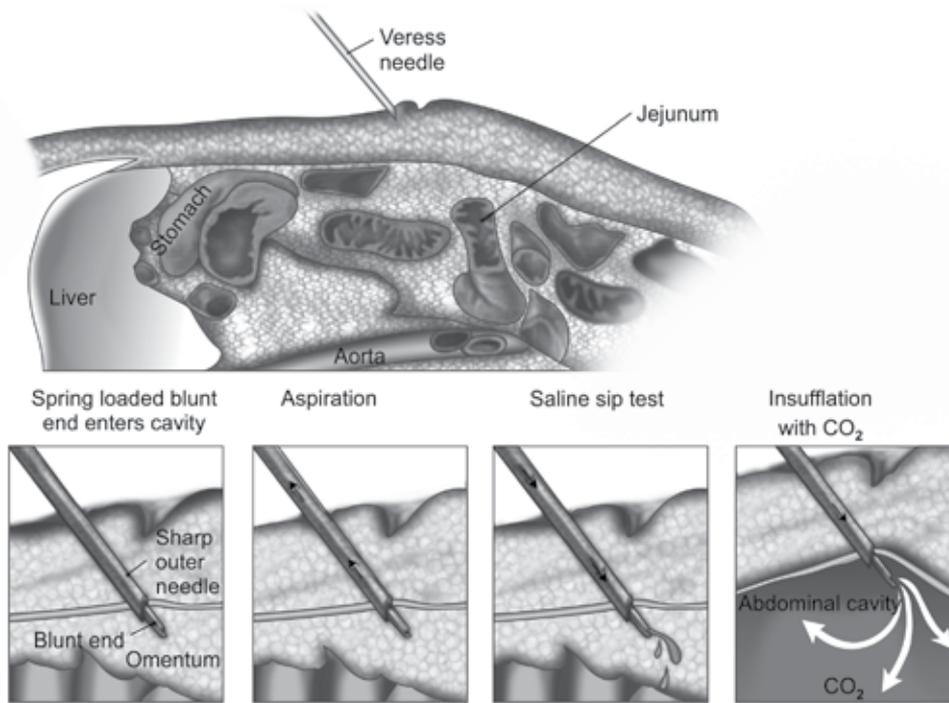


Fig. 1: Different access technique

insufflations commenced after visualizing omentum and bowel. Long standing controversy remains about the optimal primary access technique. Some authorities believe that Hasson open technique is superior to the classic closed entry technique defending their views in

that it is faster, eliminate the risk of gas embolism, and significantly reduces the vascular and bowel injuries related to primary access. However, there is conflicting evidence between different studies and there is no unified opinion regarding this issue (Fig. 2).¹⁴

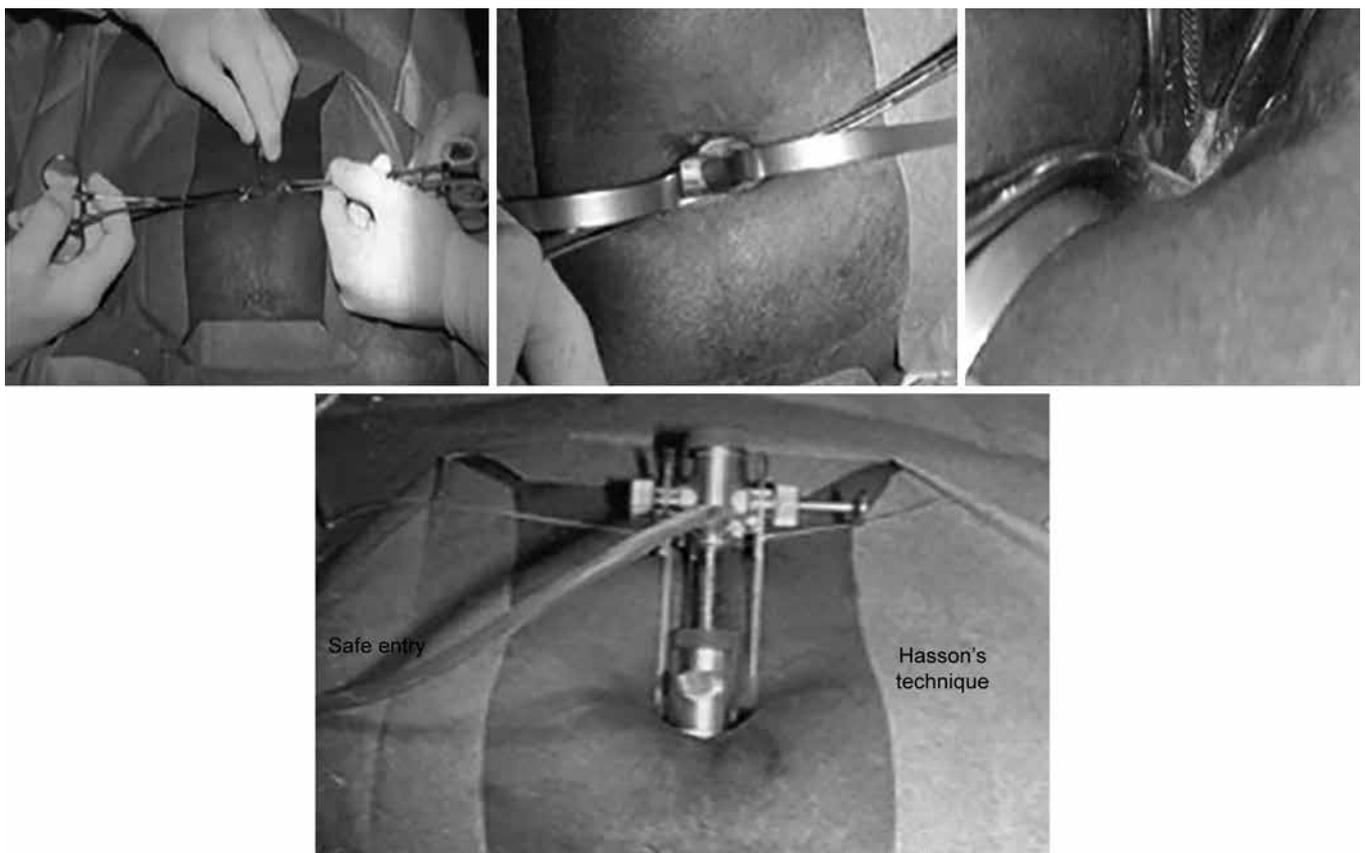


Fig. 2: Hasson's technique

Direct Trocar Entry Technique

This technique was introduced by Dingerfield in 1978. In his first publication, he suggested the advantages of his technique which eliminates Veress needle complications, these include failed pneumoperitoneum, preperitoneal insufflation and gas embolism. It is fast as it is a one-step pneumoperitoneum. However, being a blind procedure it does not eliminate the risk of bowel and vascular injuries.^{15,16} Several studies were published stressing on safety of this method and recommending its use for primary access. Most of these studies were retrospective, only few studies were prospective. A retrospective review of 51 publications comparing the entry-related complications with the closed (Veress/trocar technique, open and direct trocar technique). Entry-related bowel injury rate were 0.04% (Veress/trocar), 0.11% (open), and 0.05% (direct). The corresponding vascular injury rates were 0.04, 0.01 and 0% respectively.¹⁷ From the above studies, there is no clear evidence as to the optimal form of laparoscopy entry in low risk patient and it depends on the surgeon preference and experience with the individual technique.¹⁷

Disposable Shielded Trocar (Veress Trocar)

Disposable shielded 'safety' trocar when first introduced to the market in 1984, the manufacturer claimed that this trocar system works in a way that the sharp tip is and only becomes active and gets exposed when it encounter resistance through the abdominal wall. As it enters the abdominal cavity the sharp edge retract and the shield springs forward and cover the sharp tip of the trocar and the manufacturer wrote in the commercial label 'safety' trocars. These trocars were intended to avoid contact of the end of the trocar with the intra-abdominal content. However, it must be pointed out that even when this trocar was introduced correctly according to the recommended specification, there will be a moment when this trocar enters the peritoneal cavity and before its retraction, it will be in contact with abdominal content. This brief moment is sufficient to produce injury especially with its very sharp end. Disposable trocars require half the force required to introduce the classic reusable trocars. A retrospective study of 1,03,852 laparoscopy entry used the disposable shielded trocars and classic trocars showed the shielded trocars were responsible for 30% of serious injuries caused by laparoscopic entry, and two out of seven deaths caused by laparoscopic entry injury.¹⁸ Many studies were done and all disputed the complete safety of these trocars. As it is very popular in the United States, most of these studies were published in the United States, this led the Federal Drug Association (FDA) to directly

write to the manufacturers of shielded laparoscopic trocars requested that in the absence of clinical data showing reduced incidence of injuries, manufacturers and distributors voluntary eliminate safety claims from the label of shielded trocars (Fig. 3).¹⁹

Visual Entry Systems (Visiport)

These include the disposable optic trocars and the endo TIP visual cannula. These new technology aims to optimize the laparoscopic entry by facilitating entry under direct vision. Controlled randomized trials are required to assess their safety and proof their superiority to the traditional Veress needle and trocar/cannula system in order to justify their expensive cost (Fig. 4).²⁰

Transversus Abdominis Plane Block

Abdominal field blocks have been around for a long time and have been extensively used as they are mostly technically unchallenging. They, however, provide limited analgesic fields, hence multiple injections are usually required. Traditionally, these blocks have blind



Fig. 3: Veress trocar



Fig. 4: Visiport

end points (pops) making their success unpredictable. The description of the landmark technique for performing transversus abdominis plane (TAP) block advocated a single entry point, the triangle of Petit, to access a number of abdominal wall nerves hence, providing more widespread analgesia.²¹ More recently, ultrasound guided TAP block has been described with promises of better localization and deposition of the local anesthetic with improved accuracy.²² The Journal of New York School of Regional Anaesthesia 2009;12:28-33 (Fig. 5).

DISCUSSION

Over the last two decades, rapid advances have made laparoscopic surgery a well-established procedure. However, because laparoscopy is relatively new, it still arouses controversy, particularly with regard to the best method for the creation of the pneumoperitoneum.

To establish the pneumoperitoneum, access to the peritoneal cavity can be gained through minilaparotomy and insertion of a laparoscopic trocar or Hasson trocar. Alternatively, an optical trocar can be blindly inserted into the peritoneal cavity, or a Veress needle may be inserted through the abdominal midline. The latter is the most frequently used technique.

Meta-analysis failed to reveal any safety advantage of an open technique when compared with a closed method of entry, in terms of both visceral and major vascular injury. It must be noted that the included randomized controlled trials had insufficient power to effectively demonstrate an advantage.²³

Various studies have shown in Tables 1 to 7.

CONCLUSION

No single technique or instrument has been proved to eliminate laparoscopic entry-associated injury. Proper evaluation of the patient, supported by good surgical



Fig. 5: Transversus abdominis plane block

Table 1: Incidence of laparoscopic complications according to Veress trocar (total no. 222)

Laparoscopic complications	No. of patients
Vascular injury	5
Visceral injury	0
Preperitoneal insufflations	5
Gas embolism	0
Bradycardia	2
Total	12 (5.40%)

Table 2: Incidence of laparoscopic complications according to Veress needle (total no. 31)

Laparoscopic complications	No. of patients
Vascular injury	0
Visceral injury	1 (omentum)
Preperitoneal insufflations	3
Gas embolism	0
Bradycardia	0
Total	4 (12.9%)

Table 3: Incidence of laparoscopic complication according to Visiport (total no. 20)

Laparoscopic complications	No. of patients
Vascular injury	1
Visceral injury	0
Preperitoneal insufflations	0
Gas embolism	0
Bradycardia	0
Total	1 (5%)

Table 4: Incidence of laparoscopic complications according to Hasson technique (total no. 10)

Laparoscopic complications	No. of patients
Vascular injury	1
Visceral injury	0
Preperitoneal insufflations	0
Gas embolism	0
Bradycardia	0
Total	1 (10%)

Table 5: Incidence of laparoscopic complications according to Palmer technique (total no. 20)

Laparoscopic complications	No. of patients
Vascular injury	1
Visceral injury	0
Preperitoneal insufflations	0
Gas embolism	0
Bradycardia	0
Total	1 (5%)

Table 6: Incidence of laparoscopic complications according to sharp trocar (total no. 27)

Laparoscopic complications	No. of patients
Vascular injury	2
Visceral injury	1 (omentum)
Preperitoneal insufflations	0
Gas embolism	0
Bradycardia	0
Total	3 (11.1%)

Table 7: Incidence of laparoscopic complications according to blunt trocar (total no. 30)

Laparoscopic complications	No. of patients
Vascular injury	2
Visceral injury	0
Preperitoneal insufflations	0
Gas embolism	0
Bradycardia	
Total	2 (10%)

skills and reasonably good knowledge of the technology of the instruments remain to be the cornerstone for safe access and success in minimal access surgery.

For initial peritoneal access, we suggest that surgeons should adhere to the technique with which they have the most experience. Overall, complication rates for laparoscopic access are not significantly difference between the Hasson and Veress needle techniques for abdominal insufflation when performed by experienced surgeons; however, the surgeon should be familiar with alternative technique.

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