

Laparoscopic insufflation through a defined surgical point in the left upper quadrant: a 3-year experience

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Abstract Laparoscopic surgery is frequently performed in gynaecology for a variety of indications. The most important step in laparoscopy is the creation of pneumoperitoneum and safe placement of the primary trocar. Initial entry with a Veress needle for CO₂ insufflation was performed through the left upper quadrant, at the height of the dome of the lower margin of the sub-costal region. In the majority of cases, a single entry was successful in achieving CO₂ insufflation. No visceral injury was noted with our technique in 442 laparoscopic procedures. This surgical landmark provides several advantages over other entry points and was feasible in 442 laparoscopies, irrespective of the patient characteristics, such as age, body mass index (BMI), previous surgical history and operative indications.

Keywords Laparoscopy · Insufflation · Left upper quadrant · Veress needle

Introduction

Laparoscopic surgery is frequently performed in gynaecology for a variety of indications. Laparoscopic surgeries are 41% safer than laparotomy, with an overall risk of complications at

8.0% for laparoscopy versus 15.2% for laparotomy [1]. There is no consensus with regard to the best method of gaining access to the peritoneal cavity for the creation of pneumoperitoneum. More than 50% of major laparoscopic complications occur during the initial entry into the abdomen [1]. Various routes and techniques of insufflation have been developed over years. The most important step in laparoscopy is the creation of pneumoperitoneum and safe placement of the primary trocar.

The objective of this study is to assess the safety and efficacy of CO₂ insufflation through the left upper quadrant, irrespective of the patient characteristics.

The main outcome measures are successful pneumoperitoneum and the entry-related complications.

Materials and methods

The study was undertaken at a district general hospital in the north-west region of England. This is a retrospective analysis of operative theatre lists for the last 3 years (2004–2006). Data was collected for all 442 patients undergoing laparoscopy for a variety of indications (Table 1).

Our technique

Initial entry with a Veress needle for CO₂ insufflation was performed through the left upper quadrant, at the height of the dome of the lower margin of the left sub-costal region (Fig. 1). The Veress needle is passed perpendicularly by the margin of the sub-costal region with an initial pressure of 25 mmHg. As it traverses the abdominal layers, the pressure increases to 50 mmHg, and once it breaches the peritoneal layer, the pressure immediately drops to <9 mmHg high/free flow of the gas. The flow of gas is

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determined mostly by the diameter of the Veress needle and never exceeds 3 L/min, regardless of the pre-set pressure and flow of the insufflator. The most important pre-requisites are decompression of the stomach achieved with nasogastric tube suction and the patient being under general anaesthesia with good muscle relaxation. In the majority (87–88%) of cases, a single entry was successful in achieving CO₂ insufflation. Second (8–9%) and, rarely, third attempts (1%) at insufflation is performed through the same point, but angling the needle towards the diaphragm. If this is still unsuccessful, then trans-umbilical sites were chosen as an alternative entry in 3% of cases. The advantage of angling the needle cephalad is to utilise the potential space available underneath the diaphragm. We depend on the intra-abdominal pressure (25 mmHg) for primary trocar placement rather than the volume of CO₂ insufflated, as this may vary from 3 L in normal body mass index (BMI) patients to 9 L in high BMI patients or parous women. The site of the primary trocar placement depends on the patient's previous operative history. If there is no history of laparotomies, then a trans-umbilical site is chosen; else, the VISIPOINT optical trocar system is used through the left upper quadrant in order to minimise the risk of bowel injury. However, larger studies are required to compare the safety of primary trocar insertion through the umbilicus and left upper quadrant when there is no history of previous laparotomies. Although the senior author (Najia) has been performing this method for the last eight years, this technique of insufflation has only been perfected in the last four years.

Results

A total of 442 laparoscopic procedures were performed over three years. No visceral injury was noted with our technique advocating placement of the Veress needle through a defined surgical point.

Table 1 Laparoscopic procedures performed during 2004–2006

Procedure	Number
Diagnostic laparoscopy	206
Laparoscopic assisted vaginal hysterectomy	55
Laparoscopic sterilisation	50
Diagnostic laparoscopy and tubal patency test	41
Laparoscopic adhesiolysis	39
Laparoscopic ovarian cystectomy	37
Laparoscopic diathermy of endometriosis	7
Laparoscopic myomectomy	4
Laparoscopic ventrosuspension	3
Total	442

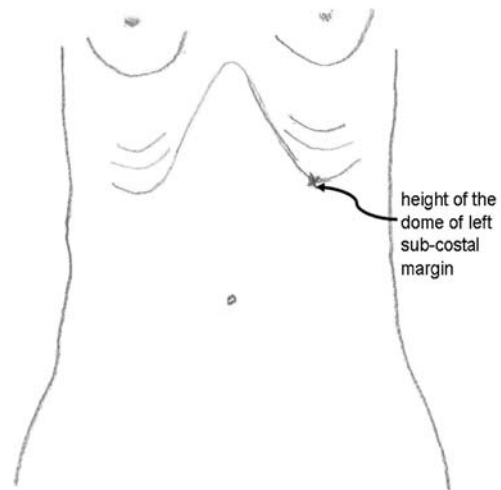


Fig. 1 Surgical point for the Veress needle insertion to create pneumoperitoneum

Discussion

To date, no method or sites of insufflations have proved to be superior over one another. In fact, they have to be selected based on the surgeon's preferences, experience and patient characteristics.

Insufflation methods are broadly classified into closed (classical) and open techniques. There are many sites available for the insertion of a Veress needle to achieve pneumoperitoneum:

1. The umbilical area (trans-, infra- or supra-umbilical through a small vertical or transverse incision) is the most common site chosen by laparoscopic surgeons worldwide to achieve pneumoperitoneum. In the closed technique, CO₂ is insufflated into the peritoneal cavity through the Veress needle and the primary trocar and sheath are placed blindly. Being a blind procedure, it is associated with injury to the vascular and visceral contents of the peritoneal cavity.
2. The second most common site for insertion of a Veress needle is Palmer's point [2]. Palmer's point lies 3 cm below the left costal margin in the mid-clavicular line. This site is chosen in obese or very thin patients, or patients with a history of previous midline incision or large pelvic mass or suspected adhesions or failed pneumoperitoneum.
3. The Lee-Huang point represents the middle upper abdomen between the xiphoid process and umbilicus as a single-entry site for the Veress needle and primary laparoscopy port. In 98.4% (184 out of 188 laparoscopies) of patients, surgery was performed without complications. Two omental and one colon injury were encountered from primary port insertion [3].
4. In a review of 918 patients, it has been shown that ninth the inter-costal space in the left upper quadrant provides

a safe alternative to umbilicus entry for laparoscopic insufflation. The authors reported two complications; one stomach and one liver injury [4].

5. Other sites that have been used in the past include transuterine and cul-de-sac approaches in obese patients [5–7]. These routes of pneumoperitoneum have fallen into disrepute, as they carry the risk of sepsis and rectal perforation.
6. The Hasson (open) technique involves incising the fascial layers and a laparoscopic sheath with a blunt trocar is inserted under vision into the peritoneal cavity. Insufflation is achieved subsequently. This method has been shown to minimise the risk of major vascular injury, but the risk of bowel injury has remained the same [8].
7. Direct trocar insertion has been recommended for thin multiparous woman. Although it reduces the operative time, it is still a blind procedure and vascular injuries have been experienced with a direct trocar, but none have been reported in any of the studies [8].

The senior author (Najia) routinely performs all laparoscopic procedures by left upper quadrant Veress needle placement and insufflation, at the height of the dome of the lower sub-costal margin. The reasons are manifold (Table 2); it is the highest fixed point in the left upper quadrant, the left liver lobe very rarely reaches underneath the left costal margin [9], it is less likely to have adhesions, the risk of major vessel injury is unlikely and it is suitable for all patients, irrespective of age, BMI and operative history. Also, it is less likely to fail by pre-peritoneal tenting, as the abdominal wall layers, including the peritoneal margin, is fixed to the costal margin [10]. This region has less subcutaneous fat and is away from rectus muscle, epigastric vessels and internal viscera. In a retrospective study of 49 patients who had computed tomography (CT) scans for various indications, it was proved that there is less subcuta-

neous fat in the left upper quadrant than at the umbilicus and that the intra-abdominal organs are far away from it. So, this region provides a safe entry in obese women [11].

There is a greater theoretical risk to the curve of the stomach, transverse colon, left lobe of liver and spleen. The risk to the stomach can be reduced by decompression by nasogastric or orogastric tube. Left upper quadrant insufflation is particularly suitable for high BMI patients, large pelvic masses, gynaecological cancers [12], previous history of abdominal surgeries and suspected intra-abdominal adhesions. In a retrospective review of 267 patients who had left upper quadrant insufflation, there were three cases of puncturing of the left lobe of the liver, but they were managed conservatively. Also, failure to achieve insufflation was seen in 1.5% of cases [13].

The correct placement of the Veress needle into the peritoneal cavity is confirmed by an immediate drop in pressure to <9 mmHg with free/high flow of the gas. This confirmatory test has been recently recommended by the Society of Obstetricians and Gynaecologists of Canada [8, 14].

It can be argued that the muscle layer is thick and the pre-peritoneal space can be more easily insufflated than at the umbilicus. Our experience shows that, following the pressure method, whether the peritoneum is breached or not is known immediately; if in any doubt, the Veress needle is then pulled back and directed towards the diaphragm. This reduces the chance of pre-peritoneal insufflation, as the sub-costal region provides a larger fixed area to manoeuvre. Hepatomegaly, splenomegaly, history of previous gastric or splenic surgery or palpable gastro-pancreatic mass should be regarded as a contraindication to left upper quadrant Veress needle placement.

Agarwala et al. reported that 54.9% of the patients had adhesions around the umbilicus with history of previous abdominal surgeries in a review of 918 laparoscopies [4],

Table 2 Comparing laparoscopic insufflation with Veress needle insertion through the left upper quadrant and umbilicus

	Sub-costal, left upper quadrant	Umbilicus
1	Gaining popularity as the primary site for insufflation	Most common site to achieve pneumoperitoneum
2	Fixed parietal peritoneum to undersurface to costal margin	Risk of preperitoneal tenting and, hence, more failures
3	Less mobile and easy to stabilise abdominal wall near to costal margin or intercostal space	Abdominal wall needs either lifting or stabilisation prior to insertion of the Veress needle
4	Advantageous in obese patients due to less fat and thinner abdominal wall	Difficulty in insertion of the Veress needle due to more fat
5	Advantageous in very thin patients due to less risk of injury to major vessels	Potential risk of injury to abdominal aorta or iliac vessels
6	Chosen for patients with prior midline incision or peritonitis as there are rarely any adhesions	Increased incidence of adhesions from bowel or omentum
7	Chosen as an alternate site if pneumoperitoneum through the umbilicus failed	Can be used as an alternative site
8	Advantageous in large pelvic masses or gynaecological cancers	Potential risk of injury
9	Potential risk to left lobe of the liver, stomach, spleen and transverse colon	Potential risk to small bowel, major blood vessels and omentum
10	Hepatomegaly, splenomegaly, history of gastric or splenic surgery or palpable gastro-pancreatic mass should be regarded as contraindications to Veress needle placement	Large pelvic masses, previous midline incision and umbilical hernia should be regarded as contraindications

which might potentially increase the risk of injury to the omentum or bowels. At second laparoscopy in 151 patients, it has been reported that adhesions to the umbilical undersurface occur in 21.2% of patients [15]. As such, we found that the left sub-costal margin at the height of the dome is a particularly beneficial and effective way of establishing pneumoperitoneum in very high BMI patients, gynaecological cancers, large pelvic masses and when peritoneal adhesions are suspected due to previous abdominal surgeries. During laparoscopic entry, visceral injury occurs at a frequency of 0.4/1,000 procedures [16], of which, only 20–25% are attributable to Veress needles. Therefore, the risk of injury from Veress needles is 1/10,000 and from primary trocars is 3/10,000. Although safety is not established, for which at least 10,000 laparoscopic procedures should be studied, this surgical landmark provides several advantages over other entry points and was feasible in 442 laparoscopies, irrespective of the patient characteristics. Moreover, our technique establishes only pneumoperitoneum, but most complications occur with the primary trocar.

Conclusion

Left sub-costal margin at the height of the dome is a particularly beneficial and effective way of establishing pneumoperitoneum in very high BMI patients, gynaecological cancer patients, large pelvic masses and when peritoneal adhesions are suspected. Although safety is not established, this surgical landmark provides several advantages over other entry points and was feasible in 442 laparoscopies, irrespective of the patient characteristics, such as age, body mass index (BMI), previous surgical history and operative indications.

Poster presentation H. Muppala, A. Bedoya-Ronga, S. Najia (2007) Laparoscopic insufflation through a defined surgical point in the left upper quadrant: a 3-year experience. In: The 31st British

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