

Trans-umbilical Direct Primary Trocar Entry in Laparoscopic Surgery: Complications & Efficiency

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ABSTRACT

Background and aims: The placement of primary trocar is a blind technique & is the most critical step in laparoscopic surgery. Several techniques have been reported to minimise complications associated with placement of first trocar. Authors describe trans-umbilical direct trocar entry method for laparoscopic surgery that provides a quick, safe and reliable initial access to peritoneal cavity.

Materials and Methods: Retrospective study was carried out over a period of 5 years from April, 2016 to April, 2021 at Maxxlyfe Hospital, Sunjwan Morh, near Bathindi, Jammu (J & K) on patients who underwent laparoscopic procedures by the trans-umbilical direct trocar entry technique for initial access to the peritoneal cavity.

Result: Authors analysed 1200 patients (F=670; M=530) in the study period. Average age of the patients was 32 years (range: 12-91). The average time to access the peritoneal cavity was 15 seconds (range: 10-40 seconds). Among the 1200 patients, there was unsuccessful entry by the direct trocar method in 30 patients. There was subcutaneous hematoma & ecchymosis in 4 patients, small gut injury in 3 patients, mesenteric tears in 2 patients and 1 had bleeding in the omentum. There was no major vascular injury and no mortality. The results were compared with those reported in the literature in terms of complications & efficiency.

Conclusion: A laparoscopic procedure using the trans-umbilical direct trocar method is quick, safe & efficient for patients who have no history of previous abdominal surgery with vertical midline scar extending above umbilicus.

Keywords: Closed technique; Direct trocar entry; Laparoscopy; Pneumoperitoneum; Port; Umbilicus

INTRODUCTION

In minimally invasive surgery, safe access to the peritoneal cavity is the first step towards a successful laparoscopic procedure. Although the complications of operative laparoscopy are low, they can be severe and life threatening. One of the most anxious moments of the laparoscopic approach is the access to the peritoneal cavity.^[1] The most common cause of stressful laparoscopic surgery is wrong port position and the dreadful complications that may occur during the insertion of first trocar are vascular and bowel

injuries^[2,3] and at least 50% of these major complications occur prior to commencement of the intended surgery. Preventing the complications associated with the initial entry is a prime concern for laparoscopic surgeons. Among the various techniques for introducing the first trocar to achieve carbon dioxide pneumoperitoneum, two common methods are usually performed. The first, also called the closed technique, requires the Verres needle^[4] which is inserted in the peritoneal cavity for carbon dioxide

insufflation followed by blind introduction of the first trocar. The second, also called the open technique was first described by Hasson.^[5] This technique begins with a small incision at the umbilical site and subsequently, all layers of abdominal wall are incised and the first trocar is then inserted into the peritoneal cavity under direct vision followed by gas insufflation.^[6-8]

In the United States, a review of 51 publications including 21,547 open technique, 16,739 direct entry technique and 134,917 Veress/trocar reported entry related bowel injuries were 0.11% (open), 0.05% (direct entry) and 0.04% (Veress/trocar) and vascular injury rates were 0.01%, 0% and 0.04% respectively.^[9] Table 1 shows the incidence of major complications associated with various techniques of abdominal entry as reported in a review of selected studies.^[10-14] This data suggests that there is no significant difference in complication rates based on the technique adopted for abdominal entry and the results have remained the same during the past three decades. The risk of complications while entering the abdominal cavity increases with a history of previous abdominal operations with vertical midline scars.

Table 1: Complication Rates Based on Technique of Abdominal Entry

Technique of Abdominal Entry	Complication Rate per 1000
Direct trocar	0.6-1.1
Veress needle	0.3-2.7
Open laparoscopy	0.6-12

Despite the associated risks, the closed technique is still one of the most popular ways to achieve access to the peritoneal cavity.^[15-17] This is mainly because the open technique requires more time to perform and there is increased risk of gas leakage through incision and has the similar incidence of complications as with the closed method of insertion.^[18] Authors also prefer the closed technique especially direct trocar entry method for primary access to the peritoneum in laparoscopic surgery. Dingfelder in 1978 was the first to advocate direct trocar entry technique where the abdomen is entered with a trocar without prior veress needle entry and pneumo-insufflation.^[19] The advantages of this method are the avoidance of

complications related to the use of the Veress needle such as failed pneumo-peritoneum, preperitoneal insufflation, intestinal insufflation or the more serious carbon dioxide (CO₂) embolism. Laparoscopic entry is initiated with only one blind step (i.e., the trocar), instead of three steps (i.e., Veress needle, insufflation, trocar). Moreover, the direct trocar entry method is faster than any other method of entry.

AIMS AND OBJECTIVES

The objective of this study is to establish the safety and efficiency of direct trocar entry method used to create pneumoperitoneum in laparoscopic surgery.

MATERIAL AND METHODS

This study includes retrospective analysis of 1200 patients who were operated at Maxxlyfe Hospital, Sunjwan Morh, near Bathindi, Jammu (J and K), India over a period of 5 years from April, 2016 to April, 2021 by the laparoscopic method using the trans-umbilical direct trocar entry technique for initial access to the peritoneal cavity. Various parameters like patient demographics, type of laparoscopic operation, time to access the peritoneal cavity, intra-operative and post-operative complications, date of discharge from the hospital and date of last follow up visit were reviewed.

Exclusion criteria were the patients who had history of prior laparotomy with a vertical midline incision extending above the umbilicus and those with a history of severe adhesions based on prior operative reports, bowel resection, peritonitis, oncological procedures with omentectomy or abdominoplasty.

Trans-umbilical direct trocar entry technique

All the patients in the study were administered general anaesthesia and placed in dorsal supine position. As a routine, umbilicus was cleaned thoroughly with the spirit and 10% Povidone iodine lotion before incision. The operating table was tilted 15 degree Trendelenburg position. After palpating the bifurcation of the aorta and sacral promontory, the umbilical skin is elevated with a skin hook and a 1 cm intra-umbilical incision is made with a sharp No.11 scalpel blade. The anterior abdominal wall is then elevated by hand or by pulling on two towel clips placed 3 cm on either side of the umbilicus. While elevating the anterior abdominal wall away from the underlying viscera, the surgeon holds a 10-

mm safety trocar with his index finger positioned 3 cm away from the tip of the trocar to guard against sudden uncontrolled entry into the peritoneal cavity. The trocar is inserted at a 90° angle and advanced in a controlled fashion into the peritoneal cavity with a twisting semi-circular motion (Figure 1). The telescope is then introduced, proper intra-peritoneal placement ascertained and pneumo-peritoneum created with high-flow carbon dioxide insufflation. The underlying structures are then carefully inspected for any injury and the laparoscopic procedure performed. At the end of the procedure, the surgical wound is irrigated with saline solution and the fascia is exposed with small rectangular skin retractors and is closed with interrupted sutures (using No. 00 vicryl) in a subcuticular fashion.



Fig 1: Demonstration of trans-umbilical direct trocar entry

OBSERVATION AND RESULT

Authors analysed 1200 patients (F=670; M=530) in the study period. As shown in Table 2, average age of the patients was 32 years (range: 12-91) who underwent laparoscopic surgery and the average time to access the peritoneal cavity was 15 seconds (range: 10-40 seconds).

Table 2: Demographic data

Characteristics	Number of Patients
Total number of cases	1200
Age in years (Mean)	32
Sex ratio (F:M)	1.26 : 1
Average time taken to access peritoneum	15 seconds
Average duration of hospital stay	12-24 hours

The abdominal disease & the type of laparoscopic surgery performed are shown in Table 3.

Table 3: Abdominal disease & the type of laparoscopic surgery

Abdominal disease	Type of laparoscopic surgery	Number of patients
Cholelithiasis	Laparoscopic Cholecystectomy	964
Acute cholecystitis	Laparoscopic Cholecystectomy	80
Ovarian Cyst	Laparoscopic cystectomy	56
Incisional hernia	Laparoscopic Hernioplasty	36
Acute appendicitis	Laparoscopic Appendectomy	28
Elective appendicitis	Laparoscopic Appendectomy	20
Non functioning kidney	Transabdominal Nephrectomy	6
Unexplained pain abdomen	Diagnostic Laparoscopy	6
Inguinal Hernia	Trans abdominal preperitoneal repair	4
Total		1200

In 30 patients, open trocar entry method was used because there was a safety risk with the direct trocar method due to the patient's obesity factor. Table 4 shows that 10 complications occurred due to direct trocar entry of which the main complication was subcutaneous hematoma and ecchymosis (bruising of the skin) in 4 patients, mesenteric lacerations in 3 patients, mesenteric lacerations in 2 patients and 1 patient had bleeding in the omentum that was controlled laparoscopically by diathermy. There was no major blood vessel injury in our series.

Table 4: Complications of direct trocar entry

Complication	Number of patients	Percentage
Inability to enter with direct trocar	30	2.5%
Subcutaneous hematoma/Ecchymosis	4	0.33%
Bowel injury	3	0.25%
Mesenteric perforation	2	0.16%
Bleeding of omentum	1	0.08%
Total	10	0.83%

In 3 patients in whom small bowel got injured while entry of the first trocar, two gave the history of abdominal Koch's in the past and one had undergone abdominal hysterectomy by the midline infra umbilical incision in the past. In all these three cases, loop of small gut was adherent around the umbilical and periumbilical area intra-peritoneally and injury was suspected and they were converted to open surgery and injured bowel repaired by interrupted 000 vicryl sutures and intraperitoneal tube drain kept and laparotomy wound closed. All the three patients recovered after a stay of 9 days in the hospital.

Conversion to open entry technique was needed in 30 (2.5%) patients due to failure to enter the peritoneal cavity by direct trocar method and conversion to open conventional surgery was required in 3 (0.25%) patients who sustained iatrogenic small gut injury while entry by the direct trocar method.

Postoperative complications included superficial port site infection in 8 patients and incisional hernia at umbilical port site in two patients. The eight patients in whom superficial umbilical port infection occurred got recovered in 2 weeks time by local wound dressings. Two patients who developed umbilical port hernia were taken for mesh hernioplasty after 12 weeks of laparoscopic surgery. Average hospital stay after laparoscopic surgery was 12-24 hours, though in three cases of iatrogenic small bowel injury, stay exceeded to 9 days in the hospital. All 1200 patients recovered and there was no major vascular injury and no mortality in this series.

DISCUSSION

For more than two decades, laparoscopic surgery has become the most commonly performed procedure in surgery around the world. In laparoscopic operations, the making of the pneumoperitoneum constitutes as the first step and uses a variety of different techniques. The direct trocar method, veress needle and open entry methods are the most commonly used techniques for establishing the pneumoperitoneum. It is still controversial which technique is better. There are many studies in literature on this topic. We prefer trans-umbilical direct trocar entry method and our work is also supported by the literature mentioned below. In the study conducted by Agresta^[20] and colleagues in 2012 in Italy, 2175 patients were evaluated during 5 years & there was no minor or major complications in the direct trocar entry method and the method was effective and fast. Also, in the 2012 in USA, a study by Jiang X,^[21] stated that the use of the veress needle increases the risk of minor complications and entry failure and for this reason the direct trocar entry method is preferred. Both studies support our study in terms of direct trocar method's safety. In 2012, Bozkurt^[22] and colleagues in Turkey conducted a prospective study comparing the efficiency, complication and post surgery pain between the direct trocar entry method and open entry method and concluded that both techniques have advantages and disadvantages and stated that the surgeons should prefer the technique that they are accustomed to and have experience in. Operation technique that the surgeons used to do will have been efficient for decreased complications and operative time. Altun^[23] and colleagues from Turkey in 2010 investigated the reliability of the direct trocar entry method in laparoscopy; the direct trocar entry method may cause minor complications but was considered a safe and fast method. In 2007 Moberg^[24] and colleagues from Sweden investigated the open entry technique in their laparoscopic surgery study and stated that the technique could be used in all patients. In our study, we resorted to open entry technique in 30 patients where direct trocar entry failed. In 2007 Corcione et al.^[25] from Italy emphasized from their study that the open entry technique is safer for patients with history of surgery and they said there are no techniques or methods that don't come without risk. In 2006 Cakir^[26] from Turkey emphasized from his study that the veress needle has not been identified as a component of organ injury and that the

veress needle method is safe. In 2006 Chávez^[27] from Mexico reviewed the use of the veress needle and direct trocar entry method in laparoscopic cholecystectomy; it was seen that the veress needle method had a higher complication rate and took longer time than the direct trocar entry method. Chávez also emphasized that the direct trocar entry method was a safe, fast and effective method.

In the present study, there was no major vascular complication in the patients who underwent laparoscopic surgery with the direct trocar entry method and just minor complications took place in 10 patients only. This shows that the direct trocar entry method is both safe and highly reliable. Even though we come across different outcomes from the literature we examined, many studies show that there were no serious complications with the direct trocar entry method. Another advantage of the direct trocar entry technique is the reduced number of blind insertions required to gain abdominal access. However, entry related complications can occur despite adequate surgical experience and up-to-date equipment. Open entry technique is reliable to use especially on the patients whose have high body mass index and more abdominal fat, but due to the over subcutaneous fat tissue open entry technique with small incision will be harder and operation time will be longer.

CONCLUSION

Trans-umbilical direct trocar entry method is a quick, safe, simple, reliable, easy to learn and easy to perform and an effective approach to peritoneal entry for laparoscopic surgery. It is associated with minimal morbidity and no mortality. Based on this experience, authors believe that trans-umbilical direct trocar entry method provides laparoscopic surgeons with a safe and reliable method to insert the first trocar and authors recommend this technique as a routine procedure to access the peritoneal cavity for abdominal laparoscopic surgery.

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