



Short communication

A safe optically guided entry technique using Endopath Xcel Trocars in laparoscopic surgery: A personal series of 821 patients

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ABSTRACT

Objective: To demonstrate the technique and clinical safety of primary entry of an optically guided entry approach in laparoscopic surgery.**Materials:** The clinical data from a personal series of 821 consecutive cases of laparoscopic surgery were used.**Methods:** The technique of an optically guided primary entry using an Endopath Xcel trocar was described.**Results:** There was no bowel, vascular, or visceral complication in this series. This entry approach was also safe in those with high surgical risks, for example, high body mass index, multiple previous abdominal surgeries and previous laparotomy. There was no failed entry, no extraperitoneal insufflation, no wound infection and wound hernia.**Conclusion:** In this personal series, the findings demonstrated the safety and feasibility of an optically guided entry technique in laparoscopic surgeries.

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Introduction

Laparoscopic surgery is increasingly being performed for nearly all gynaecological surgeries. Despite some major advances, the technique of primary laparoscopy entry has not changed significantly in recent years. The safety and risks of various entry techniques have often been compared and evaluated in the literature. However, all evidence shows that primary portal entry related injury remains similar for different techniques.¹

Several entry techniques have been described in the literature. The more commonly used are the close and direct entry technique, as well as the Hassan classic open technique. Nevertheless, none of these techniques are free of complications. Most laparoscopy related injuries occur during primary port insertion.² A French survey of 103,852 laparoscopic procedures showed that 83% of vascular injuries and 75% of bowel injuries were related to primary port access.³ Major and minor complications include vascular, bowel, visceral injuries, bladder and urinary tract injuries, extraperitoneal insufflations, and other complications. Some of

these complications can lead to severe morbidity and mortality. There are ongoing debates and controversies regarding safer and more preferred methods for gaining access into the abdominal cavity.

In addition to the traditional Veress needle pneumoperitoneum approach, some commonly used optical trocar devices for laparoscopic entry were introduced around 1994. The device, which combines the advantages of other entry techniques, is performed under direct vision prior to CO₂ insufflation. The level of penetration, that is, into fat, anterior sheath, muscle layer, posterior sheath, and peritoneal layer, is transmitted as a real-time image on the monitor. There are two common types of optical trocar systems: reusable and disposable systems.

One reusable system is the Endotip manufactured by Karl Storz. The Endotip consists of a threaded stainless steel cannula, with a proximal valve segment and a hollow distal segment with a unique sharp tip. Following initial skin incision, the laparoscope is inserted into the cannula just short of the distal opening. The whole system is placed in the wound, perpendicular to the patient's abdomen. The cannula is rotated clockwise whilst the layers of tissue are lifted up by the unique sharp tip. The fascia, muscle, and sheath layers are displaced laterally as the cannula is being advanced up until it has entered the abdominal cavity. The procedure is performed with direct vision, fully controlled with minimal axial force.^{4,5}

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Another commonly used disposable system is the Visiport manufactured by Covidien. This is a visual entry device, which serves dual functions. It has a hollow trocar, which allows the insertion of a 5- or 10-mm endoscope and is completed with a separate cannula. The trocar consists of a trigger handle. With each squeeze, a sharp cutting blade of 1 mm in length is advanced, which enables the tissue to be transected. The blade will retract swiftly into the trocar after the trigger action. The surgeon can then access the abdominal cavity by a sharp entry.

Since 1996, the author has used another disposable system, which is the Endopath Xcel Trocar system from Ethicon-EndoSurgery Ltd. The hollow trocar is fitted with a transparent clear tip, which is winged (Fig. 1). Unlike the Visiport, it is designed to displace instead of cutting the tissues. The hollow trocar is loaded with either a 5-mm or a 10-mm zero degree laparoscope and the umbilical entry is achieved with rotating motion and under real-time optical monitoring.

This paper reports the author's personal series after he had adopted this optically guided direct entry device for his laparoscopic surgery from 1996 onwards. This report will detail his entry technique, patients' demographic data, and outcomes.

Materials and methods

A total of 821 consecutive patients underwent laparoscopic surgery performed by the author at Liverpool Hospital in Sydney and private hospitals in Hong Kong from 1996 to 2011 using an optically guided direct entry technique for primary entry. An Endopath Xcel Trocar (5- or 12-mm size) was the only entry instrument used. Data were accessed from patient records stored in his personal digital media storage.

Patient data

The patients' characteristics are shown in Table 1. There were 821 patients, with age ranging from 18 to 63 years, with a mean age of 47 years. The mean body mass index (BMI) was 28.1, and ranged from 18 to 47. In total, 41% of patients had undergone previous laparoscopic procedures and 55% had laparotomy. Out of these patients, 35% had two or more previous above surgeries (Table 1).

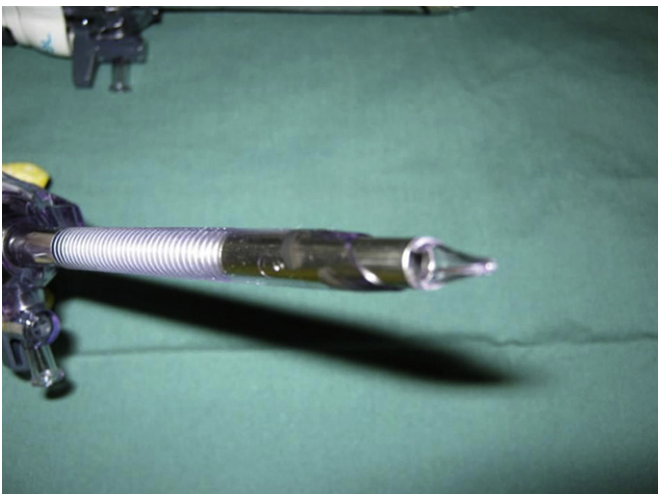


Fig. 1. An Endopath Xcel Trocar 5-mm size with a transparent tip.

Table 1

Demographic data of patients ($n = 821$) in the series.

	Total number (n)	%
Median age (range 18–63)	47	
Mean BMI (range 18–47)	28.1	
Previous laparoscopy	337	41
1	205	25
2	107	13
>2	25	3
Previous laparotomy	452	55
1	271	33
2	82	10
>2	99	12
≥2 of any above surgeries	287	35
Complications		
Including bowel, visceral, vascular and bladder injury, haematoma or extraperitoneal inflation	0	0

Surgical technique

An initial skin incision 5- or 11-mm long is performed at the umbilicus following local infiltration with 1% Marcaine and adrenaline. When there is midline incision with suspected peri-umbilical adhesion, the primary trocar site can be changed to other entry sites such as the Palmer's point at right upper quadrant and the Lee Huang point above the umbilicus.

A 5-mm or 10-mm zero degree laparoscope is inserted into the Xcel cannula. The abdominal wall is lifted up by the surgeon and an assistant on both sides of the umbilicus, acting to counteract the axial and penetrating force of the trocar. This is followed by the introduction of the Xcel trocar device into the abdominal cavity under real-time image monitoring. No prior CO₂ insufflation by Veress needle is required. During advancement of the trocar various layers can be identified, including fat, anterior sheath, muscle, posterior sheath, and peritoneal layer. Trocar advancement is achieved by a rotating and pushing force that displaces all subcutaneous tissue, fascial sheath, and muscle tissues until finally the peritoneum is pushed open (Fig. 2). Once the peritoneal cavity is entered, it is routine to inspect the abdominal contents. The bowel surface and its movement can be observed and potential adhesions and omentum can also be identified. Once entry is successful, gas insufflation can begin. The laparoscope is now removed from the trocar, and is reinserted into the abdominal cavity via the Xcel cannula. The procedure is followed by insertion of other ports as per standard procedures. All of the above entry procedures are recorded in digital media for future reference.

Results

It is encouraging that the author found no bowel, vascular, or visceral complications in his series of 821 patients. Access was successful in all patients without port placement related injury. It was also found to be safe in those with high surgical risks, for example, patients with high BMI, multiple previous abdominal surgeries, and previous laparotomy. There were no cases of failed entry, extraperitoneal insufflation, wound infection, or wound hernia in this series. Only one patient had a reported bowel injury but this was not related to the port entry. This bowel injury occurred during adhesiolysis after laparoconversion due to severe abdominal adhesions.

Discussion

The Veress needle close access method, which involves introduction of peritoneal hyperdistension prior to trocar entry, has

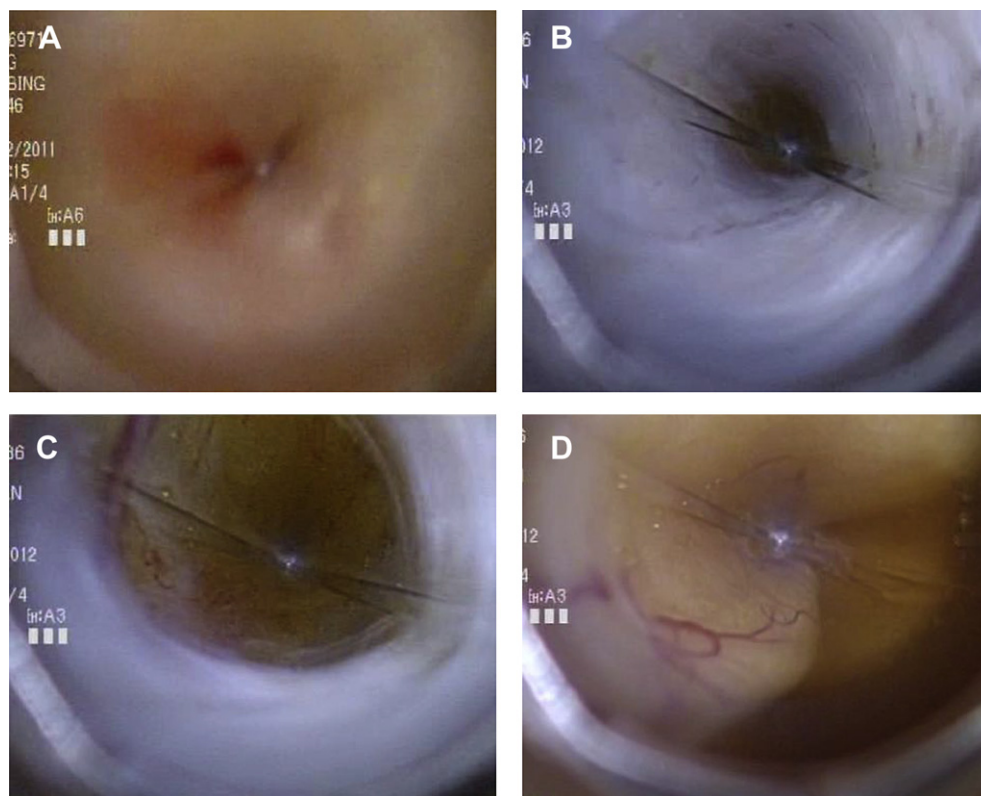


Fig. 2. Various layers of tissue during advancement of the Endopath Xcel Trocar at the primary entry site at the umbilicus. (A) Subcutaneous layer prior to entering the rectus sheath. (B) Rectus sheath layer with whitish appearance and the trocar tip just opening it. (C) Extraperitoneal layer after just puncturing through the rectus sheath. (D) Inside the peritoneal cavity with bowel surface seen through the transparent trocar tip.

been considered theoretically safer because of the increased distance between the abdominal wall and the abdominal viscera.⁶ However, injury to viscera has been reported with the Veress needle access method. The optically guided direct entry approach is now considered as a viable alternative approach by many endoscopists for laparoscopy surgery. The above-described optical-guided direct entry device is easy to assemble, with similar or less time required to achieve port entry. One of the other advantages is its ability to display the successive tissue layers during the trocar penetration process. This enables a controlled access under vision and ensures safety of entry. It also provides visual cues and allows error recognition. Typically, the optically guided trocar can be positioned in different layers of tissue under vision, the surgeon is able to advance it further through the rectus sheath or peritoneum, or retract it from adhesions or omentum prior to gas insufflation. For those patients with multiple adhesions or large pelvic mass, this is a particularly useful system to

help the surgeon in entering the correct space. In his personal case series, there was no complication of extraperitoneal insufflation, or gas collection in the omentum or mesentery. The latter, however, has sometimes been found with Veress needle gas insufflation.

Although the optically guided direct entry system may not completely prevent injuries, especially when there are dense periumbilical adhesions, it does allow prompt recognition and repair of the injury in order to improve the patient's outcome. Once there is a suspected injury, the umbilical trocar will be left *in situ*, and another optically guided trocar insertion made at a new entry site such as the Palmer's point or the Lee Huang point to gain a direct inspection of any suspected injury, followed by the appropriate adhesiolysis and repair. As the required axial force is less because of its mechanism of action at trocar penetration, this is likely to reduce the risk of inadvertent serious bowel and vessel injury. Overall visceral and vascular complications using this

Table 2
Reported complications of optical-guided entry techniques in large reported studies.

	Number of study patients	Complications
String et al ⁷	650 patients for different laparoscopic procedures	Complications (0.3%) included one bowel injury and one gallbladder injury; these injuries were recognised and repaired immediately.
Rabl et al ⁹	196 morbidly obese patients with BMI >36	No bowel or major abdominal vessel injuries occurred. Trocar-related injuries occurred in three patients: a superficial mesenteric laceration in two patients and a laceration of a greater omentum vessel in one patient.
Berch et al ⁸	349 patients for gastric bypass procedures	There were no trocar-related bowel or vascular injuries in the entire series.
Bernante et al ¹⁰	200 morbidly obese patients for bariatric procedure	There was no evidence of hollow viscus or organ injury during initial trocar placement. The insertion of the initial trocar was successful in all patients. The average trocar insertion time was 20 s (range 10–50) and BMI did not affect the time of insertion.
Wong (present series)	821 patients for laparoscopic gynaecological surgery	There were no bowel, vascular, or visceral complications in this series. It was also found to be safe in those with high surgical risks, e.g., high BMI, multiple previous abdominal surgeries, and previous laparotomy. There was no failed entry, no extraperitoneal insufflation, no wound infection and wound hernia.

approach are rare according to current available studies.^{7–10} String et al from Cleveland Clinic Foundation conducted the largest series of 650 patients in which the optically guided Opti-View trocar was used for laparoscopic surgery. There was one bowel injury, which was recognised and repaired immediately. Owing to the favourable outcome, the optically guided entry technique has become the standard method for abdominal access in their Medical Centre since 1995.⁷

Similarly, Rabl et al and Bernante et al performed laparoscopic surgery on morbidly obese patients with the same entry technique. It was reported that there were no bowel or vascular injuries to any of their patients.^{9,10} Table 2 illustrates the complication rates in their studies, which are all favourable with regard to the optically guided direct entry technique.

Although widely recognised as being an effective alternative for direct primary port entry, there are still not many laparoscopic surgeons using the optically guided approach for direct entry. One of the reasons is that this technique poses a different learning curve as compared with the conventional Veress needle method. Another important consideration may be the burden of cost for these disposable instruments.

Although a larger scale and randomised controlled trial would be desirable to provide further evidence to support the safety and effectiveness of the optically guided direct entry technique, such a study would be extremely hard to achieve due to the size of a population required given the background of a low complication rate among all the different entry approaches. It is also hardly possible to conduct a comparison study in a personal series as one's clinical skill and experience tend to direct his choice for the approach. As the complication rate has been very low in this author's series and his number of patients has reached a reasonable large size, the author has decided to report the findings of this series to those who seek to improve their skills and ensure

maximum safety to their patients. This is an example of “practice based evidence medicine” being practiced by experienced surgeons.

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