NOVEL TECHNIQUE FOR SAFE PRIMARY TROCAR INSERTION IN LAPAROSCOPY: CHOU’S METHOD

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SUMMARY

Objective: To report a novel method to minimize major vascular injury during laparoscopic entry and to audit its safety.

Materials and Methods: A novel method (Chou’s method) for primary insertion of a reusable conical trocar was applied at a tertiary-referral medical center in a cohort study of women undergoing laparoscopic surgery for gynecologic indications between March 1991 and March 2004. This method uses the unique concept of directly holding the fascia. Complications related to primary trocar insertion, including vascular and visceral injury, were audited.

Results: A consecutive series of 2,963 laparoscopic surgeries performed by the author was studied. No major vascular injury, fascial dehiscence, or hernia was encountered. Two entries failed due to inability to ensure an intraperitoneal location of the trocar because of extensive adhesions; these operations were converted to laparotomy. Eight serosal abrasion injuries of the intestines (0.27%) in severe adhesion cases and one abrasional injury to the gastric serosa (0.034%) were encountered, but fortunately none were severe and all patients recovered uneventfully without repair.

Conclusion: The results with this novel method incorporating the unique concept of directly holding the fascia suggest it to be relatively safe, simple, and economic. The risk of major vascular injury was decreased to nil by this technique and the chance of visceral injury was also minimal. [Taiwanese J Obstet Gynecol 2005;44(2):153–157]

Key Words: laparoscopy, major vascular injury, primary laparoscopic entry, trocar insertion

Introduction

Major vascular injury is an uncommon but catastrophic, potentially life-threatening complication of laparoscopic access. Its incidence is estimated to range from 0.04% to 0.5% [1–3], but is probably under-reported. Mortality due to major vascular injury caused by trocar or Veress needle insertion is occasionally reported [4–7].

Major vascular injury can occur regardless of which method is chosen to insert the primary trocar. This suggests that a pitfall might exist in all previously available methods reported in the literature, by which major vascular injury cannot be avoided. The author thus tried to devise a safer technique to minimize major vascular injury during primary trocar or Veress needle insertion. The proposed method underwent an audit for its safety during application over 12 years in a large patient population.

Materials and Methods

Patient population

Between March 1991 and March 2004, 2,963 laparoscopic surgeries for various gynecologic indications were performed by the author. All laparoscopic surgery was carried out using the procedure described below.
Preoperative preparation and positioning

Almost all patients received medication with 30 mg sodium picosulfate (Dulcolax®, Boehringer Ingelheim GmbH, Mannheim, Germany) orally the night before surgery. Under general anesthesia and after Foley insertion, particular attention was paid to cleanse the umbilicus with a cotton-tip applicator soaked in acetone solution. Cotton balls drenched with povidone-iodine were applied with modest force and turned 20 rounds clockwise and 20 rounds counterclockwise.

The surgical field was prepared by aseptic technique in an area from the tip of the xiphoid process superiorly to the mid-thigh inferiorly. The lateral margins of skin preparation were extended to the mid-axillary line bilaterally. Nasogastric intubation was not performed routinely. Patients were appropriately positioned supine on the table, not in a head-down or modified Trendelenburg position.

Primary entry into the abdomen

In order to find the fascial layer easily and to decrease the amount of muscle to be penetrated, the skin incision was started intrumbinically and caudally, across to the inferior rim of the umbilicus, with a total length of 1.5–2 cm (Figure 1). We used a cutting diagonal needle with 1-O Dexon to suture two bites on the fascia of the abdominal muscles without cutting the thread. Suturing was facilitated by grasping the fascia with a Kocher clamp (Figures 2 and 3). With a fully extended middle finger applied to the shaft of the trocar, thereby limiting the length of the device that could reach the peritoneal cavity, a 5- or 10-mm conical trocar was inserted perpendicularly using the operator’s dominant hand with rotational force between the two bites, while the fascia was lifted firmly using the 1-O Dexon with the operator’s non-dominant hand together with the dominant hand of the first assistant (Figure 4). This firm control of the fascia can control the insertion force better and more easily than with other techniques. A small opening was initially made between the two bites of the fascia with a conical trocar tip, then the trocar was advanced through the fascial and muscular layers.
Slow advancement of the primary trocar was therefore ensured. Pneumoperitoneization only began after visual confirmation of the correct intraperitoneal position of the primary trocar.

Wound closure after surgery
At the conclusion of the surgery and after withdrawal of the primary trocar, the operator pulled the two ends of the 1-O Dexon and tied them together to close the fascial layer or pulled out the 1-O Dexon without fascial closure if only a 5-mm trocar was used. Skin closure with 4-O Prolene followed.

Results
Two entries (0.067%) failed due to inability to confirm the intraperitoneal location of the trocar because of extensive adhesions beneath the site of trocar insertion. These two operations were converted to traditional laparotomy. None of the patients suffered major vascular injury. Occasionally, small periumbilical vessels were injured, but the bleeding stopped spontaneously. There was no intestinal entry. However, eight (0.27%) serosal abrasion injuries of the bowel were noted and these were due to adhesions involving bowel loops situated directly beneath the umbilicus. One (0.034%) abrasion with serosal oozing occurred in a patient whose stomach was distended to three finger-breadths below the umbilicus after hyperventilation. Fortunately, all injured cases recovered uneventfully without suturing. No wound dehiscence or herniation was noted in the umbilical wounds in this series.

Discussion
Major vascular injury can occur regardless of which previously available method of primary laparoscopic trocar entry is used, even with the open method [8,9]. One reason may be the relatively close proximity of the abdominal wall to the great vessels, especially in thin individuals [10,11]. In order to obtain a greater distance, skin elevation (rather than fascia elevation) and/or pneumoperitoneization have been used before primary trocar insertion. It is obvious that, after skin incision, most resistance during umbilical insertion originates from the fascia. However, there are unpredictable variations in the individual thickness of the abdominal wall and the fascia, especially in obese patients.

Usually, the fascia is pushed downwards for an unknown distance when the trocar meets it, and it is dimpled and tented. Accordingly, with considerable force, the trocar may suddenly “pop” into the peritoneal cavity in an uncontrolled fashion after breaching the fascial layer. Injuries may occur as a consequence. It has been reported that 26 of 408 patients with trocar-related major vascular injuries died [6], and 87% of injuries occurred despite using a disposable trocar with “safety shields”. Additionally, four deaths occurred in 37 major vascular injuries related to two optimal access devices claimed to provide reliable safety [7]. The US Food and Drug Administration therefore forbids the term “safety” in the labeling of such products.

Unfortunately, available closed methods that seem to provide indirect holding and lifting of the fascia may still lead to the inadvertent use of excessive, uncontrolled force during insertion. The essence of this novel technique is that firm, direct holding of the fascia, which is the main layer that offers resistance, allows penetration during primary trocar insertion with a more controllable, rotational force. The major resistance during entry into the abdominal cavity is created by the rectus fascia, not the abdominal skin. Thus, holding the fascial layer is more plausible.

In a French study, approximately 75% of vascular injuries were related to the insufflation needle and only 25% were related to the trocar [12]. There is also evidence that the insertion of the primary cannula can be safely accomplished without pre-insufflation, provided that there has been no previous peritonitis or abdominal or pelvic intraperitoneal surgery [13–15]. In the author’s experience, there is no additional risk with Chou’s method despite the lack of pre-insufflation by Veress needle, which also carries a risk of major vascular injury as well as other complications [12,16].

Disposable pyramidal trocars are the most commonly used devices. Generally speaking, they require the least force because of their excellent cutting effect. On the other hand, conical trocars dilate, rather than cut, the fascial and muscular tissue. In the author’s opinion, the demands for trocar sharpness or force to penetrate the fascia layer (only a few millimeters thick) in Chou’s method are not high. The conical trocar was therefore chosen for its splitting rather than cutting effect during tissue separation to lessen the trauma to the tissue. Consequently, better wound healing and decreased risk of dehiscence are achieved [17–19]. In addition, starting the vertical skin incision intraumbilically and caudally across the lower rim of the umbilicus was chosen to minimize the amount of rectus muscle to be penetrated and to make the fascial layer easier to find.

The safety of Chou’s method was verified by the lack of major vascular injury in nearly 3,000 insertions without pre-insufflation and by using each reusable conical trocar for more than 5 years without sharpening, contrary
to previous practice [20]. Furthermore, all of the author’s colleagues and residents who practiced and witnessed Chou’s method adopted the same method without encountering a single major vascular injury. The total number of their cases has probably exceeded that reported here.

Traditionally, the fascia is sutured at the conclusion of surgery. The author simply changed the order, so no additional time was spent for the whole operation compared with other methods. In the author’s opinion, it is even easier to suture the fascia before the planned procedure than to do it at the end of the operation.

The author was pleased to achieve no major vascular injuries using this method. Nevertheless, he was lucky to have no visceral injury in this series other than serosal abrasion injury to the abdominal organs in a small percentage of adhesion cases. He speculates that intestines adhering to the subumbilical area could be pushed aside by slowly advancing the trocar tip under excellent control of rotational force during insertion. As a consequence, the risk of visceral entry was minimal. Intestinal entry is still possible if there is firm adhesion directly beneath the opening of the conical tip. However, it can be diagnosed intraoperatively by checking with a 5-mm laparoscope in an ancillary port at the beginning of surgery. In fact, the intestine can be entered inadvertently even in laparotomy, regardless of the size of the wound.

In the case with temporary oozing from the stomach serosa, entry was made unnoticed because a distended stomach three finger-breadths below the umbilicus was mistaken for the peritoneal cavity. There was a sensation of “bumping” during the attempted advance. Insertion of a laparoscope disclosed the injury. It may be better that the stomach be decompressed routinely using a nasogastric tube.

It is claimed that the “EndoTIP” (Karl Storz Endoscopy-America Inc, Culver City, CA, USA) used with rotational force carries little chance of visceral or vascular injury [21,22] and its damage is similar to a similar-sized conical trocar [18,23]. However, this is yet to be proven.

Without special instrumentation or additional procedures, the author has demonstrated that the method described in this article is a safe, simple, timesaving, easy-to-learn, economic alternative for primary umbilical trocar insertion. It can be regarded, to a certain degree, as a modification and combination of the direct method of trocar insertion [13], the open method proposed by Hasson [24], and the perpendicular method proposed by Luciano [25]. Chou’s method is, however, unique, safe, and worthwhile to share with colleagues worldwide.

Acknowledgments

Special thanks is given to Dr. Ming Chen (Associate Editor of the *Taiwanese Journal of Obstetrics and Gynecology* at the time this article was written) for giving valuable assistance and advice on the preparation of this manuscript. The author also thanks all colleagues at Changhua Christian Hospital during the past 14 years who witnessed and helped his surgeries.

References


