The optical trocar in gynecological surgery: clinical and technical outcomes

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Summary

Optical trocars have been introduced as an alternative technique for obtaining access to the peritoneal cavity. The advantage is that each layer of the abdominal wall can be identified avoiding inadvertent injuries due to a lack of vision. From March 2010 to March 2011, 138 women underwent laparoscopy for benign diseases. They were submitted to gynecological laparoscopy for direct optical access. There was no evidence of vascular injuries. This study confirms that the optical trocar is a safe, rapid, and effective method, that offers a real perception of the safety of the entrance into the abdomen.

Key words: Optical trocar; Gynecological laparoscopy: Laparoscopic entry techniques; Laparoscopic complications.

Introduction

Laparoscopy is a very common procedure in gynecology, especially for the treatment of benign conditions. Over the past three decades, the laparoscopic technique has significantly evolved and it is now accepted as the first choice for the management of most gynecological problems [1, 2]. Several studies comparing laparoscopy and laparotomy performed for benign gynecological diseases demonstrated that the risk of minor complications is 40% lower with laparoscopic vs "open" surgery; on the other hand, the risk of major complications is similar [3]. The initial entrance into the abdominal cavity for establishing pneumoperitoneum is a very important and critical step during laparoscopy [4]. The literature demonstrates that at least 50% of major complications occur during the first phase of the procedure [5, 6]. The available methods include closed or open techniques [2, 7]. The blind Veress needle introduction for the creation of pneumoperitoneum is followed by the blind trocar insertion [8]. The basic concept of the open Hasson technique is to create a small skin incision, directly incising all the layers of the abdominal wall one by one (including the anterior peritoneum) and then entering the abdomen [9]. Another technique is represented by a direct trocar which enters into the abdominal cavity without prior Veress needle and pneumo-insufflation. Initial entrance can be performed with a disposable trocar designed with a shield that partially retracts and exposes a sharp tip as it encounters resistance during the passage through the abdominal layers; when the shield reaches the peritoneal cavity, it springs forward and covers the sharp tip. The optical trocar allows a clear visualization of the abdominal tissue planes on the monitor which are separated (not cut) under steady vision by advancement of the edge of the cannula. There is no evidence that one of these techniques is superior or inferior to the other entry methods currently available, and there is no clear consensus as to the optimal method of the entry into the peritoneal cavity. The closed-entry with the use of the Veress needle is the most popular approach for gynecological laparoscopists [10]. Although this technique is generally considered to be safe, several injuries (major and minor) to numerous abdominal structures have been reported (0.9/1000) [11]. Blind entrance, using the Veress needle and the first or the direct trocar, may cause several lesions (vascular, bowel, and abdominal wall injuries). The optical trocars have been introduced as an alternative technique for obtaining access to the peritoneal cavity (traversing the tissue planes under direct view). The theoretical advantage of these trocars, which allow a clear optical entry, is that each layer of the abdominal wall can be identified, avoiding the inadvertent injuries due to a lack of vision [12]. However, they have not obtained a large approval among laparoscopists.

Materials and Methods

From March 2010 to March 2011, a total of 138 women underwent laparoscopic surgery for simple ovarian cysts, sactosalpinx, extrauterine pregnancies, uterine myomas, chronic pelvic pain (adhesions and endometriosis), and sterility. They were all submitted to gynecological laparoscopy for the direct optical access with a bladeless trocar. All the patients were evaluated with a Pap smear (or human papilloma virus (HPV)-DNA test), bimanual examination, and pelvic ultrasound to exclude a premalignant or a malignant condition. Women with previous abdominal surgery and obese patients were not excluded from the study (these conditions were not considered as confounding factors). The maximum diameter of the ovarian cysts and of the uterine myomas was ten cm. The procedures were carried out under general anesthesia by endotracheal intubation. The patient was placed in a steep Trendelenburg position of 45° causing the

Revised manuscript accepted for publication June 7, 2012

intraperitoneal organs to move (dislocate towards the diaphragm) and liberating the operative field of the pelvis and of the lower part of the abdominal cavity. A small, appropriate, intra-umbilical longitudinal incision was performed and the abdominal wall was pulled up with a countertraction by both the first operator and the first assistant; a 12-mm disposable bladeless trocar (Endopath trocar, Ethicon Endo-Surgery, Inc., Cincinnati, OH, USA) with a 0° laparoscope (inserted into the cannula) was advanced into the wound. Under constant direct vision, with a gentle rotating motion combined to a moderate pressure, the trocar was advanced sequentially through the layers of the abdominal wall, from the subcutaneous tissue (white/yellow) to the rectus sheath (bright white) and the peritoneum (translucent, vascular). This movement provides the dilating and the separating of the tissue planes, not their cutting. The peritoneum typically extends over the tip, which offers a classical image of a white ring. If an adhesion is present, a white reflection appears in the center of the ring; on the contrary, a dark area suggests a free abdominal cavity (absence of adhesion to the abdominal wall). The peritoneum is punctured and, in many cases, the unmistakable respiratory movement of the intestinal loops can be identified; the intra-abdominal position of the trocar is confirmed and insufflation can be started. All the patients were generally healthy (ASA I-II); their problems were related to benign gynecological conditions. They presented the following characteristics: average age of 38.1 years (range 21-63), average body mass index (BMI) of 25.2 (range 20-31). The previous abdominal operations (31 cases) included both laparoscopy and laparotomy (12 laparoscopy, 15 Pfannenstiel, 4 midline laparotomy). The procedures and the indications are demonstrated in Table 1.

Table 1. — *Procedures and indications for laparoscopic surgery using an optical trocar.*

Procedures/Indications	No. of patients
Hysterectomy	13
Myomas enucleation	7
Adnexectomy	24
Ovarian cysts enucleation	31
Tubal pregnancy	11
Chronic pelvic pain (adhesions/endometriosis)	27
Sterility	20
Sactosalpinx	5

Results

In this study, the following parameters were evaluated: occurrence of major and minor vascular injuries, occurrence of major and minor bowel and urological injuries, blood loss, time required for trocar insertion, and the creation of pneumoperitoneum. In all the procedures, no problems or difficulties were encountered during the initial placement of the optical trocar. There was no evidence of any vascular injury (major and/or minor injuries). At times, a slight bleeding (accrued from the small vessels of the abdominal wall) which occurred during the first phase of the laparoscopy, but this blood loss did not prevent the operator from introducing the trocar nor did it interfere with visual control in the monitor. No lesion occurred to the intraperitoneal organs and/or to the omentum, to the bladder and/or to the ureters. There were no port-site hernias; the closure of the fascia was not considered a necessary step and it was carried out in only nine cases (based on the clinical assessment of the surgeon). The average time for the introduction of the trocar and the establishment of pneumoperitoneum was 61.5 seconds; if the patient had had a previous surgery, this time was 72.3 seconds. There was no necessity of conversion to open laparoscopy or laparotomy. In one case, the presence of a peri-umbilical omental adhesion did not give rise to any problems, because the continuous visual control allowed to find a space (an area which was free of adhesion) through which the trocar was inserted into the abdominal cavity. The patients, after assessing the most important clinical parameters, were discharged on day-1 postoperatively. The range of the follow-up period was one to 12 months and no late complications occurred.

Discussion

This study confirmed that the optical trocar can be used for the first abdominal access as a safe, efficacious, and feasible approach. This method can be considered an alternative route to other techniques, both closed and open entries, and it can be proposed to minimize visceral and vascular lesions [13]. Generally, these complications occur when the intraperitoneal structures are located very close to the insertion area of the blind trocar (or of the Veress needle) or when these devices penetrate into the retroperitoneal space. Major vascular injury during the first phase is a highly-feared complication of the procedure. This represents the major cause of death due to laparoscopic early complications. These lesions may occur when the blind Veress needle enters into the abdomen prior to pneumoperitoneum or when the first blind trocar is inserted (prior or after insufflation). The proximity of the anterior wall to the retroperitoneal major vascular structures is apparently the reason for these serious complications. The aorta, the inferior vena cava, and the iliac vessels are strongly exposed and prone to severe or fatal lesions; in fact, in some cases, such as in very thin patients, the distance between the anterior and the posterior layers of the peritoneum is really exiguous (three to five cm).

Intestinal perforation represents one of the three principles causes of death (the main: vascular injury and other complications associated to anesthesia). These lesions, which often are diagnosed in the postoperative period and not immediately, can be detected or avoided with the use of the visual access device. The optical trocar allows an excellent visualization of the abdominal wall layers and its blunt tip can avoid lesions to the vessels and to the gastrointestinal (GI) tract during the entry into the peritoneal cavity. This risk is obviously higher in patients with previous abdominal surgery due to a more likely occurrence of visceral and omental adhesions. Even when complications are encountered, the optical trocar has the advantage of allowing immediate recognition and the repair of injuries (otherwise these could be missed and might lead to serious sequelae, such as peritonitis and sepsis or death, if their diagnosis is delayed).

The limit of this study was that a comparison with other techniques of primary port-entry was not performed; on the other hand, no complications occurred. Although visual control is continuous, the risk of injuries still exists, and some data, based on the international literature, show that this technique cannot entirely avoid the initial trocar-related incidents. The optical device offers the possibility for the surgeon to assess, under direct vision with a monitor, every traversed layer of the body wall, the exact position of the vessels (avoiding bleeding and the consequent hematoma which requires a laparotomy) and, especially in patients with previous midline laparotomy, potential adhesions of the intra-abdominal organs to the anterior peritoneal sheet. Therefore, after the cautious and safe entrance into the abdomen, the risk of lesions to the urological and GI tract and to the abdominal vascular tree is very low (bladder and ureteral injuries are more likely to occur during oncological procedures, urogynecological operations, and the treatment of deep endometriosis).

In conclusion, this technique can be considered a rapid and effective method and it can offer a real perception of the safe entrance into the abdomen. The optical trocar is disposable and its cost is reasonable. The authors' experience with this type of trocar in a large population with various characteristics (Italians or not, wide range of BMI, and patients of all ages, postmenopausal or not) has been excellent and this method has become their first choice for obtaining entry into the abdomen and initiating pneumoperitoneum.

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