

A safe and simple method for routine open access in laparoscopic procedures

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Abstract

Background: Access to the peritoneal cavity in laparoscopic procedures is generally achieved by means of a pneumoperitoneum, following introduction of a Veress needle. Because this procedure must be done blindly, it is not without visceral or vascular hazards. Therefore, we sought an alternative technique that might obviate these complications.

Methods: In a series of 803 patients, a modified Hasson technique was used to obtain a pneumoperitoneum without risking the complications associated with the introduction of a Veress needle.

Results: The modified Hasson technique proved to be feasible in all cases. No visceral or vascular complications resulted, but 10 patients had a transient serous discharge. Follow-up ranged between 5 and 52 months.

Conclusion: The modified Hasson technique should always be used in laparoscopic procedures.

Key words: Laparoscopy — Iatrogenic lesions — Peritoneal access — Techniques — Open laparoscopy

Laparoscopy, as first described by Kelling in 1902 [11], was used by gynecologists for several decades before it gained widespread popularity among general surgeons. Since Dubois et al. proved its feasibility for cholecystectomy [6], it has become the gold standard for that indication [25]. Indeed, indications for the procedure are still continuing to expand.

Despite its numerous advantages, however, laparoscopy entails some procedure-related complications that, although not frequent, may cause major morbidity in the individual patient. Some of these complications are related to the creation of the pneumoperitoneum and the introduction of the first trocar. The most commonly practiced technique for

gaining access to the peritoneal cavity is the use of a Veress needle to create a pneumoperitoneum, after which the first trocar is introduced blindly, a technique long supported by the American Association of Gynecological Laparoscopists [20].

Major vascular and visceral injuries with a slight predominance of the former, due to blind puncture with the Veress needle or the first trocar have been reported [1, 4, 5, 8, 14, 16, 22]. Moreover, there have even been some deaths as a result of aorto-iliac injuries [7, 13, 19].

To reduce the risk of such injuries, general guidelines have been proposed for the blind introduction and verification of correct intraperitoneal placement [23], but these guidelines cannot guarantee absolute safety.

In 1971, Hasson devised an open approach to gain access to the peritoneal cavity that would minimize the risk of vascular and organ puncture by using a specially developed blunt-tipped trocar [9]. However, this technique has not gained wide acceptance for routine use in laparoscopic procedures, despite the decades of predominant gynecological use and the more recent widespread use of laparoscopy in general surgery. Instead, the open method has generally been reserved for patients in whom previous abdominal surgery has caused scarring near the umbilicus, even though the reports in the literature do not correlate blind puncture and major injury with previous abdominal surgery.

Since 1992, we have routinely gained open access to the peritoneal cavity using a modified Hasson technique for every laparoscopic procedure in order to avoid vascular and visceral injuries. The results in a series of over 800 procedures are presented.

Materials and methods

Between December 1992 and December 1996, 803 patients operated in the Department of Gastrointestinal Surgery of a community teaching hospital ($n = 768$) and the Surgical Department of a large university-affiliated hospital ($n = 35$) underwent laparoscopic surgery with an open-access technique. The indications for surgery are shown in Table 1, as well as the site of incision for introduction of the first trocar.

Table 1. Indications and incision sites for surgery in 803 laparoscopy patients

| Type of laparoscopic intervention | Incision site for primary trocar | Number of patients |
|-----------------------------------|----------------------------------|--------------------|
| Biliary surgery | Right upper umbilical quadrant | 650 |
| Gastric surgery | Right upper umbilical quadrant | 6 |
| Appendectomy | Right lower umbilical quadrant | 45 |
| Right inguinal hernia | Right lower umbilical quadrant | 26 |
| Left inguinal hernia | Left lower umbilical quadrant | 31 |
| Bilateral inguinal hernia | Right lower umbilical quadrant | 5 |
| Diagnostic | Right lower umbilical quadrant | 9 |
| Gastroesophageal reflux surgery | Left epigastric region | 31 |
| Total | | 803 |

First, a 2-cm curved periumbilical skin incision is made. The place is dependent on the type of intervention. Incision is made in the right upper umbilical quadrant for gastric or biliary surgery and in the right or left lower umbilical quadrant for appendectomy, transabdominal inguinal hernia repair, or diagnostic laparoscopy (Fig. 1). In cases of gastroesophageal reflux surgery, the skin incision is made a few centimeters above the umbilicus paramedian to the left.

Subcutaneous tissue is dissected until the rectus fascia is encountered. A pursestring suture is placed paramedially on the fascial surface. The midline is avoided; thus needle bites only affect the fascia and do not grasp the underlying rectus muscle. Using forceps and scissors, the fascial sheet is opened longitudinally and the rectus muscle exposed. Using wound retractors, the entire rectus muscle is retracted laterally by the assistant and the medial fascial edge retracted medially. The lower rectus sheet and peritoneum—or sole peritoneum in cases of lower abdominal surgery—are incised in a similar manner while the assistant tents the abdominal wall. Care must be taken not to injure the underlying viscera while intraperitoneal access is provided. A blunt-tipped Hasson trocar is introduced. In the pursestring suture is tied once and fixed, under tension, to the gasket for the maintenance of an airtight seal.

In the beginning of the series, a disposable blunt-tipped trocar (Ethicon Endo-Surgery, Cincinnati, OH, USA) was used, but later this type was replaced by a reusable metallic variant (R. Wolf GMBH, 75438 Knittlingen, Germany). In the few cases where a small umbilical hernia was present, the hernia defect was used as an entry port in a similar fashion. A pneumoperitoneum is achieved with CO₂ insufflation. Other trocars are introduced under laparoscopic vision. In performing cholecystectomy, the gallbladder is extracted using an endo-bag whenever it was perforated or appeared extremely inflamed.

After the laparoscopic procedures finished, the pneumoperitoneum is released and the trocars withdrawn. To close the fascial defect, the pursestring suture is simply tied. Additionally, the fascial is closed at every port >5 mm.

Follow-up for the patients in this series was 5–52 months. All patients were interviewed and checked clinically with respect to trocar-site healing, infection, evisceration, or late herniation at this site.

Results

The 2-cm skin incision always proved adequate for clear view and comfortable handling. The technique was feasible in all cases. Once a routine was achieved for both the surgeon and the assistant, the procedure was not time-consuming, especially because of the time saved by rapid insufflation through a large-caliber trocar, as compared with the Veress needle, and by the rapid closure of the fascial defect at the end of the intervention, with the already-placed pursestring suture. We never encountered any damage to the underlying viscera, nor did we cause any vascular injury.

Ten patients (1.24%), all of whom had laparoscopic cholecystectomy for acute cholecystitis, developed a transient discharge of the umbilical wound that did not need further treatment.

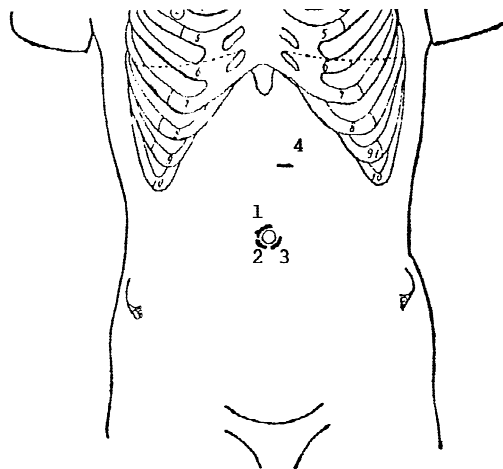


Fig. 1. There are four different procedure-dependent incision sites for the first trocar in open laparoscopy: 1. right upper umbilical quadrant, 2. right lower umbilical quadrant, 3. left lower umbilical quadrant, and 4. left epigastric region.

In cholecystectomy cases, the fascial defect allowed enough room for extraction of the gallbladder and its stones. In 12 cases, it had to be widened, and additional stitches were needed to close the defect. So far (follow-up of 5–52 months), no patient has developed a trocar hernia at the entry site of the blunt-tipped trocar.

Discussion

The introduction of a Veress needle to achieve a pneumoperitoneum in laparoscopic surgery and the subsequent blind introduction of the first trocar can cause damage to (intra)abdominal organs and vessels [1, 4, 5, 8, 14, 16, 22]. This access technique is the method of choice advocated by the American Association of Gynecological Laparoscopists [20] and has been copied by general surgeons.

Visceral injury mainly consists of damage to the small intestine, ranging from superficial serosal damage to complete perforation, but it can also involve the liver, duodenum, colon, stomach, bladder, uterus, mesenterium, or spleen.

In a French survey of 103,852 laparoscopic procedures, visceral injury due to trocar insertion was reported in 0.06% [4]. This resulted in a 65% conversion rate and one fatality. Precise figures on the frequency of visceral injury caused by blind insertion of the Veress needle and first trocar are difficult to find in the literature; this complication is probably underreported. In a series of 781 laparoscopic cholecystectomies, Sigman et al. reported visceral perforation in three patients (0.38%) [24].

Gastric perforation during blind abdominal puncture can be the result of overdistention of the stomach secondary to the induction of anesthesia. Urinary tract injury can be caused by inadequate decompression of the bladder or congenital anomalies, such as vesicourachal diverticulum [27]. Usually, these visceral injuries cause only minor morbidity when they are treated promptly, but they can result in intraabdominal sepsis if they are not recognized at the time of the initial procedure.

Although vascular injuries are slightly less frequent, they are often more serious. Since the insertion site of both the Veress needle and the first trocar is usually near the umbilicus, the injured vessels are usually either the aorta close to its bifurcation, the iliac vessels, or the caval vein. In a review of the complications of closed laparoscopy, Bonjer et al. reported a frequency of 0.075% vascular injuries [3]. Geers and Holden reported three major vascular injuries in 2,201 laparoscopic procedures (0.14%) [8]. These injuries always require prompt conversion for immediate repair with sometimes difficult vascular reconstructive techniques and present a mortality rate due to exsanguination of $\leq 8.8\%$ [5].

In addition to substantial blood loss insufflation after the puncture of a large vessel can cause gas embolism—a potentially lethal condition [17].

Inproper intraabdominal placement of the Veress needle can also result in insufflation of pre- and retroperitoneal spaces, thus complicating access to the peritoneal cavity secondary to subcutaneous emphysematous distortion of the preperitoneal space [22].

Several measures can be taken to minimize the complications associated with the blind approach. Semm recommends several subsequent steps for the insertion of the primary trocar, including palpation of the aortic bifurcation, testing of the intraperitoneal position of the Veress needle by means of fluid drip, positioning the trocar towards the pelvis, and controlled insertion [23].

The pharmaceutical industry, which is well aware of these complications, has developed a trocar with a safety shield, but no prospective study has proven its superiority. Indeed, when excessive force is needed to enter the abdomen due to a tough fascial structure or when an inadequate pneumoperitoneum is obtained, the safety shield may not deploy quickly enough to obviate injury. In cases where abdominal wall adhesions are present, there is no advantage at all.

Translucent trocars, in which the laparoscope is introduced to allow direct visualization during penetration of the abdominal wall, were also developed to avoid major inadvertent injuries, but Thompson et al. have reported two cases of caval vein injuries using the Visiport (United States Surgical Corporation, Norwalk, CT, USA) that went unrecognized during puncture [26].

Hasson first described his blunt-tipped trocar and open-access technique for laparoscopy in 1971. This method used a transverse subumbilical midline incision and two separate stay sutures through the peritoneal edge [9]. Although no vascular injuries were ever reported using this technique, it did not gain widespread use by either gynecologists nor abdominal surgeons. The largest published series of open laparoscopies consists of 10,840 procedures performed by 18 gynecologists and reviewed in a retrospective manner. The study found only six cases of bowel laceration (0.05%) [18]. Of course, just as in laparotomy, visceral injury is possible while gaining visual intraabdominal access. It is, however, more readily recognized than in blind puncture; thus, immediate repair can be done, and subsequent morbidity is minor. Two other cases of visceral injury during open laparoscopy were reported in urologic cases. One involved a bowel injury in a 2-year-old boy whose serosal bowel surface was grasped by the pursestring suture; the

second case was a male adult whose small bowel was perforated during incision of the peritoneum [12, 21].

Most of the reported series of open laparoscopy cases have been retrospective studies. Three of these studies compared open- to closed access; all three of them concluded that the open technique was superior [2, 3, 24]. As of now, no prospective randomized studies have been done.

Opponents of the open technique argue that it is more time-consuming. In fact, it saves time because insufflation of the peritoneal cavity is done with high flow through a 10-mm trocar, as compared with the low flow allowed by the Veress needle. Moreover, at the end of the operation, fascial closure is quickly obtained by simply tying the already-placed pursestring suture on the fascial surface. Two comparative studies have shown a shorter operating time with the open technique [2, 24].

Our series represents the largest number of routine open laparoscopies yet reported in general abdominal surgery. We used a modified technique through a curved umbilical quadrant incision, avoiding the midline with a pursestring suture on the upper rectus fascial sheet. The rationale for this modification is that there is less air leakage, less postoperative hernia formation, and better cosmetic result. In 803 procedures, we never caused any vascular or visceral injury due to trocar introduction. The open technique was always feasible, even in the very obese, and hardly ever required a larger incision. Postoperatively, 10 patients (1.24%) developed a transient discharge of the umbilical wound. All these patients underwent laparoscopic cholecystectomy for acute cholecystitis and gallbladder removal like all other patients, through the umbilical port, mostly using an endo-bag. We never had to drain a subcutaneous infectious collection.

These results are comparable to the other reports of open laparoscopy [15]. Trocar hernias have been reported in 0.23% of patients using 10-mm ports and 3.1% using 12-mm ports [10]. In our series, none of the patients developed a postoperative trocar hernia at the umbilical site, possibly due to the use of the pursestring suture and the paramedian access, which allows the rectus muscle to slide back in place in front of the fascial defect following retraction of the trocar.

Conclusions

To prevent the procedure-related complications associated with blind abdominal puncture in laparoscopic procedures and their associated morbidity and mortality, we strongly advocate routine use of the open technique with a Hasson trocar. Our series of 803 patients proves that this modified technique is feasible, safe, and reproducible.

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