

Original article

Evaluation of the Safety and Efficacy of the Open Entry Technique in Laparoscopic Surgery

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Abstract

Laparoscopic surgery has significantly improved patient recovery and reduced morbidity. However, the method of entry into the peritoneal cavity remains a concern due to potential complications. This study revisits an open entry modification that utilizes the umbilical cicatrix tube for fascia incision and blunt dissection, aiming to assess its safety, efficacy, and applicability relative to existing laparoscopic entry methods. A total of 400 laparoscopic cholecystectomies were performed using the proposed technique. Data on patient demographics, body mass index (BMI), previous surgeries, and complications were collected. Results showed no vascular or visceral injuries, and zero incidence of gas leakage. The technique proved effective across surgeon experience levels and in patients with prior abdominal surgery and obesity (16% with BMI > 30). The open access technique demonstrated safety, efficacy, and ease of learning for surgeons of varying experience. It is suitable for obese patients and those with previous abdominal surgeries.

Keywords. Open Access Technique, Laparoscopic Surgery, Umbilical Cicatrix Tube, Pneumoperitoneum

Introduction

There is no debate that laparoscopic surgery has had a tremendous positive impact on patients and the healthcare system. Patients usually go back to their daily routines faster and experience less pain and fewer complications. As a result, the number of laparoscopic surgeries performed each year is increasing significantly. In the U.S., over 2 million laparoscopic procedures are done annually [1].

Laparoscopic surgery, often called minimal access surgery, uses special tools that are inserted through small cuts in the skin. To perform this type of surgery, it's necessary to access the peritoneal cavity to create a pneumoperitoneum, which helps improve visibility by pushing the abdominal wall away from the organs. Establishing pneumoperitoneum is usually done blindly using either open or closed techniques. There are various methods to access the abdomen for laparoscopic surgery, such as the Veress needle, the open Hasson technique, direct trocar insertion, and visual entry systems. However, there is no agreed-upon best method for entering the peritoneal cavity. The first trocar insertion is the riskiest part of using trocars and could be the most dangerous step in minimally invasive surgery [2]. The risks involved in blind access and creating pneumoperitoneum are not present in open surgery.

Despite advances in laparoscopic tools and the experience of many surgeons, injuries and deaths still occur each year from the insertion of trocars and Veress needles [3]. Creating pneumoperitoneum and inserting trocars can lead to serious injuries to abdominal organs and blood vessels [3]. The complications linked to trocar insertion differ in their severity and the timing of their presentation. It is well established that over 50% of the trocar-related injuries to the bowel and vasculature occur during the initial entry [4]. Unfortunately, 30-50% of the bowel injuries and 15-50% of the vascular injuries are not diagnosed at the time of injury [4]. This delay has contributed to mortality rates of 3-30% for bowel and vascular injuries [3,4]. This study revisits an open entry modification that utilizes the umbilical cicatrix tube for fascia incision and blunt dissection, aiming to assess its safety, efficacy, and applicability relative to existing laparoscopic entry methods.

Methods

This retrospective analysis included 400 patients undergoing laparoscopic surgery, predominantly cholecystectomy, performed with the open entry technique. Inclusion criteria encompassed adult patients with or without prior abdominal surgeries; exclusion criteria included laparoscopic surgery with a close entry technique. Data collected from medical records comprised demographics (age, sex, BMI), previous surgical history, surgeon experience level, and intraoperative complications. BMI classifications followed WHO guidelines.

The statistical analysis for this study was conducted using [SPSS version 27.0 for Windows]. Comparative analyses were conducted to evaluate intraoperative complications and outcomes between patients with and without previous abdominal surgeries. Pearson's Chi-square test was used for the analysis of complications. A significance level of $p < 0.05$ was established for all tests to determine statistical significance. The findings were contextualized against the existing literature to validate the safety and efficacy of the open entry technique compared to traditional laparoscopic entry methods.

Operative Technique

The technique may be performed either supra-umbilically or infra-umbilically. It involves a meticulous, layer-by-layer approach to abdominal entry. Initially, a transverse or longitudinal skin incision is made within the umbilical fold, with its length tailored to match the diameter of the trocar. The umbilical cicatrix tube is then carefully dissected using artery forceps until the linea alba is reached. A towel clip is applied to the cicatrix tube of the umbilicus to provide upward traction. At the junction of the linea alba and the cicatrix tube, a midline incision of suitable length is made, ensuring that only the fascia is incised. In obese patients, the use of two retractors can aid in facilitating access.

The peritoneum is then bluntly opened with artery forceps, allowing negative pressure to draw air into the abdominal cavity. This creates a safe distance between the peritoneum and the underlying intestines, further enhanced by the upward traction from the towel clip. A blunt 10 mm trocar is subsequently introduced through the incision into the abdominal cavity, followed by the insertion of the camera. Pneumoperitoneum is then established through insufflation. Upon completion of the procedure, the fascia is exposed and securely closed with sutures.

Results

Among the 400 patients included in the study, the predominant age group ranged from 31 to 50 years, with females comprising 85% of the cohort (Table 1). The majority of procedures performed were laparoscopic cholecystectomies. Surgical participation was distributed across three levels of expertise: consultants carried out 50.25% of the operations, specialists performed 19.75%, and residents were responsible for 30%. Body Mass Index (BMI) was recorded for only 100 patients, of whom 16 were classified as obese with a BMI exceeding 30. A history of previous abdominal surgery was absent in 64% of the patients, while the remaining had undergone prior abdominal procedures. Notably, there were no instances of gas leakage, no conversions due to entry failure, and no reported injuries to intra-abdominal organs or vascular structures. Additionally, no cases of wound infection were observed.

Table 1. Patients' demographics

Variables	Number	Percentage
Age Group		
15 – 20	7	1.75%
21 – 30	54	13.5%
31 – 40	118	29.5%
41 – 50	96	24%
51 – 60	54	13.5%
61 -70	36	9%
71 -80	22	5.5%
81 – 90	13	3.25%
Gender		
Male	60	15%
Female	340	85%
Operation		
Lap. Cholecystectomy	385	96.25%
Others	15	3.75%
Surgeon		
Consultant	201	50.25%
Specialist	79	19.75%
Resident	120	30%
BMI		
Underweight (BMI < 18.5)	0	0 %
Healthy weight (BMI 18.5 - 24.9)	38	38%
Overweight (BMI 25-29.9)	46	46%
Obese (BMI > 30)	16	16%

Discussion

Laparoscopic access to the abdominal cavity predominantly relies on the Veress needle with blind trocar placement or direct trocar insertion without pneumoperitoneum [5,6]. Following rapid adoption by general surgeons, pediatric surgeons, gynecologists, and urologists in the early 1990s, the concurrent learning curve among practitioners led to increased major complications, including vascular and visceral injuries. Champault et al. reported vascular injury incidence at 0.04% and visceral injuries at 0.06% in over 100,000 Veress technique cases [7].

The open access technique, first described by Hasson in 1971, offers advantages including prevention of gas embolism and preperitoneal insufflation, with potential reduction in visceral and major vascular injuries [8]. Hasson's analysis of 17 open laparoscopy publications (9 by general surgeons [7,205 patients]; 8 by gynecologists [13,486 patients]) compared outcomes against closed laparoscopy (7 general surgery publications [90,152 patients]; 12 gynecology publications [579,510 patients]). Open laparoscopy demonstrated lower complication rates: umbilical infection 0.4%, bowel injury 0.1%, and vascular injury 0% versus closed laparoscopy's 1% umbilical infection, 0.2% bowel injury, and 0.2% vascular injury. Based on 29 years of experience with 5,284 laparoscopic cases (including only one bowel injury in his first 50 cases), Hasson advocated open technique as the preferred access method [8]. Supporting this, Merlin et al.'s meta-analysis found vascular injuries in 0.003–1.33% of closed techniques versus 0–0.03% in open techniques, and visceral injuries in 0.04% (closed) versus 0–1.3% (open) [9], suggesting open access reduces major complications, particularly vascular injuries.

Despite these findings, some studies report higher bowel injury rates with open laparoscopy, potentially reflecting patient selection bias since patients with prior abdominal surgery often receive open procedures. Current European Association for Endoscopic Surgery guidelines note insufficient evidence to favor either technique [10], though they acknowledge that major vascular injuries occur most frequently with the Veress approach. The original Hasson technique requires a 3–4 cm midline mini-laparotomy with specialized equipment: a cone-sleeved cannula to minimize gas leakage, a blunt trocar, and often a secondary sleeve for stay sutures. This complexity and instrument dependency limited its adoption [8], prompting numerous modifications to eliminate specialized tools. Hurd et al. reported a modification achieving instrument independence but with 14% gas leakage [11], while Pawanindra, Moberg, Petersson, and Montgomery also trialed open access variations [12].

This study presents a modified open-access technique requiring only standard instruments. Utilizing the umbilical cicatrix tube, abdominal wall elevation is achieved with a towel clamp, creating space for a blunt trocar insertion via a minimal fascial incision at the tube junction. Blunt artery forceps open the peritoneum to prevent visceral injury. Upon entry, ambient air creates working space while upward towel clamp traction increases the peritoneal-intestinal distance. The blunt trocar advances horizontally parallel to the abdominal wall, minimizing injury risk. The fascial opening's minimal size (accommodating only the trocar tip) prevents gas leakage and ensures stability.

Applied in 400 laparoscopic operations, this technique resulted in zero vascular injuries—consistent with other open access studies—and notably zero visceral injuries. This improves upon Merlin et al.'s reported 1.3% visceral injury rate with open techniques and Hasson's 0.1% [8,9]. Even among 144 patients with prior abdominal surgery, no vascular or visceral injuries occurred, confirming safety in high-risk cohorts. Furthermore, no cases exhibited the common open laparoscopy drawbacks of CO₂ leakage (literature range: 4.2–14.2% [11]) or extraperitoneal insufflation—a complication causing procedure abandonment in 2.7–100% of cases depending on attempt frequency [13,14]. Our technique prevents this by verifying the trocar position via camera before insufflation. It also enables higher insufflation flow rates (>6 L/min through 10–12 mm trocars) versus the Veress needle's 2.5 L/min limit (14-gauge constraint) [12,13,15].

The technique demonstrated broad surgeon acceptance across experience levels, with residents performing 30% of operations, indicating ease of learning. It proved effective in challenging populations: among 100 documented cases, 46 overweight (BMI 25–29.9) and 16 obese (BMI >30) patients underwent successful access without requiring alternative entry sites (e.g., Palmer's point). Crucially, it eliminates dependence on costly, limited-availability equipment like Hasson's cone-shaped cannula, radially expanding polymeric sleeves, or optical trocars (e.g., Endopath Optiview). Using only a towel clamp, blunt artery forceps, and a standard trocar, it achieves secure entry without gas leakage or stay sutures.

Study Limitations

This retrospective analysis of 400 patients limits generalizability. Non-randomized patient assignment may introduce confounding variables affecting reliability. Follow-up duration may be insufficient to assess long-term outcomes like hernia development.

Conclusion

The open access technique used in this study is safe, fast, easy to learn, and applicable even in obese patients and in patients with previous abdominal surgery. Future studies should focus on increasing the sample size and conducting multi-center trials to enhance generalizability. Implementing randomized controlled designs will help reduce bias, while extending the follow-up duration is essential for assessing long-term outcomes. Comparative analyses with established techniques are recommended to contextualize findings, along with clear inclusion criteria to minimize selection bias. Finally, developing standardized protocols for the new technique will ensure consistency in its application.

Conflicts of Interest

no conflicts of interest.

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