

COMPARISON OF OPEN (HASSON'S) TECHNIQUE AND CLOSED ENTRY TECHNIQUE FOR CREATION OF PNEUMOPERITONEUM IN LAPAROSCOPIC CHOLECYSTECTOMY

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Abstract

Background : Laparoscopic cholecystectomy has become the gold standard for treating benign gallbladder disease, where the creation of a pneumoperitoneum—an insufflation of the abdominal cavity with gas—is a critical prerequisite. The main objective of the present study was to compare the safety and efficacy of the Open (Hasson's) method and Closed (Veress Needle) method for creating a pneumoperitoneum in laparoscopic cholecystectomy and to determine safe practices for pneumoperitoneum creation with minimal complications and higher efficacy.

Methods: This prospective, randomized clinical study was conducted on 50 patients divided into 2 groups having 25 patients each at Government Medical College, Rajindra Hospital, Patiala, Punjab (India) from May 2019 to December 2020, following ethical committee approval. Data was gathered by recording the time from abdominal incision to pneumoperitoneum creation and to close the wounds. Incidence of complications were noted during the procedure and during a three-month postoperative follow-up.

Results: More time was taken to achieve pneumoperitoneum and to close the port site wounds in case of Closed method of pneumoperitoneum creation, however there was no significant difference in intra-operative or post-operative complications between the two groups.

Conclusion: This study indicates that both the open (Hasson's) and closed (Veress needle) techniques are effective and safe for pneumoperitoneum creation in laparoscopic cholecystectomy, with the open technique offering a slight advantage in terms of reduced procedure time and minimal complications. Further large-scale studies may be needed to confirm these findings and provide additional insights into technique optimization.

Keywords: Laparoscopic Cholecystectomy, Pneumoperitoneum, Hasson's technique, Veress needle.

INTRODUCTION

Laparoscopy, derived from the Greek words "laparo" (abdomen) and "scopion" (to examine), initially referred to minimally invasive surgery, later evolving into "minimal access surgery" due to its invasive nature and associated risks similar to conventional open surgery¹. Laparoscopic cholecystectomy has become the gold standard for treating benign gallbladder disease, where the creation of a pneumoperitoneum—an insufflation of the abdominal cavity with gas—is a critical prerequisite².

The pneumoperitoneum allows for clear visualization and examination of the abdominal contents using a laparoscope. However, accessing the peritoneal cavity presents risks of injury to major blood vessels and gastrointestinal organs, as 50% of complications in laparoscopic procedures often occur before dissection begins³⁻⁴. Traditional methods for creating pneumoperitoneum involve the closed Veress needle technique followed by direct trocar insertion, which introduces the trocar blindly. Conversely, the open technique (Hasson's technique) includes an initial incision into the skin, rectus sheath

and peritoneum which allows direct visualization during insertion of trocar⁵, reducing the number of "blind steps" and potentially decreasing complications⁶.

Despite advancements in laparoscopic techniques, the complication rates associated with primary access remain significant⁷. Studies report various rates of injuries, with complications from the Veress needle or direct trocar insertion being among the most common⁸. As surgical methods continue to improve, debate persists about the safest technique for pneumoperitoneum creation, with no clear consensus on the optimal approach. The main objective of the present study was to compare the safety and efficacy of the Open (Hasson's) method and Closed (Veress Needle) method for creating a pneumoperitoneum in laparoscopic cholecystectomy and to determine safe practices for pneumoperitoneum creation with minimal complications and higher efficacy.

Materials and Methods

Study Design

This prospective, randomized clinical study, titled "Comparison of Open (Hasson's Technique) and Closed Entry Technique for Creation of Pneumoperitoneum in Laparoscopic Cholecystectomy" was conducted at the Government Medical College, Rajindra Hospital, Patiala, Punjab (India) from May 2019 to December 2020, following ethical committee approval.

Sample and Randomization

The sample size was set at 50 patients, with an equal number (25) allocated to two groups Group 1 and Group 2 using standard randomization. Patients in Group 1 underwent peritoneal access via the open method (Hasson's Technique), and the those in Group 2 via the closed method (Veress Needle Technique).

Inclusion Criteria:

1. Patients aged 18-65 years undergoing elective laparoscopic cholecystectomy for cholelithiasis.

Exclusion Criteria:

1. Previous upper abdominal midline surgery.
2. Serious comorbidities contraindicating laparoscopic surgery (e.g., severe cardiac

dysfunction, congestive heart failure, COPD).

3. Presence of palpable abdominal lumps or umbilical/para-umbilical hernias.

Treatment Protocol

Following institutional ethical committee approval, patients meeting the inclusion and exclusion criteria were thoroughly evaluated preoperatively through physical examination, abdominal and systemic examination, and routine laboratory tests (e.g., liver function tests, ultrasound for gallbladder assessment).

Peritoneal cavity was accessed by either of these two techniques.

1. **Open Technique (Hasson's Method):** After anesthetizing the patient, a 10-12 mm incision was made near the umbilicus, and the subcutaneous fat was dissected to reach and incise the linea alba and peritoneum, allowing blunt insertion of Hasson's cannula into the peritoneal cavity. After securing the cannula with a collar for gas seal, CO₂ was insufflated at a pressure of 12-15 mmHg, and the laparoscope was introduced.
2. **Closed Technique (Veress Needle Method):** A small incision was made, and the Veress needle was inserted through the linea alba at specific angles, with CO₂ insufflation at 12-15 mmHg once the cavity was accessed. After insufflation, a trocar port was inserted, and the laparoscope was introduced.

Data Collection and Analysis

Data was gathered by recording the time from abdominal incision to pneumoperitoneum creation. Incidence of complications were noted during the procedure and during a three-month postoperative follow-up. Statistical analysis was performed using SPSS 26.0, with p-values below 0.05 indicating significance.

Results

Out of the 50 patients included in this study, the distribution across gender, age, and procedural outcomes for the two techniques—Open (Hasson's) and Closed (Veress Needle)—are presented below.

Gender and Age Distribution

Both the groups were comparable in terms of age and

gender distribution highlighting the more prevalence of cholelithiasis in females of mean age around 40 years. There was no statistically significant difference among the two groups regarding age and gender distribution.

Table 1: Gender and Age Distribution of Study Population

Group	Male (%)	Female (%)	Mean Age (years)	Age Range (years)
Group 1 (Open technique)	12	88	40.80	20 – 62
Group 2 (Closed technique)	16	84	39.96	18 – 65
Total	14	86	-	18 – 65

Time Required to Achieve Pneumoperitoneum

Statistical analysis showed that Group 2 (Closed technique) required significantly more time to achieve pneumoperitoneum compared to Group 1 (Open technique) ($p < 0.001$).

Time Required for Wound Closure

The time taken for wound closure was significantly longer in Group 2 (Closed technique) than in Group 1 (Open technique) ($p < 0.001$).

Table 2 : Time Required to Achieve Pneumoperitoneum and for Wound Closure.

Group	Mean Time for Pneumoperitoneum (minutes)	Std. Deviation	Mean Time for Wound Closure (minutes)	Std. Deviation
Group 1 (Open technique)	4.96	1.06	4.82	0.74
Group 2 (Closed technique)	7.18	0.87	7.96	1.28
p-value	< 0.001 (significant)		< 0.001 (significant)	

Intra-operative Complications

Our study observed that there was no statistically significant difference between the two groups in the incidence of intra-operative complications like extra-peritoneal insufflation ($p = 0.312$), gas leakage ($p = 0.074$) and minor vessel injuries ($p = 0.297$).

Table 3: Incidence of Intra-operative Complications

Complication	Group 1 (Open technique)	Group 2 (Closed technique)	Statistical Significance (p-value)
Extra-peritoneal insufflation	0 (0%)	1 (4%)	0.312 (non-significant)
Gas leakage	3 (12%)	0 (0%)	0.074 (non-significant)
Minor vessel injury	3 (12%)	1 (4%)	0.297 (non-significant)

Post-operative Complications

It was observed in the present study that there was no significant difference regarding the incidence of post-operative complications like periumbilical hematoma ($p = 0.297$), port site infection ($p = 0.552$) or incisional hernia ($p = 0.312$) between the two groups.

Table 4: Incidence of Postoperative Complications

Complication	Group 1 (Open technique)	Group 2 (Closed technique)	Statistical Significance (p-value)
Port site infection	2 (8%)	1 (4%)	0.552 (non-significant)
Incisional hernia	1 (4%)	0 (0%)	0.312 (non-significant)
Periumbilical hematoma	3 (12%)	1 (4%)	0.297 (non-significant)

Discussion

Laparoscopic techniques have transformed surgical practice by offering reduced postoperative pain, quicker recovery, and fewer complications, such as wound infections and hernias, compared to open techniques⁹. However, approximately 50% of major laparoscopic complications occur during primary access for creating pneumoperitoneum, underscoring the critical nature of this initial step in laparoscopic procedures¹⁰. The creation of pneumoperitoneum, while essential, introduces hemodynamic and respiratory effects that require careful anesthetic management to minimize adverse outcomes¹¹. Yet, iatrogenic injuries during this phase remain a significant concern, particularly in traditional closed methods, where the blind entry approach accounts for more than half of the related

injuries before anatomical dissection even begins¹²⁻¹³. In response to these complications, alternatives to the closed entry technique have been developed, including the open technique pioneered by Hasson, as well as direct trocar insertion, optical trocars, and expanding trocars¹⁴⁻¹⁵. Despite these advances, the Veress needle and Hasson techniques remain the most widely practiced, each with modifications designed to enhance safety and efficiency¹⁶⁻¹⁷.

The time required to create pneumoperitoneum was notably different between the two techniques in this study. The mean time for the closed entry technique was significantly longer at 7.18 ± 0.87 minutes compared to 4.96 ± 1.06 minutes for the open technique. Similar findings were reported by Akbar et al¹⁸, who observed shorter access times for the open technique, as well as by Channa et al¹⁹, who found that the mean access time in the Hasson group (4.6 ± 1.1 minutes) was lower than that for the Veress needle (5.4 ± 0.7 minutes). Studies by Chotai et al²⁰ and Jain et al²¹ have also demonstrated quicker access times with the open method, highlighting its efficiency compared to the closed approach. These time differences stem from multiple factors, including the routine performance of Veress needle entry tests, such as the suction-irrigation and saline drop tests, which prolong the closed entry process.

Closure time was also found to be shorter in the open technique due to the application of stay sutures, which facilitate efficient wound closure. Akbar et al¹⁸ similarly noted that wound closure time was significantly shorter for the open method, underscoring its procedural simplicity and potentially positioning it as a standard approach for such surgical procedures.

In terms of complications, both techniques exhibited strengths and weaknesses. Port site infections showed no significant difference between the two techniques, with two cases in the open group and one case in the closed group, aligning with findings from Abdullah et al²², who reported similar minor infection rates across both methods. Gas leakage was observed more frequently in the open technique, though this difference was not statistically significant. Parveen et al²³ reported similar findings,

with higher leakage rates in the open method, while Ali et al²⁴ found rates of 2.91% in the closed method and 6.2% in the open method. However, advancements in insufflator technology, which provide high CO₂ flow rates, have mitigated these minor leaks without affecting overall procedural safety.

The incidence of extra-peritoneal insufflation was low across both groups, with only one case observed in the closed method. This outcome is consistent with studies by Chotai et al²⁰, Ali et al²⁴, and Perunovic et al²⁵, which report low rates of extra-peritoneal insufflation in both open and closed techniques. These findings suggest that, with careful technique, both methods can be employed safely with minimal risk of extra-peritoneal insufflation.

Bowel injuries are a rare but serious complication of laparoscopic entry, and fortunately, no cases were reported in this study for either method. This finding aligns with previous studies by Chotai et al²⁰ and Ali et al²⁴, which also reported low incidences of bowel injuries. Other studies, such as those by Molloy et al²⁶ and Chapron et al²⁷, indicate a similarly low incidence of bowel injuries, further supporting the safety of both techniques when performed by experienced surgeons.

The lack of major vascular injuries in this study is encouraging, with only minor vessel injuries observed in three patients in the open group and one in the closed group. Studies by Molloy et al²⁶ and Taye et al²⁸ also support the open technique's safety profile concerning vascular injuries. However, the closed method has been associated with major vascular injuries, especially in less experienced hands, as Schafer et al²⁹ found that major vascular injuries can occur even among highly skilled surgeons. Consequently, careful verification of needle placement is essential to minimize these risks. Additionally, Pickersgill et al³⁰ and Chapron et al²⁷ found higher rates of vascular injuries in the closed method compared to the open technique, suggesting that the open approach may offer a safer alternative in terms of major vascular protection.

Finally, this study found no cases of pneumoperitoneum creation failure in either group, which is consistent with findings by Akbar et al¹⁸,

who reported no failures with the open technique. However, Ali et al²⁴. noted a slightly higher failure rate with the Veress needle compared to the Hasson technique. The success rate of both methods in this study reinforces their suitability for laparoscopic entry.

In summary, this study demonstrated that both the open and closed techniques have unique benefits and risks. While the closed technique is associated with a slight increase in procedural time, the open method showed marginally lower complication rates and may be preferable for patients with a higher risk of vascular injury. Limitations of this study include its single-center design and relatively small sample size, which may impact the generalizability of the findings. Future studies across multiple centers and with

larger samples are necessary to establish more definitive conclusions.

Conclusion

This study indicates that both the open (Hasson's) and closed (Veress needle) techniques are effective and safe for pneumoperitoneum creation in laparoscopic cholecystectomy, with the open technique offering a slight advantage in terms of reduced procedure time and minimal complications. While both methods are viable, the open technique may be preferable for reducing minor complications and ensuring safe entry, especially in patients with high-risk profiles. Further large-scale studies are needed to confirm these findings and provide additional insights into technique optimization.

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