



Original Article

## Comparison of Access Time and Safety Between Closed (Veress Needle) and Open (Hasson) Techniques for Creating Pneumoperitoneum in Laparoscopic Surgery: A Prospective Comparative Study

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### ABSTRACT

Laparoscopic surgery is now the preferred approach for many abdominal procedures because of reduced postoperative pain, shorter hospitalization, and faster recovery. However, the creation of pneumoperitoneum remains the most critical step and is responsible for the majority of laparoscopic entry-related complications. The two most commonly used techniques are the closed method using a Veress needle and the open method described by Hasson. This study aimed to compare access time, safety, and perioperative outcomes between these two techniques in a tertiary care hospital.

A prospective comparative study was conducted among patients undergoing elective laparoscopic surgery. Participants were divided into two groups according to the entry technique used. Access time was defined as the interval between skin incision and successful trocar placement. Intra-operative and postoperative complications were recorded and analysed statistically.

The mean access time using the open technique was 7.23 minutes, significantly shorter than the 9.09 minutes observed with the closed technique. No major vascular or visceral injuries occurred in either group. Minor complications such as gas leak and port-site issues were infrequent and comparable between groups. Postoperative recovery and hospital stay were similar.

The findings indicate that both techniques are safe and effective for establishing pneumoperitoneum. However, the open technique offers an advantage in terms of faster access. Selection of entry method should therefore depend on surgeon experience, patient characteristics, and institutional practice.

**Keywords:** Laparoscopy, Pneumoperitoneum, Veress needle, Hasson technique, Entry complications.

### INTRODUCTION

Laparoscopic surgery has transformed surgical practice over the past three decades and is now widely accepted as the standard approach for numerous abdominal procedures. Compared with conventional open surgery, it offers significant advantages including reduced postoperative pain, shorter hospital stay, improved cosmetic results, and faster return to routine activities (1,2). These benefits have led to its widespread adoption across general surgery, gynecology, urology, and other specialties. Despite these advantages, laparoscopic surgery carries specific risks not encountered in open procedures. The most hazardous step is the initial entry into the abdominal cavity and the creation of pneumoperitoneum. It is estimated that nearly half of serious laparoscopic complications occur during this phase, particularly during insertion of the primary trocar (3,4). Reported injuries include vascular trauma, bowel perforation, omental injury, gas embolism, and subcutaneous emphysema. Although these complications are rare, they can be life-threatening and are responsible for most entry-related morbidity and mortality (5,6).

Several techniques have been developed to establish pneumoperitoneum safely. The closed technique, commonly performed

using a Veress needle, involves blind insertion of a spring-loaded needle into the peritoneal cavity followed by carbon dioxide insufflation. It is widely used due to its simplicity, minimal incision size, and familiarity among surgeons (7). However, the blind nature of insertion raises concerns regarding unrecognized visceral or vascular injury (8).

The open technique, first described by Hasson, involves making a small infra-umbilical incision and entering the peritoneal cavity under direct vision before placing a blunt trocar (9). This method is believed to reduce the risk of major injuries by eliminating blind needle insertion. It is particularly recommended in patients with previous abdominal surgery, suspected adhesions, or obesity (10,11). However, critics argue that the open method may take longer, cause gas leakage, and require more surgical skill (12).

Numerous studies have attempted to compare these two techniques. Some authors have reported lower rates of vascular and bowel injury with the open method (13,14), while others have found no significant difference in complication rates between the two approaches (15–17).

Similarly, conflicting results exist regarding access time. Certain studies suggest that the Veress needle technique may be faster in experienced hands (18), whereas others report quicker entry with the open technique due to direct visualization (19,20).

Because of these conflicting findings, there is still no universal consensus on the ideal entry technique. The choice often depends on surgeon training, institutional practice, and patient characteristics. In high-volume tertiary care centres, identifying an entry method that is both safe and efficient is essential for optimizing operative outcomes and reducing surgical delays.

Local data comparing laparoscopic entry techniques remain limited. Therefore, this prospective comparative study was undertaken to evaluate the access time and safety of closed and open pneumoperitoneum techniques in a tertiary care teaching hospital. The study aims to contribute to existing evidence and help guide surgeons in selecting the most appropriate entry approach for laparoscopic procedures.

## MATERIALS AND METHODS

This prospective comparative study was conducted in the Department of General Surgery at a tertiary care teaching hospital after obtaining institutional ethical clearance and informed consent from all participants. The study included patients undergoing elective laparoscopic procedures during the study period. Patients aged 18–70 years scheduled for elective laparoscopic surgery were eligible for inclusion. Patients undergoing emergency surgery, those with contraindication to pneumoperitoneum, and those with severe cardiopulmonary instability were excluded. Participants were allocated into two groups based on the technique used to establish pneumoperitoneum. Group A underwent the closed technique using a Veress needle, while Group B underwent the open technique using the Hasson method.

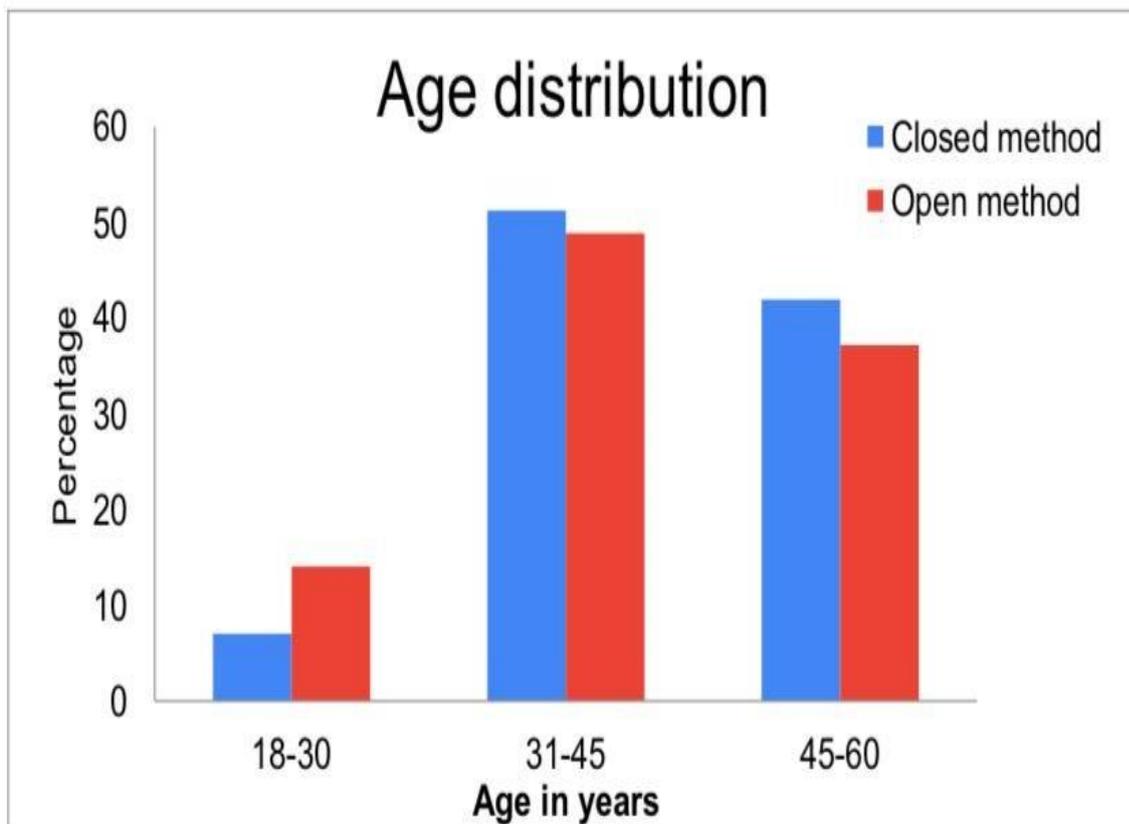
All procedures were performed under general anesthesia using standard aseptic precautions. In the closed technique group, the Veress needle was inserted through an infra-umbilical incision, and correct placement was confirmed using standard safety tests before insufflation. In the open technique group, a small infra-umbilical incision was made, the fascia and peritoneum were opened under direct vision, and a blunt trocar was inserted.

The primary outcome variable was access time, defined as the interval from skin incision to successful placement of the primary trocar with established pneumoperitoneum. Secondary outcome variables included intra-operative complications such as bowel injury, vascular injury, gas leak, and failed entry, as well as postoperative complications such as port-site infection and subcutaneous emphysema.

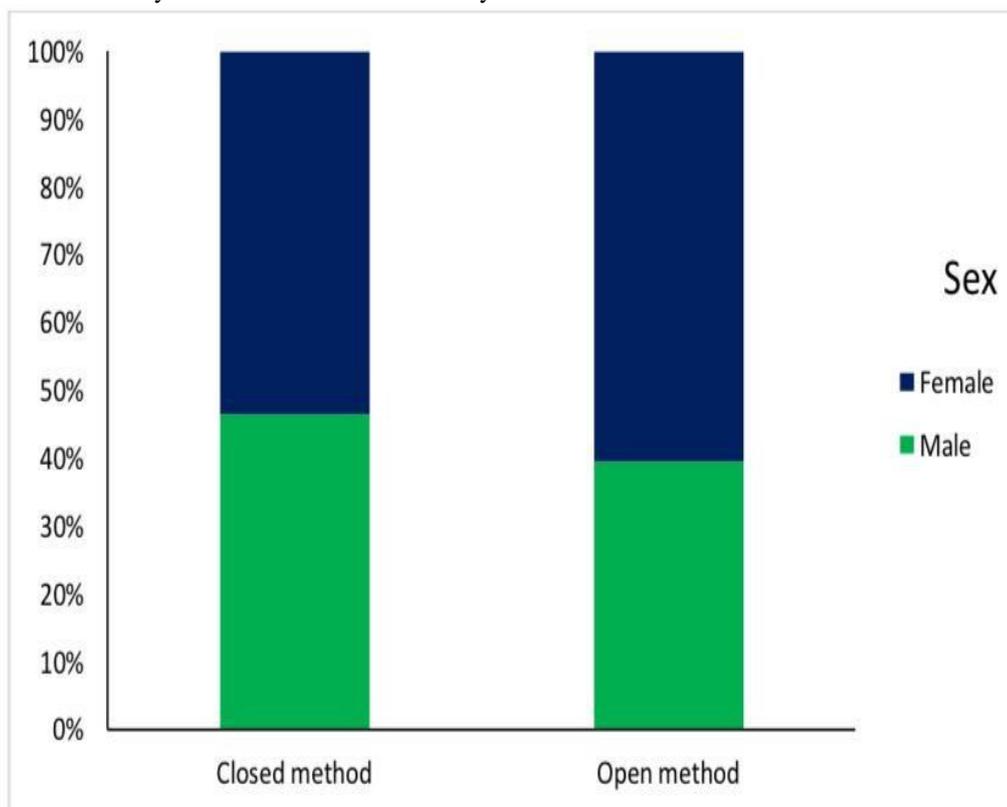
All observations were recorded using a standardized proforma. Postoperative follow-up was performed during hospital stay and at outpatient review. Data were entered into statistical software and analysed using appropriate tests. Continuous variables were expressed as mean  $\pm$  standard deviation, and categorical variables as proportions. A  $p$ -value  $<0.05$  was considered statistically significant.

## RESULTS

A total of patients undergoing elective laparoscopic procedures were included in the study and divided equally between the closed and open technique groups. The demographic characteristics of patients in both groups were comparable, with no significant difference in age distribution (Figure 1), gender ratio (Figure 2), or type of laparoscopic procedure performed. This ensured that the two groups were suitable for comparison.



The primary outcome analysed was accesstime.Thestudydemonstratedthatthemeanaccesstimein the closed technique



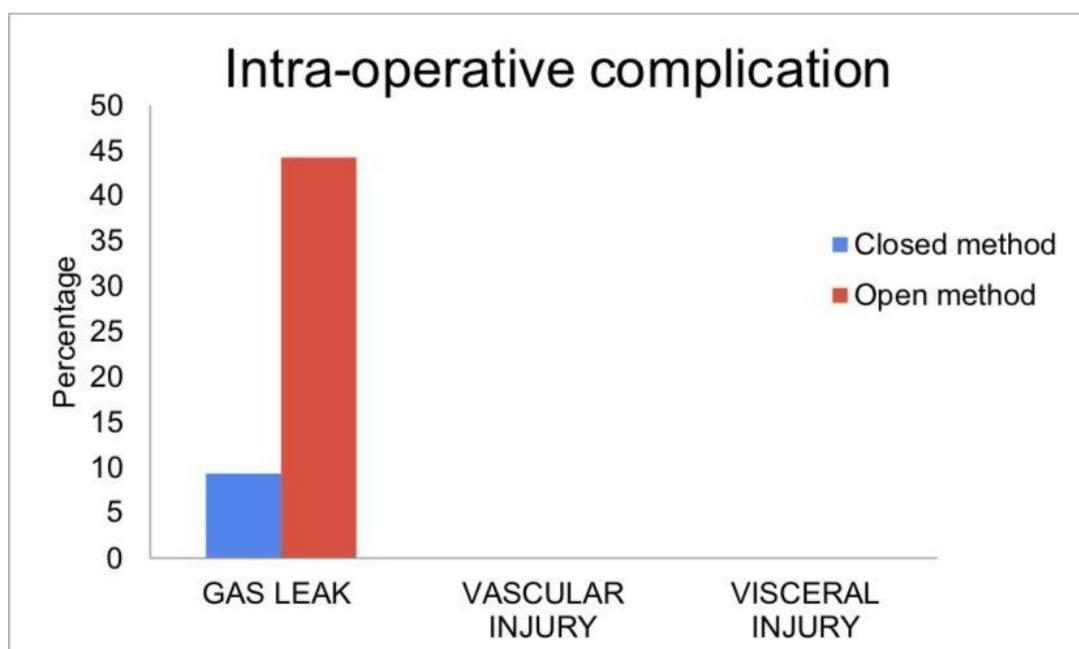
group was 9.09 minutes, whereas the mean access time in the open technique group was 7.23 minutes Table 1 & Figure 3

**TABLE 3 TIME TAKEN FOR ACCESS**

Time taken to access (minutes)	Closed method		Open method		Total		$\chi^2$	df	p
	N	%	N	%	N	%			
<5	1	2.3	3	7	4	4.7	7.21	2	0.027
6-10	36	83.7	40	93	76	88.4			
>10	6	14	0	0	6	7			
Total	43	100	43	100	86	100			

	N	ACCESS TIME(MIN)		t	p
		Mean	sd		
Closed method	43	9.09	1.44	6.699	<0.001
Open method	43	7.23	1.11		

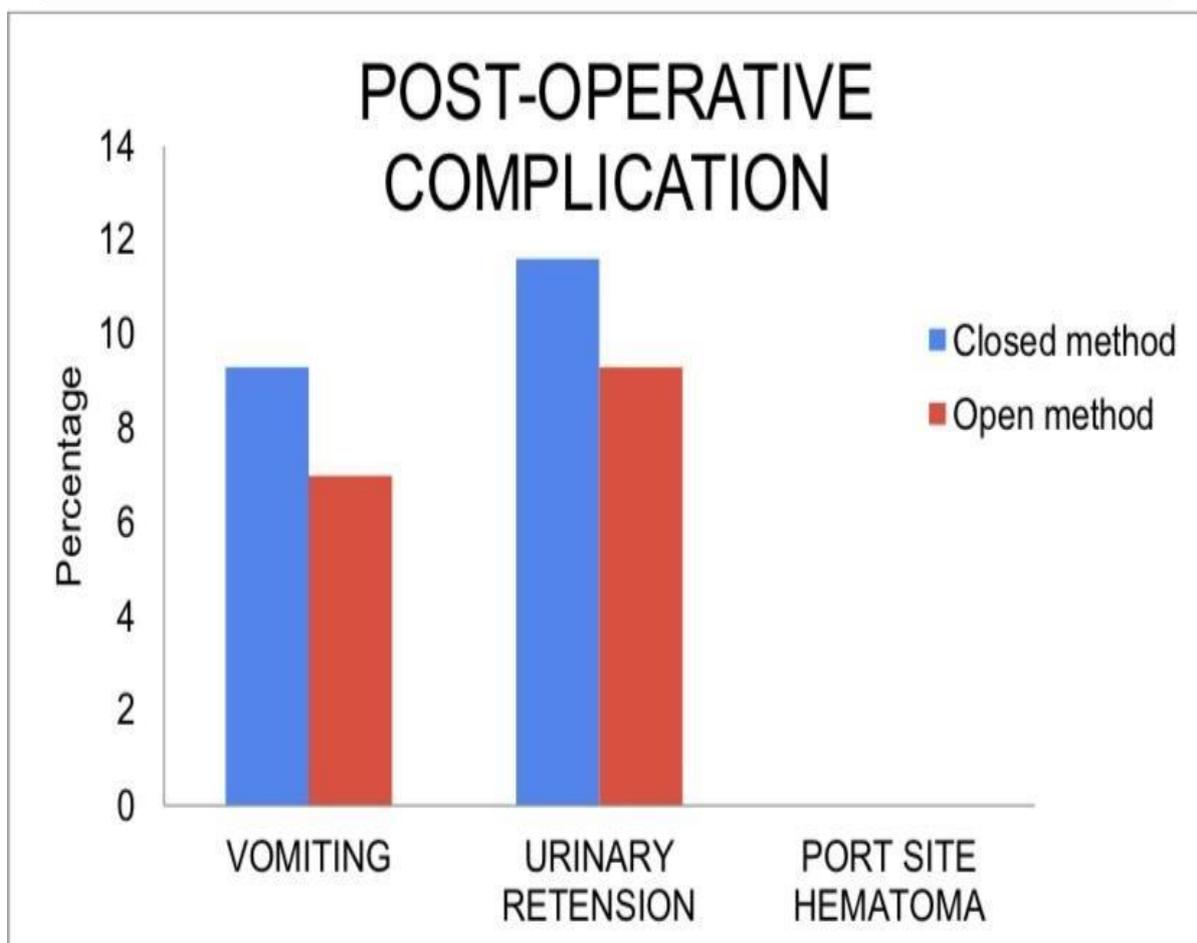
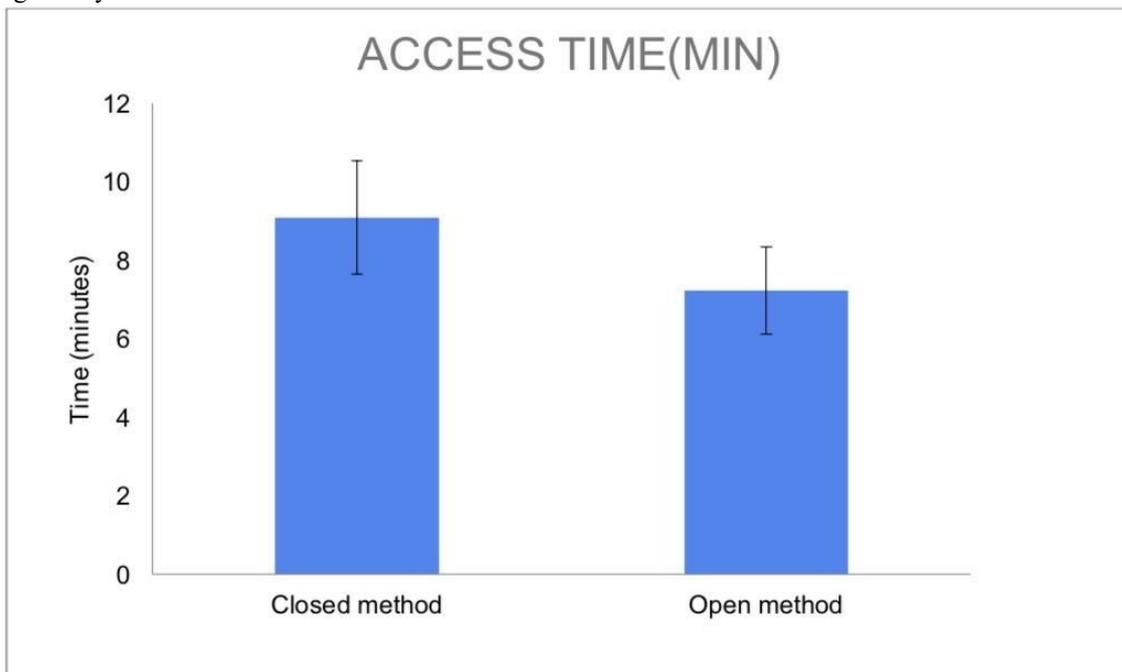
Statistical analysis showed that this difference was significant, indicating that pneumoperitoneum was established more rapidly using the open method in the present study. The shorter entry time observed with the open technique may be attributed to direct visualization of tissue layers and elimination of confirmatory tests required for Veress needle placement. With regard to intra-operative complications, no major vascular or visceral injuries were observed in either group Figure 4.



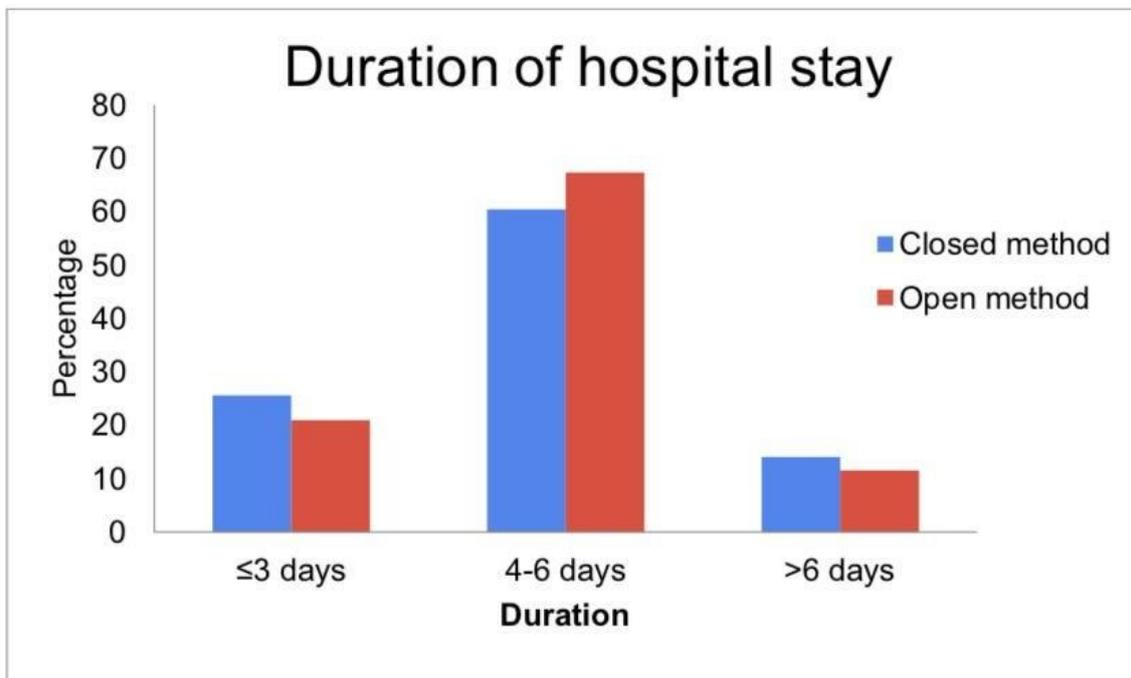
This indicates that both entry techniques were safe when performed by trained surgeons in a controlled surgical setting. Minor complications were noted in a small proportion of cases in both groups. These included transient gas leak around the trocar site, difficulty in initial entry, and minimal

subcutaneous emphysema. The incidence of these minor complications was similar in both groups and did not show statistical significance.

Postoperative outcomes were also comparable Figure 5. No patient required conversion to open surgery due to entry-related complications. Port-site infections were rare and responded to conservative treatment. Duration of hospital stay did not differ significantly between the two groups, suggesting that entry technique did not influence postoperative recovery in a meaningful way



The duration of hospital stay was comparable between the two groups, with no statistically significant difference observed, indicating that the choice of entry technique did not influence postoperative recovery or length of hospitalization (Figure 6).



Overall, the results of this study demonstrate that both closed and open techniques are safe for establishing pneumoperitoneum. However, the open technique showed a statistically significant advantage in terms of shorter access time.

## DISCUSSION

The present study evaluated two widely practiced techniques for creation of pneumoperitoneum in laparoscopic surgery and found that both methods were safe, with the open technique providing faster access.

Our finding of shorter entry time with the open technique is consistent with reports by Jamiletal. and Vilos et al., who observed that direct visualization allows quicker trocar placement and avoids repeated attempts required in blind needle insertion (19,20). Similar observations were made by Merlin et al., who concluded that the open approach reduces delays associated with incorrect Veress needle positioning (21).

However, other studies have suggested that the closed technique may be faster when performed by experienced surgeons (18,22). The variation in findings may be explained by differences in surgeon training, patient characteristics, and institutional protocols.

In terms of safety, our study showed no major visceral or vascular injuries in either group. This supports earlier studies by Jansen et al. and Chapron et al., which concluded that both techniques have comparable safety profiles when performed by trained surgeons (3,15). Hasson originally introduced the open technique specifically to reduce blind insertion injuries, and subsequent research has supported its use in patients with prior abdominal surgery or suspected adhesions (9,11,12-15).

Minor complications observed in the present study, including gas leak and subcutaneous emphysema, have also been reported in previous comparisons of entry techniques (15,16,23). These complications are usually self-limiting and rarely affect operative outcomes.

Several large observational studies and systematic reviews have shown that most serious complications in laparoscopy occur during abdominal entry, although the absolute incidence remains low. Previous analyses report that vascular and bowel injuries are rare but potentially life-threatening, reinforcing the importance of safe pneumoperitoneum creation techniques (24,26,28). Comparative reviews of entry methods indicate that no single technique completely eliminates risk, and outcomes depend largely on surgical expertise and patient factors (25,29). Studies evaluating trocar and Veress needle injuries confirm that the majority of complications occur at the time of primary access rather than during the operative procedure itself (26,28).

Evidence from both international and Indian studies suggests that complication rates are generally comparable between open, closed, and direct trocar insertion methods, with differences mainly seen in access time and technical ease rather than safety (27,31,32). Research comparing pneumoperitoneum techniques has also demonstrated that surgeon familiarity with the method plays a greater role in preventing complications than the choice of entry technique itself (29,31). In

patients with previous abdominal surgery, alternative entry strategies and careful technique selection are recommended to reduce the risk of adhesional injury (30-32). Taken together, these findings support the results of the present study, which also demonstrated comparable safety between techniques with differences primarily related to access efficiency. Taken together, the available evidence suggests that no single entry technique is universally superior. Surgeon experience, patient anatomy, and operative context play a critical role in determining outcomes. Training programs should therefore ensure proficiency in both methods so that surgeons can tailor the approach to individual patients.

## CONCLUSION

Both the closed (Veress needle) and open (Hasson) techniques for creation of pneumoperitoneum are safe and effective methods for laparoscopic entry. The present study demonstrated that the open technique provides a statistically shorter access time while maintaining a comparable safety profile. Selection of entry techniques should therefore be individualized based on surgeon expertise and patient factors.

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## Conflict of Interest

The authors declare that there is no conflict of interest related to this study.

## Author Contributions

All authors contributed substantially to the conception, study design, data collection, analysis, manuscript preparation, and final approval of the version submitted for publication.

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