

Research Article

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The Comparative Study of Intra-peritoneal Access by Open Versus Closed Method to Create Pneumoperitoneum in Laparoscopic Surgery

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Abstract: Background: Laparoscopic surgery has become an integral part of modern surgical practice and critical step is the safe establishment of pneumoperitoneum. The two commonly employed techniques for intraperitoneal access are the closed method using a Veress needle and the open (Hasson) method however there remains a lack of consensus regarding the safer and more efficient method for creating pneumoperitoneum. This study compares intraperitoneal access by closed versus open methods in laparoscopic abdominal surgeries with respect to efficacy, access time and access-related intraoperative and postoperative complications. **Patients and Methods:** Total of 74 patients undergoing elective laparoscopic abdominal surgeries and divided into two groups based on the technique used for pneumoperitoneum creation. Parameters assessed included time required for access and creation of pneumoperitoneum, number of attempts, intraoperative complications, postoperative pain using the Visual Analogue Scale (VAS) and postoperative access-related complications. **Results:** The open method demonstrated a comparable efficacy to the closed method in establishing pneumoperitoneum. The time required for access and creation of pneumoperitoneum showed no clinically significant difference between the two groups. Access-related complications were fewer in the open method, while postoperative pain scores and minor complications were comparable between both techniques. No major vascular or visceral injuries were observed in either group. **Conclusion:** Both open and closed methods are effective and safe for creating pneumoperitoneum. The open (Hasson) technique may offer a safety advantage, particularly in those with previous abdominal surgeries or altered anatomy. The choice of technique should be individualized based on patient factors and surgeon expertise.

Keywords: Intraperitoneal access, laparoscopic surgery, pneumoperitoneum, open method, closed method.

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INTRODUCTION

Laparoscopic surgeries have brought a revolution to the modern surgical arena over the past couple of decades. It has transformed patient outcomes as well as the approach to surgical intervention. After the beginning of laparoscopic surgeries, a noteworthy shift was seen from open to minimally invasive procedures. Since introduction of laparoscopy in the late 20th century, it has been widely used in all surgical disciplines such as general surgery, gynaecology, urology, gastrointestinal surgery, and many other surgical sub-specialties. Despite the advantages of laparoscopic procedure, one of the most critical and important steps in laparoscopy remains the safe access to the peritoneal cavity [1-2].

Pneumoperitoneum creation is essential in any laparoscopic procedures which enables optimum

visualization of internal structures as well as facilitates the safe and accurate performance of surgical intervention in a magnified view. Despite the practical applications, the creation of pneumoperitoneum is not without any risks. Initial access to the peritoneal cavity represents a crucial step where most major complications occur which is associated with laparoscopic surgery. The appropriate position of the access port and building a safe pneumoperitoneum is, therefore, of paramount importance to avoid injuries to major vessels, bowel loops, and solid organs [3].

Pneumoperitoneum created by the different methods, with the most widely used known being the closed (Veress needle) method and the open (Hasson) method. Veress needle enters via a small incision at or near the umbilicus and the needle is inserted blind which can

cause damage to the intra-abdominal viscera or major blood vessels particularly in patients with previous abdominal surgery or distorted anatomy [4].

Hasson technique or open method involves a small incision through the abdominal wall directly which allows to enter the peritoneum safely before the introduction of trocar. It minimizes the risk of injury for the underlying structures due to direct visualization, but it requires a little larger incision and more time for the placement of port. One of the major issues with the open method is the leakage of gas around the cannula which can be avoided with proper suturing. The choice between both the methods is dependent upon the surgeon's experience, institutional protocols and other patient factors with both the techniques being widely used over the globe [5].

As laparoscopy has become an integral part of modern surgical practice, and more and greater procedures are routinely undertaken everywhere in the world today, any small enhancement of the safety and efficiency of peritoneal access is likely to be beneficial. In the light of these considerations, the present study aims to compare intraperitoneal access by closed versus open methods in laparoscopic abdominal surgeries, focusing on the efficiency and safety of pneumoperitoneum creation. The findings are expected to contribute to the ongoing efforts to establish evidence-based guidelines for safe laparoscopic entry and to optimize patient outcomes. This study thus addresses a key aspect of laparoscopic practice that continues to challenge surgeons worldwide, emphasizing the need for precision, vigilance, and continuous learning in pursuit of surgical excellence.

PATIENTS AND METHODS

Place of study

Santosh Medical College & Hospital, Ghaziabad, Uttar Pradesh, India

Study Design

Comparative Observational Study

Study Setting

Department of General Surgery, Santosh Medical College and Hospital Ghaziabad, Uttar Pradesh, India.

Duration of Study

The study was carried out over a period of two years, from April 2024 to April 2026.

Study Population

The study population comprised patients, of both sexes who underwent abdominal laparoscopic surgical procedures during the study period. Patients with local skin infections or umbilical hernia and the ones not giving consent were excluded from the study.

Sample Size

A total of 74 patients were included in the study. The patients were divided into two comparative groups (Closed-C, Open-O) with 37 patients in each group, based on predefined study parameters.

Institutional Ethics Committee Approval: SU/R/2024/1350[25]

Statistical Analysis

All collected data were entered and analysed using Microsoft Excel. Categorical variables were presented as frequencies and percentages.

RESULTS

A total of 74 patients were included in the study, with 37 patients allocated to closed and open methods groups. In Group C and Group O, demographic characteristics were compared. There was no statistically significant difference between the both groups with respect to demographic parameters like age and gender distribution, or body mass index, indicating appropriate matching and minimizing the influence of demographic confounders on outcome assessment (Table 1).

Table 1: Baseline Demographic Characteristics of Study Participants

Parameter	Category	Group C (Closed)	Group O (Open)	Statistical Test	p value
Age distribution (years) Mean age (years)	10–20	0	4		
	21–30	9	7		
	31–40	8	11		
	41–50	8	6		
	51–60	7	6		
	61–70	3	3		
	71–80	2	0		
	Mean $\pm$ SD	43.92 $\pm$ 15.42	39.00 $\pm$ 14.33	—	0.16
Gender	Male	8	11	$\chi^2 = 0.63$	0.42
	Female	29	26		
BMI (kg/m ²)	Mean $\pm$ SD	22.68 $\pm$ 3.84	23.59 $\pm$ 3.99	—	0.32
Total participants		37	37		



The spectrum of operative procedures performed in both groups was broadly similar. The most frequently performed procedure in each group was laparoscopic cholecystectomy. There were no substantial difference between the two groups, ensuring procedural comparability for subsequent analyses (Table 2).

Table 2: Distribution of Operative Procedures in Both Study Groups

Operative Procedure	Group C (Closed)	Group O (Open)
Laparoscopic cholecystectomy under GA	27	26
Laparoscopic converted to open cholecystectomy	3	2
Laparoscopic cholecystectomy	4	1
Laparoscopic appendectomy	1	2
Laparoscopic IPOM plus under GA	1	0
Laparoscopic TAPP repair	0	4
Diagnostic laparoscopy → exploratory laparotomy	0	1
Lap cholecystectomy with choledochotomy	0	1
Laparoscopic excision of liver cyst	1	0
Total	37	37

On comparing access-related parameters, it was observed that Group C demonstrated a significant difference, in shorter access time compared to Group O. The distribution of access time also favored Group C, with a higher proportion of cases achieving access within the shorter time interval. The time required for

creation of pneumoperitoneum was significantly shorter in Group O, both in terms of mean duration and overall distribution, have a procedural advantage in pneumoperitoneum establishment in this group (Table 3).

Table 3: Access Characteristics and Pneumoperitoneum Parameters

Parameter	Category	Group C (Closed)	Group O (Open)	Statistical Test	p value
Access time (min)	Mean ± SD	1.34 ± 0.31	1.60 ± 0.50	—	<0.01**
Access time distribution	1–2 min	35	29	$\chi^2 = 5.74$	0.016*
	2–3 min	2	8		
Time for pneumoperitoneum (min)	Mean ± SD	2.05 ± 0.59	1.37 ± 0.56	—	<0.01**
Pneumoperitoneum time distribution	<1 min	1	7		
	1–2 min	12	23		
	2–3 min	22	7		
	>3 min	2	0		

With regard to technique, successful access was achieved mostly in a single attempt in both groups, with no significant difference in the number of attempts required. There was a statistically significant difference between the two groups on postoperative pain

assessment. The Group C patients experience lower pain scores when compared to Group O, suggestive of the postoperative comfort in the closed access technique (Table 4).

Table 4: Number of Attempts and Postoperative Pain Assessment

Parameter	Category	Group C (Closed)	Group O (Open)	p value
Number of attempts	One	30	32	—
	Two	7	5	—
VAS score	Mean ± SD	2.30 ± 0.74	2.76 ± 0.68	0.007

Overall significant differences were noted while comparing baseline characteristics and operative profiles.

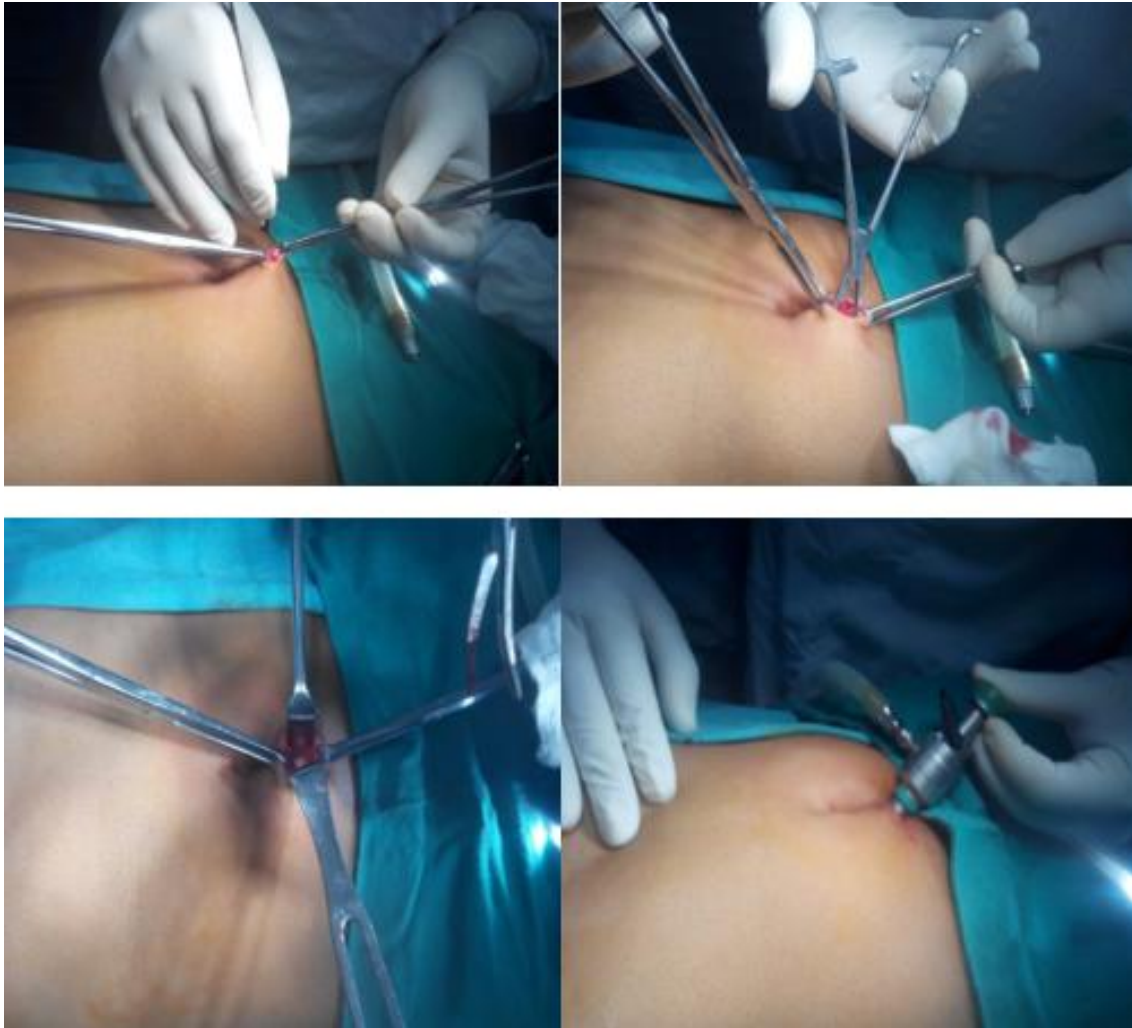


Fig. 1: Placement of first port by Open entry



Fig. 2: Entry through Veress needle

DISCUSSION

In this present study, open (Hasson) (Fig. 1) and closed (Veress needle) (Fig. 2) techniques were compared for intraperitoneal access in laparoscopic abdominal surgery with main focus on pneumoperitoneum creation, technical feasibility, access efficiency, postoperative pain, and access-related morbidity. On analyzing parameters like demographic and operative profiles, access related parameters like number of attempts, complications, and pain scores, the findings were similar to the existing literature. The demographic parameters as age, gender, and body mass index (BMI) may reflect abdominal wall characteristics and difficult entry, comparison is essential when evaluating laparoscopic access outcomes. In the present study, demographic parameters were similar between two groups, minimizing confounding variables. Most of the patients belongs to the young and middle-aged adult, who underwent elective laparoscopic surgery. Similar findings have been reported by Wasim *et al.* (2023) [6], Kumar *et al.* (2024) [7], Pahuja *et al.* (2021) [8], and Jain *et al.* (2019) [9]. In the study by Jansen *et al.* (2004), found preferential use of open access method in elderly patients, this was mainly due to previous abdominal surgery rather than age alone.[10] Gallbladder stone disease as per gender distribution show female predominance. Most of the studies, shows female predominance in laparoscopic cholecystectomy, with gender-related differences more closely matched to disease severity than access technique [11]. BMI profiles were matched between two groups, allowing interpretation of access outcomes independent of body habitus, similar findings have been reported by Kumar *et al.* (2024) [7] and Tayar *et al.* (2022) [12]. The BMI may influence particular choice of access methods by the surgeon on obese populations, but such effects were unlikely to be relevant in the present study. The operative procedure spectrum was compared between the two groups, with laparoscopic cholecystectomy have the majority of procedures. This is important, as access-related parameters may vary with procedural complexity. Several studies show similar results on laparoscopic cholecystectomy to minimize variability, while mixed cohorts have shown that procedure type does not independently influence access outcomes when profiles are balanced [13]. Equal distribution of patients to open and closed access groups show unbiased comparison. Selection of the entry technique is influenced by surgeon experience rather than protocol-driven preference, though the use of both techniques reflects routine surgical practice. In the study by Agresta *et al.* found that no single-entry technique is universally applicable [14]. There were significant differences in access-related timing parameters. The closed technique has faster initial access compared to open technique for creating pneumoperitoneum. This distinction has been similarly reported in previous studies. The closed technique has faster needle insertion, however the need for confirmation of correct placement and occasional

repositioning is required, while direct visualization in the open technique permits immediate insufflation once peritoneal access is achieved. The open access technique has a higher successful first-attempt entry, whereas the multiple attempts frequently required in closed technique. These finding were similar with the previous studies and systematic reviews shows, that Veress needle insertion have higher failed-entry or multiple -attempt rate. Intraperitoneal access by closed entry is the blind nature, and depends on indirect confirmation tests, may require repositioning, particularly in the patients with variable abdominal wall anatomy. However, this does not show inferiority of the closed technique but depends on the surgeon experience and patient selection. However, postoperative pain following laparoscopy is multi factorial. Postoperative pain scores were lower in the closed access group, due to small facial incisions and less tissue handling. Several studies have shown that pain is more likely due to pneumoperitoneum pressure, peritoneal stretch, and diaphragmatic irritation than to the access technique. Kumar *et al.* (2024) [7] and Singla *et al.* (2014) [15] demonstrated that pneumoperitoneum play a dominant role in postoperative pain, irrespective of the access method. Despite the early pain perception difference, overall pain score is particularly influenced by various factors in operative and perioperative periods. No major access-related complications were observed in both group, and minor complications occurred at comparable rates. Hence these finding shows that the safety of both techniques when performed by experienced surgeons and similar results noted in multiple comparative studies, which shows low and comparable rates of serious access-related complications. Multiple observational series have suggested, technique-specific risk patterns, however these events remain rare and without consistent statistically significant differences [16]. Port-site and wound-related complications were rare. In open intraperitoneal access technique despite the larger rectus fascia incision, it was observed that there was no increase in wound morbidity. However, port-site complications are more closely related to sterilization practices, operative contamination, and wound care rather than access technique. The present study supports this view [17].

The present study shows that, in elective laparoscopic abdominal surgery, both open (Hasson) and closed (Veress needle) method are safe and effective for intraperitoneal access. The open method had higher first-attempt success and fewer access attempts, while the closed method had faster initial access and lower postoperative pain scores however intraperitoneal access-related and port-site complications were rare. So, these findings in this study shows, that no single intraperitoneal access methods are universally superior, and selection of the access method should be individualized on the basis of patient related factors, experience of the operating surgeon, and surgeon's favourable practice.



CONCLUSION

The current study presented that both the types of techniques (Veress and Hasson) were safe and are very effective in carrying out surgeries involving creation of pneumoperitoneum in laparoscopic surgeries. It was observed that the closed technique had a shorter initial access time and was also associated with lower postoperative pain scores whereas the open technique was associated with faster creation of pneumoperitoneum which can lead to a higher likelihood of successful first-attempt entry. There were no complications observed in both the methods. These findings imply that neither of the technique was superior so the choice of intraperitoneal access should be based on patient factors, surgical background and expertise. Adherence to safety should be a priority and familiarity with the chosen method should remain paramount in minimising complications.

Conflict of Interest-NIL

Source of Funding-NIL

Data Availability Statement- Study data is available with author.

Ethical Approval- Approval from Institutional Ethics Committee SU/R/2024/1350[25]

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