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Original Article

Direct Trocar Insertion Reduces Pneumoperitoneum Creation Time but Does Not Shorten Overall Operative Duration

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ABSTRACT

Background: Direct trocar insertion (DTI) is considered faster than Veress needle (VN) insertion for creating pneumoperitoneum, but it is uncertain whether time saved at entry shortens the total operation. **Objective:** To compare the time required to create pneumoperitoneum and the total operative duration between VN insertion and DTI in elective laparoscopic abdominal surgery. **Methods & Materials:** This prospective comparative study was carried out in the Department of General Surgery, Bangladesh Medical University, Dhaka, from August 2024 to July 2025. Thirty-eight patients undergoing elective laparoscopic surgery were purposively enrolled and divided equally into a VN group (n=19) and a DTI group (n=19). Pneumoperitoneum creation time was measured from the first incision to entry of the telescope and operative duration from the first incision to the last port-site closure. Data were analyzed in SPSS version 26 ($p<0.05$ considered significant). **Results:** The groups were comparable at baseline. The mean pneumoperitoneum creation time was significantly shorter with DTI than with the VN technique (2.69 ± 1.06 versus 6.29 ± 2.71 minutes; $p<0.001$) and the range was narrower (1.5–5.5 versus 1.0–15.0 minutes). Total operative duration was 54.63 ± 16.15 minutes in the DTI group and 57.63 ± 10.79 minutes in the VN group, a difference that was not significant ($p=0.505$). **Conclusion:** DTI shortened pneumoperitoneum creation by more than half, but this saving did not produce a statistically significant reduction in total operative duration. Time efficiency at entry alone should therefore not be the sole reason for choosing DTI.

Keywords: *Laparoscopy; Pneumoperitoneum; Veress needle; Direct trocar insertion.*

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INTRODUCTION

Laparoscopic surgery is now the standard approach for many abdominal operations and efficient use of theatre time is an important consideration for busy surgical units alongside patient safety [1]. In resource-limited tertiary hospitals, where operating lists are long and theatre capacity is restricted, even modest differences in duration can affect throughput. Every laparoscopic operation begins with the creation of pneumoperitoneum and the method chosen determines how soon the team can proceed to the definitive procedure.

The Veress needle technique involves a blind needle puncture, confirmation of intraperitoneal placement through a series of checks, insufflation to the target pressure and only then a separate blind introduction of the primary trocar [2]. Direct trocar insertion, first reported by Dingfelder in 1978, places the trocar directly through the abdominal wall before insufflation and therefore removes the needle-related steps [3,4]. This reduction in blind steps is the main reason why direct entry is expected to save time. Because of this, it has long been regarded as the faster method and it is one of the two closed techniques used most often in current practice, although no single technique has been accepted as the best and its speed cannot be separated from the skill of the surgeon [5,6].

Several trials support a time advantage. In bariatric surgery, Ertugrul et al. recorded a mean entry time of 79.6 seconds with direct trocar insertion against 217 [6]. Seconds with the Veress needle [7]. Kirti et al. reported first-attempt trocar placement times of 102.6 and 142.3 seconds, respectively, in a mixed surgical population [8]. These trials differ in population, device and definition of the timed interval. In laparoscopic sterilization, Borgatta et al. found that direct trocar use shortened operating time from 9 minutes 40 seconds to 7 minutes 30 seconds and required fewer instrument insertions [9]. The evidence is not uniform, however. A meta-analysis of 16 randomized trials and 5 observational studies found no significant difference in the time needed to achieve complete insufflation, with a mean difference of about 15 seconds [10].

Variation in trocar type, insertion site, timing definitions and surgeon experience probably explains this inconsistency. Much of the randomized evidence has also been generated in gynecologic practice,[11,12] although comparisons in laparoscopic cholecystectomy have also been reported [13,14]. In patients undergoing general surgical procedures the definitive operation is considerably longer than the entry step, so a saving of a few minutes at entry may be diluted by the variability of the main procedure. It is therefore uncertain whether faster creation of pneumoperitoneum translates into a shorter overall operation and this question has practical importance for theatre scheduling and for surgeons who choose between the two techniques on the basis of efficiency. Data measuring entry time and total operative duration together in the same patients are especially useful, because they show how much of the entry time saving survives in the total duration of the operation.

This study compared the time required to create pneumoperitoneum and the total operative duration between Veress needle insertion and direct trocar insertion in patients undergoing elective laparoscopic abdominal surgery.

METHODS & MATERIALS

This prospective comparative study was conducted in the Department of General Surgery, Bangladesh Medical University, Dhaka, Bangladesh, over one year from August 2024 to July 2025. Patients scheduled for elective laparoscopic abdominal surgery in the department formed the study population. Using purposive sampling, 38 patients were enrolled and divided equally into the Veress

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needle (VN) group (n=19) and the direct trocar insertion (DTI) group (n=19); this size was derived from the standard formula for comparing two proportions at 95% confidence and 80% power.5 Patients who gave written informed consent were included, whereas those with a previous abdominal operation leaving a central abdominal scar, severe abdominal wall or intra-abdominal sepsis, abdominal cocoon, or an emergency presentation were excluded. Data were recorded on a semi-structured questionnaire and a structured data collection sheet covering age, sex, weight, height, body mass index, surgical indication and operative details. After standard preoperative preparation and anesthetic assessment, pneumoperitoneum was created with conventional non-optical devices. In the DTI group, a 1 cm transverse umbilical incision was followed by elevation of the abdominal wall and direct introduction of a 10 mm reusable trocar, with the CO_2 stopcock open until peritoneal entry. In the VN group, a 2 to 3 mm umbilical incision was used for blind needle insertion and CO_2 insufflation, followed by the 10 mm port. The time required to create pneumoperitoneum was measured from the first incision to the entry of the laparoscopic telescope and the duration of surgery from the first incision to the application of the last port-site skin stapler or suture. To ensure accuracy and consistency, both intervals were recorded for every patient on the same data sheet using the same definitions and the data were checked for consistency before entry. Ethical clearance was obtained from the Institutional Review Board of Bangladesh Medical University and the study followed the Declaration of Helsinki. Participants were informed of the aims, procedures and their right to withdraw, written informed consent was obtained, identities were protected through coded identification numbers with restricted access to records and no financial incentive was offered. Time variables were summarized as mean, standard deviation and range and categorical variables as frequencies and percentages. The independent t-test was used to compare pneumoperitoneum creation time and operative duration, the chi-square test was used for categorical comparisons, the analysis was performed in SPSS version 26 and $p<0.05$ was considered statistically significant.

RESULTS

A total of 38 patients undergoing elective laparoscopic abdominal surgery were included in the analysis, with 19 patients in the Veress Needle Group and 19 patients in the Direct Trocar Insertion Group. The baseline demographic and clinical characteristics are presented in *Tables I* and *II*.

Table I shows that participants in both groups had a broadly similar age distribution. The largest proportion of patients in the Veress Needle Group was aged 31–40 years (47.4%), whereas the largest proportion in the Direct Trocar Insertion Group was aged 41–50 years (36.8%). The mean age was 39.21 ± 10.66 years in the Veress Needle Group and 44.32 ± 13.57 years in the Direct Trocar Insertion Group. The majority of participants were female in both groups. BMI distribution was identical between the groups, with 52.6% of participants having normal BMI and 47.4% being overweight in each group. The mean BMI was 24.52 ± 2.01 kg/m² and 25.01 ± 2.26 kg/m², respectively. None of the demographic or anthropometric variables differed significantly between the groups

Table I
Age, sex and BMI characteristics of the study participants.

Variable		Veress Needle Group (n=19)	Direct Trocar Insertion Group (n=19)	p-value
Age group (years)	18–30	3 (15.8)	2 (10.5)	0.508
	31–40	9 (47.4)	5 (26.3)	
	41–50	4 (21.1)	7 (36.8)	
	51–60	3 (15.8)	4 (21.1)	
	>60	0 (0.0)	1 (5.3)	
	Age, mean ± SD	39.21 ± 10.66	44.32 ± 13.57	0.205
Sex	Male	6 (31.6)	7 (36.8)	0.732
	Female	13 (68.4)	12 (63.2)	
BMI category	Normal	10 (52.6)	10 (52.6)	0.488
	Overweight	9 (47.4)	9 (47.4)	
	Underweight	0 (0.0)	0 (0.0)	
	Obese	0 (0.0)	0 (0.0)	
	Mean ± SD (kg/m²)	24.52 ± 2.01	25.01 ± 2.26	

Table II presents the distribution of surgical indications. Chronic calculus cholecystitis was the predominant indication in both groups, occurring in 15 (78.9%) patients in the Veress Needle Group and 17 (89.5%) patients in the Direct Trocar Insertion Group. Other indications were infrequent. The distribution of surgical indications was not significantly different between the two groups (p=0.294).

Table II
Distribution of surgical indications.

Surgical indication	Veress Needle Group (n=19)	Direct Trocar Insertion Group (n=19)	p-value
Acute cholecystitis	0 (0.0)	1 (5.3)	0.294
Chronic calculus cholecystitis	15 (78.9)	17 (89.5)	
Cholelithiasis	1 (5.3)	0 (0.0)	
Cholelithiasis with choledocholithiasis	0 (0.0)	1 (5.3)	
Paraumbilical hernia	1 (5.3)	0 (0.0)	
Recurrent appendicitis	2 (10.5)	0 (0.0)	

Table III shows a marked difference in the time required to establish pneumoperitoneum. The mean pneumoperitoneum creation time was 6.29 ± 2.71 minutes with the Veress Needle technique compared with 2.69 ± 1.06 minutes with Direct Trocar Insertion. The difference was statistically significant ($p<0.001$). The observed range was also narrower in the Direct Trocar Insertion Group.

Table III
Time required to create pneumoperitoneum.

Outcome	Veress Needle Group (n=19)	Direct Trocar Insertion Group (n=19)	p-value
Pneumoperitoneum creation time (min), mean ± SD	6.29 ± 2.71	2.69 ± 1.06	<0.001
Range (min)	1.0–15.0	1.5–5.5	

Table IV presents the total operative duration. The mean operative duration was 57.63 ± 10.79 minutes in the Veress Needle Group and 54.63 ± 16.15 minutes in the Direct Trocar Insertion Group. Although the mean duration was numerically shorter in the Direct Trocar Insertion Group, the difference was not statistically significant (p=0.505).

Table IV
Total operative duration.

Outcome	Veress Needle Group (n=19)	Direct Trocar Insertion Group (n=19)	p-value
Total operative duration (min), mean ± SD	57.63 ± 10.79	54.63 ± 16.15	0.505
Range (min)	40–75	30–100	

DISCUSSION

This study found that direct trocar insertion shortened the creation of pneumoperitoneum considerably but did not produce a statistically significant reduction in total operative duration. The mean time to establish pneumoperitoneum was 2.69 minutes with DTI and 6.29 minutes with the VN technique (p<0.001), a saving of 3.60 minutes or about 57% of the time needed with the needle. The two groups were similar in age, sex, weight, height and body mass index and their surgical indications did not differ, which makes it unlikely that patient factors explain the time difference.

A time advantage for direct entry has been reported elsewhere. Ertugrul et al.7 measured entry times of 79.6 and 217.6 seconds in bariatric patients, a difference of about 2.3 minutes and Kirti et al. recorded 102.6 and 142.3 seconds for first-attempt trocar placement, a difference of about 40 seconds [8]. Erdem et al. likewise found a significantly shorter entry time with DTI in gynecologic laparoscopy and Zakherah16 compared the two techniques in 1,000 patients operated on by the same surgeon [15]. The saving we observed was larger than in the first two trials, probably because our interval began at the first incision and ended when the telescope entered the peritoneal cavity and so included needle placement, testing and insufflation. Taliento et al. pooled randomized trials and 5 observational studies and found no significant difference in the time to complete insufflation, a heterogeneity that presumably reflects differences in devices, insertion sites and operator experience [16,10]. The range of creation time was also narrower with DTI (1.5 to 5.5 minutes) than with the VN technique (1.0 to 15.0 minutes) and the standard deviation was less than half as large. Predictability is a practical advantage, because a prolonged entry is often associated with repeated needle placement or unsuccessful insufflation. In our series one patient in the VN group had failed pneumoperitoneum and four had preperitoneal insufflation, which may account for some of the longest entry times, although time was not analyzed by complication. Byron et al. reported more failed insertions with the needle, the Cochrane review by Ahmad et al. found that direct insertion reduced failed entry and Elnaggar et al. reached the same conclusion in their meta-analyses [17-19].

The absence of a significant difference in total operative duration (57.63 versus 54.63 minutes; p=0.505) indicates that a saving at entry has limited influence on overall case length. The pneumoperitoneum interval is part of the operative duration and the 3.60 minute saving at entry was slightly larger than the 3.00 minute difference in mean total duration, so the direction of the effect is coherent. What prevented significance was the dispersion of operative times, which ranged from 40 to 75 minutes in the VN group and from 30 to 100 minutes in the DTI group (standard deviations 10.79 and 16.15 minutes), far exceeding the entry time difference. Because chronic calculus cholecystitis accounted for most cases, differences in gallbladder inflammation, adhesions and surgeon technique probably produced much of this variation. Entry time formed about 11% of the total duration in the VN group and about 5% in the DTI group and from the observed standard deviations we estimate that more than 300 patients per group would be needed to detect a 3-minute difference with conventional power. Borgatta et al. found shorter operating time with direct trocar use in laparoscopic sterilization, a brief procedure in which entry forms a larger share of the whole operation, which is compatible with this explanation [9].

The practical consequence is that the time gain from DTI is real at the entry step but small in relation to the whole operation. For a list of four cases it would amount to roughly 14 minutes, which may matter in high-volume units but does not justify the technique on efficiency alone. Safety and familiarity should also guide the choice, since results in obese patients have been less favorable with blind bladed insertion,7 trials in obese women have examined both closed techniques and the Veress needle remains widely used by experienced operators [20,21]. Our cohort had no obese patients and excluded previous central abdominal scars, which limits extension to higher risk groups. Larger multicenter studies that record entry time and total duration by procedure type are needed.

LIMITATIONS

The study was conducted at a single center with a small, purposively selected sample, which limits generalizability and the power to detect modest differences in total duration. Case complexity and surgeon experience were not analyzed as determinants of operative time. Only elective procedures were included and patients with previous central abdominal scars or obesity were not represented.

CONCLUSION

Direct trocar insertion reduced the time needed to create pneumoperitoneum by more than half compared with the Veress needle technique and produced a narrower range of entry times, but it did not shorten the total operative duration to a statistically significant degree. The efficiency gain is therefore confined to the entry step. Direct trocar insertion is a reasonable option for trained surgeons, though its selection should also consider safety and patient factors and larger studies are warranted.

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