

Original Research Article

Comparative study of outcomes in patients where pneumoperitoneum is created by Veress needle versus open method in laparoscopic surgeries

Digpal Thakore, M. S. Ray, Naresh Modi, Brinda Panchal*, Aditya Raval, Vishal Patel

Department of General Surgery, SGT Medical college and hospital, Gurugram, Haryana, India

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***Correspondence:**

Dr. Brinda Panchal,

E-mail: brindap94@gmail.com

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ABSTRACT

Background: The establishment of pneumoperitoneum is the inevitable first step in laparoscopic surgery as it increases the distance between the anterior abdominal wall and intra-abdominal viscera, thus creating a working space.

Methods: This prospective study was conducted on 50 patients. Patients were randomly divided into two groups, in first group, pneumoperitoneum is created by Veress needle and in second group, pneumoperitoneum is created by open method.

Results: The open method takes less time to create pneumoperitoneum while leads to statistically significant more gas leaks as compared to the closed method.

Conclusions: The open technique is almost equal to closed technique or Veress technique in terms of the time taken to complete the operation and major and minor complications because there was no statistically significant difference in the frequency of these parameters between the two techniques. The open method takes less time to create pneumoperitoneum while leads to statistically significant more gas leaks as compared to the closed method.

Keywords: Pneumoperitoneum, Veress needle, Open method, Trocar, Gas leak

INTRODUCTION

The one difficulty with laparoscopy that is unique to the insertion of surgical equipment through small incisions to gain access into the abdomen. Currently, laparoscopy is often employed in medical settings for both therapeutic and diagnostic goals. Most benign abdominal disorders that require surgery are now treated using a minimally invasive technique. Laparoscopic surgeries obviously carry some risk, though. Laparoscopic entrance is a blind technique, and all associated consequences are problematic because of this. Laparoscopic surgical complications are uncommon and mostly happen when trying to enter the peritoneal cavity.¹

Laparoscopy aims to reduce patient morbidity while retaining positive results. A crucial tool for both

diagnosis and treatment during surgery is laparoscope. Studies evaluating the risks associated with laparoscopy use have been conducted in light of the increased use of this procedure in surgery during the past 15 years.

A working space is created by increasing the distance between the anterior abdominal wall and the intra-abdominal viscera by establishing pneumoperitoneum, which is a necessary initial step in laparoscopic surgery. The most risky part of using a trocar and possibly the riskiest step in minimally invasive surgery is the first insertion. The majority of the complications that develop during the insertion of the primary umbilical trocar-more than 50% of them-occur at this time.²⁻⁴ Laparoscopy has a vascular injury rate of 2 per 10,000 operations and a major complication with a mortality rate of 3.3 per 100,000 procedures.⁵

Optimizing the entry approach is crucial as a result. Pneumoperitoneum is produced using four fundamental methods: open laparoscopy, optical trocar insertion, blind Veress needle (VN), and direct trocar insertion (open method) (Hasson). All of these techniques have the potential to have difficulties, even with good surgical training and execution. Numerous studies comparing the effectiveness and safety of various access procedures have been conducted, but their meta-reviews have been found to be equivocal, necessitating further research.⁶

Because of uncertainty, the surgeon's preference usually determines the procedure to be used. For more seasoned surgeons, this is effective, but for residents and less experienced surgeons, it might be confusing. Complications from using a Veress needle to induce pneumoperitoneum include damage to anterior abdominal wall vessels, pelvic and big retroperitoneal vessels, bowel perforation and insufflation, gas embolism, and subcutaneous or subfascial insufflations. There is currently a wealth of evidence in the literature that supports the viability and efficacy of direct trocar implantation (Open method).⁷⁻¹⁰

Laparoscopy has advanced significantly over the past 20 years in order to reduce the risk of complications, thanks to advancements in optics, electronics, and auxiliary tools. Furthermore, there are now more laparoscopic training facilities, workshops, and online videos, as well as better surgical proficiency and expertise. These assist in implementing practical advice to avoid problems.

Although it is a blind technique, it diminishes number of "blind steps" from three with the Veress to just one, the one of trocar introduction. With direct trocar insertion (Open Method), it is possible to recognize any injury and repair it immediately.⁶

This technique without pre-insufflation is an alternative to Veress needle insertion for accessing the abdominal cavity for operative laparoscopy. Direct trocar entry (Open Method) has been reported as an alternative to Veress needle for the creation of the pneumoperitoneum. The present study aimed to compare the safety and efficacy of open method versus the Veress needle technique in laparoscopic surgeries.

Aims and objectives

Aim and objectives were-time taken for establishment of first port and complication-bowel and vascular injuries, port site infection within 1 month and port site hernia within 3 months

METHODS

This study has been approved by institutional ethics committee of SGT university. The declaration of Helsinki was adequately addressed for the research.

This study was a pilot prospective study conducted among 50 patients presenting to SGT hospital for laparoscopic surgeries from January 2021 to June 2022. Two study group i.e., pneumoperitoneum by Veress needle and pneumoperitoneum by open method were formed. An equal distribution of patients was done randomly between these two groups and each group comprised of 25 patients each.

Veress needle insertion technique is same as done routinely.

Open method technique

To establish the pneumoperitoneum by open method, first the umbilicus is held by towel clip umbilicus stretched at 45 degree. Umbilicus stalk is felt and incision of 10 mm given on the stalk. Subcutaneous fat dissection is done by artery forceps and stalk is being cleared till it appears pearly white in colour and then stalk is held with another towel clip and 2 mm nick is given on the stalk, and obturator is inserted and peritoneum is breached. Cut margins of the stalk is sutured with vicryl 2/0 round body suture. Blunt trocar and port assembly placed, obturator removed, CO₂ insufflation is done and entry checked with camera.

Inclusion criteria

Patients of age ≥ 18 years admitted for any laparoscopic surgery were included in the study.

Exclusion criteria

Patients with hostile abdomen (Scarred abdomen), BMI >35 kg/m², bleeding diathesis and obstetrics and gynaecological surgeries were excluded.

Statistical analysis

The continuous variables will be presented as average mean and standard deviation (SD), while categorical variable as absolute number and percentage. The parametric data will be analysed by 'Student's t-test for unpaired samples', while non-parametric data will be analysed using 'Chi-square test' or 'Fisher's-exact test', $p < 0.05$ was taken as statistically significant.

Ethical approval

The study was approved by the institutional ethics committee.

RESULTS

Females were comparatively more as compared to males in both the study groups. Maximum subjects were from the age group of 21-40 years in group 1 (64%) as well as group 2 (52%) followed by 41-60 years. Minimum subjects were from the age group of >60 years in both the

groups. In this hospital, Lap cholecystectomy and lap appendectomy are mainly performed. More than 2/3rd of the subjects in this study underwent lap cholecystectomy (Table 1 and 2).

Table 1: Gender distribution among the study groups.

Gender	Group 1 (Veress needle)		Group 2 (Open method)	
	N	%	N	%
Male	9	36	6	24
Female	16	64	19	76
Total	25	100	25	100

Table 2: Age distribution among the study groups.

Age group (Years)	Group 1 (Veress needle)		Group 2 (Open method)	
	N	%	N	%
11-20	3	12	4	16
21-40	16	64	13	52
41-60	4	16	5	20
>60	2	8	3	12

Table 3: Comparison of time required (in minutes) to create pneumoperitoneum among the study groups.

Surgical procedure	Group 1 (Veress needle)		Group 2 (Open method)		P value
	Mean	SD	Mean	SD	
Lap appendectomy	7.4	0.48	5.5	0.41	<0.01*
Lap cholecystectomy	8.6	0.41	8.2	0.26	0.021*
Average	8.3	0.67	7.9	0.53	0.006*

Table 4: Per operative findings among the study groups.

Findings	Group 1 (Veress needle)		Group 2 (Open method)		P value
	N	%	N	%	
Multiple attempts	6	24	1	4	0.13
Gas leak at port site	2	8	3	12	
Port site bleeding	1	4	2	8	

DISCUSSION

Surgery is the one of the best branch of medicine, perfect in itself and ever-present in practice.¹¹ Large incisions were historically essential to a successful treatment. The secret to a risk-free and effective operation was exposure. Minimally invasive treatments have developed as a result of surgeons' ongoing search for novel ways to address patients' conditions while minimising harm from the procedure. A method for gaining access to body cavities without making a significant incision in order to perform surgical treatments has been in development for some time.¹² The basic idea of limited access surgery is that it is now possible to undertake surgical operations by entering bodily cavities through smaller incisions, even though exposure is still necessary for safe and successful procedure. It's possible that minimally invasive surgery predates civilization. The creation of Eve was mentioned in the Bible as having undergone "operation," and there is mention of what may have been first "endoscopy" when

Mean time required creating pneumoperitoneum by Lap appendectomy and lap cholecystectomy in group 1 and 2 was 7.4, 8.6 and 5.5, 8.2 seconds respectively. Hence time required creating pneumoperitoneum was more in group 1 as compared to group 2 with statistically significant difference as $p < 0.05$ (Table 3).

There is no incidence of bowel/vascular injury was found in this study.

Per operative findings viz. multiple attempts, gas leak at port site and port site bleeding was reported among 24%, 8%, 4% and 4%, 12%, 8% of the subjects in group 1 and 2 respectively. Although per operative findings were found more in group 1 as compared to group 2, but no significant difference was revealed (Table 4).

In this study, port site hernia (within 03 months of surgery) was not found in any of the subject.

In this study, port site infection was not found in any of the subject.

"The King of Babylon stood at the parting of the ways to use divination, he made his arrows bright, he consulted with images, and he looked in liver."

In the initial phase of development of laparoscopic cholecystectomy, surgeon adept in open surgery had lot of difficulty in performing the lap chole-intensive efforts, eye hand co-ordination, surgeon exhausting long hours of surgery. The gallous humor going around in OT then was "At the end of lap chole, the patient is wheeled to general ward and the surgeon is admitted in ICU.

Predictably, the number of surgical blunders and injuries to the common bile duct rose. The "weekend" or short course without continued proctoring was quickly realised to not be the best training model for the adoption of these new methodologies.

Initial step in performing laparoscopic surgery for diagnostic and therapeutic purposes is to create

pneumoperitoneum.^{13,14} A sharp insufflating needle or trocar must be inserted in order to create a pneumoperitoneum. Pneumoperitoneum formation and peritoneal access are important first steps in laparoscopic surgery. Open entrance technique and closed entry technique are the two options for insufflating pneumoperitoneum and introducing the laparoscope at onset of the procedure. Pneumoperitoneum is produced using one of five fundamental techniques: the Veress needle, the direct trocar, the optical trocar, the open technique, and the modified open technique. The most popular technique for gaining access to the peritoneum is to blindly insert a Veress needle via an infra-umbilical stab incision before inflating the peritoneum.¹⁵

The most serious risks associated with laparoscopy include trocar injuries while inserting into the peritoneal cavity, complications at the port site, such as infection, edema, pain, as well as a raised risk of hypothermia and peritoneal trauma from increased exposure to cold and dry gases during insufflations.¹⁶ Patients with low weight or a history of abdominal surgery have a greater chance of these injuries, especially those that occur during trocar entry.¹⁷ Laparoscopic surgery still has a lower overall incidence of problems than open surgery, nevertheless studies from the past suggest that the open technique is greater than the closed method in terms of the length of procedure, occurrence and seriousness of complications, particularly in patients with low weight, surgical scars from prior procedures, abdominal Koch's, and PID.¹⁸

The present prospective, randomized, observational and comparative study was conducted among 50 patients admitted for any laparoscopic surgery in general surgery department of SGT medical college, hospital and research institute, Budhera, Gurugram, Haryana. In 25 patients, pneumoperitoneum was created by Veress needle (Group 1) and in other 25 patient's pneumoperitoneum was created by open method (Group 2). The aim of the study was to compare the outcomes in patients where pneumoperitoneum is created by Veress needle versus open method in laparoscopic surgeries.

Gender

Females were comparatively more as compared to males in both the study groups. This is in accordance with the study done by Nawaz et al.¹⁸

Age

Maximum subjects were from the age group of 21-40 years in group 1 (64%) as well as group 2 (52%) followed by 41-60 years. Minimum subjects were from the age group of >60 years in both the groups.

Similarly, Jain et al in their study showed that subjects that included in their study belonged to the age group of 10-69 years out of which majority were 15-50 years old.¹⁹

Nawaz et al too reported similar age distribution in their study.¹⁸

Time required (min) to create pneumoperitoneum

Mean time required creating pneumoperitoneum by Lap appendectomy and Lap cholecystectomy in group 1 and 2 was 7.4, 8.6 and 5.5, 8.2 seconds respectively. Hence time required creating pneumoperitoneum was more in varies needle as compared to open method which has p value <0.05 showing statistical significance in the present study.

Petigen et al stated that the open method needed half the time required by the closed technique and concluded that it could be used on the basis as it is more cost-effective.^{14,20}

Similarly, Jain et al in their study reported that mean time taken to achieve pneumoperitoneum by Veress needle (group C) was 9.3 seconds while by open technique (group O), it was 7.84 seconds with p<0.001.¹⁹

In their study, Durge et al demonstrated that the time required to create a pneumoperitoneum during laparoscopic procedure was shorter in the open technique group than in the closed method group. This is in concordance to the present study.²¹

The first trocar is inserted more quickly using the open technique than using a Veress needle, according to the European association for endoscopic surgery.²²

Additionally, Sigman et al discovered that the open technique needed less time and recommended using it as a result.²³

In terms of the amount of time needed to produce pneumoperitoneum, our study's findings are comparable to the study of the Borgatta et al.²⁴

Due to use of the umbilical stalk, the open approach used in our study required less time to produce pneumoperitoneum. This technique is based on the anterior abdominal wall's anatomy at the umbilicus. A ring of thicker fascia surrounds the umbilical cord in embryonic time and fastens it to the front abdominal wall. This ring remains throughout adulthood and is unattached intraperitoneally. Trocar and cannula can be inserted through an incision created superiorly or inferiorly to the umbilicus. Numerous surgeons currently employ this technique. By using this novel approach, open method might be elevated to the top tier. Due to the frequent usage of validation of entrance tests such as the drop test and first intra-abdominal pressure test, among others, Veress needle approach requires longer time to produce pneumoperitoneum. Despite the fact that the open method was faster at creating pneumoperitoneum, there was no discernible difference in the amount of time needed to perform surgery between the two techniques. In some

instances, the phenomena known as "gas leak" may be responsible for this. This was fixed by securing the sliced fascia to the trocar more firmly. This requires time and disrupts the process in middle of it.

Vascular/bowel injury

There is no incidence of any Vascular/Bowel injuries seen in this study.

Per operative findings

In the present study; per operative findings viz. multiple trials, port site gas seepage as well as bleeding was reported among 24%, 8%, 4% and 4%, 12%, 8% of the subjects in group 1 and 2 respectively. Although per operative findings were found more in group 1 as matched to group 2, but no significant difference was revealed.

Durge et al found that open approach had more minor mechanical issues, such as several trials ($p=0.039$), gas leak at the port site ($p=0.037$), and minor problems, such as bleeding at the port site, than closed method, which only had one case of pre-peritoneal insufflation.²¹

According to Bonjer et al comparison of open and closed methods, the rates of visceral and vascular harm following closed method were 0.08% and 0.07%, respectively, and 0.05% and 0%, following open method.²⁵

Although randomised controlled trials discovered the open strategy sooner and were linked to a decreased incidence of mild issues, major outcomes studies indicated that the closed group experienced less complications.

When comparing the complexities of the two strategies, Schafer et al came to the conclusion that the open access method did not demonstrate any superiority over the closed methodology.²⁶

In their investigation, Zakherah et al found that the open method is a secure substitute for the closed technique for the creation of pneumoperitoneum. Additional benefits of this strategy include quicker pneumoperitoneum formation and lower instrumentation and cost requirements.²⁷

The benefit of the open approach is that the peritoneal cavity can be accessed while being seen clearly, preventing the most serious injuries. Injury to intra-abdominal structures is a laparoscopic complication that may be preventable. When performing a procedure known as closed method, many injuries are connected to the blind insertion of the Veress needle or sharp trocar into the abdomen. The majority of laparoscopic surgeons still have faith that using the traditional closed technique

to first generate pneumoperitoneum before inserting the trocar as part of a routine laparoscopic technique is safer.

Limitations

This study's main drawback is its limited sample size; in order to thoroughly examine the parameters, a higher sample size is needed.

Because this study was conducted in a single location, its findings cannot be extrapolated.

Additionally, because the surgical procedures considered in this study are carried out by a variety of medical professionals, it is challenging to control the confounding factors.

CONCLUSION

The open technique is almost equal to closed technique or Veress' technique in terms of the time taken to complete the operation and major and minor complications because there was no statistically significant difference in the frequency of these parameters between the two techniques. The open method takes less time to create pneumoperitoneum while leads to statistically significant more gas leaks as compared to the closed method. Hence, multi-centric studies with a large sample size, systematic reviews, and meta-analysis on this topic are required for more conclusive data

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