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A simple and safe technique of creating closed pneumoperitoneum

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Abstract
Laparoscopic surgery has become the standard of care for many diseases like symptomatic gallstone disease, acute appendicitis, achalasia and gastroesophageal reflux disease. One of the key steps in the procedure is to obtain pneumoperitoneum and insert the first trocar safely. We describe a simple technique which detects the precise entry point when the reusable metallic Veress needle enters the peritoneal cavity.

Keywords: abdominal, bariatric, bowel, cholecystectomy, complications, pneumoperitoneum

Introduction
Laparoscopic surgery has become the standard of care for many diseases such as symptomatic gallstone disease, acute appendicitis, achalasia and gastroesophageal reflux disease. One of the key steps in the procedure is to obtain pneumoperitoneum and insert the first trocar safely. Closed pneumoperitoneum is usually obtained by inserting a Veress needle through the abdominal wall inside the peritoneal cavity. There are various tests described in the literature to confirm the position of the needle tip inside the peritoneal cavity. Atmospheric air is sucked into the abdomen with an audible hiss (Hiss test), aspiration of air into a partially filled syringe, free instillation of saline through the needle, sucking in of a drop of saline placed onto the hub of the Veress needle due to negative intraperitoneal pressure (Drop test), etc.–all these tests confirm the needle tip position once it is inside the peritoneal cavity [1].

We describe a simple technique which detects the precise entry point when the reusable metallic Veress needle enters the peritoneal cavity. This technique prevents overshooting of the needle inside the abdomen, thereby lessening the chance of any visceral injury. A 5 cc syringe (without the plunger) with about 3 ml saline in it is fitted with the reusable Veress needle. Keeping the air channel locked the needle is inserted as usual through the skin nick. When the needle is in the muscle layer, the lock is released. After that the needle is pushed further.

As soon as the needle punctures the peritoneum the water of the syringe starts flowing through the needle. The flow of water confirms the intraperitoneal position of the needle tip. By this technique one can make pneumoperitoneum with the most superficial position of the needle tip inside the abdomen. We have used this technique in 25 consecutive patients of laparoscopic procedures without any difficulty in creating pneumoperitoneum.

The incision is long enough to be able to dissect down to the fascia, incise it, and enter the peritoneal cavity under direct vision. There is no clear consensus as to the optimal method of entry into the peritoneal cavity. Some authorities believe that Hasson open technique is superior to the classic closed entry technique, defending their views in that it is safer, eliminates the risk of gas embolism, and significantly reduces the risk of vascular and bowel injuries related to primary access. However there is conflicting evidence between different studies and there is no unified opinion regarding this issue. The purpose of this study was to describe the safety between these two techniques for accessing the abdominal cavity and creation of pneumoperitoneum in laparoscopy.

Materials and methods
A total of 100 patients having undergone operative procedure for laparoscopic surgery were selected for the study. Informed consent was taken from the patients. Single blinding was done as the patients were not aware of the group to which they belonged.

The patient population consisted of 43 males and 57 females study population was randomized to two groups: Open method – 50 patients Closed method – 50 patients The patients were diagnosed on the basis of clinical symptoms, physical examination and hematological, as well as radiological investigations available in our hospital.

The personal details of the patient in the form of Name, Age/Sex, Date of Admission, Date of Operation, Date of Discharge and Registration number were noted. The findings were recorded in the proforma. The recorded data included thorough history, clinical and abdominal examinations, BMI (body mass index), routine investigations like Hb/TC/RFT, USG abdomen findings. Per operative findings like method of pneumoperitoneum creation and its duration, multiple attempts, incision size, extra peritoneal insufflation, port site bleeding, gas leak, total gas used were recorded.

Per operative complications like visceral/vascular injury, port site hematoma, conversion to open surgery noted. Patients were assessed in the immediate postoperative period and followed after one week, two months, 6 months and one year of discharge to assess for complications. Postoperative complications like wound hematoma, wound infection, gas embolism, port site hernia noted in follow up. The study was approved by the institutional authorities. Confidentiality was

strictly maintained. Patients were managed as routine cases in the ward.

Results

A total of 100 cases were enrolled. 50 were randomized to the veress needle (closed) technique while the remaining 50 in the open technique. Majority of the patients are middle-aged (mean age 42±7 years), female (57%) male (43%). There are no major differences in the demographic profile of both the study groups. The comparative analysis of the study variables are presented in Table I. The time to establish pneumoperitoneum was less in open technique (4.6±1.1minutes) as compared to the closed technique.

Pneumoperitoneum was achieved in all 100 cases. In the open group, gas leak occurred in 6 (12%) cases, port-site bleeding in 9 (18%) cases, port-site hematoma occurred in 1 (2%) case while port site wound infection occurred in 2 (4%) cases. In the closed group, gas leak occurred in 3 (6%) cases, port-site bleeding in 3 (6%) cases, port-site hematoma occurred in none case while port site wound infection occurred in 2 (4%) cases. There were one complications of extraperitoneal insufflation in closed method group. Visceral or vascular injury or port-site hernia did not occurred in either of the study arm. Laparoscopic converted to open surgeries were reported in both study groups. They were because of surgical difficulties and were not related to the complications of peritoneal access.

Table 1

Variables	Open Method (N=50) N (%)	Closed Method (N=50) N (%)
Incision size (p<0.001)*	11.68 mm	9.83 mm
Access time (p < 0.03)*	2.52 min	2.83 min
Multiple attempts	9 (18%)	3 (6%)
Gas leak	6 (12%)	3 (6%)
Port site bleeding	9 (18%)	3 (6%)
Extra peritonea insufflations	0 (0%)	1 (2%)
Visceral injury	0 (0%)	0 (0%)
Vascular injury	0 (0%)	0 (0%)
Gas embolism	0 (0%)	0 (0%)
Port site hematoma	1 (2%)	0 (0%)
Port site wound infection	2 (4%)	2 (4%)
Post site hernia	0 (0%)	0 (0%)
Need for conversion	2 (4%)	1 (2%)
Mortality	0 (0%)	0 (0%)

Discussion

Over the past 50 years, many techniques, technologies and guidelines have been introduced to eliminate the risks associated with laparoscopic entry. No single technique or instrument has been proved to eliminate laparoscopic entry associated injury. Besides the classic blind veress technique, there are open laparoscopy (hasson type, direct trocar insertion), use of disposable shielded trocars, radially expanding and optical trocars.

The advantage of open technique is that peritoneal cavity access is gained under direct vision, preventing most severe injuries. Injury to intra-abdominal structures is potentially avoidable complication of laparoscopy. Many of these injuries are related to the blind placement of the veress needle or sharp primary trocar into the abdomen when performing a technique referred as closed laparoscopy.

Most laparoscopists still feel it safer to use classic blind veress needle entry to create pneumoperitoneum first before inserting the trocar as routine laparoscopic approach. This study showed a slightly better safety profile with the veress needle over the open method. There were less complications, which makes it difficult to give conclusive evidence about the superiority between the two techniques. However, a trend towards better safety of the veress needle was demonstrated. Using the veress needle (closed) method to establish pneumoperitoneum was as effective as the open method (direct trocar insertion) and may even be safer.

With the open method, there were issues like multiple attempts, gas leak at port site, port site bleeding more compared to close method and one complication of port-site hematoma with open method, which resolved on its own. There were two cases with port-site infection in both the groups, which were treated successfully with antibiotics.

The complications were due to the larger incision associated with the open method. Indeed, the incision is a mini laparotomy as opposed to the needle puncture of the closed technique. Major visceral/vascular injuries or gas embolism did not occur in any of the study groups. The results conform to those found in other studies. Schafer *et al*. while comparing the complications of both techniques concluded that the open access method failed to show any superiority over the closed technique.

However, Bonjer *et al*. in their comparison between open and closed techniques found that the rates of visceral and vascular injury were respectively 0.08% and 0.07% after closed laparoscopy, and 0.05% and 0% after open laparoscopy (p=0.002). There was no significant difference in the mortality rates [2]. In this study, there was no mortality in either of the two study arms.

Chapron *et al*. on the other hand, reported that the bowel and major vessel injury rates were 0.04 % and 0.01% in the closed technique (n = 8324) and 0.19% and 0% in the open technique (n = 1562), respectively. They concluded that open laparoscopy does not reduce the risk of major complications during laparoscopic access [3].

Chandler *et al*. also found that the open technique had no advantage over the closed technique in terms of safety [4]. In this study, we encountered no major complication in either of the groups. In its clinical practice guideline, the European Association for Endoscopic Surgery states that, the randomized controlled trials comparing closed versus open approach have an inadequate sample size to find a difference in serious complications.

In large outcomes studies, there were fewer complications in the closed group, although RCTs found the open approach faster and were associated with a lower incidence of minor complications [5]. The panel did not favour the use of either technique over the other. In this study, we found that the open technique was faster than the closed technique. This is also similar to previous studies. Petigen *et al*. found that the open technique took half the time required by the closed technique and recommended its use on the basis of it being more costeffective [6].

The European Association for Endoscopic Surgery also concluded that the insertion of the first trocar with the open technique is faster compared to the veress needle method.[18]

Sigman *et al*. also found that less time was required for the open method and advocated its use on this basis [7].

Zakherah *et al*. in his study concluded that the open technique is safe alternative to the closed entry technique for the creation of pneumoperitoneum. Such an approach has further advantages such as less cost and instrumentation and rapid creation of pneumoperitoneum. In his study he reported no major injuries but minor complications were more with open technique which is comparable to our study [8].

Moberg A *et al*. in his study reported no major injuries using open technique. He also reported lesser incidence of minor complications like gas leak. However, time taken for access was significantly more in case of patients with BMI >25 for open technique [9].

In our study, time for access is more with patients having BMI >25. Shailesh Kumar *et al*. concluded in his study that veress needle (closed technique) is comparable or even superior to open technique in terms of access related complications [10].

The entry of open method was faster in this study, but in one out of eight cases, we encountered the problem of 'gas leak'. This was resolved by tightening and anchorage of the cut fascia to the trocar. This consumes time and causes a disturbance in the middle of the procedure. The main limitation of this study was the number of patients. However, the sample suited the objectives of this study with regard to most of the variables. Another limitation is that this was a single center study and like all single center trials, the results cannot be widely generalized.

Conclusion

On analyzing the data, we found both the closed method and the open method for gaining access into the peritoneal cavity are safe. The open technique has a time advantage over the closed method. However, there are more complications associated with it, like multiple attempts, port site bleeding and gas leak. But major vascular and visceral injuries did not occur in any of the groups. Overall, open technique is as good as closed technique and is a good alternative to closed technique for pneumoperitoneum creation in laparoscopic surgery.

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