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**Original Research Article**

# A comparative study of the open versus closed method of pneumoperitoneum creation in laparoscopic surgery

**Bhavesh V. Vaishnani, Kapil R. Kachhadiya*, Mohit R. Chauhan**

Department of General Surgery, Pandit Dindayal Upadhyay Medical College, Rajkot, Gujarat, India

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***Correspondence:**
Dr. Kapil R. Kachhadiya,
E-mail: kachhadiyakapil@gmail.com



## ABSTRACT

**Background:** The main challenge facing the laparoscopic surgery is the primary abdominal access, as it is usually a blind procedure and associated with many complications including life threading vascular and visceral injuries. Techniques for the creation of pneumoperitoneum in laparoscopy include the standard technique of insufflation after insertion of the Veress needle (closed method), open laparoscopy (Hasson technique) and many others.
**Methods:** This is observational study conducted in the department of General surgery, PDUMC, Rajkot from September 2018 to September 2020 comprising of 100 cases, 50 cases from each methods. The patients admitted in our department for Laparoscopic surgery was taken up for the study. The Purpose of our study is to assess the practicality of both methods in creation of pneumoperitoneum and to compare both methods with regards to ease of performance and incidence of complications.
**Results:** Average size of incision (p=-5.426) is more in open method, hence more incidence of minor complications like multiple attempts, gas leak at port site and port site bleeding in open method while less duration for creating pneumoperitoneum (p=0) as compared to closed method. While there is no major complications in either groups.
**Conclusions:** Open technique is as good as closed technique, and is good alternative to closed technique.

**Keywords:** Pneumoperitoneum, laparoscopic surgery, port site incisional hernia

## INTRODUCTION

The word laparoscopy is the method of examining the abdominal cavity which is achieved by sufficiently distending the abdominal cavity by air called pneumoperitoneumand visualizing the abdominal contents using illuminated telescope containing camera. The major difference between laparoscopic surgery and conventional open surgery is the minimal access to the abdominal cavity, as the abdominal incision is replaced by very small incisions. As a result there is minimal traumatic insult to the patient, if achieved without complication, the patient's postoperative recovery will be shorter with less pain and return to full activity and work in shorter time

The main challenge facing the laparoscopic surgery is the primary abdominal access. As most laparoscopic injuries occur at the time of veress needle (Figure 1) and trocar insertion, preventing the complications associated with initial entry is a prime concern for laparoscopic surgeons. Techniques for the creation of pneumoperitoneum in laparoscopy include the standard technique of insufflation after insertion of the veress needle (closed method), or open laparoscopy (Figure 2) (Hasson technique), optical trocar insertion and direct trocar insertion, as well as variation of these techniques. In 1971, Hasson introduced the concept of open laparoscopy to eliminate the risks associated with blind insertion of the Veress needle and trocar.[1]

The purpose of this study was to compare the safety between these two techniques i.e. closed method or open (Hasson technique) for accessing the abdominal cavity and creation of pneumoperitoneum in laparoscopy.

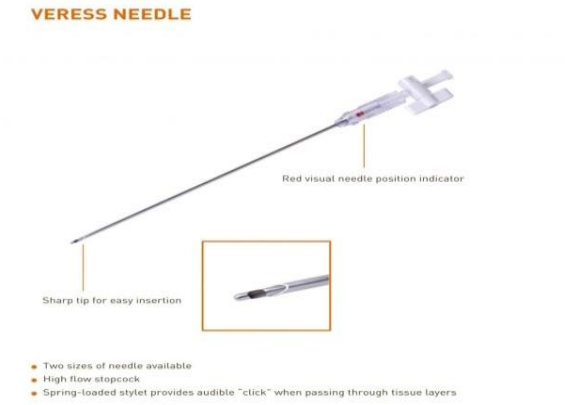


**Figure 1: Veress needle.**

**Figure 2: Hasson's trocar.**

## METHODS

Type of study is observational study and study duration is for 2 years. Sample size is 100 based on cost effectiveness, time consumption, convenience of collecting data and sufficient for getting statically powerful results. 100 patients of either sex were selected who undergone operative procedure for laparoscopy surgery at PDU Medical college, Rajkot from September 2018 to September 2020 and written informed consent, appropriate workup is done. The patients were diagnosed on the basis of clinical symptoms, physical examination and haematological as well as radiological investigations. Per operative findings like method of pneumoperitoneum creation and its duration, multiple attempts, incision size, extraperitoneal insufflation, port site bleeding, gas leak, total gas used were recorded. Per operative complications like visceral or vascular injury, port site hematoma, conversion to open surgery noted. Patients were assessed in post-operative period for wound hematoma, wound infection, gas embolism and port site incisional hernia noted in follow up to 3 months. Criteria for selection includes, All patients undergoing elective laparoscopic surgery and hemodynamically stable patients; And excludes Patients undergoing emergency laparoscopic surgery, Past history of abdominal tuberculosis or puerperal sepsis, cases of machinery failure for establishment of pneumoperitoneum, Patients having intestinal obstruction. Methods used for getting statistical significance are Chi square test.

## RESULTS

Technical difficulties like multiple attempts, gas leak at port site and port site bleeding are more in open method than in closed method, which is attributed to larger size of incision in open method, Furthermore, a significant higher incidence of such minor complications is found in case of BMI >25 p=-5.426 ($p<0.05$) at confidence level of 95%) (Figure 3).

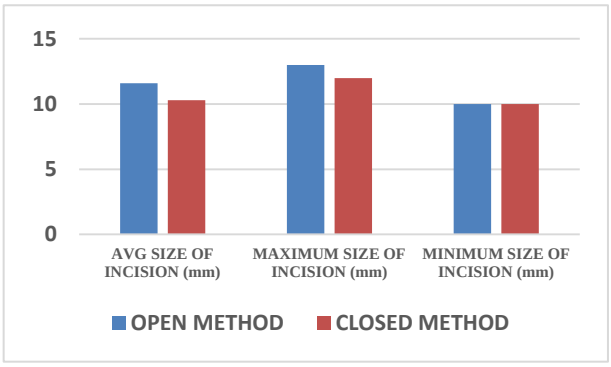


**Figure 3: Size of incision in both methods.**

Duration for pneumoperitoneum creation in open method group is shorter as compared to closed method group for pneumoperitoneum creation in laparoscopic surgery; p value is 0 ($p<0.05$) at confidence level of 95%) (Figure 4).

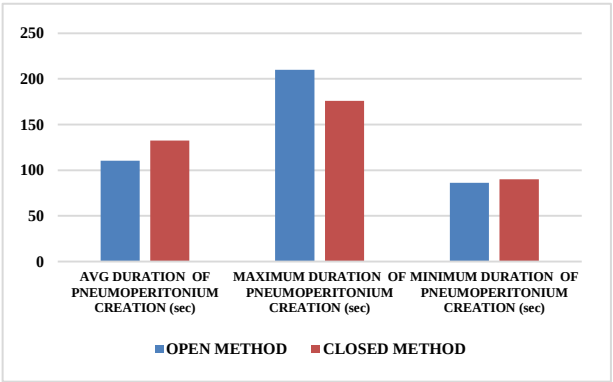


**Figure 4: Duration of pneumoperitonium creation in both methods.**

Minor technical difficulties like multiple attempts (p=0.0373), gas leak at port site (p=0.0454), and minor complications like port site bleeding are more with open method (Figure 5). While one case pre peritoneal insufflation is noted in case of closed method. Here

p<0.05 in most of the cases. Hence, it is statistically significant. In our study no case of visceral/vascular injury and port site hematoma was reported. Wound infection (clear discharge) occurred in three cases, one in open method and two in closed method group and were treated successfully by antibiotics and dressing. Port site hernia is reported in none of the cases on the follow up period till date but longer period of follow up is needed. Previous surgery especially laparoscopic surgery and surgery around umbilicus and their scar may cause adhesions between viscera and scar and may increases likelihood of injury during pneumoperitoneum. Hence it is better to perform open method of creating pneumoperitoneum in these patients. Type of the laparoscopic procedure has no impact in our study as there were no specific selection criteria for type of laparoscopic procedure.

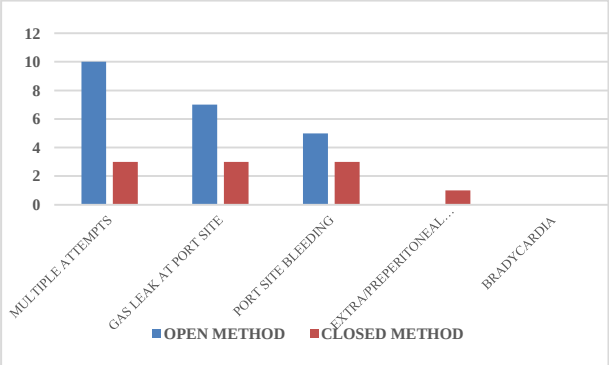


**Figure 5: Per operative findings.**

## DISCUSSION

Over the past few years, there are many techniques, instruments and guidelines have been introduced to reduce the risks associated with pneumoperitoneum creation in laparoscopic surgery. No single technique or instrument has been proved to eliminate laparoscopic entry associated injuries and complications. Besides the classic (closed) blind veress technique, there are other techniques like Hasson technique (open), 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 that minor complications are slightly more with open method of pneumoperitoneum creation like multiple attempts, gas leak at port site and port site bleeding as compared to closed method. One case of pre peritoneal insufflationis noted in case of closed method. There were two cases of port site infection in open method and one in closed method, which were treated with antibiotics and dressing. There were no major complications in both methods. There is less duration of pneumoperitoneum creation and less gas is used in open method as compared to closed method, which makes it difficult to give conclusive evidence about the superiority between the two techniques.

The complications in open method were due to the larger incision size associated with the open method. Indeed, the incision is a mini laparotomy as opposed to the needle puncture the closed technique. 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.[2] 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.[3]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.

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.[6] In large outcomes studies, there were fewer complications in the closed group, although randomized controlled trials found the open approach faster and were associated with a lower incidence of minor complications. 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 cost-effective.[7]

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. Sigman et al. also found that less time was required for the open method and advocated its use on this basis.[8] Zakherah et al in his study concluded that the open technique is safe alternative to the closed entry

technique for the creation of pneumoperitoneum.[9] Such an approach has further advantages such as less cost and instrumentation and rapid creation of pneumoperitoneum. In his study he reported no major injury occurs but minor complications were more with open technique which is comparable to our study. Moberg A et al in his study reported no major injuries using open technique.[10] 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. 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.[11] Ilias et al concluded that although minor complications occurred using open technique, it was faster.[12] Which is comparable to our study. The entry of open method was faster in this study, but in one out of ten 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 disturbance in the middle of the procedure.

### *Limitations*

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 centre study and like all single centre trials, the results cannot be widely generalized.

## CONCLUSION

In our study, we can conclude that both methods i.e. open and closed methods of creating pneumoperitoneum in laparoscopic surgery are safe to perform. The open technique has slightly more incidence of minor complications due to large incision size but has advantage of lesser duration needed for procedure. But major vascular and visceral injury did not occur in any of the groups. Hence, open technique is as good as closed technique, and is good alternative to closed technique for pneumoperitoneum creation in laparoscopic surgery.

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