

## A COMPARATIVE STUDY ON OPEN VS CLOSED METHOD OF ESTABLISHMENT OF PNEUMO PERITONEUM IN LAPAROSCOPIC SURGERY

M. Senthil Kumar<sup>1</sup>, Hariprasad P. J<sup>2</sup>, Raman<sup>3</sup>

<sup>1</sup>Associate Professor, Department of General Surgery, Govt. Kilpauk Medical College, Chennai, India.

<sup>2</sup>Assistant Professor, Department of General Surgery, Govt. Kilpauk Medical College, Chennai, India.

Received : 10/08/2023  
Received in revised form : 06/09/2023  
Accepted : 18/09/2023

**Keywords:**

Laparoscopy, pneumoperitoneum, open method, closed method.

Corresponding Author:

**Dr. M. Senthil Kumar,**  
Email: msknsk2022@gmail.com

DOI: 10.47009/jamp.2023.5.5.230

Source of Support: Nil,  
Conflict of Interest: None declared

*Int J Acad Med Pharm*  
2023; 5 (5); 1171-1174



### 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 threatening 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. **Objectives:** To see the difference between open and closed methods of creation of pneumoperitoneum for performing any laparoscopic procedures in terms of operating time, safety, failure of technique and time for creation of pneumoperitoneum. **Materials and Methods:** A total of ninety-six patients who underwent laparoscopic surgery for various conditions were included in this prospective study. Pneumoperitoneum was created by open technique in forty-eight and closed technique in the remaining. To analyze the data, descriptive statistics frequency analysis, and percentage analysis were used for categorical variables and the mean & S.D were used for continuous variables. **Results:** Out of the total 96 patients, when the data on various complications, ie, port site gas leak, bowel injury, omental injury, vascular injury, extra peritoneal insufflation, entry into the wrong space and failure of technique were compared, no statistical significance was noted. P value was always > 0.05. Out of 48 patients, the mean duration of entry in open method is 2.21 minutes and in closed method is 2.65 minutes. This data when compared is statistically Significant at  $p < 0.01$  level. **Conclusion:** Out of the total 96 patients, when the data on various complications, ie, port site gas leak, bowel injury, omental injury, vascular injury, extra peritoneal insufflation, entry into the wrong space and failure of technique were compared, no statistical significance was noted. P value was always > 0.05. Out of 48 patients, the mean duration of entry in open method is 2.21 minutes and in closed method is 2.65 minutes. This data when compared is statistically Significant at  $p < 0.01$  level.

## INTRODUCTION

Minimal access surgery has become the method of choice for management of symptomatic and uncomplicated gallbladder stones, appendectomies and hernia repair. One of the key steps in this type of surgery is induction of pneumoperitoneum, which is not physiological and has adverse hemodynamic and respiratory outcomes. These effects can be minimized with appropriate dedicated anesthetic management. Iatrogenic injuries in laparoscopic surgery, however, are still a problem confronted by the surgeon. Traditional closed method of pneumoperitoneum involves initial blind entry into abdomen and more than half of such injuries are related to this primary blind access and occur before

the start of actual anatomic dissection.<sup>[1]</sup> It is because of these complications that laparoscopic surgery faced a lot of criticism by the surgical community in the beginning. To prevent these complications, other methods were introduced in practice like open technique as devised by Harrith Hasson, direct trocar insertion, optical trocars, radically expanding trocars and use of disposable shielded trocars. However, the Veress needle technique and Hasson's technique,<sup>[2]</sup> with their different modifications are the two widely used methods today.

It is important to know that approximately 20 percent of laparoscopic complications are caused at the time of initial access.<sup>[3]</sup> Developing access skill is one of the important achievements for the surgeon practicing minimal access surgery. First entry or

access in laparoscopy is of two types, closed and open access. In closed access technique, pneumoperitoneum is created by Veress needle. This is a blind technique and most commonly practiced way of access by surgeons and gynecologists worldwide. Closed technique of access merely by Veress needle 15 insertion and creation of pneumoperitoneum is an easy way of access but it is not possible in some of the minimal access surgical procedures like axilloscopy, retroperitoneoscopy and totally extraperitoneal approach of hernia repair. In general, closed technique by Veress needle is possible only if there is a preformed cavity like abdomen. In open access technique, there is direct entry by open technique, without creating pneumoperitoneum and insufflator is connected once blunt trocar is inside the abdominal cavity under direct vision. There are various ways of open access like Hasson's technique, Scandinavian technique and Fielding technique. Some surgeons and gynecologists practice blind trocar insertion without pneumoperitoneum. The incidence of injury due to this type of access is much higher.<sup>[1]</sup> This type of direct trocar entry is practiced by gynecologists for sterilization. Sterilization may be performed because in multipara patients the lower abdominal wall is lax; making the fascia thinner and easy elevation by hand is possible. However, all the techniques are associated with risk of vascular or visceral injury and which method is the safest to use is still a debate. Primary objective of the study is to see the difference between open and closed methods of creation of pneumoperitoneum for performing any laparoscopic procedures in terms of operating time, safety, failure of technique and time for creation of pneumoperitoneum.

## MATERIALS AND METHODS

This is a prospective study which was done in Department of General Surgery, at Government Royapettah Hospital from June 2022 to November 2022. A total of 96 patients who underwent laparoscopic surgery for various causes were included in the study. Inclusion criteria were age more than 18 years in both sexes presenting with acute or chronic abdominal surgical conditions, no co-morbidity, no history of previous laparotomy, normal umbilicus and consented for inclusion. Exclusion criteria were patients less than 18 years of age and more than 60 years, with co-morbidity contraindicated for laparoscopy, pregnancy, past history of laparotomy, umbilical hernia or granuloma/abscess. Patients were divided into two groups. Patients were explained about the pathology, the need for surgery and the complications associated with it in their own understandable language; informed consent was taken, ethical committee clearance was obtained.

Pneumoperitoneum was created by closed technique in one group, and by open technique in another group.

Time required for successful pneumoperitoneum was calculated in each group. Failure to induce pneumoperitoneum was determined for each technique. Time required to induce pneumoperitoneum, total operating time, air leakage and injuries sustained during induction of pneumoperitoneum were compared in both techniques.

Statistical analysis

The collected data were analyzed with IBM SPSS Statistics for Windows, Version 23.0. (Armonk, NY: IBM Corp). To describe about the data descriptive statistics frequency analysis, percentage analysis were used for categorical variables and the mean & S.D were used for continuous variables. To find the significant difference between the bivariate samples in Independent groups the Independent sample t-test was used. To find the significance in categorical data Chi-Square test was used. Similarly if the expected cell frequency is less than 5 in 2x2 tables then the Fisher's Exact was used. In all the above statistical tools the probability value .05 is considered as significant level.

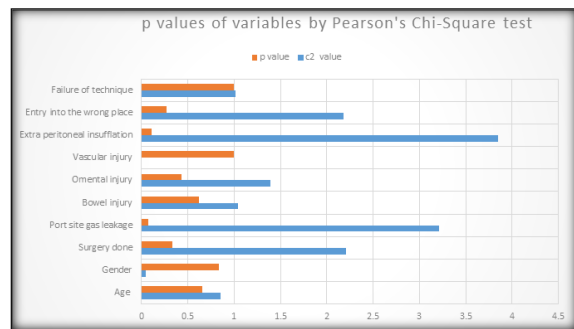
## RESULTS

A total of 98 people were included in the study and they were divided into two groups. Age distributions were 20.8% between 20-29 years, 35.4% between 30-39 years and 43.8% between 40-49 years. Gender distribution were 49.0% were female, 51.0% were male.

In group A, 26 people (54.2%) underwent laparoscopic appendicectomy, 14 people (29.2%) had laparoscopic cholecystectomy and 8 participants (16.7%) underwent laparoscopic hernia repair. These data when compared by Pearson's Chi-Square test were  $\chi^2=2.207$ ,  $p=0.332>0.05$  which showed no statistical significance association. Port site gas leakage was seen in 6(12.5%) and 13 (27.1%) participants with open and closed methods respectively. When compared by Pearson's Chi-Square test, results were  $\chi^2=3.215$ ,  $p=0.073>0.05$  which showed no statistical significance association between port site gas leakage and methods. Bowel injury occurred in 1 patient in group A where as in 3 patients in group B. When compared, results were  $\chi^2=1.043$ ,  $p=0.617>0.05$  which showed no statistical significance association between bowel injury and methods. Omental injury occurred in 2 and 5 respectively in group A and B, which included 4.2% and 10.4% of each group. When compared, p value was  $0.435>0.05$  which again showed no statistical significance association. Vascular injury occurred in 1 person (2.1%) in each group. There was no statistical significance association between vascular injury and methods as p value was 1. Extra peritoneal insufflation occurred in 1 patient who underwent open technique where as it occurred in 6 people who underwent closed technique. Data comparison by Pearson's Chi-Square test were  $\chi^2=3.852$ ,

p=0.111>0.05 which showed no statistical significance association between extra peritoneal insufflation and methods. Entry in wrong place occurred in 2 people in group A and 6 people in group B, 4.2% and 12.5% respectively. When Pearson's Chi-Square test was used on the data, results were  $\chi^2=2.182$ , p=0.268>0.05 which showed no statistical significance. Failure of technique was noted in 1 person by closed method whereas none suffered failure of technique by open method. This data when compared showed no statistical significance association between failure of technique and methods. Mean duration of entry was 2.21 minutes with open method whereas it was 2.65 minutes with closed method with a standard deviation of 0.65 and 0.86 respectively. Duration of entry was compared by Unpaired t-test and t-value=2.805, p value=0.006<

0.01 level which shows highly statistical significant difference at p < 0.01 level.



**Figure 1: P- values of study variables by Pearson's Chi-Square test**

**Table 1: Table 1: P-values of variables by Pearson's Chi –Square test**

	$\chi^2$ value	p value	significance
Age	0.852	0.653	Not significant
Gender	0.042	0.838	Not significant
Surgery done	2.207	0.332	Not significant
Port site gas leakage	3.215	0.073	Not significant
Bowel injury	1.043	0.617	Not significant
Omental injury	1.387	0.435	Not significant
Vascular injury	0.000	1.000	Not significant
Extra peritoneal insufflation	3.852	0.111	Not significant
Entry into the wrong place	2.182	0.268	Not significant
Failure of technique	1.011	1.000	Not significant

Probability value of > 0.05 was considered is of no statistical significance.

**Table 2: P-values of duration of entry by unpaired t test**

Variable	Methods	N	Mean	SD	t-value	p-value
Duration of entry	Open	48	2.21	0.65	2.805	0.006
	Closed	48	2.65	0.86		

Probability value of <0.01 was considered significant.

## 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 laparoscopic surgeons still feel it safer to use classic blind Veress needle entry to create pneumoperitoneum first before inserting the trocar as routine laparoscopic approach.

In this study ninety-six with above mentioned criteria were selected. All these patients underwent laparoscopic surgery. Out of ninety-six, pneumoperitoneum was created by open technique in forty-eight and closed technique in the remaining. The study group consisted of 96 patients. Total male patients in the study group was 49 and the female patients was 47. Out of 48 patients, 6 patients had port site gas leakage in open method and 13 had gas leakage in closed method. 1 patient had bowel injury in open method whereas 3 had injury in closed method. 2 patients had omental injury in open method and 5 had injury in closed method. 1 patient from each group suffered vascular injury. 1 patient had extra peritoneal insufflations in open method and 6 had extra peritoneal insufflations in closed method. 2 patients showed entry in wrong place in open method and 6 showed entry in wrong place in closed method. None showed failure of technique in open method whereas in closed method, 1 showed failure of technique. Out of 48 patients, the mean duration of entry in open method was 2.21 minutes and in closed method, 2.65 minutes. This data when compared was statistically significant at p < 0.01 level. When compared, there was lesser duration of

pneumoperitoneum creation and less port site gas leakage with open method than closed method. When these major and minor complications were compared, there was no significant evidence conclude the superiority of one technique over the other. These results were comparable to the study by Schafer et al.<sup>[11]</sup> Ilias et al,<sup>[12]</sup> concluded that open technique was faster than closed technique which is comparable to our study.

Chaperon et al study showed 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.<sup>[13]</sup> Chandler et al. also found that the open technique had no advantage over the closed technique in terms of safety.<sup>[14]</sup>

## CONCLUSION

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 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.

## REFERENCES

1. S.Krishnakumar and P.Tambe, "Entry complications in laparoscopic surgery,"*Journal of Gynecological Endoscopy and Surgery*, vol.1, no.1, pp.4-11, 2009. View at Publisher View at Google Scholar View at Scopus
2. H.M.Hasson, "A modified instrument and method for laparoscopy,"*American Journal of Obstetrics and Gynecology*,vol.110,no.6, pp.886-887, 1971 View at Scopus.
3. R.Varma and J.K. Gupta, "Laparoscopic entry techniques: clinical guideline, national survey, and medicolegal ramifications,"*Surgical Endoscopy and Other Interventional Techniques*, vol. 22, no.12, pp. 2686-2697, 2008. View at Publisher. View at Google Scholar View at Scopus.
4. Vilos GA, Ternamian A, Dempster J, Laberge PY; clinical practice gynaecology committee. Laparoscopic entry: a review of techniques, technologies, and complications. *J Obstet Gynaecol Can.* 2007 May;29(5):433-447. English, French. doi: 10.1016/S1701-2163(16)35496-2. PMID: 17493376.
5. D.C.Wherry, M.R.Marohn, M.P.Malanoski, S.P.Hetz and N.M.Rich, " An external audit of laparoscopic cholecystectomy in the steady state performed in medical treatment facilities of the Department of Defense," *Annals of Surgery*, vol.224, no.2,pp.145-154, 1996. View at Publisher View at Google Scholar View at Scopus
6. Peitgen K, Nimtz K, Hellinger A, Walz MK. Open approach or Veress needle in laparoscopic interventions? Results of a prospective randomized controlled study. *Chirurg.* 1997;68:910-3.
7. H.B.Peterson, J.R.Greenspan, and H.W.Ory," Death following puncture of the aorta during laparoscopic sterilization. "*Obstetrics and Gynecology*, vol.59, no.1, pp.133- 134,1982.
8. G.C.Roviaro, F.Varoli, L.Saguatti, C.Vergani, M.Maciocco, and A.Scarduelli, "Major vascular injuries in laparoscopic surgery; still of interest?"*Surgical Endoscopy and Other Interventional Techniques*, vol,16, no.8,pp.11192-1196, 2002. View at Publisher View at Google Scholar View at Scopus.
9. T.T.Velinga, S.de Alwis, Y.Suzuki, and J.I.Einarsson, "Laparoscopic entry; the modified alwis method and more,"*Reviews In Obstetrics And Gynecology*, vol.2, no.3,pp.193-198, 2009.
10. D.Polyzos, N.Papadopoulos, L.Chapman, et al., "Where is the aorta? Is it worth palpating the aorta prior to laparoscopy?"*Acta Obstetricia et Gynecologica Scandinavica*, vol.86,no.2,pp.235-239,2007.
11. Schafer M, Lauper M, Krahenbuhl L. Trocar and Veress needle injuries during laparoscopy. *Surg Endosc.* 2001;15:275-80.
12. Ilias J, Jatin B, Bhavesh V. Open vs. closed method of establishing pneumoperitoneum for laparoscopic surgery. *Int J Res Med Sci.* 2016;5(1):13-7.
13. Chapron C, Cravello L, Chopin N, Kreiker G, Blanc B, Dubuisson JB. Complications during set-up procedures for laparoscopy in gynaecology: open laparoscopy does not reduce the risk of major complications. *Acta Obstet Gynecol Scand.* 2003;82: 1125-9.
14. J.G.Chandler, S.L.Corson, and L.W.Way, "Three spectra of laparoscopic entry access injuries,"*Journal of the American College of Surgeons*, vol.192,no.4,pp.478-491, 2001. View at Publisher View at Google Scholar View at Scopus. 82
15. F.F.Tu,G.M.Lamvu, K.E.Hartmann, and J.F.Steege, "Preoperative ultrasound to predict infraumbilical adhesions:a study of diagnostic accuracy,"*American Journal of Obstetrics and Gynecology*, vol.192, no.1,pp.74-79, 2005. View at Publisher View a Google Scholar View at Scopus
16. A.Rohatgi and A.L.Widdison, "Left subcostal closed (Veress needle) approach is a safe method for creating a pneumoperitoneum." *Journal of Laparoendoscopic and Advanced Surgical Techniques A*,vol.14,no.5,pp.278-280, 2004. View at Publisher. View at Google Scholar View at Scopus.