

## Open versus close pneumoperitoneum: A pursuit for safer technique

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### ABSTRACT

**Objective:** Pneumoperitoneum is a prerequisite in all laparoscopic procedures. This is a very vital step and is still a matter of concern and a subject of further evaluation. Two basic methods commonly used with some modification are closed (veress needle) and open (Hasson) techniques and none of technique has proved to be better than other. We carried out this study to compare the two techniques in terms of access related complications and time consumed during creation of pneumoperitoneum and closure of port wounds.

**Methodology:** A comparative randomized prospective study was conducted in department of surgery. 475 patients were finally evaluated, 223 were randomized for open (Hasson) while 232 for closed (veress) technique. In open technique slight modification was used by making incision at junction of umbilical stalk and linea alba, while standard veress needle technique was used in closed group. Operative and post operative complications were recorded and analyzed.

**Results:** Mean time required to create pneumoperitoneum was significantly less with open group (6.61±3.89 minutes) compared to closed group (8.18±3.39 minutes). Time required to close port wounds was also significantly less with open group as compared to closed group (7.41±1.87 versus 10±2.44 minutes). No mortality and major complication regarding vascular and solid organ injury was recorded in both groups. Failure of procedure was observed in 4 cases (1.72%) in closed group and one case (0.44%) in open group. Bowel injury was recorded in two cases in closed group however it was not significant statistically. Other minor injuries were not significant on comparing both groups.

**Conclusion:** Open technique is safe and quicker. We recommend this method in all cases of laparoscopy requiring access into abdominal cavity.

**KEY WORDS:** Laparoscopy, Comparison, Pneumoperitoneum, Complications.

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### INTRODUCTION

Laparoscopic surgery is currently being widely used in almost every surgical Sub-specialty. Despite its superiority over open surgery, it is not completely risk free and many of its lethal complications are related to creation of pneumoperitoneum for gaining access to intra-abdominal cavity.<sup>1,2</sup> More than half of these complications are related to gaining access<sup>3</sup> and majority of these are observed during insertion of primary umbilical trocar.<sup>4</sup> Two basic methods commonly used worldwide are, the closed method involving blind insertion of veress needle and open

method involving insertion of Hasson cannula under direct vision as advised by Hasson.

Various studies have shown advantages & disadvantages of both techniques.<sup>5,6</sup> and based on the current available data, the European association for the endoscopic surgery (EAES) has concluded that no one technique can be considered superior over other.<sup>7</sup> Because of this reason both techniques have proponents and opponents as both are almost equally employed worldwide. This study was conducted to compare the two techniques in terms of access related complications and time spent on creation of pneumoperitoneum and closure of port wounds.

### METHODOLOGY

This was a randomised controlled, prospective study conducted at department of surgery Liaquat University of Medical and Health Sciences Jamshoro from July 2005 to June 2010. All patients who underwent laparoscopic surgery for various procedures were included. Patients with history of previous abdominal surgery, paraumbilical hernia and uncontrolled co-morbid conditions were excluded from the study. Written informed consent was obtained from each participant. 455 patients (M:F=65:390) were enrolled on criteria given and were randomized in two groups, closed method and open method by odd and even numbers in an opaque envelope.

Patients were placed in tredelenburg's position in both groups and operations were done under GA. In closed group, pneumoperitoneum was created by veress needle by making an infraumbilical 1-5cm transverse incision through skin and subcutaneous tissue. Abdominal wall was lifted by applying a towel clip at base of umbilical stalk. Veress needle was held in right hand like a dart and introduced into fascia until a change in resistance was felt or a double click was heard. Entry into peritoneal cavity was confirmed by aspiration and saline drop test. Needle was then attached to the insufflator to insufflate carbon dioxide at pressure of 14mmHg.

10mm Trocar in an oversleeve was introduced steadily till a hissing sound was heard and/or a change in resistance was felt. Trocar was then removed and insufflator attached to canula. Primary survey of abdominal cavity was carried out to detect any iatrogenic injury caused by blind insertion of needle & canula. Time duration from incision until insertion of laparoscope was recorded. According to need of various procedures two or three additional trocars were placed under direct vision. After completion of procedure, 10mm ports i.e: umbilical and epigastric were closed by vicryl no.1 by achiev-

ing facial approximation; while skin was closed with silk 2/0. Time of closure of port wounds was recorded from removal of last trocar till last skin stitch. In open group slightly modified technique was used by making a 3cm transverse infra/supra umbilical incision was made. Umbilical stalk was identified and picked up by a towel clip and was cleared upto its junction with abdominal wall. A small 1cm incision was made at its origin from anterior abdominal wall and closed artery forcep/finger was introduced to dilate the incision. After confirmation of intra peritoneal entry, both edges of abdominal wall incision were hold and stay suture with vicryl no.1 were placed. Abdominal wall was lifted by towel clip applied to umbilical stalk and a 10mm blunt rounded trocar in sleeve was introduced, and trocar removed. Canula was then attached to insufflator to achieve intraperitoneal pressure of 14 mmHg. Laparoscope was then introduced and inspection of peritoneal cavity was done to rule out and detect any injury inflicted during insertion of trocar. Time was recorded from incision to insertion of laparoscope, as time consumed for creation of pneumoperitoneum. Operative and post-operative complications were recorded and data analyzed.

**Statistical Analysis:** Values are reported as Mean±SD, Student's T-test and chi-square were used when appropriate. P-value of less than 0.05 considered as statistically significant.

### RESULTS

Out of 484 patients enrolled in this study, 475 patients who completed follow up were finally evaluated. 223 were randomized for open (Hasson) technique, while 232 for closed (Veress) technique. Mean age ±SD of patients in open group was 43.2±14.7 year, while 44.7±16.3 year in closed group. Majority of patients in both groups were female patients with 189 (84.75%) patients in open group and 201 (86.63%) in close group. Majority of procedures requiring pneumoperitoneum in both groups was cholecystectomy, other procedures are listed in Table-I. There was no significant difference in demographic data of patients in both Groups as shown in Table-I.

Mean time required to create pneumoperitoneum was significantly less in open group with mean ±SD 6.61±3.89 (5-17) minutes as compared to close group with mean ±SD of 8.18±3.39 (4.5- 15) minutes. Port wounds closure time was also significantly less in open group (7.41±1.87 minutes) as compared to closed group (10±2.44 minutes) as shown in Table-II.

Table-I: Patient Demographics.

	Open Method (n=223)	Closed method (n=232)	p-value
<b>Number of patients (n)</b>			
Females	189(84.75%)	201 (86.63%)	NS
Males	34 (15.24%)	31 (13.36%)	
Mean age±SD	43.2±14.7	44.7±16.3	
<b>Indications</b>			
Cholecystectomy	181 (81.16%)	192 (82.75%)	NS
Appendicectomy	19 (8.52%)	16 (96.89%)	
Suturing of perforating peptic ulcer	03 (1.34%)	02 (0.86%)	
Diagnostic Laparoscopy & Others	19 (8.52%)	23 (9.91%)	

No mortality was observed & there was no major complication regarding vascular or solid organ injury or air embolism recorded in both groups. Other minor injuries like bowel injury, extra peritoneal insufflations, port-site gas leakage and infection, hernia and failure of procedure are shown in Table-II. There was no statistically significant difference in majority of minor complications in both groups. However failure of procedure was recorded in 4 cases in closed group and one case in open group with statistically significant difference.

## DISCUSSION

Pneumoperitoneum is prerequisite in all laparoscopic procedures as it increases the distance between anterior abdominal wall and intra-abdominal viscera, thus creating a working space. This is a very vital step therefore to establish pneumoperitoneum at laparoscopy is still a matter of concern and a subject of further evaluation, to avoid any iatrogenic injury during first access to abdominal cavity. Traditional closed (Veress needle) method of pneumoperitoneum is a blind entry into abdomen and more than half of these iatrogenic injuries are related to this primary blind access before commencement of actual operation.<sup>3,8</sup>

For this reason many alternative methods were introduced like open technique by Harrith Hasson, direct trocar, optical trocars, radially expanding trocar & disposable shielded trocars.<sup>9-11</sup> But none of these entry techniques have proved to be better than others till yet, therefore various studies are continuously being carried out. We carried out this study to compare the various parameters of two techniques. We are working in general surgical department and routinely use open technique to create pneumoperitoneum with satisfaction.

Looking at various studies showing satisfaction by using close (veress needle) technique, we also started close technique and compared the two techniques in

relation to the time consumed and various operative and post operative complications. The veress needle was introduced by veress in 1938 and remains the most commonly used method of creating pneumoperitoneum. Historically, gynaecologist have been trained and are frequent user of close method for creation of pneumoperitoneum.<sup>12</sup> Various studies have suggested that close technique is easy and quick to gain entry.<sup>13,14</sup> Open technique was first introduced by Hasson in 1971.<sup>15</sup> It remains preferred choice of gaining access into abdominal cavity by many surgeons, particularly general surgeons.

Complications related to close entry technique ranges between 0.05% to 0.67% according to literature.<sup>16</sup> Joao Luiz et al have concluded a systemic literature review that insertion of veress needle in the abdominal midline, poses serious risk to the life of patients and further studies should be conducted to investigate alternate sites for veress needle insertion.<sup>17</sup>

Previous literature has reported that open access takes longer time to be performed and is associated with difficulty in maintaining the peritoneum and a definite incidence of major abdominal trauma.<sup>18</sup> Our study is not consistent with this and other studies of same view point. In this study we were able to achieve pneumoperitoneum in the mean time 6.61±3.89 minutes in open group, which was significantly less than closed group with mean time 8.18±3.39 minutes. This observation is in consistent with other studies showing less time required to create pneumoperitoneum by open technique.<sup>19-22</sup>

European association of endoscopic surgery has also reported that insertion of first trocar is faster in open technique as compared to close technique.<sup>7</sup> However some other studies have reported longer time consumed using open technique.<sup>22,23</sup> In our study less time was consumed in open technique to achieve pneumoperitoneum may be due to reason that we as general surgeons were well versed with anatomy

Table-II: Operative &amp; Post Operative variables, comparing the two procedures.

Time Required For: (Minutes)	Open Method (N=223)		Closed Method (N=232)		p-value
	Range	Mean±SD	Range	Mean±SD	
Induction of pneumoperitonium	5-17	6.61 ±3.89	4.5-15	8.18±3.39	0.047
Closure of port wound	7-12	7.41 ±1.87	7-14	10±2.44	0.042
Peri-Operative Complications					
	Patients	%	Patients	%	p-value
Vascular injury	0	0	0	0	NS
Bowel injury	0	0	02	0.86	NS
Solid organ injury	0	0	0	0	NS
Extra peritoneal insufflation	0	0	02	0.86	NS
Gas leakage	23	10.3	11	4.7	NS
Air embolism	0	0	0	0	NS
Failure of procedure	01	0.44	04	1.72	0.023
Post-Operative Complications					
Port site Hematoma	01	0.45	0	0	NS
Port site Wound Infection	4	1.79	02	0.86	
Hernia	02	0.86	0	0	

of abdominal wall and the other reason that we used modified technique instead of conventional Hasson technique.

Closure of ports was also achieved in significantly less time in open group with mean time ±SD 7.41±1.87 as compared to close group consuming 10±2.44 minutes. This difference was also statistically significant with  $P<0.05$ . The less time consumed in open group is due to already placed suture to rectus sheath and other reason being in modified open technique depth of wound is comparatively lesser, so access is easy.

There was no major complication regarding vascular or solid organ injury in both groups in this study. There was no significant difference related to other minor injuries in both groups. In our study, minor bowel injury was recorded in close group in 2 cases and none in open group. Chapron et al has concluded in their study that bowel injury rate were 0.19% in open group and 0.04% in close group.<sup>10</sup> Furthermore close "blind" technique may be associated with unrecognised intestinal injuries, and thus are only detected when symptoms develop. This late recognition of injury may result in increased morbidity and mortality rates in close technique as compared to open technique where injuries are recognized immediately.<sup>24</sup>

Gas leak was observed more in open group with 10.3% cases compared to 4.7% cases in close group, however it was statistically insignificant. Gas leak can be prevented by making comparatively small incision at base of umbilical stalk. When it occurs, it can be sealed by placing wax gauze around cannula.

Intraperitoneal adhesion with or without previous surgery are identified as a predisposing factor for increased risk of injury during placement of first trocar. As intraabdominal adhesion are more common in developing world due to typhoid and intestinal tuberculosis, this factor is more relevant to third world.

Failure of procedure, in which pneumoperitoneum could not be achieved was significantly higher in closed group with four patients as compared to open group with one patient. In the four patients of closed group, open (Hasson) technique was used to achieve pneumoperitoneum and one patient of open group was converted to open surgery due to severe adhesions.

Rest of minor injuries like port site hernia, hematoma and wound infection were slightly more in open group, however they were statistically insignificant. There are other randomized clinical studies which have compared the closed technique (Veress needle) with open technique<sup>25,26</sup>, but none of these could provide answer that which of the two techniques is better comparatively, probably due to limited statistical power to detect a difference in these rare complications. The open technique was introduced to decrease the frequency of injuries. We are very encouraged by using this modified open technique by making incision at base of umbilical stalk, and achieving less consumption of time in achieving pneumoperitoneum and closure of ports. Above all surgeon is more comfortable in open technique as compared to close technique.



Previously use of open technique has been recommended only to patients with previous surgical operations, pregnant, children and very thin patients.<sup>18</sup> Infact surgeon's preference is a determining factor for selection of technique. Surgical skill and experience of surgeon are the most important factors in the complication rate of procedure. With our experience we recommend the open technique routinely in all cases with more safety and consuming lesser time and surgeon being comfortable.

### CONCLUSION

We conclude that open method for induction of pneumoperitoneum is safe and quicker with almost same rate of complication as compared to closed technique. We recommend this technique routinely in all cases of laparoscopy requiring pneumoperitoneum and access into peritoneal cavity.

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