

COMPARISON OF OPEN (HASSON) AND CLOSED (VERESS NEEDLE) METHODS OF CREATING PNEUMOPERITONEUM IN LAPAROSCOPIC SURGERIES

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ABSTRACT

Objectives: To compare Open versus Closed method of creating pneumoperitoneum in terms of first access complications.

Study Design: Randomized clinical trial.

Place and Duration of Study: Surgical Department, CMH Rawalpindi, from October 2014 to April 2015.

Material and Methods: Total 550 Patients presenting in surgical OPD and undergoing elective laparoscopic procedures were included and randomly divided into two equal groups by lottery method. In group A, open technique (Hasson cannula) and in group B, closed technique (Veress needle) was used. All patients were monitored during surgery for any first access related complications and this was carried out at regular intervals. Data for each patient was recorded on patient's proforma.

Results: We found better safety profile of open (Hasson) method over close (Veress Needle). Except for more gas leakage in open group (6.2%) as compared to closed (5.1%), all other complications occurred more frequent in closed group. The mean access time in the Open Group (3.2 ± 1.1 minutes) was less than for the Closed Arm (5.4 ± 0.7 minutes).

Conclusions: There was difference in frequency of complications in both groups with Open method being safer and rate of complication was less as compared to the close method.

Keywords: Hasson cannula, Laparoscopy, Veress needle, Pneumoperitoneum.

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INTRODUCTION

The word laparoscopy originated from the Greek word (Laparo-abdomen, scopion-to examine). Laparoscopy is the art of examining the abdominal cavity and its contents. Initially laparoscopic surgery was termed a minimally invasive surgery, but this term was changed to minimal access surgery as laparoscopic surgery is an invasive procedure associated with similar risks of major complications as compared with the conventional open surgery¹. Laparoscopic surgery carries its own risks and complications. The rate of these complications is however very low. Almost half of these complications occur at the time of port placement in the abdominal cavity. Around 220% of these complications are attributed to time of initial or first port

placement for creating the pneumoperitoneum². The establishment of pneumoperitoneum requires the introduction of a sharp insufflating needle or trocar. Peritoneal access and creation of pneumoperitoneum are key initial steps of laparoscopic surgery. Methods available for creating pneumoperitoneum and inserting the laparoscope at the beginning of laparoscopic procedure can be divided into open or closed entry technique³.

Closed techniques include Veress Needle (VN) technique and the direct trocar technique, which involve the blind insertion of the trocar directly into the peritoneal cavity, followed by laparoscopic inspection and subsequent gas insufflations. The open (Hasson) technique consists of an initial incision into the peritoneum allowing direct visualization of the insertion of a blunt trocar, before gas insufflation and laparoscope introduction⁴.

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Studies have shown different results when compared for the complications for open and closed access techniques for creating pneumoperitoneum. According to one study the rates of visceral and vascular injury were respectively 0.048 per cent and zero after open access technique and 0.083 and 0.075 per cent after closed access technique. Mortality rates after closed and open laparoscopy were respectively 0.003 per cent and zero⁵. Similarly another study showed no significant difference between the two techniques⁶. The open laparoscopy (OL) is an alternative to the VN technique, being relatively safer⁷. Yet others conclude that no method of primary access is superior to other in terms of primary access related complications, and the close primary access is as safe as the open approach⁸.

With the increasing use of laparoscopy for different kinds of surgical procedures, it has become imperative to identify and minimize the complications associated with first port and creating a pneumoperitoneum. The rationale of doing a study on this topic is to compare the two different access techniques and identify, if possible, the procedure with minimum complication.

MATERIAL AND METHODS

This randomized clinical study was carried out at the General Surgery Department of Combined Military Hospital (CMH) Rawalpindi, which is a tertiary care hospital. The sample collection was carried out from October 2014 to April, 2015. The study consisted of elective therapeutic and diagnostic laparoscopic procedures. Only those cases which fulfilled the inclusion criteria were included in the study. A total of 550 cases were studied during this period and were included in the study by using WHO Calculator. The sampling technique was consecutive (non probability) sampling. Both male and female patients >20 and <65 years of age and patients undergoing elective laparoscopic procedures were included in the study. Patients with history of previous abdominal surgery, para umbilical hernia and those known

to have peritoneal adhesions, with history of diabetes mellitus, chronic renal failure, chronic liver disease and bleeding disorders and very obese patients (BMI>35) were excluded from the study. The study design was randomized clinical trial. All the patients above the age of 20 and below 65 years regardless of gender and BMI <35,



Figure-1: Introduction of veress Needle.



Figure-2: Open technique. Hassan Cannula.

with diseases requiring laparoscopic procedures were considered for inclusion in the study. To exclude any other systemic infection patients were evaluated on three parameters, i.e. history, examination and investigations. Ultra sound abdomen was carried out in doubtful cases in which intra-abdominal pathologies requiring open procedures were ruled out and excluded from the study. Participants were then randomized to be in either of the two groups using lottery method. Surgeries were performed by experienced surgeons in all cases. A total of 550 cases were enrolled in the study. 275 were randomized to the Veress needle (closed)

technique, while the remaining 275 were in the Hasson cannula (closed) technique.

Laparoscopy was performed using standard laparoscope. All patients were closely monitored during the course of surgery for any first access related complication including extra peritoneal insufflation, failed attempt, minor and major vessel injury, injury to bowel and gas leakage and this was regularly carried out till the completion of surgery and closure of wounds.

females and 80 (29.1%) were males, and in group 2 (N=275), 218 (79.3%) were females and 57 (20.7%) were males. In age group A, total of 219 individuals, including (n=103) in open and (n=116) in close group. In age group B, 253 individuals with (n=130) in Open and (n=123) in close group. In age group C, 78 individuals with (n=42) in Open and (n=36) in Closed were included in the study.

Total of 57 complications (10.4%) occurred

Table-I: Individual complications with respect to study groups with *p*-values.

Complications	Open Group (n=275)	Close Group (n=275)	<i>p</i> -value
Gas Leakage	17	08	0.065
Failed Attempts	2	08	0.055
Extra Peritoneal Insufflation	2	6	0.28
Minor Vessel Injury	3	4	0.5
Bowel Injury	2	4	0.68
Major Vessel Injury	0	1	0.99
Total	26	31	0.489

Data Analysis

All the data collected through the proforma were entered into the statistical package for social sciences (SPSS) version 16 and analyzed through its statistical package. Mean and standard deviation was used for quantitative data like age while frequency and percentage stratification with age and gender was done and Chi-Square test applied for categorical variables like complications (failed attempts, minor vessel injury, major vessel injury, extra peritoneal insufflation, bowel injury, and gas leakage) were calculated. Stratification of these with age and gender was done. A *p*-value of less than 0.05 was considered significant. Both groups were compared using Chi-Square test and Fisher Test.

RESULTS

A total of 550 cases were included in the study after observing inclusion and exclusion criteria. These cases were divided into 3 age groups (A=20-35 years, B=36-50 years, C=51-65 years)

Out of 550 cases 413 were females (75.1%) and 137 were males (24.9%) with a female to male ratio 3:1. In group 1 (N=275), 195 (70.9%) were

over all with maximum complications occurring in females 40 cases (7.3%) and to a lesser extent in males, 17 cases (3.09%), although the number of males in study were very less as compared to females. Most of the complications occurred in age group A, (24 cases 4.36%) out of these 19 cases (3.45%) occurred in females and 5 cases (0.91%) in males. In age group 36-50 a total of 23 complications (4.2%) including 16 cases (2.9%) in females whereas 7 cases (1.27%) occurred in males. In age group 51-65 a total of 9 cases (1.63%) including 5 cases (0.91%) in females and 4 cases (0.08%) occurred in males.

The results of this study have been summarized in tables-I-III.

DISCUSSION

Over the last two decades, rapid advances have made laparoscopic surgery a well-established procedure. However, because laparoscopy is relatively new, it still arouses controversy, particularly with regard to the best method for the creation of the pneumoperitoneum. 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. To prevent these complications other methods were introduced in practice like open technique as devised by

more popular and widely used by surgeons and gynecologists because it is thought to be quicker of the two. Several studies have shown that use of Veress needle has been associated with many life

Table-II: Frequency of total complications in age groups.

Group A			Group B				
Frequency of total complications in age groups							
Age	Yes n(%)	No n (%)	Chi Square = 0.3305 <i>p</i> -value = 0.884	Age	Yes n (%)	No n (%)	Chi Square = 1.208 <i>p</i> -value = 0.547
20-35 (n=103)	11 (10.7%)	92 (89.3%)		20-35 (n=116)	12 (10.3%)	104 (89.7%)	
36-50 (n=130)	11 (8.5%)	119 (91.5%)		36-50 (n=123)	13 (10.6%)	110 (89.4%)	
51-45 (n=42)	4 (9.5%)	38 (90.5%)		51-65 (n=36)	6 (16.6%)	30 (83.4%)	
Frequency of total complications in gender groups							
Gender	Yes n (%)	No n (%)	Chi Square = 0.5 <i>p</i> -value = 0.48	Gender	Yes n (%)	No n (%)	Chi square = 5.844 <i>p</i> -value = 0.016
Male (n=80)	4 (5%)	53 (95%)		Male (n=57)	12 (21.1%)	48 (78.9%)	
Female (n=195)	22 (11.3%)	196 (89.7%)		Female (n=218)	19 (8.7%)	196 (91.3%)	
Gas leakage in age groups							
Age	Yes n (%)	No n (%)	Chi square = 0.2132 <i>p</i> -value = 0.900	Age	Yes n (%)	No n (%)	Chi square = 4.5099 <i>p</i> -value = 0.104811
20-35 (n=103)	7 (6.8%)	96 (93.2%)		20-35 (n=116)	3 (2.6%)	113 (96.4%)	
36-50 (n = 130)	8 (6.2%)	122 (93.8%)		36-50 (n=123)	2 (1.6%)	121 (98.4%)	
51 45 (n=42)	2 (4.8%)	40 (95.2%)		51-65 (n=36)	3 (8.3%)	33 (91.7%)	
Gas Leakage in genre groups							
Gender	Yes n (%)	No n (%)	Chi Square = 1.150 <i>p</i> -value = 0.284	Gender	Yes n (%)	No n (%)	Chi Square = 1.411 <i>p</i> -value = 0.233
Male (n=80)	3 (3.8%)	77 (96.2%)		Male (n=57)	3 (5.3%)	54 (94.7%)	
Female (n=195)	14 (7.2%)	181 (92.8%)		Female (n=218)	5 (2.3%)	213 (97.7%)	
Failed Attempt in age groups							
Age	Yes n (%)	No n (%)	Chi square = 3.3643 <i>p</i> -value = 0.1860	Age	Yes n (%)	No n (%)	Chi square = 1.2498 <i>p</i> -value = 0.5355
20-35 (n=103)	2 (1.9%)	101 (98.1%)		20-35 (n=116)	4 (3.4%)	112 (95.6%)	
35-50 (n=130)	0	130 (100%)		35-50 (n=123)	4 (3.3%)	119 (95.7%)	
51-65 (n=42)	0	42 (100%)		51-65 (n=36)	0	36 (100%)	
Failed Attempt in genre groups							
Gender	Yes n (%)	No n (%)	Fisher test <i>p</i> -value = 0.498	Gender	Yes n (%)	No n (%)	Fisher test <i>p</i> -value = 0.99
Male (n=80)	1 (1.3%)	79 (98.7%)		Male (n=57)	1 (1.8%)	56 (98.2%)	
Female (n=195)	1 (0.5%)	194 (99.5%)		Female (n=218)	7 (3.2%)	211 (96.8%)	

Harrith Hasson⁹.

Of the both methods of creating pneumoperitoneum, close method of creating pneumoperitoneum using veress needle has been

threatening complications including e.g. injury to the bowel, bladder and major intraabdominal vessels. Therefore surgeons shifted towards open method considering it a more safer method¹⁰.

In our study, we did not find bladder injury and major vessel injury in open laparoscopy. We observed 2 (0.73%) cases of bowel injury in group A and 4 (1.45%) in group B (*p*-value 0.68). We

reported abdominal wall emphysema in 12 (0.3%) cases, omental injury in 11 (0.28%) cases, small bowel injury in 2 (0.050%) cases, mesenteric vascular injury in 2 (0.050) cases of their total

Table-III: Frequency of extraperitoneal insufflation, bowel, minor vessel injury.

Group A			Group B				
Extraperitoneal Insufflation in Age Groups							
Age	Yes n(%)	No n (%)	Chi Square = 2.638 <i>p</i> -value = 0.2688	Age	Yes n (%)	No n (%)	Chi square = 0.2119 <i>p</i> -value = 0.8994
20-35 (n=103)	1 (0.8%)	102 (99.2)		20-35 (n=116)	2 (1.7%)	114 (98.3%)	
36-50 (n=130)	0	130 (100%)		36-50 (n=123)	3 (2.4%)	120 (97.6%)	
51-45 (n=42)	1 (2.4%)	41 (79.6%)		51-65 (n=36)	1 (2.8%)	35 (97.2%)	
Extraperitoneal Insufflation in Gender Groups							
Gender	Yes n (%)	No n (%)	Fisher Test <i>p</i> -value = 0.999	Gender	Yes n (%)	No n (%)	Fisher Test <i>p</i> -value = 0.0017
Male (n=80)	0	80 (100%)		Male (n=57)	5 (8.8%)	52 (91.2%)	
Female (n=195)	2 (1 %)	193 (99%)		Female (n=218)	1 (0.5%)	217 (99.5%)	
Minor Vessel Injury in Age groups.							
Age	Yes n (%)	No n (%)	Chi Square = 0.7183 <i>p</i> -value = 0.6983	Age	Yes n (%)	No n (%)	Chi square = 0.7491 <i>p</i> -value = 0.6876
20-35 (n=103)	1 (1%)	102 (99%)		20-35 (n=116)	1 (0.9%)	115 (99.1%)	
36-50 (n=130)	2 (1.5%)	128 (98.5%)		36-50 (n=123)	2 (1.6%)	121 (98.4%)	
51 45 (n=42)	0	42 (100%)		51-65 (n=36)	1 (2.8%)	35 (97.2%)	
Minor Vessel Injury in Gender groups.							
Gender	Yes n (%)	No n (%)	Fisher Test <i>p</i> -value = 0.559	Gender	Yes n (%)	No n (%)	Fisher test <i>p</i> -value = 0.58
Male (n=80)	0	80 (100%)		Male (n=57)	0	57 (100%)	
Female (n=195)	3 (1.5%)	192 (98.5%)		Female (n=218)	4 (1.8%)	214 (98.2%)	
Bowel Injury in Age Groups							
Age	Yes n (%)	No n (%)	Chi Square = 2.3486 <i>p</i> -value = 0.3090	Age	Yes n (%)	No n (%)	Chi Square = 0.7491 <i>p</i> -value = 0.6875
20-35 (n=103)	0	103 (100%)		20-35 (n=116)	1 (0.9%)	115 (99.1%)	
35-50 (n=130)	1 (0.8%)	129 (99.2%)		35-50 (n=123)	2 (1.6%)	121 (98.4%)	
51-65 (n=42)	1 (2.4%)	41 (97.6%)		51-65 (n=36)	1 (2.8%)	35 (97.2%)	
Bowel Injury in Gender Groups							
Gender	Yes n (%)	No n (%)	Fisher test <i>p</i> -value = 0.99	Gender	Yes n (%)	No n (%)	Fisher Test <i>p</i> -value = 0.029
Male (n=80)	0	80 (100%)		Male (n=57)	3 (3.38%)	54 (96.2%)	
Female (n=195)	2 (1%)	193 (99%)		Female (n=218)	1 (0.5%)	217 (99.5%)	

observed 3 (1.1%) cases of minor vessel injury in open group and 4 cases in close group (*p*-value 0.5) and 6 (2.2%) cases of extra peritoneal insufflation occurred in closed laparoscopy and 2 cases in Open group (*p*-value 0.28). Kumar *et al*,

4014 cases with Verres needle¹¹.

Opilka *et al*, concluded after meta-analysis of 31 studies that the open approach (Hassan) was the safest¹² studies (54.84%), and the closed approach (veress Needle) was found to be

safest in only three studies (9.68%)⁶. In a study the closed technique was used in 474 operations and the open technique in the 4873 cases. Three cases of major vascular injury were identified and all injuries occurred in the closed-access. The injury location was abdominal Aorta in 2 patients and the external iliac vein in 1 patient¹³. In our study we found one (0.36%) case of major vessel injury, location was Abdominal Aorta with veress needle. No major vessel injury in open group (p -value 0.99). Taye *et al.*, in their study of 3000 cases reported that the incidence of vascular injury in close laparoscopy was 0.13% compared with 0% in open laparoscopy. The incidence of bowel perforation was 0.21% and 0% respectively¹⁴. Like we have concluded in our study, the authors concluded that the open (Hasson) technique is relatively safer as major complications are rare and should be adopted in learning and beginning phase¹⁴.

Parveen *et al.*, concluded in their study of 90 cases (45 in each group) that leakage of gas during procedure was observed in 80% (40) cases in open method, while this problem was not faced in closed method¹⁵. We have found leakage of gas in 2.91% (8) and 6.2% (17) in closed and open laparoscopy respectively (p -value 0.065). Though leakage of gas was found more in cases of open laparoscopy, this as such did not increase the risk of the operation or delayed complication.

Chapron *et al.*, concluded in a non-randomized comparison of open versus closed laparoscopic entry. The major vessels and bowel injury rates were 0.01% and 0.04% in the closed technique and 0.19% and 0% in the open technique respectively. They concluded that open laparoscopy does not minimize major complications in laparoscopic entry¹⁶. Hasson *et al.*, concluded that there is no evidence to support abandoning the closed entry technique in laparoscopy; however, the selection of patient for an open or alternative procedure is still recommended¹². Jansen *et al.*, in a clinical trial that compared closed and open entry methods and the complications rate were 0.07% and 0.17% for the closed and open technique respectively.

The entry related complications with the open technique were significantly higher than with the closed technique¹⁷.

Channg *et al.*, concluded that both the closed (Veress needle) and the open (Hasson cannula) method for gaining access into the peritoneal cavity are safe. The open technique had a time advantage over the closed method. However, there were more complications associated with it¹⁸. In our study we found complications in both methods, open technique being safer in terms of all complications.

Failure to create pneumoperitoneum is also considered a complication. Akbar *et al.* in their study of 70 cases (35 cases in each group) observed failure of technique in 4 (11.4%) cases of close technique and none in open group (p -value 0.039)¹⁹. Our study had results which are statistically not significant. We observed 8 (2.9%) cases in Veress needle group and only 2 (0.73%) cases in Hassan group (p -value 0.055).

Our study at Combined Military Hospital is comparable to any study carried out nationally and internationally. Our sample size ($n=550$) is more than the sample size in almost any of the study carried out in Pakistan. Moreover frequency for categorical variables like complications were calculated and presented separately for age and gender groups.

In our study total complications significantly occurred in males in close group (p -value=0.0039) as well as in extra peritoneal insufflation (p -value=0.00696) and in bowel injury ($p=0.038$). Main reason for this is that males have a strong built and rectus muscles are well developed, a considerable amount of force is required to place first port. Blind Verres Needle insertion requires precision and any amount of unbalanced force causes these injuries (as seen significantly) in verres needle group. Open method utilizes direct vision of these muscles and cutting rather than applying blind force.

Females in closed group suffered statistically significant failed attempts (p -value=0.047) owing to fat distribution over the abdominal wall.

In open group, significant gas leakage (p -value =0.01797) occurred in females owing to fatty wall and large incisions for placement of trocar.

CONCLUSION

There was difference in frequency of complications in both groups with Open method being safer and rate of complication was less as compared to the close method.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

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