

Comparison between Four different Techniques of Laparoscopic Abdominal Port Entry

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ABSTRACT

Background: Creation of the pneumoperitoneum is the first and most critical step of a laparoscopic procedure because that access is associated with injuries to the gastrointestinal tract and major blood vessels and at least 50% of these major complications occurs prior to commencement of the intended surgery. This complication rate has remained the same during the past 25 years. **Objective:** To focus on the safety of the most used methods of entry into the peritoneal cavity in laparoscopic surgery with particular attention to patients submitted to previous surgery without comorbidities. **Patients and Methods:** Types of studies: prospective study. This study was conducted at Ain Shams university Hospital and El-Minia University Hospital in the duration from January 2018 till July 2018. The studied cases were divided in four groups of ten patients each comparing between different techniques of laparoscopic port entry in the abdominal wall: Group (A): open technique Group (B): visiport technique. Group (C): veress needle technique Group (D): closed entry technique. **Results:** We compared between different techniques of laparoscopic entry (Open-entry technique, Veress Needle entry, Direct-vision entry, closed entry technique). Our study reported no events of failed entry in different groups of laparoscopic port entry techniques. **Conclusion:** Overall, there is insufficient evidence to recommend one laparoscopic entry technique over another. More studies are required with larger sample size to determine the safer technique of laparoscopic port entry in the abdominal wall.

INTRODUCTION

Creation of the pneumoperitoneum is the first and most critical step of a laparoscopic procedure because that access is associated with injuries to the gastrointestinal tract and major blood vessels and at least 50% of these major complications occurs prior to commencement of the intended surgery. This complication rate has remained the same during the past 25 years⁽¹⁾

The number of vascular injuries in laparoscopy is 2 in 10.000 procedures and a serious complication associated with mortality occurs in 3.3 per 100.000. Finding a safe entry technique is a priority not only for the life of the patients but also for the increasing rate. In the last three decades, rapid advances in laparoscopic surgery havemade it an invaluable part of general surgery, but there remains no clear consensus on the optimal method of entry into the peritoneal cavity⁽²⁾.

Many different laparoscopic-entry methods have been described. These include a closed technique, which has two variations. The first involves the insertion of a Veress Needle (a

needle equipped with a spring-loaded obturator) into the peritoneal cavity, followed by gas insufflation (act of blowing) then insertion of a trocar (a sharp, pointed instrument with a cannula used to enter the body cavity); finally the laparoscope is passed through the trocar once the obturator is removed. The second involves the insertion of a trocar directly into the peritoneal cavity, followed by laparoscopic inspection and then gas insufflation. The potential benefits of the direct entry are shorter operating times, immediate recognition of bowel or vascular injuries and near exclusion of entry failure. The alternative open technique involves the peritoneum being cut down, followed by the insertion of a blunt trocar under direct visualisation, gas insufflation and insertion of the laparoscope. The potential benefits of this technique are the prevention of vascular injury, gas embolism, pre-peritoneal insufflation and a low incidence of bowel injury. However, direct entry may be an under- utilised and safe alternative to the Veress Needle and open-entry techniques⁽³⁾.

Several other methods, including the radially expanding access system and single-incision laparoscopic surgery, was developed to minimize tissue trauma. This system uses a pneumo peritoneum needle with a polymeric sleeve. Following routine insufflation the needle is removed, leaving the outer sleeve in situ. Direct dilatation of the sleeve results in a port 12 mm in size. The suggested benefits are that only one sharp instrument enters the abdominal cavity, less tissue trauma occurs and, in theory, fewer bowel and vascular injuries occur⁽⁴⁾.

single incision laparoscopic surgery was designed with the aim of reducing the invasiveness of entry into the peritoneal cavity when compared to traditional laparoscopic entry techniques. This approach involves a single intra-umbilical 12 mm incision with the umbilicus being pulled out, exposing the fascia. Pneumo peritoneum is induced with an atraumatic trocar introduced into the abdomen by an open technique. Second and third trocars are introduced to the left and right of the first trocar, leaving a small bridge of fascia between them to avoid leakage of carbon dioxide. The suggested benefits include a reduction in post-operative pain and an improved cosmetic result⁽⁵⁾.

There can be complications related to the method of entry of the laparoscope. The most serious complications can be life threatening and include bowel, major abdominal vessel and anterior abdominal wall vessel perforation. Fortunately these most serious complications are rare, with the incidence of bowel perforation reported as being 1.8 per 1000 cases, and the incidence of major abdominal vessel and anterior abdominal wall vessel perforation reported as being 0.9 per 1000 cases. Whilst these low rates are heartening, it still implies that over 250 individuals in the United Kingdom will suffer a serious complication each year⁽⁶⁾.

As well as these very serious operative complications, there are other less serious complications such as post-operative infection, subcutaneous emphysema, and extra peritoneal insufflation⁽⁷⁾.

Aim of the Work

Aim of this study is to focus on the safety of the most used methods of entry into the peritoneal cavity in laparoscopic surgery with particular attention to patients submitted to previous surgery without comorbidities.

METHODOLOGY

Types of studies: prospective study.

Study setting: Randomized controlled trial will be included in the study by comparison between four techniques of port entry of the abdominal laparoscopic complications:

Major complications: Mortality. Vascular injury (major vessels and abdominal wall vessels). Visceral (bladder or bowel) injury. Gas embolism. Solid organ injury.

Minor complications: Extra peritoneal insufflation. Trocar site bleeding. Failed entry (unable to access the peritoneal cavity).

Study period: for six months.

Study population:

Inclusion: Age: from 15: 60 years. Men, women and children undergoing diagnostic, operative or mixed laparoscopy, performed by general surgeons.

Exclusion: sever medical comorbidities interfering with insufflation of the abdomen. previous open abdominal cases. Patient refusal.

Sampling method: Randomized controlled trial.

Place of study: El-Minia University Hospital, Ain Shams University Hospital

Sampling size: forty cases divided into four techniques.

Ethical Considerations: according to approved standards to ethical committee of Ain Shams University.

Study Tools: the abdominal laparoscope

Study Procedures: laparoscopic abdominal procedures by general surgeons

Study interventions: The following laparoscopic-entry techniques: Open-entry technique. Veress Needle entry. Direct-vision entry. Closed entry technique.

Methods of statistical analysis: Data were collected, revised, verified, coded, then entered PC for statistical analysis done by using SPSS statistical package version 20.

The following had been done:

Descriptive statistics: For qualitative data: number (N) and percentage (%). For quantitative data: mean (\bar{X}) and standard deviation (SD). Kolmogorov- Smirnov for normality test was used to differentiate between parametric data and non-parametric data.

Analytical statistics:

Normally distributed variables (parametric) between two study groups were analyzed using:

Student (t) test for analysis of quantitative variables. Chi – square (x2), Fischer's exact test for analysis of qualitative data. Mean (arithmetic mean): obtained by adding the observed values & dividing them by the total number of values. Standard Deviation (SD): is a measure of the variation or dispersion in a distribution. It is equal to the square root of the arithmetic mean of the squares of the deviations from the arithmetic mean. p-Value: is the probability of rejecting the null hypothesis (Ho). If the p- value is less than the chosen significance level then the null hypothesis (Ho) is rejected.

Chi-squared (χ) test: evaluates the significance level of the Ho that the probability of success is the same in two distinct groups. For all tests probability (p) was considered: Non-significant if ≥ 0.05 . Significant if < 0.05 . Highly significant if < 0.01 . Very highly significant if < 0.001 .

RESULTS

Table (1): Socio-demographic characteristics of the studied group.

demographic -Socio characteristics	Studied group (n)
Age (years), Range Mean \pm SD	18 – 58 9.3 \pm 33.2
Age groups <30 years (10 - 30)	19 (47.5%) (% 47.5) 19
Sex Male Female	7 (17.5%) (% 17.5) 33

Table (2): Operational characteristics of the studied group.

Operational characteristics	Studied group (n)
Operational time (min), Range Mean \pm SD	45 – 60 3.2 \pm 48.9
Type of technique The open technique Versee needle technique Visiport technique Closed technique	10 (25%) 10 (25%) 10 (25%) (% 25) 10
Length of stay (days) Range Mean \pm SD	1 - 3 1.6 \pm 1.0

* Continuous data represented by mean \pm SD, while categorical data represented by number and (%).

Table (3): Incidence of laparoscopic complication according to open technique.

Laparoscopic complication	Patient No. (n)
Mortality	0(0%)
Vascular injury	0 (0%)
Visceral injury	0 (0%)
Extra peritoneal insufflation	0 (0%)
Gas embolism	0 (0%)
Failed entry	0 (0%)
Trocar site bleeding	(% 1) 1
Total	(% 1) 1

* Categorical data represented by number and (%).

Table (4): Incidence of laparoscopic complication according to visiport technique.

complication Laparoscopic	Patient No. (n)
Mortality	0(0%)
Vascular injury	0 (0%)
Visceral injury	1 (10%)
Extra peritoneal insufflation	0 (0%)
Gas embolism	0 (0%)
Failed entry	0 (0%)
Trocar site bleeding	(% 0) 0
Total	(% 1) 1

* Categorical data represented by number and (%).

Table (5): Incidence of laparoscopic complication according to verse needle technique.

Laparoscopic complication	Patient No. (n)
Mortality	0(0%)
Vascular injury	1 (10%)
Visceral injury	1 (10%)
Extra peritoneal insufflation	0 (0%)
Gas embolism	0 (0%)
Failed entry	0 (0%)
Trocar site bleeding	(% 0) 0
Total	(% 2) 2

* Categorical data represented by number and (%).

Table (6): Incidence of laparoscopic complication according to closed technique.

Laparoscopic complication	Patient No. (n =10)
Mortality	0(0%)
Vascular injury	1 (10%)
Visceral injury	1 (10%)
Extra peritoneal insufflation	0 (0%)
Gas embolism	0 (0%)
Failed entry	0 (0%)
Trocar site bleeding	(% 1) 1
Total	(% 3) 3

* Categorical data represented by number and (%).

Table (7): Comparison of laparoscopic complication according to different technique.(n=40).

Laparoscopic complication	Group I (1 · n=)	Group II (1 · n=)	Group III (1 · n=)	Group IV (1 · n=)	P value
Mortality	(%) ·	(%) ·	(%) ·	(%) ·	0.7
Vascular injury	(%) ·	(%) ·	1) 10(%)	1) 10(%)	
Visceral injury	(%) ·	1) 10(%)	1) 10(%)	1) 10(%)	
Extra peritoneal insufflation	(%) ·	(%) ·	(%) ·	(%) ·	
Gas embolism	(%) ·	(%) ·	(%) ·	(%) ·	
Failed entry	(%) ·	(%) ·	(%) ·	(%) ·	
Trocar site bleeding	1) 10(%)	(%) ·	(%) ·	1) 10(%)	
Total	1) 10(%)	1) 10(%)	2) 20(%)	3) 30(%)	

* Chi square test was used.

DISCUSSION

Laparoscopy is a procedure which uses a laparoscope, a thin tube with a light and camera on the end, like a telescope, that is inserted under general anesthesia through a small cut (0.5 cm to 1 cm) in, or near, the umbilicus. The camera can project images onto external screens which allow surgeons to directly visualize the pelvic and abdominal organs. This permits keyhole surgery to be performed, which uses much smaller surgical tools without the need for large incisions. To perform laparoscopy, gas is gently pumped into the abdomen to increase the workspace for the camera and tools. The method by which incisions are made to introduce the laparoscope may influence the likelihood of complications although laparoscopy is usually safe, a small minority of patients experience life-threatening complications, including injuries to surrounding blood vessels or the bowel. These complications often occur at the first step of the procedure when the abdominal wall is pierced using specialized instruments to insert the gas. Different doctors use different specialized instruments and techniques *Ahmad et al.* ⁽⁸⁾.

Different studies have analyzed and compared outcome of different entry techniques, failing, unfortunately, in revealing any safety advantage of an open technique in comparison with a closed method of entry ⁽⁹⁾.

In this study we compared between different techniques of laparoscopic entry (Open-entry technique, Veress Needle entry, Direct-vision entry, closed entry technique)

Angioli et al. ⁽⁹⁾ stated that the mean and SD of the age of the studied groups was (33.9 ±10.3)

in veress needle group and (36.1 ±10.5) in direct entry group and (38±2) in open group

Our study showed that the mean and SD of the age of the studied groups was(33.2 ± 9.3) at all groups ranged between 18 and 58 years with and male patients were 17.5% of studied patients and females were 82.5%.

Our study showed that the operation time rang was (45-60) min and the length of hospital stay rang was (1-3) days.

Cases in our study were divided in four groups of 10 cases each.

Minor complications are rare but not avoidable events. *Merlin et al.* ⁽¹⁰⁾ reported in a meta-analysis a reduced risk of minor complications in cases with Open entry compared to Veress insertion and a trend for the Open technique in reducing the likelihood of conversion to laparotomy.

Ahmad et al. ⁽⁸⁾ and *Angioli et al.* ⁽⁹⁾ reported that no event of mortality in studied groups.

Our study showed that no event of mortality in studied groups.

Angioli et al. ⁽⁹⁾ stated that extra peritoneal insufflation was seen only after Veress needle insertion, with a significant difference compared to Open and direct access.

Our study showed that extra peritoneal insufflation was not reported in the four techniques of laparoscopic port entry in the abdominal wall.

Angioli et al. ⁽⁹⁾ stated that visceral injuries were more frequent with Veress insertion with 3.1% compared to closed technique with 1.6% and open technique with 0%.

Moreover, he reported an advantage of the Open technique in terms of visceral injuries in

comparison to the Veress technique and closed technique.

Our study showed that visceral injury was reported in closed technique with 10% and veress technique with 10% and wasn't reported in either the direct or open techniques.

These results suggested that closed technique has higher risk of visceral injury compared with other techniques of port entry.

Angioli et al.⁽⁹⁾ stated that vascular injury showed a non-significant difference among the different groups.

Our study showed non-significant difference among the different groups regarding vascular injury among different techniques of laparoscopic port entry in the abdominal wall.

Ahmad et al.⁽⁸⁾ reported no event of gas embolism among the different groups.

Our study showed that no event of gas embolism among the different groups as well.

There is no universally accepted definition of failed entry. Akbar defined failed entry as failure to aspirate following Veress needle insertion on three consecutive attempts (Akbar 2008). Angioli defined failed entry as entry requiring more than three consecutive attempts⁽⁹⁾. Both of these study authors reported a high rate of failed entry in the Veress needle group. This is not consistent with routine practice, which classifies failed entry after two attempts of Veress needle insertion⁽¹¹⁾.

Our study reported no events of failed entry in different groups of laparoscopic port entry techniques.

Ahmad et al.⁽⁸⁾ reported no event of trocar site bleeding among the different groups.

Our study showed that trocar site bleeding was reported in closed technique with 10% and open technique with 10% and wasn't reported in either the direct or veress needle techniques.

CONCLUSION

There is no difference between different groups of laparoscopic port entry in the abdominal wall regarding mortality, gas embolism, vascular injury, extra peritoneal insufflation and failed entry. Visceral injury was noted with a higher rate at closed group more than veress needle group and wasn't noted at other techniques. The evidence was generally of very low quality with small numbers of participants in our study; our findings should be interpreted with

caution. Overall, there is insufficient evidence to recommend one laparoscopic entry technique over another. More studies are required with larger sample size to determine the safer technique of laparoscopic port entry in the abdominal wall.

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