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Original Research Article

A comparative study between direct safety trocar insertion versus veress needle technique for creating pneumoperitoneum in laparoscopic surgeries

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ABSTRACT

Background: There are two methods of trocar insertion in laparoscopic surgeries one is direct insertion and second is Veress needle insertion. In this study we compared these two methods.
Methods: In this study we divided 50 patients equally into two group group A for in group A patients, direct trocar insertion technique was used for creation of pneumoperitoneum whereas amongst patients of group B, pneumoperitoneum was created using Veress needle insertion technique.
Results: The incidence of visceral injuries, vascular injuries and other post-operative complications were similar in both the groups. The present study observed no significant difference in failure rates between two methods.
Conclusions: Both the techniques i.e.; Direct trocar insertion (DTI) and Veress needle technique are equally effective, safe and feasible for creation of pneumoperitoneum during laparoscopic procedure.

Keywords: Laparoscopic surgery, Pneumoperitoneum, Trocar insertion

INTRODUCTION

Laparoscopic surgeries have become the preferred method for performing abdominal surgeries as they are associated with good cosmetic results and lesser complications in terms of patients' morbidity and suffering.[1] The first integral step of successful laparoscopic procedure includes the creation of pneumoperitoneum as it allows creation of operative field.[2-4] Creation of pneumoperitoneum can be achieved by both open or closed methods. Classical open method was described by Hasson whereas Classical closed method includes Veress needle method. direct trocar insertion, disposable-shielded trocars, expanding trocars, and visiportsinsertion.[5,6] The closed method i.e.; Veress method was introduced in 1938 by Veress of Hungary and it include the insertion of Veress needle blindly into the abdominal cavity. Following the insertion of needle, the position of the needle tip is confirmed inside the peritoneal cavity by various tests. Though the Veress needle technique is widely used method yet it has been associated with slow insufflation rate and rare life-threatening complications.

Other alternative to closed method is an open technique which are considered relatively safe. Direct trocar insertion (DTI) as an alternative to Veress needle insertion for creating pneumoperitoneum was first reported in 1978 by Dingfelder. Though DTI technique is also a blind technique but it has been associated with reduced number of 'blind steps' as compared to Veress needle technique. Veress needle involves 3 blind steps (insertion, insufflation, and trocar introduction) whereas DTI technique involves single step (trocar introduction).[7] Though the complications associated with laparoscopic surgeries are quite uncommon, but it has been observed that approximately 50% of the complications occur during creation of pneumoperitoneum i.e.; while gaining access to abdominal cavity. [8-10]

The present randomized study was thus conducted at a tertiary care centre to compare and evaluate the safety, efficacy and time taken for creating pneumoperitoneum following two methods i.e.; Veress needle technique and DTI technique for gaining access to the peritoneal cavity for laparoscopic surgery.

METHODS

This randomised comparative study was conducted on patients who attended the outpatient department of Surgery at Peoples College of Medical sciences and Research Centre, Bhopal, Central India during the period that extended from 1st December 2018- 1st May 2020.

All patients undergoing elective laparoscopic surgeries in department of surgery and meeting the inclusion criteria during the study period were included in the study. The patients belonging to age group of 15 to 65 years were enrolled for the study. Patients who have undergone previous midline laparotomy, BMI more than or equal to 35, Pregnant women were not included in the study. Patients with uncorrected coagulopathy, peritonitis and those not consenting to participate were also excluded.

After obtaining ethical clearance from Institute's ethical committee, all the patients fulfilling inclusion criteria were enrolled and written consent was obtained from all the patients. Sociodemographic details such as age, gender, place of residence, family income, number of family members were obtained from all the study participants. Detailed history regarding their presenting complaints, presence of comorbidities and indication of laparoscopy were noted and entered in pretested semi structured questionnaire. Further all the patients were subjected to detailed general and systemic examination. Height in cm and weight in kg was recorded and body mass index was calculated.

Randomization

All the selected patients were allocated randomly into 2 groups using random number table. Group A comprised of cases in which DTI technique was used whereas group B included cases in which Veress needle insertion technique was used.

Technique of direct trocar insertion

After full preparation of the patient for surgery and maintaining adequate anesthesia, an initial supraumbilical transverse skin incision was given in linea alba (approximately 2-3 mm) avoiding peritoneum. Abdominal wall was elevated with the non-dominant hand and tip of blunt trocar was inserted directly. Once the tip of trocar was inserted into skin, it was pushed using screwing movement through fascia and muscle of abdomen. However, the other hand was used for balanced counter traction so as to avoid uncontrolled entry and overshooting. The angulation towards the pelvis was adjusted according to the surgeon's assessment of the patient's bodily habitus. Following this, placement of trocar was verified and CO_2 gas was insufflated under direct visualization at a pressure of 15 mmHg. However, it was ensured that CO_2 stopcock is open so as to relieve negative intra-abdominal pressure due to abdominal wall elevation.

Veress needle technique

Veress needle technique was performed as per standard guidelines in present study. Patient was placed in Trendelenburg position and 3 mm incision was given. An angle of 45° towards pelvis was maintained and Veress needle was introduced into the abdomen carefully. While inserting the needle, 2 sounds were ensured i.e.; one while entering fascia and second while entering into peritoneum. The needle was then then aspirated and the position was verified with the saline drop test before initiating insufflation. Following this, the gas tube was connected to the Verres needle and peritoneum was insufflated with CO_2 and then the trocar was inserted.

Throughout the intraoperative period, vital parameters were recorded in both the groups. Time from incision to creation of pneumoperitoneum was noted. Number of failed attempts, ability to create pneumoperitoneum, conversion of closed method to open method was noted. Also, the incidence of intraoperative as well as post-operative complications such as subcutaneous emphysema, port site bleeding, injuries to bowel, bladder or major abdominal vessels, omental injury, gas leak etc. were noted and compared between two groups.

Statistical analysis

Data was compiled using MS excel and IBM SPSS software version 20 was used for data analysis. Descriptive and inferential statistics was applied. Data was grouped and expressed as frequency and percentage whereas numerical data was expressed as mean and standard deviation. Chi square test was applied to assess the difference in proportions between two groups whereas t test was applied to assess the difference in mean values of two groups. P value<0.05 was considered significant whereas p<0.01 was considered highly significant.

RESULTS

The present study was conducted for a period of 18 months in department of surgery, People's Hospital Bhopal. The study included a total of 50 patients admitted in surgery department who underwent laparoscopic surgeries. All the 50 patients were randomly divided into two groups. In group A patients, DTI technique was used for creation of pneumoperitoneum whereas amongst patients of group B, pneumoperitoneum was created using Veress needle insertion technique. In present study, mean age of 50 patients was 46.14±15.68 years whereas mean age of DTI and Veress needle group was 47.52±14.88 and

44.76±16.66 years respectively. Majority of patients in DTI group (28%) belonged to 51 to 60 years of age group whereas maximum patients (24%) in Veress needle group belonged to less than 30 years of age group. However, test of significance (Chi square test) showed no statistically significant difference in age structure of two group (p>0.05).

Majority of patients who underwent laparoscopic surgeries in present study were females (60%). About 64% and 56% cases in DTI group and Veress needle insertion group respectively were females. The observed difference in gender composition of two groups was statistically insignificant and thus two groups were comparable in terms of gender composition (p>0.05). Table 1 represents that in both DTI group (80%) and Veress needle insertion group (68%), majority of patients underwent laparoscopic cholecystectomy. Overall, most common procedure conducted in both the groups was laparoscopic cholecystectomy (74%) and least common surgical procedure was laparoscopic liver abscess drainage and laparoscopic TP (4% each). Patients of two groups were comparable with respect to procedure (p>0.05).

In present study, vascular and visceral injuries were not reported in any of the patients of either group.

The present study documented complications in 9 (18%) cases. Port site bleeding was observed in 8% cases of direct trocar insertion group whereas incidence of port site bleeding in Veress needle group was 4% and the observed difference in incidence of port site bleeding amongst patients of two groups was statistically insignificant (p>0.05). Similarly, incidence of port site infections and subcutaneous emphysema was similar in both the groups and test of significance revealed no statistically significant difference in incidence of complications between patients of two groups (p>0.05) (Table 2).

Mean number of attempts in DTI groups were 1.04±0.20 whereas that in Veress needle insertion group were 1.08±0.28. Multiple attempts (>1) were required in 4% cases and 8% cases in DTI and Veress needle insertion group respectively. Test of significance (Chi square test) observed no significant difference in number of attempts between two groups (p>0.05) (Table 3).

Table 1: Distribution according to type of procedure.

Procedures	Direct trocar insertion (n=25)		Veress Needle (n=25)		Total (n=50)	
	N	%	N	%	N	%
Lap appendectomy	3	12	3	12	6	12
Lap cholecystectomy	20	80	17	68	37	74
Lap liver abscess drainage	1	4	2	8	3	6
Lap TAPP	1	4	3	12	4	8
χ^2=3.44, p=0.49						

Table 2: Comparison of complications between two groups.

Complications	Direct trocar insertion (n=25)		Veress Needle (n=25)		Total (n=50)		χ^2	P value
	N	%	N	%	N	%		
Port site bleeding	2	8	1	4	3	6	0.355	0.55
Port site infection	2	8	2	8	4	8	0.001	1.0
Subcutaneous emphysema	1	4	1	4	2	4	0.001	1.0
None	20	80	21	84	41	82	0.133	0.72

Table 3: Comparison of number of attempts between two groups.

Number of attempts	Direct trocar insertion (n=25)		Veress Needle (n=25)		Total (n=50)	
	N	%	N	%	N	%
1	24	96	23	92	47	94
2	1	4	2	8	3	6
Mean	1.04±0.20		1.08±0.28		1.06±0.24	
χ^2=0.355, p=0.552						

DISCUSSION

The ultimate goal of laparoscopic surgeries is to reduce patient's morbidity and provide successful outcome. As compared to open abdominal surgeries, laparoscopic surgeries have been associated with faster recovery, shorter length of stay in hospital, and faster return to daily activities. During laparoscopic surgeries, creation of pneumoperitoneum is one of the most essential steps as it allows creating of working field inside peritoneal cavity. Though multiple open and closed methods have been tried for creation of pneumoperitoneum, there is still a debate

regarding the safety, efficacy as well as feasibility of one method over other.[11]

Sociodemographic variables

Age

The morbidity as well as mortality of surgical patients have been documented to increase with age. When limited to laparoscopic procedures, the outcomes in elderly patients is superior. Lopez et al in their study in Spain documented superiority of laparoscopic surgery with morbidity and mortality of 10.8% and 3.4% amongst patients older than 70 years of age.[12] Briet et al in another study documented significant improvement in quality of life in terms of physical functioning, social functioning even in elderly (>65 years old) following laparoscopic surgeries.[13]

In present study, mean age of overall patients who underwent laparoscopic surgeries was 46.14±15.68 years. Mean age of patients in whom DTI technique was used was 47.52±14.88 years whereas that of patients managed using Veress needle technique was 44.76±16.66 years and two groups were comparable in age composition (p>0.05).

The mean age of patients who underwent laparoscopic surgeries by either technique in a study by Mushtaq et al was 47.54±11 years which was similar to present study.[11] Mean age of 150 patients who underwent laparoscopic cholecystectomy in a study by Abdullah et al was 41±0.9 years which was slightly lower as compared to present study.[14] Mean age of patients in a study by Ganesh et al was 40 years.[15] The observed difference in the age between present study and reference study could be due to difference in inclusion criteria. The present study included all the cases of laparoscopic surgery whereas the reference study was conducted on patients who underwent laparoscopic cholecystectomy.

Gender

In our study, approximately 60% patients who underwent laparoscopic surgeries were females. In both the groups, female predominance was observed and two groups were comparable in gender composition (p>0.05). These findings were supported by findings of Abdullah et al, in which maximum patients who underwent laparoscopic cholecystectomy were females.[14] Mushtaq et al also documented female predominance with a male female ratio of 1:1.56.[11] In contrast to the findings of present study, majority of patients in a study by Ganesh et al were males (86%).[15] Chauhan et al in their study documented higher age and male gender required higher conversion of laparoscopic surgery into open surgery.[16]

Procedure

In present study, most common surgery performed laparoscopically was cholecystectomy (74%), followed by appendicectomy (10%). Laparoscopic cholecystectomy was most commonly performed surgery in both the groups i.e.; in 80% and 68. Other surgeries performed in our study were laparoscopic appendicectomy, laparoscopic TEP, laparoscopic liver abscess drainage and laparoscopic TAPP. Patients of two groups were comparable with respect to procedure (p>0.05). Similar to present study, laparoscopic cholecystectomy was the most common surgical procedure performed in 52.08% patients followed by laparoscopic appendectomy (13.02%) in a study by Mushtaq et al.[11] In a study by Sreejith et al maximum patients underwent laparoscopic cholecystectomy followed by laparoscopic ovarian cyst excision and laparoscopic appendicectomy.[17]

Time taken for creating pneumoperitoneum

DTI technique has been described as rapid, feasible and safe technique for creation of pneumoperitoneum in laparoscopic surgeries. Shatta et al documented 100.6±19.27 sec as mean time to induce pneumoperitoneum using direct trocar insertion.[18] Mean time for induction of pneumoperitoneum with DTI technique was 2.3±1.1 min as compared to Veress technique (5±0.9 min) in a study by Abdullah et al.[14] Creation of pneumoperitoneum while using Veress needle technique involves three steps i.e.; insertion, insufflation and trocar introduction whereas that in direct trocar insertion technique is reduced to one thus reducing number of steps and hence the time.[11]

Comparison of vascular and visceral injuries and other complications between two techniques

Laparoscopic surgeries may be associated with various complications. The incidence of visceral and vascular injuries is much less with DTI and Veress needle technique as compared to classical open method.[19,20] In present study, vascular and visceral injuries were reported in none of the patients with either technique. The findings of present study were supported by findings of Imran et al in which no vascular or visceral injuries in either group was documented.[21] Abdullah et al also documented no incidence of vascular and visceral injuries in patients of both the groups i.e.; DTI and Veress needle group.[14] Ahmad et al concluded that as direct trocar insertion is associated with easy elevation of abdominal wall, this allow the viscera to fall off the parietal peritoneum before coming in contact with the advancing trocar. Since direct trocar insertion technique does not allow the use of any needle, it is quick method and is associated with less complications.[22]

The present study port site bleeding was observed in 8% cases in direct trocar insertion group whereas incidence of port site bleeding in Veress needle group was 4%. Other complications noted were port site infections, subcutaneous emphysema. The present study documented no statistically significant difference in various complications between two groups (p>0.05). The finding of present study was similar to findings of Abdullah et al

in which port site infection was documented in 2 cases and 1 case of direct trocar insertion and Veress needle insertion technique respectively. However, port site hematoma was documented in only one case treated with DTI method.[14]

Godara et al also documented no significant difference in complications between the two groups. They documented port site bleeding in 4% and 2% cases of Veress needle and DTI group respectively. However, incidence of omental laceration was documented in 4% cases of Veress needle group and zero cases in direct trocar group.[23] In contrast to the findings of present study, Mushtaq et al incidence of intraoperative complications i.e.; omental injury, omental emphysema and post-operative complications such as port site infection, port site ecchymosis and subcutaneous emphysema were significantly higher in Veress needle group as compared to direct trocar insertion group ($p<0.05$).[11]

Number of attempts

In present study, though the mean number of attempts were higher in Veress needle group (1.08±0.28) as compared to DTI group (1.04±0.20) but the observed difference was statistically insignificant ($p>0.05$).These findings were similar to study by Garrido et al in which two or more attempts were required in 12.3% cases of Veress needle group as compared to 7.8% cases of DTI group but the difference was statistically insignificant ($p>0.05$).[24] In contrast to present study, Sinha et al documented significantly higher number of attempts in Veress needle group as compared to direct trocar insertion group.[25] Chavez et al also documented significantly higher number of failed attempts in Veress needle group as compared to direct trocar insertion group.[21] Both the techniques are safe and feasible for creation of pneumoperitoneum during laparoscopic procedure. However, time taken to create pneumoperitoneum is much lesser in DTI group as compared to Veress needle group.

Limitation of this study was that it has been carried out in one centre and all the surgeries was carried out by one surgeon, we need study on large number of patients and we need multiple centres.

CONCLUSION

The incidence of visceral injuries, vascular injuries and other post-operative complications were similar in both the groups. The present study observed no significant difference in failure rates between two methods. Based on the finding of present study, it was concluded that both the techniques i.e.; DTI and Veress needle technique are equally effective, safe and feasible for creation of pneumoperitoneum during laparoscopic procedure.

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