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SAFETY AND EFFICACY OF MODIFIED OPEN TECHNIQUE AS A FIRST LAPAROSCOPIC ENTRY IN COMPARISON WITH DIRECT TROCAR ENTRY AND VERESS NEEDLE TECHNIQUE

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Abstract

The creation of pneumoperitoneum is an essential step in laparoscopy, Veress needle, direct trocar entrance and modified open methods with their different modifications are the three widely used methods nowadays. Each method has its own advantages & disadvantages and each surgeon has his own preferred method of creating pneumoperitoneum based on his training and experience.

The aim is to compare the safety and efficacy of modified open insertion technique (MOIT) with the direct trocar insertion (DTI) and Veress needle techniques (VN).

From January 2013 to December 2015, two hundred ten patients with different indications for laparoscopic surgery were included in this study for evaluation of three different methods of creating pneumoperitoneum, one hundred forty of them were operated upon in Al-Sadir teaching hospital by same laparoscopic surgeon with closed technique, this group was equally divided in to two groups; Veress needle technique (VN group) and direct trocar insertion technique (DTI group) each group included 70 patients, the remaining seventy patients were operated upon in Al Shiffa general hospital by same laparoscopic surgeons with modified open trocar insertion technique (MOTI group).

Of the 210 patients; 70 (33.33%) patients operated with Veress needle (VN) technique in patients, 70 (33.33%) patients operated with Direct trocar insertion (DTI) technique and 70 (33.33%) patients operated with Modified open trocar insertion (MOTI), the patient's ages ranged from 17 to 76 years, 172 (82%) patients were females and 38 (18%) patients were males. The mean time required for entry in patients subjected to VN technique was 3.63±0.64 minutes in comparison to 1.79±2.39 minutes and 2.01±1.82 minutes for (DTI) and (MOTI) techniques respectively, this difference is statistically significant (p-value <0.001), the VN technique associated with high rate of minor complications 32 (45.71%) patients in comparison with 7 (10%) patients and 5 (7.14%) patients reported during DTI and MOTI respectively, this difference is statistically significant (p-value <0.001), there were no reported major complication in this study like visceral or vascular injury and gas embolism.

In conclusion, both DTI and MOTI techniques are safe and effective procedures to create pneumoperitoneum during laparoscopic surgery, they are associated with few minor complications and no failer rate in comparison to VN technique.

Introduction

Laparoscopy is the technique of examining the abdominal cavity and its contents. It requires working space intra-abdominally that can be created by insertion of a cannula through the abdominal wall, distention of the abdominal cavity with gas or air, and visualization of the abdominal contents with an illuminated telescope. With the advent of video cameras, laparoscopy rapidly advanced from being a diagnostic procedure to the one used in wide variety of therapeutic surgical procedures among which laparoscopic cholecystectomy is the most commonly performed worldwide[1,2].

The creation of pneumoperitoneum is an essential step to carry out this procedure . Several techniques, instruments, and

approaches have been introduced during the last century for the creation of pneumoperitoneum. These include Veress needle, open Hasson's technique, and modified open method, direct trocar insertion without prior pneumo-peritoneum, optical Veress needle, optical trocars and shielded disposable trocars. Each surgeon has his own preferred method of creating pneumoperitoneum based on his training and experience, however open and Veress needle methods with their different modifications and direct trocar enterance are the three widely used methods nowadays[3].

The Veress needle was introduced by Veress in 1938 and remains the most commonly used method of creating pneumoperitoneum specially by gynecologists[4].

Hasson introduced the open technique in 1971 but it did not become widely accepted perhaps because it requires a mini laparotomy, which can be difficult in obese patients[5].

Pawanindra et al described modified Hasson techniques for open access using the incision (1 cm) at the junction of the umbilical cicatrix pillar with the linea alba to enter the peritoneal cavity , this technique is safe, effective, easy to learn, and quick to perform[6-9].

Dingfelder was the first to publish (in 1978) on direct trocar entry into the abdomen with a trocar, the suggested advantages of this method of entry are the avoidance of complications related to the use of the Veress needle: failed pneumoperitoneum, preperitoneal insufflation, intestinal insufflation, or the more serious CO2 embolism, laparoscopic entry is initiated with only one blind step (trocar) instead of three (Veress needle, insufflation, trocar), the direct entry method is faster than any other method of entry[10-13].

Laparoscopic surgery is currently being widely used in almost every surgical sub-specialty and despite its superiority over open surgery, it is not completely risk free and many of its lethal complications are related to creation of pnuemoperitoneum for gaining access to intra-abdominal cavity[14-16].

More than half of these complications are related to gaining access and majority of these are observed during insertion of primary umbilical trocar[17,18].

Various studies have shown advantages & disadvantages of these techniques. 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 and because of this reason these techniques have proponents and opponents as all are almost equally employed worldwide[19-21].

This study was conducted to compare the safety and efficacy of modified open technique with the direct trocar entry and Veress needle techniques in terms of access related complications and time spent on creation of pneumoperitonuem.

Patients and methods

This study was conducted in Al Sadder teaching hospital and Al Shiffa general hospital in basrah, Iraq during the period from January 2013 to December 2015 and following the approval of the local´s ethics committee, two hundred ten patients with different indications for laparoscopic surgery were included in this study; one hundred forty of them operated in Al Sadir teaching hospital by same laparoscopic surgeon using closed technique, they were equally divided into two groups; Veress needle technique (VN group) and direct trocar insertion technique (DTI group) each group include 70 patients.

The remaining Seventy patients were operated in Al Shiffa general hospital by same laparoscopic surgeons with modified open trocar insertion technique (MOTI group). The techniques adopted in these groups were performed by two teams of certified surgeons with at least seven years' experience in laparoscopic surgery.

The selection of technique depends on surgeon, s experience and preference. Exclusion criteria include patients with upper abdominal and/or umbilical scar, umbilical or paraumbilical hernia and morbidly obese patients.

Techniques

All patients underwent surgery under general anesthesia with endotracheal intubation with full abdominal relaxation. The skin of the abdominal wall was prepared and draped.

Closed techniques:

An initial umbilical skin incision (a transverse 1 cm long incision in the lower umbilical fold) is followed by elevation of the abdominal wall with the grip of the non-dominant hand of the surgeon and the grip of the assistant hand. A direct entry of the abdominal wall was performed by a 10 mm reusable trocar by the surgeon's dominant hand with a balanced counter-traction so as to prevent inadvertent uncontrolled entry and possible overshoot. The angulation towards the pelvis is adjusted according to the surgeon's assessment of the patient's bodily habitus. Factors such as adequate skin incision, sharp instruments, abdominal wall relaxation, naso-gastric decompression, placing of a finger as a guard along the trocar and optimal table height are ensured as necessary. The CO2 stopcock is left open so as to relieve the negative intra-abdominal pressure caused by the abdominal wall elevation and allow apposed viscera to fall back. As soon as peritoneal penetration is perceived, the trocar is withdrawn and the telescope introduced part way into the cannula in order to detect inadvertent mal-position immediately, placement confirmed and only then CO2 insufflation is commenced. The flow rate and pressure attained are monitored and interpreted as usual.

While the technique of Veress needle was done through an umbilical incision from which the Veress needle was introduced followed by blind CO2 insufflation, then the 10 mm port was introduced by the same way described above.

Modified open insertion technique:

A small transverse or semicircular skin incision approximately 1.5 cm to 2 cm is made in the skin of the superior umbilical fold, and the skin edges are retracted with small Langenbeck retractors and the fat separated from the umbilical scar. The umbilical scar is picked up by the small Allis forceps or towel clip at the highest point and retracted up to facilitate the lifting up of the abdominal wall, this method clearly displays the point on the abdominal wall where the peritoneum is tightly fused and allows direct entry to the peritoneal cavity, while the abdominal wall is kept tented and away from the underlying viscera at all times, a vertical incision (1 cm) at the junction of the umbilical cicatrix pillar with the linea alba is made, this incision is perform with sharp blade involve only the fascia, while the peritoneum is gently entered with the tip of closed artery forceps,. The 10mm metallic cannula without the trocar is introduced in to the abdominal cavity under direct vision. After insufflation of carbon dioxide through the sleeve, the optical equipment is introduced in the usual manner, if there is gas leakage around the cannula; the two edges of the wound grasp together with Allis forceps to tighten around the cannula.

Major and minor injuries and complications related to access techniques were observed. The time needed for entry to the abdomen (from skin incision till the introduction of the telescope) was recorded. All the data were analyzed by using SPSS system; One Way ANOVA-test used to compare three different variables and t-test used to compare two different variables with a p-value of <0.05 regarded as significant.

Results

This study included 210 patients who underwent elective laparoscopic surgery

using Three different techniques of entry, the Veress needle (VN) technique in 70 (33.33%) patients, Direct trocar insertion (DTI) technique in 70 (33.33%) patients and Modified open trocar insertion (MOTI) in 70 (33.33%) patients.

The age distribution is shown in Table I. The patient's ages ranged from 17 to 76 years. The gender of the patients participating in this study was; 172 (82%) females and 38 (18%) males.

Table I: Age distribution of the study population.

Age (year)	No.	%
10 – 20	4	2
21 - 30	80	38
31 - 40	70	33.3
41 - 50	46	22
51 - 60	5	2.3
- 70	3	1.4
>70	2	1
Total	210	100

The commonest laparoscopic operation done in this series was laparoscopic cholecystectomy in 185 (87.9%) patients followed by 21 (10%) diagnostic laparoscopy, 3 (1.4%) elective laparoscopic appenedicectomy and 1 (0.7%) laparoscopic assisted orchiopexy.

The mean time required for entry in patients subjected to VN technique was 3.63±0.64 minutes, ranged from 3 to 6.45 minutes, while the mean time of DTI and MOTI technique are shorter (1.79±2.39 minutes) for DTI technique ,ranged from 1.5 to 2.25 minutes and (2.01±1.82) for MOTI technique, ranged from 1 to 3 minutes , with the use of One Way ANOVA test the mean time for entry for these three techniques was compared and the difference is statistically significant (p-value <0.001) but there was no significant statistical difference in the mean time required for entry between DTI and MOTI technique with use of t-test (p-value = 0.08) as shown in Table II.

Table II: Time difference between the Three techniques.

Type of entry	Mean time (Mean±SD)	P value	
Veress needle (VN)	3.63 ± 0.64		P< 0.001*
Direct trocar insertion (DTI)	1.79 ± 2.39	P=0.08*	
Open trocar insertion (MOTI)	2.01±1.82		

P<0.001*=result of comparison between three different variables (VN, DTI and MOTI).
P=0.08* =result of comparison between two different variables (DTI and MOTI).

Regarding entry techniques complications, the most common reported complications in all types of entry techniques were the minor complications and there were no reported major complication in this study like visceral or vascular injury and gas embolisim as shown in Table (III).

Table III: Minor and major complications in each group.

Complications	VN No. = 70	DTI No.= 70	MOTI No. = 70
	No.(%)	No.(%)	No.(%)
Minor complications			
Port-site bleeding	12(17.14)	5 (7.14)	3 (4.28)
Preperitoneal insuflation	8 (11.42)	0 (0)	0 (0)
Periumbilical brusing	6 (8.57)	1 (1.42)	0 (0)
Failed pneumoperitoneum	3 (4.28)	0 (0)	0 (0)
Subcutaneous emphysema	2 (2.85)	0 (0)	0 (0)
Omental laceration	1 (1.42)	1 (1.42)	0 (0)
Gas leakage	0 (0)	0 (0)	2 (2.85)
Port – site haematoma	0 (0)	0 (0)	2 (2.85)
Total complications	32 (45.71)	7 (10)	5 (7.14)

The most frequent minor complication reported in this study was the port-site bleeding that occurred in 12(17.14%) patients in VN group, in 5(7.14%) patients in DTI group and in 3 (4.28%) patients in MOTI group. Preperitoneal insuflation and failed pneumoperitoneum were reported only in VN group in 8(11.42%) and 3 (4.28%) patients respectively. Gas leakage and port-site hematoma were reported in 2(2.85%) patients with MOTI technique. The frequencies of other complications are shown in table III.

Regarding the total rate of entry related minor complications; the VN technique associated with high rate of minor complications, 32(45.71%) patients in comparison with 7 (10 %) patients and 5 (7.14%) patients reported with DTI and MOTI respectively, this difference is statistically significant (p-value <0.001) but again there was no significant statistical difference in the total rate of entry related minor complications between DTI and MOTI technique (p-value = 0.07) as shown in Table IV.

Table IV: Total frequency of minor complications according to type of entry.

Type of entry	Complications		P Value	
	present	absent		
	No. (%)	No. (%)		
Veress needle VN	32 (45.71)	38 (54.29)		P< 0.001*
Direct trocar insertion DTI	7 (10)	63 (90)	P= 0.07 *	
Open trocar insertion OTI	5 (7.14)	65 (92.86)		

P<0.001*=result of comparison between three different variables (VN, DTI and MOTI).
P=0.07* =result of comparison between two different variables (DTI and MOTI).

Discussion

In the era of modern surgery, laparoscopic surgery has gained much popularity amongst the doctor as well as the patients due its advantages like minimal access approach, shorter hospital stay, early return to daily activity and minimal post-operative morbidity and good cosmesis[22].

Primary trocar insertion and creation of pneumoperitoneum is the essential key step in laparoscopic surgery and most commonly now days it is performed by either the closed or the modified open method[23].

The most commonly used closed method is the verees needle and the direct trocar insertion techniques, the later was introduced to decrease the complications associated with veress needle technique[24].

Both these closed techniques essentially a blind procedures and may be associated

with complications like bowel perforation, major vessels injury, subcutaneous emphysema, etc.[25].

Regarding the modified open technique which introduced to minimized the incidence of gas leakage associated with the original open Hasson technique and to shorten the time needed to create pneumoperitoneum, previous studies reported an absence in the incidence of major vascular injury and gas embolisim and reduction in the incidence of bowel perforation and the time needed to create pneumoperitoneum in comparison with verees needle technique[26-28].

In our study we have compared the safety and efficacy of the three basic techniques (MOTI, DTI and VN) of primary trocar insertion. In this study, MOTI and DTI reported less mean time (minutes) for creation of pneumoperitoneum (2.01±1.82 and 1.79±2.39) respectively in comparison with (3.63±0.64) for VN technique, this results were similar to the results of Bemelman WA et al in 2000[29].

Regarding the complications associated with each type of entry method; VN reported high rate of total minor complications 32 (45.71%) patients in comparison to 7 (10 %) and 5 (7.14%) patients for DTI and MOTI respectively and the most frequent of these minor complications were the port-site bleeding ; VN reported 12(17.14%) patients with port site bleeding in comparison to 5 (7.14%) and 3 (4.28%) patients in DTI and MOTI respectively, the relative high incidence of this complication in VN may be due to multiple steps of VN technique which lead to multiple injuries in the site of entry in comparison DTI which is a one-step technique and the MOTI in which the anterior abdominal wall incised with sharp blade in scared relatively less vascular area in the junction of umblical cicatrix and anterior abdominal rectus sheath , all cases of port site bleeding were treated conservatively by compressing the bleeding point against the abdominal wall by the trocar.

The other most frequent minor complications that reported only in VN technique are the Preperitoneal insuflation in 8 (11.42%) patients, failed pneumoperitoneum in 3 (4.28%) patients and subcutaneous emphysema in 2 (2.85%) patients.

Gas leakage and port–site haematoma were reported only in MOTI technique with incidence of 2 (2.85%) patients for each complication, the gas leakage treated by grasping together the edges of entry wound to narrow the entry opening around the troca whereas cases of port – site haematoma treated by removal of one wound stitch and evacuation of hematoma.

The results of minor complications in our study were similar to study done by Merlin TL et al in (2003)[30].

No major complications were reported in our study in any type of entry technique, Altun and associates compared DT and VN techniques and reported 2.2% major complication for VN, but nothing for DT. They also reported 6.7% minor complication for VN and 2.05% for DT. They concluded that surgeon's preference, skill, anatomic knowledge, and experience are determining factors in the selection of technique[23].

Simforoosh and colleagues described outcome of 3000 patients that underwent laparoscopic procedure during 10 years Labbafinejad Medical Center. They concluded that a new version of MOTI as Modified Hasson,s technique is the preferred method[24,25,28].

Bemelman and associates compared DT, VN, and OA technique in 2000 patients. They reported similar results[29].

The absence of major complications in our study may be due to in part to the fact that the incidence of these complications is very low and the need for larger number of patients to report these complications, the other cause may be due to surgeons long period experience with adopted specific entry technique.

Conclusion

From the results of this study we concluded that both DTI and MOTI techniques are safe and effective procedures to create pneumoperitoneum during laparoscopic surgery, they are associated with few minor complications and no failur rate in comparison to VN technique. The MOTI technique was simple, easy to learn to trainees in laparoscopic surgery because it is an under vision procedure while the DTI is a blind procedure and need the skills of experience laparoscopic surgeon to feel the moment of penetration of the sharp trocar in to the peritoneal cavity to minimized the incidence of visceral and vascular injuries.

So; surgeon's preference, skill, anatomic knowledge, and experience are determining factors in the selection of technique for first entry to create pneumoperitoneum.

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