



The Comparison of Postoperative Pain, Nausea, and Vomiting between Veress Needle Entry and Direct Trocar Entry Methods in Patients Undergoing Laparoscopic Cholecystectomy

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ABSTRACT

BACKGROUND

Postoperative pain, nausea, and vomiting are the most common side effects of laparoscopic cholecystectomy (LC). In the present study, we investigated the differences in postoperative pain, nausea, and vomiting between Veress needle and direct trocar entry methods among patients undergoing LC.

METHODS

96 patients with gallstones were studied. They were randomly divided into two groups: the patients in the first group (n = 48) were insufflated 8.1 liters per minute CO₂ gas by direct trocar port, and the patients in another group (n = 48) were insufflated 2.1 liters per minute CO₂ gas by Veress needle. Pain intensity, nausea, and vomiting were assessed at 20 minutes, 4 hours, and 12 hours after the operations.

RESULTS

The duration of CO₂ gas insufflation in Veress needle was 88.7 ± 10.7 seconds and indirect trocar was 16.6 ± 1.6 seconds. Visual analog scale (VAS) score significantly reduced in Veress needle compared with direct trocar (0.39 ± 0.98 vs. 1.68 ± 1.48) at 20 min after the operation, while there was no difference at 4 hours and 12 hours after the operation. The requirement and dose of pethidine injection were significantly lower in Veress needle than direct trocar. In addition, nausea and vomiting occurred in Veress needle less than direct trocar at 20 min, 4 hours, and 12 hours after LC.

CONCLUSION

Pain intensity just in the short term after LC in the group with CO₂ gas insufflation in Veress needle was significantly less than the other group, while nausea and vomiting were significantly less during the whole follow-up periods in the group with CO₂ gas insufflation in Veress needle.

KEYWORDS:

Laparoscopic cholecystectomy, Nausea, Pain, Vomiting

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INTRODUCTION

Gallstone is a common gastrointestinal disorder. In Europe and the USA, one-fifth of adults suffer from cholelithiasis. Laparoscopic cholecystectomy (LC) is the gold standard treatment of symptomatic gallstones.^{1,2} Several studies have suggested that LC is a safe and effective technique with a lower rate of mortality, morbidity, and hospitalization compared with open cholecystectomy (OC).^{3,4} Nevertheless, postoperative pain, nausea, and vomiting are still common side effects of LC. Although the intensity of pain after LC is lower than OC, some patients have experienced discomfort in the abdomen and shoulders for a few days after LC.^{5,6} The main causes of pain after operation can be due to injury of the abdominal wall and the accumulation of CO₂ gas in the abdominal cavity.^{5,7} Inserted CO₂ gas into the abdomen makes a visible and clear view of the inside of the abdomen; nevertheless, this gas in the peritoneal cavity might result in postoperative pain.⁵ In addition, nausea and vomiting after LC that is performed under general anesthesia are more common. These side effects might lead to a longer stay in hospital or even aspiration and respiratory complications.^{8,9}

Therefore, reducing these side effects can play an important role in reducing the recovery periods and other side effects.¹⁰ Several treatments have been suggested to control the side effects: opioids, non-steroids anti-inflammatory drugs (NSAIDs), local anesthetics, single incision, and low pressure of peritoneal cavity; however, most of them are ineffective or have disadvantages. The presupposition of this study was that method of entry and gas insufflation might have a direct relation with the severity of postoperative side effects after LC. The purpose of this study was to investigate the differences in pain, nausea, and vomiting among patients undergoing LC with two different methods of entry: Veress needle and direct trocar entry.

MATERIALS AND METHODS

This study was conducted in Imam Khomeini (affiliated to Tehran University of Medical Sciences) and Erfan Hospitals from January to December 2015, and was approved by the Ethics Committee of Tehran University of Medical Sciences

The full sample of this study was 96 patients with

symptomatic gallstones aged 20 or more years. Patients with a history of abdominal surgery (except inguinal hernia surgery) or medical co-morbidities that contraindicated to LC were excluded. These cholecystectomies were performed by a single surgeon (K.T.). The patients were randomly divided into two groups: the patients in the first group (n = 48) were insufflated 8.1 liters per minute CO₂ gas by direct trocar port, and the patients in the other group (n = 48) were insufflated 2.1 liters per minute CO₂ gas by Veress needle. Pain intensity, nausea, and vomiting were assessed at 20 minutes, 4 hours, and 12 hours after the operations.

General anesthesia was started by midazolam and sufentanil as a pre-medication, and also propofol and atracurium besylate were used in order for induction of anesthesia and continued with isoflurane, intravenous propofol, and remifentanil. Then CO₂ gas was insufflated for both groups to create standard pressure (13 mm Hg) in the abdominal cavity. LC was performed in the supine position with four incisions, a 5-mm supraumbilical incision for the camera, 10-mm epigastric incision, and two other 5-mm incisions. The gallbladder was retrieved through the epigastric incision. We did not repair the fascial defect of the epigastric incision. At the end of surgery, isoflurane, propofol, and remifentanil were discontinued, neostigmine and atropine were administered to reverse anesthesia. The score and severity of pain intensity, nausea, and vomiting of the patients were assessed by a physician who was blinded to intervention at 20 minutes after operation in the recovery room and 4 hours and 12 hours after operation in the ward.

To assess pain intensity, visual analog scale (VAS) was used. VAS is a self-reported tool with 10 items in which the patients were asked to make a mark from 0 to 10 on a horizontal line to show their pain feeling. Zero = no pain, 1-3 = minor pain, 4-6 = moderated pain, and 7-10 = severe pain. Based on the patients' complaint, intravenous pethidine (25 mg) and indomethacin suppository (50 mg) was prescribed to relieve mild and moderate to severe pain, respectively, at 20 min, 4 hours, and 12 hours after LC. However, for some patients who suffered from mild pain, we substituted indomethacin for pethidine if the pain was persistent after pethidine administration. The score of nausea and vomiting was recorded at 0 to 20 min, 20 min to 4 hours, and 4 hours to 12 hours

Table 1: Basic characteristics of patients

Variables	Direct trocar	Veress needle	<i>p</i> value
Age (year)	47.5 ± 13.4	49.9 ± 15.7	0.42
Weight (kg)	73.1 ± 13.8	76.7 ± 11.5	0.17
Height (cm)	165.1 ± 6.9	165.0 ± 11.0	0.96
BMI (kg/m ²)	26.3 ± 5.3	28.4 ± 5.9	0.17
Diabetes (%)	10.4	18.7	0.24
Hypertension (%)	22.9	22.9	0.99
Renal disorders (%)	4.1	2.0	0.55
Surgery time (min)	34.1 ± 6.9	34.6 ± 5.5	0.66
Insufflation time (se)	16.6 ± 1.6	88.7 ± 10.7	< 0.001

postoperation. In patients who suffered from severe vomiting and did not respond to conservative management, metoclopramide was administered at 20 min, 4 hours, and 12 hours after LC.

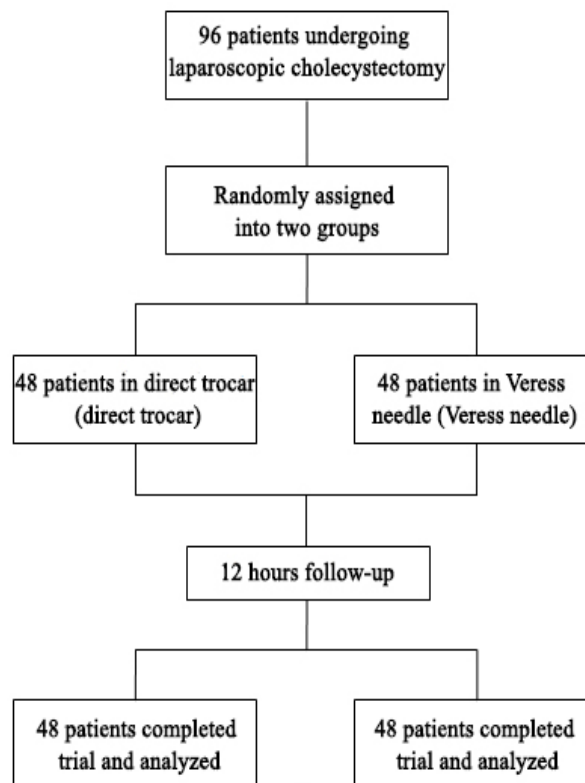
Statistical analysis was conducted by using SPSS software version 20 (SPSS, Inc., Chicago, IL, USA). T test was used for continuous variables, and Chi-squared test was used for non-continuous variables. $p < 0.05$ was considered statistically significant.

RESULTS

The flow chart of the study is presented in figure 1. 96 patients (29 males and 67 females) undergoing LC were enrolled and followed up for 12 hours after operation. The mean age of the participants was 47.5 ± 13.4 years and 49.9 ± 15.7 years in direct trocar and Veress needle groups, respectively. No mortality was found after surgery. There were no significant differences in weight, body mass index (BMI), the prevalence of diabetes, hypertension, renal disorders, and surgery time between the two groups. However, CO₂ insufflation duration in the Veress needle group was significantly higher than the direct trocar group (88.7 ± 10.7 vs. 16.6 ± 1.6 seconds, $p < 0.001$) (Table 1).

Pain intensity at 20 min, 4 hours, and 12 hours after LC is presented in Table 2. 20 minutes after surgery VAS score was significantly lower in the Veress needle group compared with the direct trocar group (0.39 ± 0.98 vs. 1.68 ± 1.48 , $p < 0.001$). There were no significant differences in VAS score between the two groups at 4 hours and 12 hours after surgery.

The number of patients without pain was significantly

**Fig.1: Flow chart of the study**

higher in the Veress needle group compared with the direct trocar group at 20 min (83.3 vs. 39.6%) and 12 hours (33.3 vs. 4.2%) after LC. On the contrary, the prevalence of mild pain in the Veress needle group was significantly lower than the direct trocar group at 20 min (14.6% vs. 54.1%) and 12 hours (2.1% vs. 37.5%) after operation. The prevalence of moderate pain was similar between the two groups at 20 min, 4 hours, and 12 hours after surgery. No patient suffered from severe pain during the follow-up periods.

The requirement for analgesics at 20 min, 4 hours, and 12 hours after LC is presented in Table 2. At 20 min after surgery, 26 patients in the direct trocar and seven patients in the Veress needle groups received pethidine ($p = 0.001$). There were no significant differences between the two groups in pethidine and indomethacin requirements 4 hours after operation. At 12 hours after LC, pethidine requirement was significantly lower in the Veress needle group compared with the direct trocar group (2.1% vs. 27.1% of the patients, $p < 0.001$). Indomethacin requirement was similar between the two groups at 20 min and 12 hours after surgery.

Table 2: Pain intensity at 20 min, 4 hours, and 12 hours after LC

	20 min		4-h		12-h	
	Direct trocar	Veress needle	Direct trocar	Veress needle	Direct trocar	Veress needle
VAS score	1.6 ± 1.4	0.3 ± 0.9	2.2 ± 1.3	2.3 ± 1.2	3.7 ± 1.7	3.2 ± 2.3
<i>p</i> value	< 0.001		0.64		0.27	
Pain severity						
No pain (no.)	19 (39.6%)	40 (83.3%)	7 (14.6%)	3 (6.3%)	2 (4.2%)	16 (33.3%)
<i>p</i> value	< 0.001		0.36		< 0.001	
Mild pain (no.)	26 (54.1%)	7 (14.6%)	32 (66.7%)	37 (77.1%)	18 (37.5%)	1 (2.1%)
<i>p</i> value	< 0.001		0.36		< 0.001	
Moderate pain (no.)	3 (6.2%)	1 (2.1%)	9 (18.7%)	8 (16.6%)	28 (58.3%)	31 (64.6%)
Severe pain (no.)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

Table 3: Requirement for analgesics at 20 min, 4-h and 12-h after LC

Analgesics administration	20 min		4-h		12-h	
	Direct trocar	Veress needle	Direct trocar	Veress needle	Direct trocar	Veress needle
Pethidine requirement (no.)	26 (54.1%)	7 (14.6%)	31 (64.6%)	37 (77.1%)	13 (27.1%)	1 (2.1%)
<i>p</i> value	< 0.001		0.25		0.001	
Indomethacin requirement (no.)	3 (6.2%)	1 (2.1%)	9 (18.8%)	8 (16.7%)	33 (68.8%)	31 (64.6%)
<i>p</i> value	0.31		0.50		0.33	
Pethidine dosage (mg)	13.5 ± 12.5	3.6 ± 8.9	19.2 ± 10.6	16.1 ± 12.2	6.2 ± 10.9	0.5 ± 3.6
<i>p</i> value	< 0.001		0.18		0.001	
Indomethacin dosage (mg)	3.1 ± 12.2	1.0 ± 7.2	9.3 ± 19.7	8.3 ± 18.8	35.4 ± 22.9	32.9 ± 24.1
<i>p</i> value	0.31		0.79		0.51	

The dose of pethidine administered in the direct trocar group was significantly higher than the Veress needle group at 20 min (13.5 ± 12.5 vs. 3.6 ± 8.9 mg) and 12 hours (6.2 ± 10.9 vs. 0.5 ± 3.6 mg) after operation. No significant differences were found between the two groups in taking indomethacin.

Prevalence of nausea and vomiting 20 min, 4 hours, and 12 hours after LC are shown in Table 3. No significant differences between the two groups in the prevalence of nausea 20 min after operation were observed. However, the occurrence rate of nausea was significantly lower in the Veress needle group compared with the direct trocar group at 4 hours (68.8% vs. 89.6% of the patients, *p* = 0.01) and 12 hours (2.1% vs. 52.1% of the patients, *p* < 0.001) after surgery.

We also found that the occurrence of vomiting in the direct trocar group was significantly higher than the Veress needle group at 20 min (18.8% vs. 4.2% of the patients, *p* = 0.02), 4 hours (37.5% vs. 12.5% of the pa-

tients, *p* = 0.005), and 12 hours (14.6% vs. 2.1% of the patients, *p* = 0.02) after LC (Table 4). Administration of metoclopramide in the Veress needle group was significantly lower than direct trocar group during the follow-up periods.

DISCUSSION

Results of the present study have indicated that slow CO₂ gas insufflation using Veress needle results in significantly lower VAS score compared with conventional insufflation at 20 min after operation; however, there were insignificant differences in VAS score at 4 and 12 hours after LC between the two groups. The prevalence of mild pain and pethidine requirement was significantly less in the Veress needle group than the direct trocar group. There were no significant differences between the two groups in moderate pain and indomethacin administration. The occurrences of nausea and vomiting and administration of metoclopramide in the Veress needle group were significantly lower than the direct trocar group during the follow-up periods.

Table 4: Prevalence of nausea and vomiting 20 min, 4 hours, and 12 hours after LC

	20 min		4-h		12-h	
	Direct trocar	Veress needle	Direct trocar	Veress needle	Direct trocar	Veress needle
Nausea (no.)	20 (41.7%)	13 (27.1%)	43 (89.6%)	33 (68.8%)	25 (52.1%)	1 (2.1%)
<i>p</i> value	0.13		0.01		< 0.001	
Vomiting (no.)	9 (18.8%)	2 (4.2%)	18 (37.5%)	6 (12.5%)	7 (14.6%)	1 (2.1%)
<i>p</i> value	0.02		0.005		0.02	
Metoclopramide requirement (no.)	8 (16.7%)	2 (4.2%)	16 (33.3%)	6 (12.5%)	8 (16.7%)	0 (0.0%)
<i>p</i> value	0.04		0.01		0.003	

LC is a gold standard technique to treat gallbladder stones; however, pain is a common event after LC that may result in longer hospitalization and patient's discomfort. Studies have reported that four-fifth of patients undergoing surgery have experienced postoperative pain, especially moderate and severe pain.¹¹

Several factors such as over-distention of the abdominal cavity, damage of visceral nerves or abdominal wall, and CO₂ insufflation-induced acidosis are responsible for postoperative pain. Previous RCTs have investigated various methods to control pain after LC; however, most of them are ineffective. Some studies have demonstrated that low-pressure (7 mmHg) pneumoperitoneum significantly reduced postoperative pain compared with standard-pressure (14 mmHg) pneumoperitoneum.¹²⁻¹⁴ On the contrary, some studies have reported no significant differences in pain between low- and standard-pressure pneumoperitoneum after LC.¹⁵⁻¹⁷ Opioids are commonly administered to relieve postoperative pain, but they result in nausea and vomiting.^{18,19} The effect of mini-port versus standard-port techniques was investigated in some RCTs. They have suggested that the mini-port technique has more cosmetic outcomes than the standard-port technique; however, they have a similar effect on pain, nausea, and vomiting after LC.²⁰⁻²² Results of single-incision LC are inconsistent.²³⁻²⁵ Type of anesthesia also contributes to the occurrence of complications after LC. Previous studies have reported that spinal anesthesia and local peritoneal anesthesia have a lower rate of postoperative complications compared with general anesthesia.²⁶⁻²⁸

To the best of our knowledge, our study is the first investigation that assessed the effect of the speed of CO₂ insufflation into the abdominal cavity on pain, nausea, and vomiting after LC. It seems that slow insufflation using

Veress needle leads to gradual distention of the abdominal cavity and slower stretching of the abdominal wall and diaphragm, hence reducing postoperative pain. However, this beneficial effect was seen in the short term and was vanished 4 hours after surgery. Besides, the number of patients without pain and mild pain was significantly higher in slow insufflation by Veress than more rapid insufflation by the trocar, at 20 min and 12 h after operation. Further studies to confirm the effect of slow insufflation on postoperative pain is essential.

Postoperative nausea and vomiting are other common complications after LC that lead to a longer hospital stay. It has been reported that one-fifth to one-third of patients undergoing LC suffer from nausea and vomiting.⁸ Therefore, the management of them is important. Anti-emetic agents such as dexamethasone and ondansetron are commonly used to prevent postoperative nausea and vomiting.^{29,30} Both pain and opioids are causes of nausea and vomiting after surgery.³¹ In the present study, the prevalence of nausea and vomiting and the requirement of metoclopramide in the Veress needle group was significantly less than the direct trocar group. Lower pethidine requirements in the Veress needle group compared with the direct trocar group may be responsible for the fewer occurrences of nausea and vomiting after LC in this group. Another possible explanation for lower nausea and vomiting after surgery in Veress needle may be related to the lower number of patients without pain in this group versus the direct trocar group.

Disclosure

Authors declare that they have not received any grant from any firm or institutes, and they have no conflict of interests pertaining to the content of this article.

ETHICAL APPROVAL

This study was approved by the Ethics Committee of Tehran University of Medical Sciences and complied with the provisions of the Declaration of Helsinki in 1995 (as revised in Brazil 2013)

CONFLICT OF INTEREST

The authors declare no conflict of interest related to this work.

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