

The protective effect of body mass index in overweight patients with herniation through unclosed port of trocar: a randomized clinical trial

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Abstract

Background: The incidence of trocar site herniation differs in various studies. The incidence of these hernias is increased in patients who experience significant weight gain post-operatively. The aim of this study was to compare the complication of closed trocar port site with open port and effect of body mass index on the herniation using trocar site incision in laparoscopic surgery.

Methods: In this prospective, randomized clinical, a total of 100 patients were scheduled to undergo appendectomy, cholecystectomy, ovarian cyst excision, herniorrhaphy and diagnostic laparoscopy at the Surgical Gastroenterology Service of The Baqiyatallah Hospital. Patients were randomly distributed into group OP (open port, n= 52) and group CP (closed port, n = 48). The follow up intervals were at 3 and 12 months after surgical operation

Results: Five patients in OP group developed incision hernia. Regarding infection, hematoma, there was no significant difference between the two groups. Surprisingly, in OP group the average BMI (kg/m²) in herniated patients was significantly less than non-herniated cases.

Conclusion: An important step to avoid post laparoscopic hernias is suturing the fascia whenever the trocar diameter exceeds 10 mm. If surgeons tend to have an open trocar site of 10 mm, particularly in facial defects; the trocar site is protected from incision hernia in obese patients with high BMI.

Keywords: Trocar site; Incisional hernia; BMI; Obesity

Introduction

The incidence of trocar site herniation differs in various studies.^{1,2} The incidence of these

hernias is increased in patients who experience significant weight gain post-operatively.³ The increase in the intra abdominal pressure will amplify the risk of herniation.³ To avoid this, by a controversial procedure, all port sites larger than 5 or 10 mm should be closed by means of either an absorbable or non-absorbable fascia suture.^{1,4} On rare occa-

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sions, the closure of ports larger than 5 or even 10 mm does not always eliminate the risk of hernias.^{1,5} Due to this controversy, some surgeons tend to leave certain trocar ports open even at 10 mm.⁶

The purpose of the present study was to compare the complication of closed trocar port site with open port and effect of BMI on the herniation through trocar site incision in laparoscopic surgery.

Patients and Methods

This was a prospective, randomized clinical trial that compared the complications of closed and open trocar port sites. A total of 100 adult patients, with no previous malignancy and acquired or congenital immunodeficiency were underwent appendectomy cholecystectomy, ovarian cyst excision, herniorrhaphy and diagnostic laparoscopy two surgeons at the Surgical Gastroenterology Service of the Baqiyatallah Hospital affiliated to Baqiyatallah University of Medical Sciences. The same technique of operation was used for both groups. Patients were ran-

domly distributed into two groups of OP (open port, n=52, in which trocar site was not sutured) and CP (closed port, n=48, with trocar site closed by means of absorbable or non-absorbable suture).The follow up intervals were at 3 and 12 months after surgical operation. Demographic data of the patients are shown in Table 1. Herniation, hematoma, and infection of port site were assessed during follow up period. This study was approved by the Research Ethics Committees of the Health Care Institute for Baqiyatallah University of Medical Sciences. Groups OP and CP were matched (Table 1) in relation to age, sex, and clinical condition that required laparoscopy ($p < 0.05$). The anesthesiologist performed randomization of patients by flipping a coin after they were anesthetized immediately prior to the surgical operation. A dose of 0.1 mg/kg of midazolam was administered to patients 30 minutes before anesthesia. Doses of 2 mg/kg of propofol and 0.5 mcg/kg of fentanyl were use for induction of anesthesia. A dose of 0.5 mg/kg of atracurium was used for curarization. Patients were submitted to general anesthesia with orotracheal intubation

Table 1: Comparison of demographic data between the two groups

Parameter	Open port group (n=48)	Close port (n=52)	P value
Age	38.5±8	40.7±12	NS*
Sex			
Male	11 (21.2%)	5 (10.4%)	NS
Female	43 (79.8%)	43 (89.6%)	
Type of operation			
Cholecystectomy	44 (84.6%)	40 (83.3%)	NS
Appendectomy	3 (5.8%)	4 (8.3%)	
Cyst excision	3 (5.8%)	3 (6.3%)	
Herniorrhaphy	1 (1.9%)	1 (2.1%)	
Diagnostic Laparoscopy	1 (1.9%)	0 (0%)	

*NS: Not significant (P>0.05)

and controlled mechanical ventilation. An orogastric tube was then inserted for aspiration of the stomach contents. For the midline puncture, a 10 mm longitudinal skin incision was made in the supraumbilical region with patients in the Trendelenburg position (approximately 20 degrees). This was followed by subcutaneous tissue divulsion with Kelly forceps for visualization of the aponeurosis. The aponeurosis was then held and pulled with Kocher forceps to lift the abdominal wall. In both groups, well-established tests were used to verify that the needle was inside the peritoneal cavity by aspiration, injection, recovery and saline drop. In addition, initial pressure was measured before insufflations. Aspiration test was performed using a syringe attached to the Veress needle. This test was considered positive when no material was aspirated. Injection test consisted of delivering 5 ml of saline through the needle. The test of resistance to liquid flow was considered positive when liquid flow encountered no increasing resistance. Recovery test consisted of trying to aspirate the injected saline solution. This test was considered positive in cases where no liquid was recovered. Saline drop test comprised passing 2 ml of saline through the needle. This test was considered positive if the liquid disappeared after removing the syringe. The procedure was aborted, if any of the above tests were negative. Failure to reach the peritoneal cavity was recorded and the entire procedure was restarted. A Veress needle was obliquely inserted into the abdominal cavity with an angle of 30 degrees, through the midline, with a caudal orientation. The peritoneal cavity was insufflated with carbonic gas only if all of the four previous tests were positive. Final intraperitoneal pressure was set at 12 mm Hg and maximum flow rate at one liter per minute. The initial

intraperitoneal pressure was considered negative when it was over 8 mm Hg during the first ten seconds of insufflation. The procedure was thus aborted, and the unsuccessful attempt was recorded. The insufflation continued if all tests were positive,

The data were submitted to statistical analysis. Qualitative variables were represented by absolute and relative frequencies. Quantitative variables were represented by mean, standard deviation, and minimum and maximum values. Homogeneity between groups was assessed by means of Chi-Square or the Student t test whenever necessary and the level of significance was set at 0.05. Equivalence between groups with regard to postoperative parameters was determined by overlapping confidence intervals (CI_{95%}), constructed for each parameter assessed within each group. Intervals with 95% confidence level for means and proportions were constructed assuming normal distribution. Regression models were estimated to evaluate the distribution of BMI (kg/m²), post operative hernia, Infection and hematoma, and adjustment was based on analysis of residuals and coefficient of determination (R²). Intervals with confidence level of 95% were constructed for each coefficient estimated by the models, and both groups were compared according to these intervals.

Results

The study comprised 100 patients randomized into either CP or OP groups. The 2 groups were similar with respect to age, sex, and type of laparoscopic surgery (Table 1). There was a significant difference in the BMI (kg/m²) between groups. (25.9±4 in the OP group *vs* 26.6±3.9 in the CP group (*P*=0.005). Five patients developed incision hernia in both

groups through the port during follow up period. All 5 patients were in OP group ($P=0.028$, $RR=11.2$). Regarding infection and hematoma, no significant difference was found in complication rates between OP and CP groups (1.92% vs 2.08%, $P=0.954$, 1.9% vs 4.1%, $P=0.64$, $CI=95\%$, 0.06-8.15 respectively). The overall complication rate in OP group was not significantly more than that of CP group ($P=0.114$, 11.55% vs 2.08% respectively).

To our surprise, the average BMI (kg/m^2) in herniated patients whom belonged to OP group was significantly less than that of non-herniated group ($P=0.001$, 22.2 ± 0.8 vs 28.1 ± 4). Table 2 simply indicates odd ratios for herniation based on underlying factors and type of repair.

Discussion

The first outcome of our study was to avoid herniation by repaired trocar site of ≥ 10 mm. This is due to the fact that the rate of herniation was significantly higher when trocar site at 10 mm was not repaired compared with that of the closed port site. Whereas the rate of hematoma and infection is not different between repaired and open trocar port, the risk of herniation is 11-fold higher in open trocar site.

The overall incidence of trocar site herniation appears to be approximately 0.13%.⁷ Not surprisingly; there was an association between the size of trocar and the incidence of herniation.^{8,9} In view of the fact that currently

many general surgical tend procedures are performed by the laparoscopic technique, nevertheless more surgeons to leave some trocar sites open. However, the question remains as to which size of the trocar port should be closed. Trocar site hernias with fascial defects of 10 mm or larger should be closed, including the peritoneum, although the closure of trocar site measuring 5 mm remains controversial.¹⁰ In another study, the closing of the facial defect of 10 mm or larger was compared with open trocar sites.⁶ Unlike our study, no incision hernias were found in either group during a follow-up period of 6 to 18 months.⁶ On the other hand, some studies suggested the importance of suturing the fascia when the trocar diameter exceeded 5 or even 3 mm in order to avoid post laparoscopic hernias.^{11,12} Our study showed that because of higher incidence of herniation in open trocar site, it was highly recommended to suture all trocar sites larger than 10 mm. The second outcome of our study was to assess the role of BMI in estimating the risk of herniation. Although the BMI was lower in OP than that of CP patients, it showed the crucial role of suturing the trocar port in prevention of herniation, with BMI in herniated patient with open port group being surprisingly low.

Risk factors, such as chronic bronchitis or weight increase, which give rise to intra abdominal pressure, and malnutrition, may have a major role in increasing the risk of herniation.¹³ All foregoing risk factors were evaluated among patients with close trocar

Table 2: Odd ratios for herniation based on underlying factors among open port group

Factors	OR	95% CI	P value
Sex: Male/Female	1.73	0.25-11.88	NS*
Age: Under 40/Above 40 years	4.11	0.62-27.3	NS
BMI (kg/m^2): Under 25/Above 25 years	49.3	2.61-934	$P<0.001$
Type of operation: Cholecystectomy/Others	8.56	1.53-47.6	$P<0.006$

*NS: Not significant ($P>0.05$)

site. However, it was confirmed that the risk of trocar-site herniation was greater in obese and bariatric patients, due to the larger preperitoneal space and elevated intra-abdominal pressure. On the other hand the risk of herniation in obese patients with unclosed trocar site was not investigated. However, our study emphasized the role of size in trocar site. In overweight patients having high BMI (925-30) with fascial defects of 10 mm remaining open, the thickness of abdomen may play a protective role against herniation as op-

posed to that of open site with probable normal BMI. We believe that this conclusion is limited to 10 mm trocar site and more studies are recommended in regard to smaller sizes. To avoid post laparoscopic hernias, it is important to suture the fascia whenever the trocar diameter exceeds 10 mm. Our study suggested that if surgeons tend to open trocar site especially fascial defects from 10 mm, the high BMI in range of overweight obesity is able to protect trocar site from incisional hernia.

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