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Retrospective Study

Is fascial closure required for a 12-mm trocar? A comparative study on trocar site hernia with long-term follow up

Trocar site hernia and fascial closure

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Abstract

BACKGROUND

Abstract

Background: Despite the infrequency of trocar site hernias (TSHs), fascial closure is still recommended for their prevention when using a ≥ 10 -mm trocar.

AIM

We aimed to identify the necessity of fascial closure for a 12-mm non-bladed trocar incision in minimally invasive colorectal surgeries.

METHODS

Materials and Methods: Between July 2010 and December 2018, all patients who underwent minimally invasive colorectal surgeries at the Minimally Invasive Surgery Unit of Siriraj Hospital were retrospectively reviewed. All patients underwent cross-sectional imaging for TSH assessment. Clinicopathological characteristics were recorded. Incidence rates of TSH and postoperative results were analyzed.

RESULTS

Results: Among the 254 patients included, 70 (111 ports) were in the fascial closure (closed) group and 184 (279 ports) in the non-fascial closure (open) group. The median follow up duration was 43 mo. During follow up, three patients in the open group developed TSHs, whereas none in the closed group developed TSHs (1.1% vs. 0%, $p = 0.561$). All TSHs occurred at the right lower abdomen. Patients whose drains were placed through the same incision had higher rates of TSHs compare to patients with no drain. The open group had a significantly shorter operative time and lesser blood loss than the closed group.

CONCLUSION

Conclusion: Routine performance of fascial closure when using a 12-mm non-bladed trocar may not be needed. However, further prospective studies with cross-sectional imaging follow up and greater number of sample size should be conducted to confirm this finding.

Key Words: Trocar site hernia; Port site hernia; Fascial closure; Laparoscopic colorectal surgery; Non-bladed trocar

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Core Tip: Incidence of trocar site hernias were varying from 0.1% to 2%. Previous studies and guidelines have also suggested fascial closure when using a > 10-mm trocar. The data from this recent study demonstrated no significant difference in the incidence of trocar site hernias between facial close and non-closure groups (0% vs. 1.1%, $P = 0.561$), which the median clinical follow up duration was 41 mo. Therefore, fascial closure may be selectively omitted when using a 12-mm non-bladed trocar.

INTRODUCTION

Introduction

Minimally invasive surgical approaches have gained widespread acceptance worldwide given their superior benefits in terms of postoperative recovery and wound problems. However, certain complications can occur following laparoscopy, including trocar site hernias (TSHs), the incidence of which varies from 0.1% [Editor1] to 2%.^{1,2} Clinical presentation of patients can range from asymptomatic to bowel strangulation with delayed diagnosis.³ Despite the multifactorial etiology of this condition, older age,

obesity, and wound infection have been identified as predisposing factors.⁴⁻⁶ Several studies have also suggested fascial defect closure when using a ≥ 10 -mm trocar.⁷⁻⁹ As such, focus should be given to this preventable circumstance in high-risk patients.

Similarly, minimally invasive colorectal surgeries have become the standard approach for treating many centers. Indeed, laparoscopy facilitates meticulous dissection and bowel transection using staplers. Equivalent long-term oncologic outcomes could be achieved by minimizing postoperative morbidities and promoting earlier recovery of bowel function.¹⁰⁻¹² During the procedure, 12-mm ports are commonly used for 10-mm clips or stapler application. Unlike routine midline incision closure, fascial closure of a 12-mm port incision remains optional. Therefore, we aimed to evaluate the necessity of fascial closure of a 12-mm non-bladed trocar incision performed during colorectal surgeries.

MATERIALS AND METHODS

Methods

Study design

This single-center retrospective study was approved by the Siriraj Institutional Review Board (SIRB Protocol No. 900/2562). Data were collected from July 2010 to December 2018.

Patients

All patients aged 18 and above who underwent non-urgent minimally invasive colorectal surgery at the Minimally Invasive Surgery Unit of Siriraj Hospital, Mahidol University, Thailand, were included. Patients who had incomplete medical records, had connective tissue disease, underwent different fascial closure methods, required conversion to open surgery, had less than 12 mo of follow up, and did not undergo postoperative cross-sectional imaging were excluded.

Procedures

We entered the abdominal cavity at the periumbilical region using Hasson's open technique for laparoscopic surgery or mini-midline incision for hand-assisted laparoscopic surgery (HALS) to create pneumoperitoneum. A 12-mm non-bladed trocar was then inserted at a non-periumbilical location according to the type of surgery. After completing the laparoscopic phase, a mini-midline incision that extended from the periumbilical incision was created for specimen retrieval. A 10-mm abdominal drain was then placed as specified by the intraoperative findings. The abdominal fascia at the midline incision was closed *via* continuous absorbable suture. Closure of the 12-mm trocar site was optional following the surgeon's preference. The techniques include direct suture with absorbable material and closure under laparoscopic direct vision with suture passer needle technique. Because of our study is its retrospective design. Details regarding the TSHs and repair technique cannot be clearly determined. All patients were followed up *via* cross-sectional imaging based on the primary disease.

Outcome measurement

The clinicopathological characteristics of the patients, including age, sex, body mass index, diabetes mellitus, benign prostatic hyperplasia, American Society of Anesthesiologists physical status classification, Modified Charlson Comorbidity Index, serum albumin level, creatinine level, disease diagnosis, type of operation, number, and location of the 12-mm port, were reviewed. The primary outcome was the incidence of TSHs in the non-periumbilical area, which was diagnosed *via* postoperative clinical examination or cross-sectional imaging. The date of diagnosis and further management were recorded. Details regarding the primary surgery, complications according to the Clavien–[Editor1] Dindo classification,¹³ and incidence rates of incisional and parastomal hernia were also assessed.

Statistical analyses were performed using SPSS statistical software version 21. Variables are expressed as number (%), mean \pm SD, and median with interquartile range (IQR). Data were analyzed using Student's t-test, Mann–Whitney U test, and chi-

square test. Analysis of TSH incidence was performed using the Kaplan–Meier curve and log-rank test. P values < 0.05 indicated statistical significance.

RESULTS

Results

A total of 537 patients with colorectal diseases underwent minimally invasive colorectal surgery. After applying the exclusion criteria, 254 patients (390 ports) were ultimately included for analysis. To facilitate comparison, we categorized 70 patients (111 ports) into the fascial closure (closed) group and 184 (279 ports) into the non-fascial closure (open) group (Figure 1). Both groups had comparable baseline characteristics and operative details, except for a higher body mass index in the open group. Table 1 summarizes details regarding the clinicopathological characteristics.

Three patients (3/279 ports, 1.1% per port) in the open group developed TSHs, whereas none in the closed group developed TSHs (0/111 port, 0% per port). There was no significant difference in the incidence of TSHs between the two groups ($p = 0.561$). The median clinical follow up duration was 41 mo (IQR 25, 63), while the median cross-sectional imaging follow up duration was 31 mo (IQR 20, 51). Figure 2 demonstrates Kaplan–Meier analysis of TSH events. Three TSH cases were females with adenocarcinoma of the colon who underwent anterior resection. Surveillance computed tomography found that all such cases developed TSHs at right lower quadrant area containing omental fat. Time to diagnosis ranged from 13 to 34 [Editor2] months. One patient underwent elective hernia repair at another hospital. Table 2 describes clinical data. Moreover[Editor3], one of the mentioned three patients had a concomitant asymptomatic incisional hernia at the midline incision. There were no significant correlations between TSHs and incisional hernia ($p = 0.19$). None of the cases with TSHs underwent stoma creation during the primary surgery. Subgroup analysis showed that the incidence of TSHs was slightly increased in patients with drain placement than in those without drain placement (3.1% vs. 0.5%, $p = 0.371$).

The open group showed shorter operative time and lesser blood loss than the closed group. Moreover, the open group had significantly lower fitted postoperative pain at 6, 12, 24, and 48 h[Editor1] ($p = 0.018$) (Figure 3). Length of hospital stay was comparable between the two groups. No significant difference in complications, such as surgical site infection, anastomosis leakage/bleeding, small bowel obstruction, ileus, arrhythmia, electrolyte imbalance, and urinary tract infection, was observed. Surgical site infection in our study occurred at the midline incision (Table 3).

DISCUSSION

Discussion

At present, laparoscopic surgery is a globally acceptable approach across many fields of surgery. Unfortunately, the development of postoperative TSHs remains one of its specific complications. Although prior studies have reported the rare incidence of TSHs after surgery, this complication can be avoided through proper intraoperative management. Predisposing factors for developing hernias may comprise both patient-related factors and type of instrument.^{3,14} To improve surgical outcomes and lessen the incidence of TSHs, modifications to the laparoscopic trocar tip have been attempted. Indeed, one study showed that a bladeless trocar allows for tissue penetration without cutting abdominal muscle fibers, which reduces trocar site bleeding and overall complications.¹⁵ However, some laparoscopic instruments may require trocars with larger diameters as working ports. Nonetheless, routine closure of these fascial defects remains controversial. Owing to the potentially harmful consequences, some studies have recommended closing the defect when using a 10-mm trocar.^{3,16}

Previously, prospective data on other laparoscopic procedures had proven the safety and feasibility of leaving the fascia open after application of a 10-mm trocar.¹⁷ Our study mainly aimed to determine the necessity of 12-mm trocar fascial closure after minimally invasive colorectal surgeries. Notably, our results demonstrated that routine closure provided no significant benefit. The incidence of TSHs observed in our series was 1.1%, which was comparable to that observed in other reports. All cases underwent

cross-sectional imaging based on the index diagnosis. We believe that reliable results were achieved given that computed tomography is considered one of the best methods for occult hernia detection.^{18,19} In 2004, Tonouchi *et al*⁹ classified TSHs into three types. All three cases of TSHs included in this study were of late-onset type. No bowel obstruction or strangulation occurred during follow up. Concerning the precipitating factors, only advanced age was found in two patients. None of them were obese or had prior wound infections at the trocar site. Moreover, Sakamoto *et al* found TSHs after laparoscopic colectomy in elderly patients with low body mass index. Frailty may lead to decreased abdominal wall strength over time. Furthermore, another observation found a relationship between TSH incidence and abdominal drain placement. Based on their data, all TSH cases also underwent drain placement at the same location of the TSHs after the trocar was removed intraoperatively.²⁰

Regarding other postoperative results, this study showed that non-fascial closure, in particular, yielded several advantages. Closure defect usually takes time and may prolong the duration of operation.²¹ Postoperative pain is also greater with trans-fascial suture. However, these parameters may be confounded by various factors. Operative time varies due to cancer staging or degree of adhesion in benign diseases. The amount of blood loss may be attributed to intraoperative findings or surgical techniques.

Another limitation of our study is its retrospective design. Details regarding the TSHs and repair technique cannot be clearly determined. Given the low TSH rates in our population, factors associated with TSH occurrence could not be identified. Moreover, there was no case of TSH in closed group, whereas, 1.1% of TSH was identified in open group. Even, there was no statistical significant in this recent study. However, further prospective studies with cross-sectional imaging follow up and greater number of sample size should be conducted to confirm whether non-fascial closure had outcomes that were not inferior to those of fascial closure.

CONCLUSION

Fascial closure may be selectively omitted when using a 12-mm non-bladed trocar. To advocate for greater benefit from minimally invasive surgery, optimal intraoperative evaluation and decision-making are mandatory for TSH prevention.

ARTICLE HIGHLIGHTS

Research background

The incidence of trocar site hernias varies from 0.1-2%. Several studies have also suggested fascial defect closure when using a ≥ 10 -mm trocar especially for midline incision and bladed trocar.

Research motivation

From this recent study, there was no significant difference of trocar site hernia between closure and non-closure for 12 mm non-bladed trocar, However, further prospective studies with larger number of sample size should be conducted.

Research objectives

To identify the necessity of fascial closure for a 12-mm non-bladed trocar incision in minimally invasive colorectal surgeries.

Research methods

Closure or non-closure was decided as the surgeon's preference. All patients were followed up *via* cross-sectional imaging based on the primary disease.

Research results

Three patients in the open group developed TSHs, whereas none in the closed group developed TSHs (1.1% vs. 0%, $p = 0.561$). The open group had a significantly shorter operative time and lesser blood loss than the closed group.

Research conclusions

Fascial closure may be selectively omitted when using a 12-mm non-bladed trocar.

Research perspectives

Further prospective studies with larger number of sample size should be conducted.

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