

A case report and review of the literature of 7-millimeter lateral port-site herniation following total laparoscopic hysterectomy



Chartchai Srisombut, MD; Nahathai Paktinun, MD; Poochong Timratana, MD

Port-site herniation (PSH) is a rare complication observed postlaparoscopic surgery, typically associated with port sizes of 10 mm or larger, commonly occurred at umbilicus. While occurrences of extra-umbilicus with port size smaller than 10 mm are rare, we present a case detailing a lateral 7 mm PSH diagnosed on the 8th day following a total laparoscopic hysterectomy. The patient exhibited clinical symptoms indicative of partial small bowel obstruction, which became apparent on the third postoperative day. Computed tomography revealed significant small bowel dilatation and herniation through the previously employed 7 mm trocar site. Notably, this trocar site had been utilized with uterine screw. Prompt laparoscopic repair successfully addressed the herniation. The patient demonstrated satisfactory recovery and was subsequently discharged. While current practice recommends fascial incision closure for port size ≥ 10 mm. In light of our case, we propose considering fascial closure for small-size trocar subjected to any use of a manipulator.

Key words: 7 mm port size, laparoscopic hysterectomy, port-site herniation, trocar fascia closure, trocar-site herniation, uterine screw

From the Women Center, Bumrungrad International Hospital, Bangkok, Thailand (Srisombut and Paktinun); Department of Obstetrics and Gynecology, Faculty of Medicine, Reproductive Endocrinology and Infertility Unit, Ramathibodi Hospital, Mahidol University, Bangkok, Thailand (Srisombut); General Surgery, Bumrungrad International Hospital, Bangkok, Thailand (Timratana)

Conflicts of Interest: Authors declare no conflict of interest.

Ethical Consideration: Ethics approval was granted, and patient informed consent was waived by the Bumrungrad International Institutional Review Board (BI-IRB).

Declaration of Patient Consent: Patient consent was obtained prior to submitting case report and is available for review if requested.

Funding: This study did not receive any funding.

Acknowledgments: None.

Cite this article as: Srisombut C, Paktinun N, Timratana P. A case report and review of the literature of 7-millimeter lateral port-site herniation following total laparoscopic hysterectomy. *Am J Obstet Gynecol Glob Rep* 2024;XX:x.ex-x.ex.

Corresponding author: Chartchai Srisombut, MD. csrisombut@gmail.com

2666-5778/\$36.00

© 2024 The Authors. Published by Elsevier Inc. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

<http://dx.doi.org/10.1016/j.xagr.2024.100368>

Introduction

Port-site herniation (PSH), a recognized but rare complication following laparoscopic procedure. It manifests as a type of incisional hernia, potentially leading to severe morbidity of incarceration and bowel gangrene necessitating prompt surgical intervention. PSH was first reported by gynecologist after a laparoscopic procedure in 1974.¹ Since then, numerous case reports and extensive datasets have provided details the characteristic of PSH in cohorts and clinical trials involving various laparoscopic procedures.^{2–4} The reported incidence of PSH varies and this number derives from both symptomatic and asymptomatic cases, ranging from 0.2% to 20%.^{2,5–7} However, the true incidence of PSH presenting with incarceration remains elusive and is thought to be low. By extracting insights from data on patients with incisional hernias postopen surgery, we can estimate that the incidence of PSH with incarceration is likely less than 5%.^{8,9}

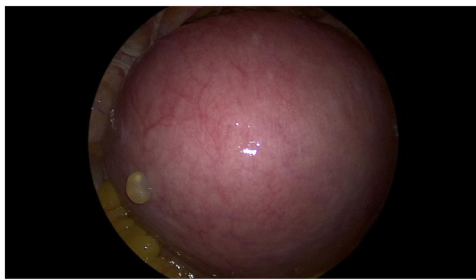
Typically, PSH is more prevalent when utilizing trocars exceeding 10 mm; however, PSH could occur despite with smaller port size.^{10,11} Numerous factors contribute to the development of PSH. These including the midline location of the trocar compared to those situated extra-umbilically,¹² the

utilization of bladed trocars, the decision to close the fascia, multiple attempts trocar insertions, and the application of vigorous instrument manipulation.^{5,6,13,14} In this case report, we present a case of women with PSH after total laparoscopic hysterectomy with bilateral salpingo-oophorectomy (TLH/BSO). This case represents the first occurrence of PSH in over 30 years of experience for our author (CS). This study was reported in accordance with the CARE guidelines.¹⁵

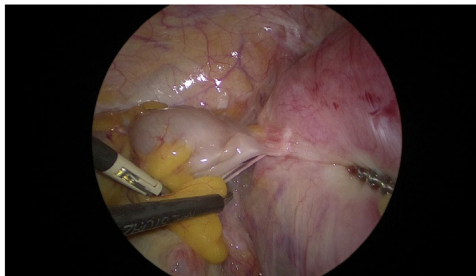
Case presentation

A 52-year-old, para 2 both by Cesarean delivery, with an unremarkable past medical history underwent a TLH/BSO. We utilized four ports, including a 5 mm intra-umbilical camera port with three 7 mm working ports: one at the left para-umbilical and two in each lower abdominal quadrant. All ports were inserted with closed technique using sharp trocar. The intraoperative findings revealed an enlarged uterus, approximately 16 weeks in size (weighing 851.5 grams) along with severe pelvic adhesions (Figure 1, A). During surgery, uterine manipulation with a uterine screw was utilized via both working ports in the right and left lower quadrants, as the uterus could not be

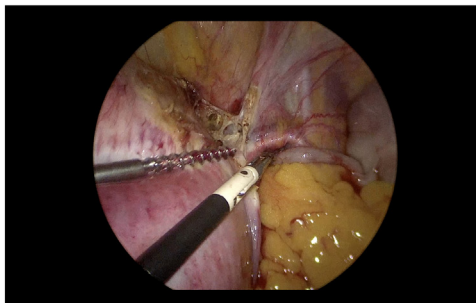
FIGURE 1
Intraoperative findings of large uterus with pelvic adhesion



(A)



(B)



(C)

(A) Large uterus size, approximately 16 weeks; (B) severe pelvic adhesion; (C) utilization of uterine screw to manipulate the uterus.

Srisombut. A case report and review of the literature of 7-millimeter lateral port-site herniation following total laparoscopic hysterectomy. Am J Obstet Gynecol Glob Rep 2024.

effectively mobilized through the transvaginal uterine manipulator (Figure 1, B and C). The specimen was removed via the vaginal route. Sheath and fascia were left unclosed, which is routine practice due to their size being smaller than 10 mm. Our decision is consistent with universal standard practice. Two days after the surgery, she was discharged with an uneventful recovery. There were no signs of gastrointestinal discomfort or abdominal distension before discharge.

On postoperative day 3, she began experiencing gastrointestinal discomfort. The symptoms progressed to nausea and

vomiting, prompting her to seek medical attention. She was subsequently admitted to a nearby hospital on postoperative day 6 for supportive management. Upon attending her scheduled follow-up with us on postoperative day 8, she complaining of persistent abdominal pain and nausea with vomiting. Physical examination revealed no signs of fever or tachycardia. Abdominal examination showed hypoactive bowel sounds, soft, markedly distended abdomen, and tenderness upon palpation with an ill-defined mass localized at left lower quadrant. Suspecting intestinal obstruction, she was promptly admitted for an emergency

surgical consultation. Computed tomography of the whole abdomen was performed, revealing marked dilatation of the small bowel with a transitional point located on the left side of lower abdomen. Additionally, evidence of small bowel herniation through the lower trocar site was observed, indicative of a laparoscopic port site hernia without evidence of bowel ischemia (Figure 2, A). Emergency surgery was planned.

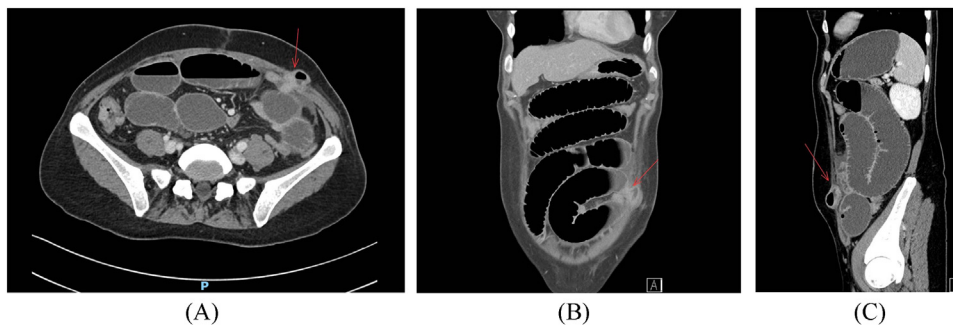
The surgical procedure was conducted laparoscopically (PT), revealing a left port site hernia with incarceration of the distal jejunum (Figure 3, A, B). The hernia muscle was incised to extend its size, facilitating the reduction of the herniated bowel. Following reduction, no signs of bowel gangrene were observed. The fascia defect in the left lower quadrant was then closed under laparoscopy using Monocryl 1-0 (Figure 3, C, D). The consulting surgeon assessed intraoperatively and decided it was unnecessary to close the previously placed right port. In retrospect, closing it would have been more appropriate to prevent a PSH on that side. The patient recovered successfully and was discharged to return home on postoperative day 8.

Discussion

In laparoscopic surgery, PSH is recognized as a known but rare complication. We describe a case of PSH occurring in a 7 mm port, adding to the ongoing discussion on the necessity of fascia closure in ports smaller than 10 mm.^{14,16} The uncertainty arises from the rarity of PSH in smaller ports without fascia closure, supported by the author's 30 years of experience in laparoscopic gynecological surgery. This case is the first occurrence of PSH in the author's experience. While our surgical practices align with norms that typically do not require fascial closure in ports under 10 mm, this case prompts further exploration of the necessity and implications of such closures in smaller ports.

The presentation of PSH varies, from acute to late manifestations years after surgery.^{7,12} A classification system for PSH proposed in 2004, categorizes PSH into three types based on the time of

FIGURE 2
Computed tomography scan with finding of a left lower PSH



(A) Axial view with evidence of small bowel herniation through the lower trocar site (red arrow). No evidence of bowel ischemia is observed. (B) Coronal view marked dilatation of small bowel with transitional point at left side of mid-abdomen (red arrow). (C) Sagittal view shown the lower trocar site of the previous laparoscopic surgery, consistent with laparoscopic port site hernia (red arrow).

Srisombut. A case report and review of the literature of 7-millimeter lateral port-site herniation following total laparoscopic hysterectomy. *Am J Obstet Gynecol Glob Rep* 2024.

presentation and the extent of the defect in the abdominal layers: (1) Early onset, (2) late-onset, and (3) special type.¹² The early onset type involves dehiscence of the anterior fascial plane, posterior fascial plane, and peritoneum. This type typically develops shortly after surgery, presenting as a small bowel obstruction as observed in our case. The true incidence of PSH, all forms combined, is

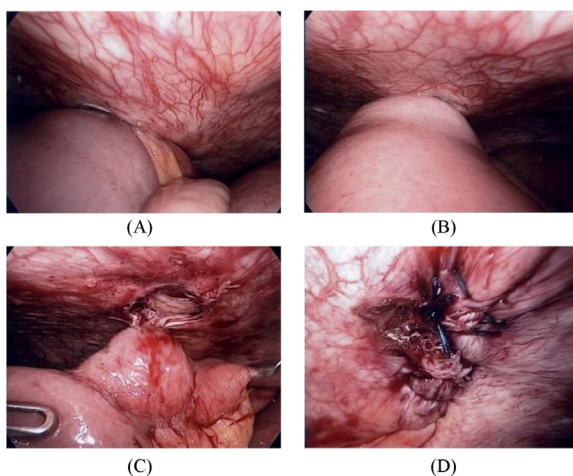
likely higher than the under-reported in existing literature, attributed to patients either not reporting symptoms or being lost to follow-up.³ Late-onset PSH is often asymptomatic, with recent report indicating an incidence as high as 23.7%, assessed through physical examination on incision sites or imaging.⁷ However, late-onset PSH appears to be less concerning due to the rare occurrence of bowel

incarceration, unlike the early onset type.^{11,12} The current guideline from the 2023 European Hernia Society suggested that surgical intervention for midline PSH should be considered optional and dependent on the choices made by both the physician and the patient.¹⁶

The first case report of PSH causing small bowel obstruction in a port size smaller than 10 mm was documented by Plaus in 1993,¹⁷ marking the initial report of two cases with 5 mm herniation PSH. Since then, numerous reports have been published, even in port sizes as small as 3 mm.¹⁰ However, a survey-based study with a sample size more than 4 million cases reported a significantly lower incidence of 0.02%. Interestingly, over 80% of the reported PSH cases, with an incidence of 0.02% were associated with port sizes larger than 10 mm.¹⁸ This suggests that the incidence of PSH in port sizes smaller than 10 mm is presumably very low. As the pathogenesis of PSH in small trocar ports remains unclear, there is still a critical need to identify the factors associated with PSH in port sizes smaller than 10 mm. Particularly, limited evidence is available, constrained to only case series or nonrandomized data, to guide proper recommendations for standard practice in PSH prevention for small trocar sizes (Table).

Various factors associated with PSH have been reported, including obesity,

FIGURE 3
Intraoperative finding during Laparoscopic repair of incarcerated PSH



Parts (A and B) shown a PSH with incarceration of the mid-small bowel (distal jejunum), leading to the dilatation of the proximal small bowel. (C) Following the reduction of the small bowel, there was no evidence of gangrenous bowel. (D) The fascia defect was closed using Monocryl 1-0 through an intracorporeal technique.

Srisombut. A case report and review of the literature of 7-millimeter lateral port-site herniation following total laparoscopic hysterectomy. *Am J Obstet Gynecol Glob Rep* 2024.

TABLE
Summary of PSH associated with trocar size smaller than 10 mm

Author	Procedure	Type of study	Number of patients	Type of trocar	Trocar's size	Site of trocar	Presentation	Fascia closure of incident port	Denote
Plaus ¹⁷	Laparoscopic cholecystectomy	Case report	5	NA	10 mm (4), 5 mm (2)	Subxiphoid (2), midline (3)	Tender, protruding mass (omentum)	Not closed	One case involved concurrent port site herniations at both the infraumbilical and supra-pubic (12 and 5 mm)
Nezhat ²²	Gynecologic	Retrospective case review (n=5300)	10	NA	10 mm (6), 5 mm (5)	Umbilical (5), Midline suprapubic (1), lateral (5)	Small bowel obstruction, Protruding mass (omentum)	Not closed	One case involved concurrent port site herniations at both the umbilical and left lateral ports (10 and 5 mm), resulting in bowel ischemia and necessitating laparoscopic segmental small bowel and large bowel resection
Reardon ²³	Laparoscopic paraesophageal hernia repair	Case report	1	NA	5 mm	Lateral	Small bowel obstruction	Not closed	Postoperative small bowel obstruction was observed on d 2 and managed conservatively, followed by surgical exploration on d 25. Laparotomy revealed no bowel ischemia
Eltabbakh ²⁴	Laparoscopic-assisted vaginal hysterectomy, bilateral salpingo-oophorectomy, lymphadenectomy	Case report	1	NA	5 mm	Lateral	Small bowel obstruction	Not closed	Presented 1-wk postsurgery. Laparotomy revealed no bowel ischemia
Bergemann ¹⁰	Laparoscopic tubal ligation	Case report	1	NA	3 mm	Umbilical	Tender, protruding mass (omentum), no abdominal symptoms	Not closed	Presented on postoperative d 2
Sirito ²⁵	Laparoscopic ovarian cystectomy	Case report	1	NA	5 mm	Lateral	Tumefactive mass	Not closed	Presented 1 y postsurgery with a mass on the lateral port site (endometriotic tissue)
Yee ²⁶	Diagnostic laparoscopy	Case report	1	Blunt	3 mm	Umbilical	Protruding mass, no	Not closed	Pediatric case (18 mo old). Detected on d 5 postsurgery

Srisombut. A case report and review of the literature of 7-millimeter lateral port-site herniation following total laparoscopic hysterectomy. *Am J Obstet Gynecol Glob Rep* 2024.

(continued)

TABLE

Summary of PSH associated with trocar size smaller than 10 mmPlease check the author name (Kanis 2013) cited here as they do not belong to Ref. [32].

(continued)

Author	Procedure	Type of study	Number of patients	Type of trocar	Trocar's size	Site of trocar	Presentation	Fascia closure of incident port	Denote
Seamon ²⁷	Robotic hysterectomy, bilateral salpingo-oophorectomy, and pelvic and aortic lymphadenectomy	Case report	1	da Vinci S bladeless obturator (Blunt)	8 mm	Lateral	abdominal symptoms Small bowel obstruction	Not closed	Presented on postoperative d 4
Moreaux ²⁸	Laparoscopic hysterectomy, bilateral salpingo-oophorectomy, and pelvic lymphadenectomy	Case report	2	NA	5 mm	Lateral	Small bowel obstruction	Not closed	Presented 6 d postsurgery, 2 d after drains were removed. Strangulated ischemic bowel required small bowel resection (Case 1). Drains were placed in 5 mm ports in both cases
Spaliviero ²⁹	Robot-assisted laparoscopic prostatectomy	Case report	1	Blunt	8 mm	Lateral	Small bowel obstruction	Not closed	Presented 13 d postsurgery. Preperitoneal herniation of small bowel
Huang ³⁰	Laparoscopic bilateral salpingo-oophorectomy and right paracaval lymph node biopsy	Case report	1	Blunt	5 mm	Lateral	Small bowel obstruction	Not closed	Presented 24 h postsurgery. Strangulated ischemic bowel required small bowel resection
Dulskas ³¹	Laparoscopic cholecystectomy	Case report	1	NA	5 mm	Lateral	Bowel obstruction	Not closed	Presented 1 y postsurgery. Drainage previously placed in this lateral 5 mm trocar port site
Yamamoto ¹¹	Laparoscopic hysterectomy	Case report	1	Blunt	5 mm	Lateral	Partial bowel obstruction (Spigelian hernia)	Not closed	Presented on postoperative d 4. Extensive trocar manipulation
Khurshid ³²	Laparoscopic tubal ligation	Case report	1	Blunt	5 mm	Lateral	-	Not closed	Large bowel herniation observed immediately after lateral port removal. The trocar was reintroduced to reduce the herniated large bowel
Kanis (2013) ³³	Gynecologic oncology	Case report	2	Blunt	5 mm	Lateral	Abdominal distention	Not closed	-

Srisombut. A case report and review of the literature of 7-millimeter lateral port-site herniation following total laparoscopic hysterectomy. *Am J Obstet Gynecol Glob Rep* 2024.

(continued)

TABLE

Summary of PSH associated with trocar size smaller than 10 mm Please check the author name (Kanis 2013) cited here as they do not belong to Ref. [32].

(continued)

Author	Procedure	Type of study	Number of patients	Type of trocar	Trocar's size	Site of trocar	Presentation	Fascia closure of incident port	Denote
Lim ³⁴	Robot-assisted laparoscopic prostatectomy	Case report	1	Blunt	8 mm	Lateral	Small bowel obstruction and tender with protruding mass	Not closed	Presented 3-d postsurgery. Preperitoneal herniation of small bowel
Tsu ³⁵	Robot-assisted laparoscopic prostatectomy	Case report	1	NA	8 mm	Lateral	Small bowel obstruction	Not closed	-
Kilic ³⁶	Robotic hysterectomy	Case report	1	NA	8 mm	Lateral	Small bowel obstruction	Not closed	Presented 3-d postsurgery
Pellegrino ³⁷	Laparoscopic total hysterectomy with bilateral annessiectomy	Case report	1	NA	5 mm	Lateral	Small bowel obstruction	Not closed	Presented 10-d postsurgery
Paul ³⁸	Laparoscopic myomectomy	Case report	1	NA	5 mm	Lateral	Small bowel obstruction	Not closed	Presented 3-d postsurgery. Uterine screw was used
Chorti ³⁹	Laparoscopic cholecystectomy	Case report	1	NA	5 mm	Lateral	Small bowel obstruction	Not closed	Drains were placed in herniated 5 mm ports
Cho ⁴⁰	Robotic cholecystectomy	Case report	1	Blunt	8 mm	Lateral	Small bowel obstruction. Palpable mass at port site	Not closed	Diagnostic laparoscopy after 5 d of failed conservative management revealed nonviable small bowel. A conversion to minilaparotomy was performed for segmental small bowel resection
Zhao ⁴¹	Laparoscopic staging surgery	Case report	1	NA	5 mm	Lateral	Partial small bowel obstruction	Not closed	Presented 8-d postsurgery
Damani ⁴²	General surgery, urology, and gynecology	Retrospective case review (n=11,566)	15 (0.13%)	Blunt	8 mm (11), 12 mm (4)	Lateral (10), Midline (5)	Small bowel obstruction	Not closed	Reoperation at median 4.0 d postsurgery (IQR 3.0–7.0 d). 2 cases (18%) required small bowel resection. 7 PSH at 8 mm were not associated with surgical drain

Srisombut. A case report and review of the literature of 7-millimeter lateral port-site herniation following total laparoscopic hysterectomy. *Am J Obstet Gynecol Glob Rep* 2024.

(continued)

TABLE

Summary of PSH associated with trocar size smaller than 10 mm Please check the author name (Kanis 2013) cited here as they do not belong to Ref. [32].

(continued)

Author	Procedure	Type of study	Number of patients	Type of trocar	Trocar's size	Site of trocar	Presentation	Fascia closure of incident port	Denote
Su ⁴³	Laparoscopic rectal resection	Case report	1	NA	5 mm	Lateral	Tender, protruding mass	Not closed	Drain associated PSH
Marton ⁴⁴	Laparoscopic hysterectomy	Case report	1	Blunt	5 mm	Lateral	Small bowel obstruction	Not closed	Presented on postoperative d 2. Required converted minilaparotomy for segmental small bowel resection
Cianfarani ⁴⁵	Robot—assisted abdominal wall surgery	Prospective case series (n=166, 513 trocars)	1	NA	8 mm	Umbilical	Asymptomatic	Not closed	Median follow-up time was 14.5 mo (range: 9.0–23.2). All cases underwent ultrasound to detect subclinical PSH
Hong ⁴⁶	Robotic myomectomy	Case report	2	NA	8 mm	Lateral	Small bowel obstruction	Not closed	On postoperative d 1, a hernia developed at the port site where a Jackson-Pratt drain remains in place (case 1). A similar case presented on postoperative d 3 with obstructive symptoms at the left port.
Seike ⁴⁷	Robot-assisted left nephrectomy, Robot-assisted distal gastrectomy	Case report	2	NA	8 mm	Lateral	Small bowel obstruction	Not closed	Presented on postoperative d 6 and d 8
Milone ⁴⁸	General surgery, urology	Retrospective case review (n=320)	1 (0.31%)	Blunt	8 mm	Lateral	Asymptomatic	Not closed	Mean follow-up time was 29.1 mo (SD 13.42)

Srisombut. A case report and review of the literature of 7-millimeter lateral port-site herniation following total laparoscopic hysterectomy. *Am J Obstet Gynecol Glob Rep* 2024.

age above 60 years, diabetes, prolonged surgical duration, manipulation force via trocar, the necessity for fascia enlargement during specimen extraction, and single-port incision laparoscopy (SILS).^{3–5} Notably, SILS has been identified as an important risk factor for PSH, demonstrating an odds ratio of 1.92 compared to conventional laparoscopic surgery.¹⁹ Anatomically, the linea alba is recognized as possibly the most vulnerable and least vascularized part of the abdominal wall, contributing to a higher incidence of PSH at the midline compared to lateral PSH.^{16,20} However, since we only utilized the midline port as a camera port, port manipulation is minimal and not sufficient to create PSH. In our case, we applied extensive leverage force by utilizing a left lower 7 mm trocar port to mobilize the large uterus, which was adhered to the pelvic cavity due to severe adhesions. This factor, involving the use of force to overcome resistance and stiffness, led to the widening of the fascia defect, which is considered the most likely cause of PSH. Although the right port site also experienced leverage force from the uterine screw, albeit to a lesser degree than the left side, it was not closed during the surgical repair. This potentially led to the development of a PSH. The mean time for early onset PSH, presenting as small bowel obstruction is 5 days (range 2–12 days).¹² This suggests that if our patient were to develop a PSH at the right port site, it would likely not present as a life-threatening small bowel obstruction but rather as a late-onset PSH with symptoms of bulging and mass, which is often subclinical.²¹ Despite applying pressure to the uterine surface without penetrating the screw tip into the fundus, resulting in increased manipulation force on the trocar, we still prefer and routinely use this technique. In our experience, using this nondrilled technique helps avoid bleeding at the penetration site on the fundus, offers more flexibility in movement, and allows convenience of changing the screw from one trocar to the other. To perform the upward manipulation, we apply firm force against the

lateral surface of the uterus to create friction and pull the screw upward.

Despite following our standard practices to prevent port site-related complications, such as observing trocar removal under laparoscopic vision and shaken the abdominal wall after CO₂ was completely evacuated to ensure that no part of the bowel would become trapped at the trocar site, and early ambulation, a PSH still occurred in our cases. This case report contributes valuable insights into the existing literature on the recommended closure of the fascia in 5 mm port site in cases involving extensive manipulation.¹¹ The application of multiple directional manipulation forces via the trocar can lead to the widening of the fascia defect, as observed in our case. To prevent such complications, we recommend closing the fascia for any trocar size that involves the application of extensive force.

Conclusion

It is strongly recommended to close the fascia in any port when significant force is applied to the trocar. Exclusive minimally invasive approach for hernia repair is essential to minimize patient dissatisfaction when complications occur. ■

CRedit authorship contribution statement

Chartchai Srisombut: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Data curation, Conceptualization. **Nahathai Paktinun:** Data curation. **Poochong Timratana:** Data curation.

REFERENCES

- Schiff I, Naftolin F. Small bowel incarceration after uncomplicated laparoscopy. *Obstet Gynecol* 1974;43(5):674–5.
- Rossi A, McLaughlin D, Witte S, LynSue J, Haluck RS, Rogers AM. An expanded retrospective review of trocar site hernias in laparoscopic gastric bypass patients. *J Laparoendosc Adv Surg Tech A* 2017;27(6):633–5.

- Comajuncosas J, Hermoso J, Gris P, et al. Risk factors for umbilical trocar site incisional hernia in laparoscopic cholecystectomy: a prospective 3-year follow-up study. *Am J Surg* 2014;207(1):1–6.
- Uslu HY, Erkek AB, Cakmak A, et al. Trocar site hernia after laparoscopic cholecystectomy. *J Laparoendosc Adv Surg Tech A* 2007;17(5):600–3.
- Noh JJ, Kim TH, Kim CJ, Kim TJ. Incisional hernia after 2498 single-port access (SPA) gynecologic surgery over a 10-year period. *Sci Rep* 2020;10(1):17388.
- Boone JD, Fauci JM, Barr ES, Estes JM, Bevis KS. Incidence of port site hernias and/or dehiscence in robotic-assisted procedures in gynecologic oncology patients. *Gynecol Oncol* 2013;131(1):123–6.
- Ciscar A, Badia JM, Novell F, Bolívar S, Mans E. Incidence and risk factors for trocar-site incisional hernia detected by clinical and ultrasound examination: a prospective observational study. *BMC Surg* 2020;20(1):330.
- Dadashzadeh ER, Huckaby LV, Handzel R, et al. The risk of incarceration during nonoperative management of incisional hernias: a population-based analysis of 30,998 patients. *Ann Surg* 2022;275(2):e488–95.
- Sneiders D, Yurtkap Y, Kroese LF, Kleinrensink GJ, Lange JF, Gillion JF. Risk factors for incarceration in patients with primary abdominal wall and incisional hernias: a prospective study in 4472 patients. *World J Surg* 2019;43(8):1906–13.
- Bergemann JL, Hibbert ML, Harkins G, Narvaez J, Asato A. Omental herniation through a 3-mm umbilical trocar site: unmasking a hidden umbilical hernia. *J Laparoendosc Adv Surg Tech A* 2001;11(3):171–3.
- Yamamoto M, Minikel L, Zaritsky E. Laparoscopic 5-mm trocar site herniation and literature review. *JLS* 2011;15(1):122–6.
- Tonouchi H, Ohmori Y, Kobayashi M, Kusunoki M. Trocar site hernia. *Arch Surg* 2004;139(11):1248–56.
- Pereira N, Hutchinson AP, Irani M, et al. 5-millimeter trocar-site hernias after laparoscopy requiring surgical repair. *J Minim Invasive Gynecol* 2016;23(4):505–11.
- Gutierrez M, Stuparich M, Behbehani S, Nahas S. Does closure of fascia, type, and location of trocar influence occurrence of port site hernias? A literature review. *Surg Endosc* 2020;34(12):5250–8.
- Gagnier JJ, Kienle G, Altman DG, et al. The CARE guidelines: consensus-based clinical case reporting guideline development. *J Med Case Rep* 2013;7(1):223.
- Muysoms FE, Antoniou SA, Bury K, et al. European Hernia Society guidelines on the closure of abdominal wall incisions. *Hernia* 2015;19(1):1–24.
- Plaus WJ. Laparoscopic trocar site hernias. *J Laparoendosc Surg* 1993;3(6):567–70.
- Montz FJ, Holschneider CH, Munro MG. Incisional hernia following laparoscopy: a

survey of the American Association of Gynecologic Laparoscopists. *Obstet Gynecol* 1994;84(5):881–4.

19. Sanders DL, Pawlak MM, Simons MP, et al. Midline incisional hernia guidelines: the European Hernia Society. *Br J Surg* 2023;110(12):1732–68.

20. Jensen KK, Kjaer M, Jorgensen LN. Abdominal muscle function and incisional hernia: a systematic review. *Hernia* 2014;18(4):481–6.

21. Baucom RB, Beck WC, Phillips SE, et al. Comparative evaluation of dynamic abdominal sonography for hernia and computed tomography for characterization of incisional hernia. *JAMA Surg* 2014;149(6):591–6.

22. Nezhat C, Nezhat F, Seidman DS. Incisional hernias after operative laparoscopy. *J Laparoendosc Adv Surg Tech A* 1997;7(2):111–5.

23. Reardon PR, Preciado A, Scarborough T, Matthews B, Marti JL. Hernia at 5-mm laparoscopic port site presenting as early postoperative small bowel obstruction. *J Laparoendosc Adv Surg Tech A* 1999;9(6):523–5.

24. Eitabbakh GH. Small bowel obstruction secondary to herniation through a 5-mm laparoscopic trocar site following laparoscopic lymphadenectomy. *Eur J Gynaecol Oncol* 1999;20(4):275–6.

25. Sirito R, Puppo A, Centurioni MG, Gustavino C. Incisional hernia on the 5-mm trocar port site and subsequent wall endometriosis on the same site: a case report. *Am J Obstet Gynecol* 2005;193(3 Pt 1):878–80.

26. Yee DS, Duel BP. Omental herniation through a 3-mm umbilical trocar site. *J Endourol* 2006;20(2):133–4.

27. Seamon LG, Backes F, Resnick K, Cohn DE. Robotic trocar site small bowel evisceration after gynecologic cancer surgery. *Obstet Gynecol* 2008;112(2 Pt 2):462–4.

28. Moreaux G, Estrade-Huchon S, Bader G, et al. Five-millimeter trocar site small bowel eviscerations after gynecologic laparoscopic surgery. *J Minim Invasive Gynecol* 2009;16(5):643–5.

29. Spaliviero M, Samara EN, Oguejiofor IK, DaVault RJ, Albrecht RM, Wong C. Trocar site spigelian-type hernia after robot-assisted laparoscopic prostatectomy. *Urology* 2009;73(6):1423.e3–5.

30. Huang M, Musa F, Castillo C, Holcomb K. Postoperative bowel herniation in a 5-mm non-bladed trocar site. *JLS* 2010;14(2):289–91.

31. Dulskas A, Lunevičius R, Stanaitis J. A case report of incisional hernia through a 5 mm lateral port site following laparoscopic cholecystectomy. *J Minim Access Surg* 2011;7(3):187–9.

32. Khurshid N, Chung M, Horrigan T, Mahan K, Geisler JP. 5-millimeter trocar-site bowel herniation following laparoscopic surgery. *JLS* 2012;16(2):306–10.

33. Kanis MJ, Momeni M, Zakashansky K, Chuang L, Hayes MP. Five-millimeter balloon trocar site herniation: report of two cases and review of literature. *J Minim Invasive Gynecol* 2013;20(5):723–6.

34. Lim SK, Kim KH, Shin TY, Hong SJ, Choi YD, Rha KH. A rare case of interparietal incisional hernia from 8 mm trocar site after robot-assisted laparoscopic prostatectomy. *Hernia* 2014;18(6):911–3.

35. Tsu JH, Ng AT, Wong JK, Wong EM, Ho KL, Yiu MK. Trocar-site hernia at the 8-mm robotic port after robot-assisted laparoscopic prostatectomy: a case report and review of the literature. *J Robot Surg* 2014;8(1):89–91.

36. Kilic GS, Bildaci TB, Tapisiz OL, Alanbay I, Walsh T, Swanson O. Trocar site hernia on an 8-mm port following robotic-assisted hysterectomy. *J Chin Med Assoc* 2014;77(2):112–4.

37. Pellegrino A, Damiani GR, Trojano G, Stomati M. A 5-mm trocar site paramedian early onset voluminous hernia: still in doubt? *Updates Surg* 2018;70(1):151–2.

38. Paul PG, Iype S, Mehta S, Geetha R, Paul G, Ponnambathayil S. A 5-mm trocar site small bowel herniation after laparoscopic myomectomy. *J Minim Invasive Gynecol* 2019;26(4):587–8.

39. Chorti A, AbuFarha S, Michalopoulos A, Papavramidis TS. Richter's hernia in a 5-mm trocar site. *SAGE Open Med Case Rep* 2019;7:2050313x18823413.

40. Cho WT, Yoo T, Kim SM. Is the 8-mm robotic port safe? A case of trocar site hernia after robotic cholecystectomy using the da Vinci Xi system. *Wideochir Inne Tech Maloinwazyjne* 2019;14(1):137–40.

41. Zhao CZ, Liu LB. Richter's Hernia in a 5-mm Trocar Site. *J Minim Invasive Gynecol* 2020;27(4):794–5.

42. Damani T, James L, Fisher JC, Shah PC. Incidence of acute postoperative robotic port-site hernias: results from a high-volume multi-specialty center. *J Robot Surg* 2021;15(3):457–63.

43. Su J, Deng C, Yin HM. Drain-site hernia after laparoscopic rectal resection: a case report and review of literature. *World J Clin Cases* 2022;10(8):2637–43.

44. Marton I, Sever M, Prka M, Šerman A, Tupek T, Klancir T. A rare case of giant 5 mm port-site preperitoneal small-bowel incarceration without fascial defect following laparoscopic hysterectomy. *J Obstet Gynaecol* 2023;43(1):2130209.

45. Cianfarani A, Mongelli F, Iaquinandi F, et al. Trocar-site incisional hernia after 8-mm robotic trocar placement: a prospective study. *World J Surg* 2024;48:1656–61.

46. Hong YH, Paik H, Kim SK, Lee JR, Suh CS. An 8-mm trocar-site hernia at a drainage insertion site after a three-port robotic myomectomy: case report and review of literature. *J Surg Case Rep* 2024;2024(3):rjae189.

47. Seike H, Nagata K, Yamana I, Fujikawa T. Preventing an 8-mm port site hernia in robot-assisted laparoscopic surgery: insights from two rare cases and future preventive measures. *Cureus* 2024;16(3):e56609.

48. Milone M, Anoldo P, Manigrasso M, et al. Robotic 8-mm trocar fascial wounds: to close or not to close? *Int J Med Robot* 2024;20(2):e2624.