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Short Communication

Surgery Section

Port Site Hernia after Laparoscopic Surgery: Incidence, Pathogenesis and Management Strategies

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ABSTRACT

Although Port Site Hernia (PSH) is a rare complication after laparoscopic surgery, with an incidence of 0.65-2.8%, it can be deadly due to the inherent risk of bowel strangulation. Various factors like trocar size, design, improper closure of the defect, and postoperative infection may cause PSH, and symptoms might occur immediately within 10 days or up to 18 months of the primary procedure. A Computed Tomography (CT) scan is a helpful adjuvant in the diagnosis and evaluation of PSH. Deformities larger than 5 mm require surgical intervention in all age groups. Early cases of suspected gangrene necessitate immediate surgical intervention. In advanced situations, anatomical repair by suture or mesh repair by open or laparoscopic method is preferred for lesions larger than 5 mm.

Keywords: Bowel strangling, Gangrene, Mesh repair, Trocar

INTRODUCTION

Laparoscopic surgery has evolved extensively and revolutionised the surgical milieu; it has achieved rapid adoption for a wide range of surgical disorders and offers benefits like less postoperative pain, early recovery, and fewer postoperative complications. However, its widespread use has resulted in added complications specific to the laparoscopic approach. One uncommon complication is Port Site Incisional Hernia (PSH), which occurs at the site of insertion of a port or trocar after laparoscopic surgery [1]. In 1991, the first case of PSH was reported after cholecystectomy [2]. PSH is caused by a variety of reasons, including large trocar size, midline ports, wound infection, and incorrect port closure.

It is a potentially serious complication, as the small size of the defect is more likely to cause incarceration or strangulation of the hernia contents, such as the small bowel or a part of it.

Incidence

According to the literature, the overall incidence of PSH is estimated to be 0.65-2.8% [3]. However, the real incidence may be higher, as patients remain asymptomatic or report late. Fascial defects occur in 3-20% of cases of conventional surgery, depending on the period of observation [4]. A meta-analysis involving 11,699 patients undergoing laparoscopic gastrointestinal procedures has shown an incidence of 0.74% of PSH, with the incidence following bariatric surgical procedures being 0.57%. The incidence after laparoscopic cholecystectomy was 0.69%, and the incidence after laparoscopic colourectal procedures was 1.47% [5].

The PSH develops most frequently when the port site has a minimum diameter of 10 mm (96%) and is placed in the umbilical region (82%) [6]. The number of PSHs in the umbilical region has increased in recent years as laparoscopic procedures have become more frequent, along with a trend of developing multiple PSHs [7].

Pathogenesis

In the early years of laparoscopy, the umbilicus was used as the first port of entry because it is the thinnest part of the abdomen, providing easy access, absence of large blood vessels, and better cosmesis. However, due to the increased risk of port site infection and inherent anatomical weakness, the supra-umbilical or infra-umbilical region of the abdominal wall is now preferred for port insertion [2].

The ligament-like structure from the Linea alba to the umbilical cicatrix is called the umbilical pillar, and its junction with the Linea alba is the thinnest part of the abdominal wall where the peritoneum is attached to the Linea alba as a single layer, making it very prone to the development of PSH. Therefore, ports/trocars placed away from the midline are less prone to the development of PSH due to multiple fascial planes and overlapping of muscles [2].

The design of the trocar is considered one of the critical factors for the development of PSH [2]. The first generation of trocars with pyramidal tips and sharp cutting edges are more prone to the development of PSH, while the later generation of trocars with bladeless designs [Table/Fig-1], incorporating visual entry systems, are associated with a lower incidence of developing PSH. The size of the trocar used for the creation of the port plays an important role in the development of PSH. A survey by the American Association of Gynaecological Laparoscopic Surgeons has shown that 86.3% of PSH occur with a trocar diameter of atleast 10 mm [8]. It has also been reported that 8 mm pyramidal trocars produce similar fascial defects as 12 mm dissecting conical trocar systems [9].

[Table/Fig-1]: Non bladed Trocar (10 mm) for port insertion to prevent Port Site Hernia (PSH).

Kadar N et al., have reported an incidence of PSH at 0.23% at the 10 mm port site and 3.1% at the 12 mm port site [10]. Mayol J et al., have reported umbilical PSH with an incidence of 1.6% [11].

Lambertz A et al., have reported that 96% of PSHs occur after the use of trocars with a diameter of 10 mm or larger [4].

Techniques of port insertion, such as oblique or para-median approaches, or creating a Z-shaped path in which two flaps are formed and get approximated after trocar removal, are associated with a lower incidence of developing PSH [2].

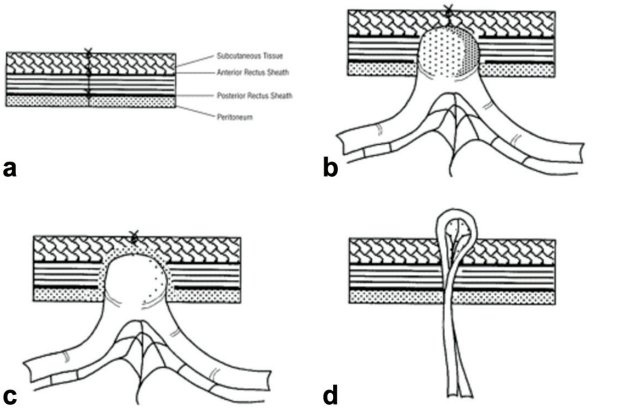
Fascial closure after a laparoscopic procedure also plays an important role in preventing the development of PSH. The incidence of PSH has been shown to decrease from 8% without closure to 0.22% with fascial closure in 12 mm bladed trocars. PSH has also been reported even for 5 mm or smaller ports, especially in children. Therefore, it is widely recommended that fascial closure should be done mandatorily in all defects larger than 5 mm in adults and in all defects, regardless of size, in children [2].

The risk of hernia development after the 5 mm trocar placement system appears to be a rare complication; hence, the 5 mm port site can be left alone without any suture. Additionally, fascial closure in such cases can be difficult and may be associated with a risk of injury to the underlying structures [4].

Several other factors have been implicated in the development of PSH. The risk of PSH is higher in obese patients due to their large preperitoneal space and elevated intra-abdominal pressure [12]. Other factors include poor nutrition, incomplete closure of the fascia, stretching of the port site for specimen retrieval, coughing movements in cases of too early reversal of general anaesthesia, and the effect of partial vacuum during port withdrawal [11]. Postoperative port site infection also plays an important role, responsible for 1.7% of patients undergoing laparoscopic appendectomy [13].

Clinical Presentation

Patients may present with non specific symptoms like nausea, vomiting, or vague abdominal pain along with the occurrence of a small swelling at the site of port insertion [14], which may exhibit a cough impulse. The time of presentation varies between two days to 18 months postoperatively but usually within a few days after the surgical procedure [5]. Sometimes, the swelling and pain at the incision site may be hard to differentiate from a haematoma or wound infections [2]. Tonouchi H et al., have suggested a classification system for PSH based on the extent of the defect and timing of presentation [Table/Fig-2] [15].



[Table/Fig-2]: Classification of the 3 trocar site hernias. a) Normal stab wound of trocar site; b) Early-onset type: dehiscence of anterior and posterior fascial plane and peritoneum; c) Late-onset type: dehiscence of anterior and posterior fascial plane. Peritoneum constitutes hernia sac; d) Special type: dehiscence of whole abdominal wall. Protrusion on intestine and/or omentum [15].

Early presentation is within a few days, and as the size of the defect is narrow, the case may present as a small Richter's hernia - a small tender swelling at the port site with signs of intestinal obstruction, frequently manifesting as a small bowel obstruction. Late presentation develops several months after postsurgery with a gradually progressive painful swelling at the previous surgical scar site. In a special type of hernia, there is the evisceration of the omentum or part of the bowel through the defect, which is a surgical emergency due to the presence of strangulation.

Management

Port site closure after any laparoscopic procedure is essential in minimising postoperative complications such as herniation and infection. The choice of port closure techniques depends on the surgeon's preference, patient characteristics, and specific requirements of the procedure. Several techniques have been employed, each with its advantages and disadvantages, including direct fascial closure, trans-fascial suture, port closure devices, preformed fascial closure systems, and sutureless closure techniques [6].

The diagnosis of PSH is usually clinical, but a CT scan is a useful adjunct to differentiate PSH formation [16]. A CT scan or Magnetic Resonance Imaging (MRI) has also been very useful for a comprehensive assessment of the case, including the exact site, size, and extent of the hernia along with its contents.

It has been shown that 86.3% of all PSHs occurred at sites where the trocar diameter was >10 mm [1]. Fascial closure of trocar sites >10 mm decreases the incidence of PSH development, thus significantly reducing postoperative morbidity and cost [17]. As PSH cases have also been found through 5 mm port sites, especially in children, it is now recommended that fascial closure should be done mandatorily in all defects of size >5 mm, especially if ports have been subjected to maximum manipulation in adults [4], and all defects regardless of size in children [2].

Preventing the occurrence of Postoperative Seroma and Hernia (PSH) following laparoscopic hernia repair involves various techniques aimed at minimising the risk of fluid accumulation, seroma formation, and hernia recurrence [1,17].

- **Deflation of pneumoperitoneum before port removal:** Gradual deflation of pneumoperitoneum reduces abdominal cavity pressure before port removal, thereby reducing shearing forces on the abdominal wall and seroma formation. This is a standard practice following laparoscopic procedures and is generally considered safe and effective.
- **Fascial defect closure techniques:** Such as fascial closure devices, suture carriers, and Deschamps needle technique with these techniques provide a secure and direct closure of fascial defects of various sizes. This approach requires additional cost and skills in needle handling with a learning curve for surgeons.
- **Placing port plugs:** This method is useful in patients at higher risk of seroma formation or those undergoing procedures with longer operative times. However, it may be associated with increased operative time and cost. Overall, the choice of technique to prevent PSH depends on various factors, including the patient's anatomy, the size of the fascial defects, the surgeon's experience, and institutional preferences.

The PSH management is determined by the type of hernia and the time of occurrence. Urgent surgical intervention is essential in early types to prevent strangulation of herniated contents. The laparoscopic approach allows for the viability of the herniated contents, after which Intraperitoneal Onlay Mesh Repair (IPOM) can be performed. If the contents have gangrenous alterations, resection and anastomosis with primary repair may be indicated.

In the late-onset type of hernia, after the reduction of contents by enlarging the port site, meticulous fascial closure is performed either by an open approach or laparoscopic approach [18]. The operative strategy includes anatomical repair by suture if the defect size is <3 cm or mesh repair in cases of larger defects, especially in patients with high-risk factors such as a high body mass index, cardiac diseases, or other pre-existing conditions [4]. Laparoscopic ventral and incisional hernia repairs are often preferred over open repairs as the risk of surgical site infection is lower in them compared to open surgical repairs [19,20].

The IPOM or IPOM plus repairs, which include hernia defect closure, have become more popular as first-line procedures in laparoscopic surgery [21]. However, complications may occur during the IPOM procedure. In cases of potential intra-abdominal adhesions during IPOM procedures, the newer technique of inserting mesh in the extraperitoneal space, such as enhanced view total extraperitoneal repair (eTEP) [22], or Mini Or Less Open Sublay operation (MILOS) [23], are gaining wide acceptance in recent years, although they have a slightly higher risk of postoperative bleeding or seroma formation due to a wider dissection range in the extraperitoneal space [24].

Some surgeons have reported a lower incidence of PSH with the use of a paramedian incision and non bladed trocars [25], but further authentication is a needed as a case report reported the recurrence of hernia despite the use of non bladed trocars [2].

CONCLUSION(S)

The PSH is a rare complication that occurs as a hernia at the site of port insertion after laparoscopic surgery. Various factors are implicated, such as a larger trocar size, improper closure of defects, and postoperative wound infection. Early cases can present within 10 days, while late cases may present up to 18 months after the operation. Early surgical intervention may be necessary in cases of suspected gangrene. Operative treatment consists of meticulous repair of defects >5 mm in all adults or irrespective of their size in children by open or laparoscopic surgery. Anatomical closure in smaller defects and mesh repair in larger defects are usually performed. Laparoscopic surgical procedures, such as IPOM, eTEP, or MILOS, are gaining acceptance in the modern-day scenario.

REFERENCES

[1] Rao P, Ghosh K, Sudhan D. Port site hernia: A rare complication of laparoscopy. Med J Armed Forces India. 2008;64(2):187-88. Available from: http://dx.doi.org/10.1016/S0377-1237(08)80081-0.

[2] Pulle MV, Siddhartha R, Dey A, Mittal T, Malik VK. Port site hernia in laparoscopic surgery: Mechanism, prevention and management. Curr Med Res Pr. 2015;5(3):130-37. Available from: http://dx.doi.org/10.1016/j.cmrp.2015.05.008.

[3] Ciscar A, Badia JM, Novell F, Bolivar 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 Dec 14;20(1):330. Doi: 10.1186/s12893-020-01000-6. PMID: 33317503; PMCID: PMC7737369.

[4] Lambertz A, Stüben BO, Bock B, Eickhoff R, Kroh A, Klink CD, et al. Port-site incisional hernia - A case series of 54 patients. Ann Med Surg (Lond). 2017;14:08-11. Available from: http://dx.doi.org/10.1016/j.amsu.2017.01.001.

[5] Owens M, Barry M, Janjua AZ, Winter DC. A systematic review of laparoscopic port site hernias in gastrointestinal surgery. Surgeon. 2011;9(4):218-24. Available from: http://dx.doi.org/10.1016/j.surge.2011.01.003.

[6] Shaher Z. Port closure techniques. Surg Endosc. 2007;21(8):1264-74. Available from: http://dx.doi.org/10.1007/s00464-006-9095-6.

[7] Tazaki T, Kohyama M, Sugiyama Y, Takahashi S, Sasaki M. A rare case of multiple port site incisional hernias repaired by laparoscopy-assisted intraperitoneal onlay mesh: A case report. Int J Surg Case Rep. 2023;106:108302. Available from: http://dx.doi.org/10.1016/j.ijscr.2023.108302.

[8] Munro MG, Tarnay CM. The impact of trocar-cannula design and simulated operative manipulation on incisional characteristics: A randomized trial. Obstet Gynecol. 2004;103(4):681-85. Available from: http://dx.doi.org/10.1097/01.AOG.0000120144.85187.61.

[9] Montz FJ, Holschneider CH, Munro MG. Incisional hernia following laparoscopy: A survey of the American Association of Gynecologic Laparoscopists. Obstet Gynecol. 1994;84(5):881-84.

[10] Kadar N, Reich H, Liu CY, Manko GF, Gimpelson R. Incisional hernias after major laparoscopic gynecologic procedures. Am J Obstet Gynecol. 1993;168(5):1493-95. Available from: http://dx.doi.org/10.1016/s0002-9378(11)90787-x.

[11] Mayol J, Garcia-Aguilar J, Ortiz-Oshiro E, De-Diego Carmona JA, Fernandez-Represa JA. Risks of the minimal access approach for laparoscopic surgery: Multivariate analysis of morbidity related to umbilical trocar insertion. World J Surg. 1997;21(5):529-33. Available from: http://dx.doi.org/10.1007/pl00012281.

[12] Eid GM, Collins J. Application of a trocar wound closure system designed for laparoscopic procedures in morbidly obese patients. Obes Surg. 2005;15(6):871-73. Available from: http://dx.doi.org/10.1381/0960892054222623.

[13] Jeddeloh K, Velji-Ibrahim J, Stock E, Bulander R, Rickard J, Harmon JV. Wound infection and subsequent port-site hernia following laparoscopic appendectomy: A case report and surveillance data analysis. Int J Surg Case Rep. 2022;95(107235):107235. Available from: http://dx.doi.org/10.1016/j.ijscr.2022.107235.

[14] Hu CF, Chi SY, Huang KH, Chuang FC, Kung FT. Strangulated small intestinal hernia through infraumbilical port site following laparoscopic myomectomy. Taiwan J Obstet Gynecol. 2012;51(4):654-55. Available from: http://dx.doi.org/10.1016/j.tjog.2012.09.026.

[15] Tonouchi H, Ohmori Y, Kobayashi M, Kusunoki M. Trocar site hernia. Arch Surg. 2004;139(11):1248-56. Available from: http://dx.doi.org/10.1001/archsurg.139.11.1248.

[16] Frager DH, Baer JW, Rothpearl A, Bossart PA. Distinction between postoperative ileus and mechanical small-bowel obstruction: Value of CT compared with clinical and other radiographic findings. AJR Am J Roentgenol. 1995;164(4):891-94. Available from: http://dx.doi.org/10.2214/ajr.164.4.7726042.

[17] Moreno-Sanz C, Picazo-Yeste JS, Manzanera-Díaz M, Herrero-Bogajo ML, Cortina-Oliva J, Tadeo-Ruiz G. Prevention of trocar site hernias: Description of the safe port plug technique and preliminary results. Surg Innov. 2008;15(2):100-04. Available from: http://dx.doi.org/10.1177/1553350608318789.

[18] Sanz-López R, Martínez-Ramos C, Núñez-Peña JR, Ruiz de Gopegui M, Pastor-Sirera L, Tamames-Escobar S. Incisional hernias after laparoscopic vs open cholecystectomy. Surg Endosc. 1999;13(9):922-24. Available from: http://dx.doi.org/10.1007/s004649901135.

[19] Forbes SS, Eskicioglu C, McLeod RS, Okrainec A. Meta-analysis of randomized controlled trials comparing open and laparoscopic ventral and incisional hernia repair with mesh. Br J Surg. 2009;96(8):851-58. Available from: http://dx.doi.org/10.1002/bjs.6668.

[20] Arita NA, Nguyen MT, Nguyen DH, Berger RL, Lew DF, Suliburk JT, et al. Laparoscopic repair reduces incidence of surgical site infections for all ventral hernias. Surg Endosc. 2015;29(7):1769-80. Available from: http://dx.doi.org/10.1007/s00464-014-3859-1.

[21] Bittner R, Bingener-Casey J, Dietz U, Fabian M, Ferzli GS, Fortelny RH, et al. Guidelines for laparoscopic treatment of ventral and incisional abdominal wall hernias (International Endohernia Society (IEHS)-part 1. Surg Endosc. 2014;28(1):02-29. Available from: http://dx.doi.org/10.1007/s00464-013-3170-6.

[22] Belyansky I, Daes J, Radu VG, Balasubramanian R, Reza Zahiri H, Weltz AS, et al. A novel approach using the enhanced-view totally extraperitoneal (eTEP) technique for laparoscopic retromuscular hernia repair. Surg Endosc. 2018;32(3):1525-32. Available from: http://dx.doi.org/10.1007/s00464-017-5840-2.

[23] Reinpold W, Schröder M, Berger C, Nehls J, Schröder A, Hukauf M, Köckerling F, Bittner R. Mini- or Less-open Sublay Operation (MILOS): A New Minimally Invasive Technique for the Extraperitoneal Mesh Repair of Incisional Hernias. Ann Surg. 2019 Apr;269(4):748-755. Available from: http://dx.doi.org/10.1097/sla.0000000000002661.

[24] Köckerling F, Simon T, Adolf D, Köckerling D, Mayer F, Reinpold W, et al. Laparoscopic IPOM versus open sublay technique for elective incisional hernia repair: A registry-based, propensity score-matched comparison of 9907 patients. Surg Endosc. 2019;33(10):3361-69. Available from: http://dx.doi.org/10.1007/s00464-018-06629-2.

[25] Liu CD, Mcfadden DW. Laparoscopic port sites do not require fascial closure when nonbladed trocars are used. Am Surg. 2000;66(9):853-54.

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