

Incidence of Port Site Hernia after Laparoscopic Surgery: Clinical and Radiological Assessment

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Abstract

Background: The general trend in general surgery for the past 25 years has been the shift toward minimally-invasive alternatives from conventional operations. Where feasible, laparoscopic surgery is becoming the gold standard in the treatment of many common pathologies. The benefits of laparoscopy have been well documented, including decreased post-operative pain, decreased hospital length of stay, improved cosmesis, and a quicker return to normal activity.

Aim of Study: To evaluate the incidence of occurrence of port site hernia after most types of laparoscopic surgery and possible related risk factors and complications.

Patients and Methods: This prospective observational study was conducted on 100 patients who underwent laparoscopic surgeries for different causes at Souad Kafafi University Hospital, Misr University for Science and Technology during the duration between January 2023 and September 2023. The last patient to be operated on was in March 2023 to be followed up during the following six months.

Results: In our current study, 75% (3 cases out of 4) of port site hernia cases had port site extension. Two cases had umbilical port extension for specimen retrieval in laparoscopic extended right hemicolectomy and laparoscopic left hemicolectomy. These two cases had diabetes mellitus, prolonged operative time (exceeding 3 hours) and post-operative seroma at the umbilical port. One case had left iliac lateral port extension for laparoscopic appendectomy for specimen retrieval and was complicated with post-operative infection.

Conclusion: Port site hernia is a rare type of incisional hernia occurring at port sites after a laparoscopic surgery. Closure of both the fascia and the peritoneum is performed if the original incision is greater than 5mm. Risk factors leading to the occurrence of post-laparoscopic port site hernia are still under investigation but based on our findings, incidence of port site hernia was significantly associated with older age, post-operative port site infection, Obese patients as identified by BMI and prolonged operative time.

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Key Words: Port site hernia – Functional residual capacity – Laparoscopic surgery.

Introduction

THE general trend in general surgery for the past 25 years has been the shift toward minimally-invasive alternatives from conventional operations. Where feasible, laparoscopic surgery is becoming the gold standard in the treatment of many common pathologies. The benefits of laparoscopy have been well documented, including decreased post-operative pain, decreased hospital length of stay, improved cosmesis, and a quicker return to normal activity [1].

Almost all general-surgical operations can be performed laparoscopically. In comparison to an abdominal approach, the minimally invasive access offers several advantages; however, laparoscopy can be associated with a number of approach-specific complications. The majority of them are related to the laparoscopic entry [2].

As laparoscopic surgery advances, there still remains the occurrence of port-site hernias. This can have severe consequences for the patient, including needing further surgery such as bowel resection [3].

Port-site hernia is an iatrogenic complication with a documented incidence between 0.65% and 2.8%. However, the true incidence could be higher because of delayed onset, asymptomatic nature, and loss to follow-up. Port-site hernia could be further complicated by incarceration or strangulation leading to commonly small bowel obstruction requiring emergent surgical intervention, thus imposing significant financial and emotional burden to patients [4].

Port site hernia (PSH) is an incisional hernia occurring at the trocar insertion sites after different types of laparoscopic surgeries. The hernias occurred mostly at the umbilical port site after using 10 mm trocar. Major risk factors include obesi-

ty, diabetes mellitus, female gender, use of 10mm trocar, lengthy procedure, extension of entry site, and wound infection. Closure of fascial defect is supposed to reduce the incidence despite weak evidence [5].

Port size remains one of the main risk factors for PSH development, with most respondents closing only 10- to 12-mm ports regardless of surgical volume or practice setting [6].

Incidence of PSH was high, although few patients underwent incisional hernia repair. Most PSH were observed in the umbilical Hasson trocar. Efforts should be addressed to avoid PSH in the umbilical Hasson trocar [7].

Aim of the work:

The aim of our study is to detect the incidence of occurrence of port site hernia after most types of laparoscopic surgery and possible related risk factors and complications.

Patients and Methods

This prospective observational study was conducted on 100 patients who underwent laparoscopic surgeries for different causes at Souad Kafafi University Hospital, Misr University for Science and technology during the duration between January 2023 and September 2023. The last patient to be operated on was in March 2023 to be followed-up during the following six months.

Ethical considerations: All patients were informed about the study procedures and a written consent was obtained from each patient.

Patients:

Inclusion criteria: Age between 18-70 years. Body mass index $20-45\text{kg}/\text{m}^2$. All Types of laparoscopic surgeries.

Exclusion criteria: Laparoscopic surgery for Para-umbilical hernias. Patients with ventral hernias before having laparoscopic surgery for other causes. Patients underwent repair of ventral wall hernias previously.

Methods:

The following data was collected from all studied cases:

Full history taking including: Sociodemographic data: Name, age, sex, occupation, residence, special habits of medical or surgical importance. History of chronic diseases: Diabetes mellitus, hypertension, pulmonary diseases, cardiac diseases or history of malignancy. History of previous ventral hernias. Drug intake (e.g., Corticosteroids, Chemotherapy or Eltroxin).

Preoperative clinical data including: Port site examination. Presence of predisposing factors as: Chronic coughing, constipation and/or straining. BMI calculation (kg/m^2).

Surgical details: Type of surgery: Cholecystectomy, appendectomy, bariatric surgery, colectomy, nissen fundoplication (hiatal hernia), inguinal hernia repair, salpingectomy and adhesiolysis. Size of ports: 5mm, 10mm, >10mm. Closure of the sheath and peritoneum (Figs. 1-3) was done to all patients using Polypropylene (prolene 2-0) sutures at ports of 10mm. or more.



Fig. (1): Showing passing suture through one end of peritoneum and sheath.



Fig. (2): Showing passing suture through the other end of peritoneum and sheath.



Fig. (3): Showing tying the knot over peritoneum and sheath.

Follow-up data: At first, the patients were reviewed three weeks postoperatively for evidence of any surgical complications such as: (Wound infection, seroma or hematoma). Then, the patients were re-assessed six months postoperatively for evidence of any port site hernias. Assessment of the patients was conducted both clinically and radiologically using Ultrasound.

Statistical analysis and data interpretation:

Data analysis was performed by SPSS software, version 25 (SPSS Inc., PASW statistics for windows version 25. Chicago: SPSS Inc.). Qualitative data were described using number and percent. Quantitative data were described using mean \pm Standard deviation for normally distributed data after testing normality using Kolmogorov-Smirnov test. Significance of the obtained results was judged at the (≤ 0.05) level. Chi-Square, Fischer exact test, Monte Carlo tests were used to compare qualitative data between groups as appropriate Student *t*-test was used to compare 2 independent groups for normally distributed data.

Results

Mean age of the studied cases was 32.33 ± 10.65 years ranging from 18 to 70 years. 35% of the cases are males and 65% are females. Mean body mass index of the studied cases is 29.11 ± 5.96 ranging from 20 to 44 kg/m^2 .

6% of the studied cases had diabetes, 15% smokers and 2% autoimmune disease including one case rheumatoid arthritis and one case hypothyroidism.

51% of the studied cases underwent Lap Appendectomy, 39% Lap Cholecystectomy, 5% Lap Sleeve Gastrectomy, 2% lap Nissen fundoplication and 1% Lap Extended Right Hemicolectomy, 1% Lap Left Hemicolectomy and 1% Lap Salpingectomy and adhesiolysis.

47% of the studied cases had Port site extension. Site of the enlarged port is distributed as following; 36% Epigastric, 9% lateral and 2% Umbilical.

Mean operative time was 82.99 ± 33.36 minutes ranging from 35 to 224 minutes.

2% of the studied cases developed infection (one at the left lateral port and the other one at the umbilical port). 2% of the studied cases developed seroma (both at the umbilical port). 4% of the studied cases developed port site hernia whereas 96% of the studied cases did not develop port site hernia. There were 4 cases that developed port site hernia, 3 of which developed the hernia at the umbilical port site and one at the left lateral port site.

A statistically significant difference was found between studied groups as regard age, presence of diabetes, type of Operation done, higher mean operative time, presence of postoperative complications in the form of higher infection and seroma rate ($p < 0.05$). There were 4 cases with port site hernia with their mean age 42.75 ± 15.48 , 50% males, mean body mass index was $33.25 \pm 4.57 \text{ kg/m}^2$. 3 cases were diabetic, one case had autoimmune disease and one case was smoker. Of the studied cases with port site hernia; 2 cases underwent Lap Appendectomy, one case underwent Lap Extended Right Hemicolectomy and one case underwent Lap Left Hemicolectomy. Mean operative duration was

157.75 ± 74.84 minutes. 2 cases developed postoperative infection and 2 cases developed seroma. Of the studied cases with port site hernia; 3 cases had port site extension.

Table (1): Sociodemographic characteristics of the studied cases.

	N=100	%
Age /years:		
Mean \pm SD (min-max)	32.33 ± 10.65 (18-70)	
Sex:		
Male	35	35.0
Female	65	65.0
Body mass index (kg/m^2):		
Mean \pm SD (min-max)	29.11 ± 5.96 (20-44)	

Table (2): Distribution of the studied cases according to associated comorbidities.

Comorbidities	N=100	%
DM	6	6.0
Autoimmune disease	2	2.0
Smokers	15	15.0

Table (3): Distribution of the studied cases according to the type of operation.

Operation done	N=100	%
Lap Appendectomy	51	51.0
Lap Cholecystectomy	39	39.0
Lap Extended Right Hemicolectomy	1	1.0
Lap Nissen fundoplication (Hiatus Hernia Repair)	2	2.0
Lap Left Hemicolectomy	1	1.0
Lap Salpingectomy and adhesiolysis	1	1.0
Lap Sleeve Gastrectomy	5	5.0

Table (4): Number and Site of port extension distribution among studied cases.

	N=100	%
Port extension number	47	47.0
Site of Port extension:		
Epigastric	36	36.0
Lateral	9	9.0
Umbilical	2	2.0

Table (5): Operative time distribution among studied cases.

	N=100	%
Operative time / minutes:		
Mean \pm SD	82.99 ± 33.36 (35-224)	

Table (6): Post-operative complications among studied cases.

Post-operative complications	N	%
Infection	2	2.0
Seroma	2	2.0

Table (7): Distribution of the studied sociodemographic, clinical and operative characteristics according to incidence of port site hernia.

	Patients with no Port site hernia n=96 (%)	Patients with Port site hernia n=4 (%)	Test of significance
<i>Age/years:</i>			
Mean \pm SD	31.89 \pm 10.29	42.75 \pm 15.48	$t=2.03$ $p=0.045^*$
<i>Sex:</i>			
Male	63 (65.6)	2 (50.0)	FET=0.412
Female	33 (34.4)	2 (50.0)	$p=0.610$
Body mass index (kg/m ²)	28.93 \pm 5.97	33.25 \pm 4.57	$t=1.43, p=0.157$
<i>Comorbidities:</i>			
DM	3 (3.1)	3 (75.0)	FET=35.17, $p<0.001^*$
Autoimmune disease	1 (1.0)	1 (25.0)	FET=0, $p=1.0$
Smokers	14 (14.6)	1 (25.0)	FET=0.327, $p=0.568$

Table (8): Distribution of the type of operation, operative time, post-operative complications and port site extension among studied groups with port site hernia.

<i>Operation done:</i>			
Lap Appendectomy	49 (51)	2 (50)	MC=49.96
Lap Cholecystectomy	39 (40.6)	0	$p<0.001^*$
Lap Extended Right Hemicolectomy	0	1 (25)	
Lap Hiatus Hernia Repair	2 (2.1)	0	
Lap Left Hemicolectomy	0	1 (25)	
Lap Salpingectomy and adhesiolysis	1 (1)	0	
Lap Sleeve Gastrectomy	5 (5.2)	0	
<i>Operative time / minutes:</i>			
Mean \pm SD	79.88 \pm 27.16	157.75 \pm 74.84	$t=5.13$ $p=0.001^*$
<i>Post-Operative complications:</i>			
Infection	0	2 (50)	FET=48.98, $p<0.001^*$
Seroma	0	2 (50)	FET=48.98, $p<0.001^*$
Hematoma	0	0	$p=1.0$
<i>Port site extension:</i>			
-ve	52 (54.2)	1 (25)	FET=1.31
+ve	44 (45.8)	3 (75)	$p=0.339$

MC: Monte Carlo test. FET: Fisher exact test. t : Student t -test.

Discussion

Despite the benefits of laparoscopic surgery, it can result in its own unique complications, such as the formation of a trocar site hernia or port site hernias, which have been reported when using non-bladed trocars [8].

Port site hernia is an incisional hernia occurring at the trocar insertion sites after different types of laparoscopic surgeries Nofal et al. [5].

Port site hernia is an iatrogenic complication with a documented incidence between 0.65% and 2.8%. However, the true incidence could be higher because of delayed onset, asymptomatic nature, and loss to follow-up. Port site hernia could be further complicated by incarceration or strangulation leading to small bowel obstruction requiring emergent

surgical intervention, thus imposing significant financial and emotional burden to patients [9].

This current study aimed to evaluate the incidence of occurrence of port site hernia after most types of laparoscopic surgery and possible related risk factors and complications. To obtain this aim, 100 patients who underwent laparoscopic surgery at Souad Kafafi University Hospital, Misr University for Science and technology were enrolled.

In our study the mean operative time among overall studied cases was 82.99 \pm 33.36 minutes ranging from 35 to 224 minutes with 4 operations out of 100 had a mean operative time of 157.75 \pm 74.8 minutes due to the type of operation itself. These 4 operations were laparoscopic extended right hemicolectomy, laparoscopic left hemicolectomy and two laparoscopic appendectomy.

In comparison to Sayed and Abu [10] study that included 150 patients who underwent laparoscopic cholecystectomy and laparoscopic appendectomy, mean operative time was 52 ± 3.2 minutes.

In comparison also Nofal et al. [5] study which included 2930 patients who underwent laparoscopic cholecystectomy were followed up for variable periods of time, the mean operative time was 41.8 minutes ranging between 20 and 120 minutes.

The presence of a great variety of operations performed in our current study contributes to the significant difference in the mean operative time in comparison to previously mentioned studies (where only laparoscopic appendectomy and cholecystectomy were done).

In the current study port site hernia was reported in 4% of studied cases.

In line with our study, Sayed and Abu [10] study reported port site hernia in 4% of patients.

On the contrary, lower incidence of port site hernia was reported in 0.20% of patients in Nofal et al. [5] study.

In Chatzimavroudis et al. [11] study, 0.94% of patients presented port site hernia.

This may be contributed to performing only one type of operation in the previous studies which was laparoscopic cholecystectomy.

Whereas Comajuncosas et al. [12] reported a remarkably high rate of port site hernia (25.9%) following laparoscopic cholecystectomy, based on the results of a prospective 3-year follow-up study. Although significantly different from the results of other studies, their results could be explained in two ways: Firstly the authors had a long follow-up period (mean 46.8 months) in comparison to our study (6 months follow-up period) and also in comparison to Chatzimavroudis et al. [11] (one year follow-up period) and secondly because they used ultrasound to diagnose asymptomatic port site hernia.

Moreover, in Hernandez et al. [13] study that included 241 patients undergoing laparoscopic appendectomy, the incidence of port site hernia after laparoscopic appendectomy was 20.3%, all of which were diagnosed via abdominal CT scan.

These differences can be attributed to different follow-up durations in each study, which underlines the importance of an adequate follow-up time and denotes that a few cases of asymptomatic port site hernia (especially in overweight and obese patients) remain undiagnosed; therefore, the true incidence of port site hernia may be considerably higher than reported.

In our current study 75% of cases with port site hernia developed were at the umbilicus. This comes along with Nofal et al. [5] who reported that two-third of cases with hernia were reported at the umbilical port site after using 10 mm trocar.

In another study conducted by Coda et al. [14], Port site hernia occurs primarily at the umbilical trocar site because most trocars used in the umbilicus are large.

Trying to explain the higher prevalence of port site hernia at the umbilical site, Helgstrand et al. [15] proposed the theory that the fascia at the umbilicus is not covered with a muscle layer and is, therefore, more prone to hernia [15].

In our current study, there was more than one significant factor that contributed to the development of port site hernia at the umbilical port in 75% of the herniated cases. Infection, seroma, port site extension and presence of comorbidities like diabetes mellitus, all contributed to occurrence of port site hernia at the umbilical port. These risk factors will be furthermore discussed in the following discussion.

In the current study Patients who had port site hernia were significantly older when compared to patients who had no port site hernia (42.75 ± 15.48 vs 31.89 ± 10.29 years; $p=0.045^*$).

In agreement with our study, most of the port site hernia cases in Sayed and Abu [10] study belonged to the older age groups.

Additionally, Hernandez et al. [13] study reported age greater than 59 years as a risk factor for port site hernia.

Furthermore, Zhu et al. [16] reported that the rate of port site hernia was significant higher in elder patients than in younger patients.

Additionally, the results of Karampinis et al. (2019) meta-analysis revealed that parous women older than 60 years may have unrecognized fascial defects, which confer a higher risk of port site hernias after laparoscopic surgery, even in the absence of incision manipulation or prolonged surgical duration.

This can be contributed to the fact that with aging there is loss of overall muscle mass and lack of muscular protection of anterior abdominal wall combined with weakness of abdominal wall with old age, especially if combined with other risk factor as diabetes and obesity.

In our study, no significant difference was reported between studied groups regarding gender.

In contrast, Sayed and Abu [10] reported higher female prevalence among port site hernia cases, the

female prevalence was higher, and the male: female ratio was 1:2.

Moreover, Nofal et al. [5] reported that female gender was a risk factor for development of port site hernia.

The difference can be attributed to smaller sample size in our study compared to the previously mentioned studies.

In the current study, the prevalence of diabetes mellitus among studied patients who had port site hernia was significantly higher when compared to patients who had no port site hernia (75% vs 3.1%; $p < 0.001$).

In accordance with our study, major risk factors for port site hernia in Nofal et al. [5] study included diabetes mellitus.

In our current study, infection was reported in 2% of studied cases. The first one at the left iliac lateral port and the second one is at the umbilical port. Both cases underwent laparoscopic appendectomy. Also in our study 2% of studied cases were reported to have seroma. Both of them had seroma at the umbilical port site after laparoscopic extended right hemicolectomy and left hemicolectomy.

In comparison to Sayed and Abu [10] where only 0.6% of cases had post-operative port site infection and 1.3% had port site seroma.

In our current study, incidence of postoperative infection among patients who had port site hernia was higher when compared to patients who had no port site hernia (50% vs 0%; $p < 0.001^*$).

In agreement with our finding, major risk factors for port site hernia in Nofal et al. [5] study included wound infection.

Whereas Sayed and Abu [10] reported that port site infection was a possible cause of port site hernia in 16.7% among patients with port site hernia.

In our study, BMI among patients who had port site hernia was higher when compared to patients who had no port site hernia (33.25 ± 4.57 vs $28.93 \pm 5.97 \text{ kg/m}^2$; $p = 0.157$). Yet the difference was not significant.

This comes along with Nofal et al. [5] who reported that obesity was a major risk factors for port site hernia.

Similarly, Hernandez et al. [13] study reported obesity (BMI > 30) as a risk factor for port site hernia.

In addition, Chatzimavroudis et al. [11] identified obesity as an independent risk factor for port site hernia.

Moreover, obesity has been identified by Julliard et al. [17]; Armananzas et al. [18] as a significant risk factor for port site hernia formation.

Additionally, Agaba et al. [19] also demonstrated that 83% of patients who developed port site hernias classified as obese and 50% of these patients meeting criteria for morbid obesity.

In the current study, operative time among patients who had port site hernia was significantly prolonged when compared to patients who had no port site hernia (157.75 ± 74.84 vs 79.88 ± 27.16 minutes; $p = 0.001^*$).

In line with our finding, major risk factors for port site hernia in Nofal et al. [5] study included lengthy procedure.

In addition, Nofal et al. [5] reported that the earliest patient to present with port site hernia was the patient who presented acutely and had the longest operative time.

In our current study, 75% (3 cases out of 4) of port site hernia cases had port site extension. Two cases had umbilical port extension for specimen retrieval in laparoscopic extended right hemicolectomy and laparoscopic left hemicolectomy. These two cases had diabetes mellitus, prolonged operative time (exceeding 3 hours) and post-operative seroma at the umbilical port. One case had left iliac lateral port extension for laparoscopic appendectomy for specimen retrieval and was complicated with post-operative infection.

Conclusion:

Port site hernia is a rare type of incisional hernia occurring at port sites after a laparoscopic surgery. Closure of both the fascia and the peritoneum is performed if the original incision is greater than 5mm. Risk factors leading to the occurrence of post-laparoscopic port site hernia are still under investigation but based on our findings, incidence of port site hernia was significantly associated with older age, post-operative port site infection, Obese patients as identified by BMI and prolonged operative time.

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نسبة حدوث فتق موقع المدخل الجراحي ما بعد الجراحة بالمنظار: تقييم اكلينيكي واشعاعى

هدفت الدراسة الحالية إلى تقييم حدوث فتق بموقع مدخل المنظار الجراحي بعد معظم أنواع الجراحة بالمنظار وعوامل الخطر ذات الصلة والمضاعفات المحتملة. ولتحقيق هذا الهدف ١٠٠ مريض ممن خضعوا للجراحة بالمنظار فى مستشفى سعاد كفاى الجامعى. جامعة مصر للعلوم والتكنولوجيا تم اختيارهم.

من الدراسة الحالية يمكننا تلخيص ما يلى:

- متوسط عمر الحالات المدروسة $32,33 \pm 65,10$ سنة تتراوح من ١٨ إلى ٧٠ سنة ٣٥٪ من الحالات إناث ومتوسط مؤشر كتلة الجسم للحالات المدروسة $29,11 \pm 96,5$ ويتراوح من ٢٠ إلى ٤٤ كجم / م ٢. من بين مرضانا الخاضعين للدراسة، كان ١٥٪ من المرضى مدخنين.

- فى الدراسة الحالية، خضع ٣٩٪ من الحالات المدروسة لاستئصال الحويصلة المرارية بالمنظار، وخضع ٥١٪ من الحالات لاستئصال الزائدة الدودية بالمنظار، وخضعت ٥٪ من الحالات لتكميم المعدة بالمنظار، وخضع ٢٪ من الحالات لإصلاح فتق الحجاب الحاجز بالمنظار، وخضع ١٪ من الحالات لاستئصال ممتد للقولون الصاعد بالمنظار، ١٪ استئصال نصفى للقولون النازل بالمنظار، ١٪ استئصال قناة فالوب وإزالة التصاقات بالمنظار.

تم تسجيل ٤٧٪ توسيع موقع مدخل المنظار الجراحي من الحالات المدروسة. تم توزيع نسبة توسيع موقع مدخل المنظار الجراحي كما يلى: فوق سرى بنسبة ٣٦٪، جانبي بنسبة ٩٪ وسرى بنسبة ٢٪.

- بلغ متوسط المدة الزمنية الجراحية للحالات المدروسة $82,99 \pm 33,36$ دقيقة تتراوح من ٣٥ إلى ٢٢٤ دقيقة.

- تم حدوث الفتق بموقع المدخل الجراحي على النحو التالى؛ سرى فى ٣٪ من الحالات وجانبي فى ١٪ من الحالات.

- كان المرضى الذين يعانون من الفتق أكبر سناً بشكل ملحوظ عند مقارنتهم بالمرضى الذين ليس لديهم فتق.

- كانت نسبة تلوث الجرح بعد العملية الجراحية بين المرضى الذين يعانون من فتق أعلى بالمقارنة مع المرضى الذين ليس لديهم فتق.

- كان مؤشر كتلة الجسم بين المرضى الذين يعانون من فتق أعلى مقارنة بالمرضى الذين لم يعانون من الفتق.

- كانت مدة الجراحة بين المرضى الذين يعانون من فتق طويلة بشكل ملحوظ بالمقارنة مع المرضى الذين ليس لديهم فتق.

ولذلك نستخلص ما يلى، كان حدوث الفتق مرتبطاً بشكل كبير مع تقدم العمر، حدوث تلوث بموقع المدخل الجراحي، السمنة حسب تعريفها بمؤشر كتلة الجسم والمدة الطويلة للجراحة.