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Di Lorenzo N, Coscarella G, Lirosi F, Gaspari A. Port-site closure: a new problem, an old device. JSLS. 2002; 6:181–183.

Di Lorenzo N, Coscarella G, Lirosi F, Pietrantuono M, Susanna F, Gaspari A. Trocars and hernias: a simple, cheap remedy. Chir Ital. 2005;57:87–90.

Ashwin Rammohan, R.M. Naidu. Laparoscopic port site Richter's hernia – An important lesson learnt. Int J Surg Case Rep. 2011; 2: 9–11.

Tonouchi H., Ohmori Y., Kobayashi M., Kusunoki M. Trocar site hernia. Arch Surg. 2004; 139:1248–1256.

Audrius Dulskas, Raimundas Lunevičius, and Juozas Stanaitis. A case report of incisional hernia through a 5 mm lateral port site following laparoscopic cholecystectomy.J Minim Access Surg. 2011; 7: 187–189.

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Subcostal Port and the Port Site Hernia: A Comparative Study

Hussain A*, EL-Hasani S**

Institution
*Doncaster & Bassetlaw Teaching Hospitals, Doncaster Royal Infirmary, Doncaster, UK
Sheffield University, Western Bank, Sheffield S10 2TN, UK

**King's College Hospital, Denmark Hill, Brixton, London SE5 9RS, UK

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Abstract

Background: A port site hernia is a complication of laparoscopic surgery with an average incidence of 1–6%. The aim of this study is to assess the incidence of port site hernias with and without the use of a subcostal port.

Methods: This is a retrospective comparative study comparing the incidence of port site hernias in 6424 and 4774 patients operated upon in 2011–2015 and 2000–2007, respectively. In the first group, laparoscopic procedures were performed using subcostal ports. The subcostal ports of 10–12 mm were inserted at the midclavicular line immediately at the subcostal region. The ports were closed at the skin level only. The patients were reviewed at 1, 3, 6, 12 and 24 months for bariatric surgery. The other patients were reviewed 6–8 weeks after the operations. This cohort was compared to a second group of patients using a non-subcostal port technique with a similar follow-up plan. The correlation and p-value were calculated.

Results: Of the 4774 patients who had operations during 2000–2007, eight port site hernias were reported, while none were reported in the other group. There were significant correlations and differences in the incidence of PIH between the two arms of the study. The p-value was 0.02.

Conclusions: The use of a subcostal port reduces the occurrence of a port site hernia.

Key Words

Subcostal Port; Port Site Hernia; Laparoscopic Surgery; Laparoscopic Cholecystectomy; Bariatric Surgery

Corresponding Author:
Dr Hussain Abdulzahra; E-mail: azahrahussain@yahoo.com

Introduction: Laparoscopic surgery is widely practiced with a high safety profile, despite known complications. One such complication is the port site incisional hernia (PIH), which has variable incidences that have been previously reported to be between 1-6%, but could be as low as 0.14% or as high as 22%. PIH can be a dangerous complication that requires a second operation: a bowel resection and a longer hospital stay with an extra cost[3]. PIH is frequently reported with large ports, usually more than10mm[4]; however, it can develop at 5mm ports[5, 6]. The aim and primary end point of this study was to assess the incidence of PIH with and without a subcostal port.

Materials and Methods: The STORBE statement was used for this study's methodology. Since January 2011 to April 2015, one to two subcostal ports were used for all consequent 6424 patients (age group 11–91 years) who underwent different laparoscopic operations (see Table 1). The subcostal ports of 10–15mms were inserted at the midclavicular line immediately at either subcostal region. Two senior surgeons performed the procedures. The subcostal port sites were inspected from the inside after withdrawal of the ports, before deflation, were closed at the skin level only. When the port was extended, closure at the sheath level under direct vision from outside and inside through laparoscopy was performed before deflation. This arm of the study was compared to 4774 patients (operated upon 2000–2007) who had their operations performed by the same team (with the same follow-up plan) using 10–15mm ports and a non-subcostal technique at sites other than the subcostal region (see Table 1). The patients' mean age was 52 years (range: 11–91). The Body Mass Index of the bariatric group was between 37 and 65 (mean: 48), while for the non-bariatric group the range was between 23 and 68 (mean: 26). The American Society of Anaesthesiologists (ASA) score ranged from 1 to 3. Our department of surgery approved the study protocol.

Table 1: Procedure type and number of subjects. 95% confidence interval(-609.69 to 954.44),

Procedure	Number of Operations in Subcostal Arm	Number of Operations in Non-Subcostal Arm	P-value
Laparoscopic Nissen fundoplication	150	456	
Laparoscopic inguinal hernia repair	1203	1833	
Laparoscopic abdominal wall hernia	96	64	
Laparoscopic appendectomy	189	250	
Laparoscopic insertion of gastric band	1891	0	
Laparoscopic gastric bypass	851	550	
Laparoscopic sleeve gastrectomy	153	0	
Laparoscopic cholecystectomy	1620	1621	
Standard deviation	769.13	728.57	
SEM	258.09	257.59	
Total	6424	4774	0.6437

Study Design: Comparative study Setting: The study was conducted at two university hospitals and included two groups of patients who underwent laparoscopic surgery by two different techniques during 2011–2015 and 2000–2007, respectively. The difference in years between the two groups of patients is due to the change from previous non-subcostal techniques to the new subcostal technique. Prospectively recorded data on Excel file sheets for all laparoscopic procedures that were performed by our team were used for this study. The data of patients who developed PIH were collected from case notes. The patients were followed up within the clinic and clinically assessed by surgeons. Patients who were referred for symptoms of PIH were clinically assessed. If there was no clinical evidence of PIH, they were referred for imaging studies by ultrasound (USS) or computed tomography (CT) scans. Patients who had PIH were managed by further surgery.

Participants: Consecutive cohorts of patients aged* 11–91 were recruited during two different periods as described above. The inclusion criteria were any patient who was referred for laparoscopic surgery, fit for general anaesthetics and pneumoperitoneum, in the age range of 11–91 years old, willing to have laparoscopic surgery and had no history of hostile abdomen or extensive laparotomies. The exclusion criteria were the age group below 11 and above 91 years, those who had converted from laparoscopic to laparotomy, had extensive laparotomies and those who were not willing to have laparoscopic surgery. Both groups had undergone different kinds of laparoscopic upper gastrointestinal, bariatric and general surgical procedures.

Variables: The primary end point was the port site hernia.

Data Sources/Measurement: The data were collected from case notes and the preoperative recorded data by the two surgeons and stored on a hospital PC using an encrypted password. Members of the team who were not involved in the primary procedure performed post-operative clinical follow-up. When the PIH were identified, further assessment by the operating surgeon was arranged. The repair of clinically or radiologically confirmed PIH was then conducted.

Bias: The inclusion of consecutive series of patients reduced the selection bias. The assessment by a member of the team who did not take part in the operations did not completely eliminate the bias but possibly minimised it. The operating surgeons had assessed all patients with the diagnosis of PIH.

Study Size: Selection of large sample sizes to

demonstrate the statistical difference was vital for this study. To demonstrate the statistically significant difference – taken power to 80%, confidence 95%, 0.2% as the accepted lower incidence of PIH – a sample size of 3919 patients were needed in each arm of the study. A total of 7838 patients needed to be included. Thus, we included a larger sample to produce the required statistical significance.

Quantitative Variables: The number of PIH incidences was recorded, and the incidence was calculated for either group.

Statistical Methods: Statistical analysis was performed using two-sample t-tests to see whether the change in the mean between the two arms was actually significant. The standard deviation was calculated for both groups. The Pearson correlation coefficient was calculated to measure the strength of a linear association between the PIH and the use of the subcostal ports. A p-value < 0.05 was considered significant.

Technique: 1. The pneumoperitoneum was induced using a Veress needle at the umbilicus, followed by an incision in the subcostal area underneath the lower border of the costal margin, stretching the abdominal wall skin and muscle towards the pelvis (see Figure 1). The port was inserted in the direction of the intended dissection but not too oblique. It was crucial not to injure the lower margin of the rib, which may cause extensive post-operative pain. The port was closed at the skin level.

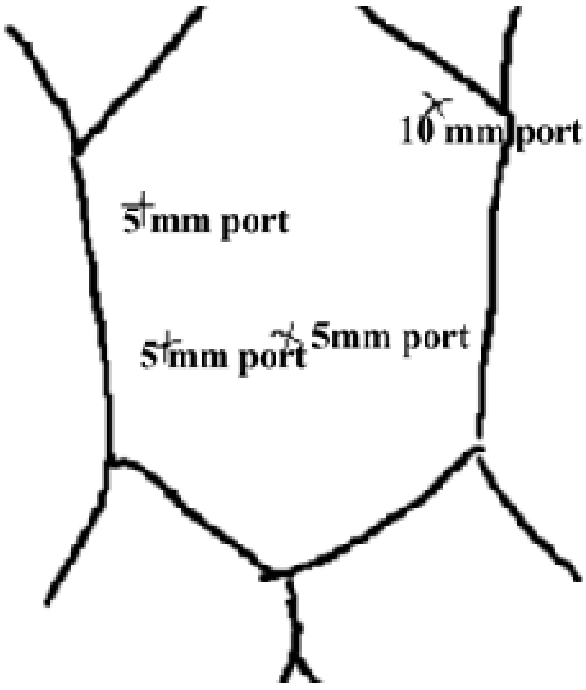

Figure 1: Subcostal port location in laparoscopic cholecystectomy

2. A traditional non-subcostal port technique was used for the second group of patients. For the bariatric patients (RYGB, LSG, AGB), we used five ports: one 5mm epigastric port, one 5mm right-side port 2 inches below the umbilicus at the midclavicular line, one 10–12mm port at the umbilicus level at the midclavicular line, one 10–12mm port at the epigastric area 3 inches below the xiphi sternum, and one 10mm port at the same level on the right side. For Nissen fundoplication, the same ports as mentioned above were used except that the left 10–12mm port was replaced by a 5mm port. For inguinal hernia repair, we used a 10–12mm port at the umbilicus and two 5mm ports at the respective side of the umbilicus 2 inches laterally and at the midclavicular line. For the abdominal wall hernia repair, we used a 10–12mm port at 3–4 inches at the umbilicus and two 5mm ports 3 inches above and below the 10–12mm port at the anterior axillary line. For the appendectomy, we used one 10mm port at the umbilicus and two 5mm ports at the suprapubic area and on the left side 3 inches from and at the umbilicus level. Lastly, for the cholecystectomy, we used a 10–12mm port at the umbilicus and the epigastrium (just below the xiphisternum) and two 5mm ports at the left subcostal and 3 inches from and at the umbilicus. Follow-up of bariatric patients were performed according to our local protocol at 1, 3, 6, 12 and 24 months. Other patients were followed up with 6 weeks after surgery, and then general practitioners referred patients when they developed PIH.

Results: The first arm included 6424 laparoscopic procedures using subcostal ports, and no port site hernias were reported. For the other arm of the study (4774 patients), 8 PIHs were reported. There was no significant difference between the two arms with regard to the number of operations, with the two-tailed p-value = 0.643. The standard deviations were 729.98 and 728.57 for the first group and second group, respectively. Two hernias developed after cholecystectomy, and one hernia developed after Nissen fundoplication. The other five hernias developed after a groin hernia repair. There was a strong linear correlation between the non-use of a subcostal port and the incidence of PIH. The Pearson correlation coefficient was 1. There was a significant difference in the incidence of PIH between the two arms, with the p-value = 0.02 (see Table 2).

Discussion: The laparoscopic ports locations were varied for each procedure according to the surgical preference, anatomical site, extent and type of the operations, body habitus and the presence of previous scars or abdominal wall changes. PIH is a rare complication, and eight (0.14%) PIH were reported in a long-term study of more than 5000

Table 2: The incidence of PIH and p-value

Technique	Subcostal Port Use	Non-Subcostal Port Use
Number of operations in subcostal	6424	4774
Number of port site incisional hernia PIH	0	8
t-test using 2-samples analysis, p-value	0.021058547	

patients in 2009[7]. Different techniques were suggested to reduce the incidence of PIH[8-11].

We used 11–12mm ports in the left subcostal area after induction of pneumoperitoneum for laparoscopic anti-reflux surgery. We used bilateral subcostal ports for gastric bypass. Five (0.3%) epigastric PIH were confirmed after 1620 laparoscopic cholecystectomies (LC). The epigastric port was 10mm but was extended to about 3–5cm in 10% of cases to extract a large gallbladder, and hence, we had problems with 5 incisional hernias even after the closure of the sheath with a PDS suture, which failed or was inadequate. Authors reported a higher incidence of PIH at the epigastric port that were used for extracting specimens[12].

To address the problem of PIH, we adopted a different port insertion approach in LC where subcostal 10mm ports were used and no epigastric port was used. The extraction port could be extended if the gallbladder or the gallstones were large (see Figure 1).

For laparoscopic repair of the inguinal hernia, we inserted a 10mm port at the umbilicus for camera and mesh deployment. The problem with this port was the difficult closure in high BMI patients or those with thick subcutaneous fat; thus, the risk of incisional hernia was possible. We changed the technique to insert a 5mm port at the umbilicus for the camera and adopted a left subcostal port (contralateral to the hernia site), where we introduced the mesh and the Vicryl stitch through to close the peritoneum. In the laparoscopic appendectomy, we used the subcostal port at the left side. On occasions when the appendix was thick and could not be extracted through a 5mm port, we used a larger port – 10mm, 12mm or even sometimes 15mm – to extract the bulky appendix without contaminating the abdominal wall and without the need for the bag. Previously, we extended the suprapubic port and closed the fascia with a PDS suture, and as a result, we had one PIH. The risk of PIH after bariatric surgery could reach 1.6%[13]. We used subcostal ports for gastric bypass, sleeve gastrectomy and gastric band insertion, and no PIH was reported for more than 2000 patients during the follow-up period of 2 years.

There was no need to close any of the muscle layers or the fascia at the subcostal port because the muscles will contract at or above the costal margin, preventing development of PIH. There were occasions where the left subcostal port in LC needed extension to extract large specimens and/or large stones. In these cases, we closed the sheath using a PDS suture.

The post-operative pain was managed by first-line analgesic ladder medications. Bearing in mind the spectrum and the workload of minimal access surgery, the use of a subcostal port in emergency and elective laparoscopic surgery is expected to reduce the incidence of PIH and its complications.

Limitations of the Study: This was a retrospective hernia study of consequent cohorts of patients using subcostal 10–12mm ports in one arm and non-subcostal ports in the second arm. Similar to other hernia studies, it has the inherent weakness of long-term follow-up. However, we conducted the full 2 years clinical follow-up of more than 2000 patients who underwent bariatric surgery, who were at risk of developing PIH. The rest of the patients were seen 6 weeks after the operation for either arms, and only early PIH was potentially detectable. The general practitioners assessed and referred patients to our unit if any suspected or diagnosed PIH. The true incidence of asymptomatic PIH may be underrepresented, especially for non-bariatric patients for whom we had a general practitioner assessment after our clinical 6 weeks of postoperative follow-up. It was not possible to review and assess 11,000 patients with longer follow-up (apart from the 2000 bariatric patients).

In the UK, about 60,000 LC are performed each year. If we take our very low 0.3% incidence of PIH following LC as a benchmark, then 185 PIH are expected to develop after LC each year, which need

repairs and put extra costs and pressure on the already stretched health system. If we consider the workload and the different practices of laparoscopic surgery in the UK, the impact is even larger.

Conclusion: The use of a subcostal port reduces the risk of port site incisional hernia. Changing from a classic to subcostal technique is expected to reduce the incidence of port site hernias, the morbidity of surgery and the cost of treatment.

Declarations

Authors' Contributions:

S El-Hasani contributed by ideation, collection of the data and approving the final version.
A Hussain, drafted the study, analysed the data, did the statistical analysis, formatted the tables and figure and approved the final version.

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Authors confirm no financial support and no sponsorship for this study.

Conflicts of Interest:

Both authors declare no conflict of interest

References

1. Di Lorenzo N, Coscarella G, Lirosi F, Gaspari A. Port-site closure: a new problem, an old device. JSLS. 2002; 6:181–183.
2. Di Lorenzo N, Coscarella G, Lirosi F, Pietrantuono M, Susanna F, Gaspari A. Trocars and hernias: a simple, cheap remedy. Chir Ital. 2005;57:87–90.
3. Ashwin Rammohan, R.M. Naidu. Laparoscopic port site Richter's hernia – An important lesson learnt. Int J Surg Case Rep. 2011; 2: 9–11.
4. Tonouchi H., Ohmori Y., Kobayashi M., Kusunoki M. Trocar site hernia. Arch Surg. 2004; 139:1248–1256.
5. Audrius Dulskas, Raimundas Lunevičius, and Juozas Stanaitis. A case report of incisional hernia through a 5 mm lateral port site following laparoscopic cholecystectomy.J Minim Access Surg. 2011; 7: 187–189.
6. Miya Yamamoto, Laura Minikel, and Eve Zaritsky.Laparoscopic 5-mm Trocar Site Herniation and Literature Review.JSLS. 2011; 15: 122–126.
7. Hussain A, Mahmood H, Singhal T, Balakrishnan S, Nicholls J, El-Hasani S.Long-term study of port-site incisional hernia after laparoscopic procedures.JSLS. 2009;13:346-9.
8. Hussain A, Mahmood H, Shuaib S, El-Hasani S.Prevention of trocar site incisional hernia following laparoscopic ventral hernia repair.JSLS. 2008;12:206-9.
9. Shafer Z. Port closure technique. Surg Endosc. 2007;21:1264–1274.
10. Chiu CC, Lee WJ, Wang W, Wei PL, Huang MT. Prevention of trocar wound hernia in laparoscopic bariatric operations. Obes Surg. 2006;16:913–918.
11. Morenzo-Sanz C, Picazo-Yeste JS, Manzanera-Diaz M, HerreroBogajo ML, Cortina-Oliva J, Tadeo-Ruiz G. Prevention of trocar site herniae: description of the safe port plug technique and preliminary results. Surg Innov. 2008;15:100–104.
12. Bunting DM1. Port-site hernia following laparoscopic cholecystectomy.JSLS. 2010 ;14:490-7.
13. Pilone V1, Di Micco R2, Hasani A3, Celentano G2, Monda A2, Vitiello A2, Izzo G2, Iacobelli L2, Forestieri P2. Trocar site hernia after bariatric surgery: our experience without fascial closure.Int J Surg. 2014;12 Suppl 1:S83-6.

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