



PORT SITE COMPLICATIONS IN MINIMALLY INVASIVE SURGERY: INSIGHTS AND OUTCOMES FROM A TEACHING HOSPITAL

Dr. Tony Mathew¹, Dr. Justine Samuel Johny², Dr. Naveen George³, Dr. Obed Manuel Kuruvilla⁴, Dr. Renji Mathew⁵, Dr. Denny Philip^{6*}

¹Associate Professor Believers Church Medical College Hospital, Kerala India

²Associate Professor, Believers Church Medical College Hospital, Kerala India

³Assistant Professor, Believers Church Medical College Hospital, Kerala India

⁴Assistant Professor, Believers Church Medical College Hospital, Kerala India

⁵Associate Professor, Believers Church Medical College Hospital, Kerala India

⁶Assistant Professor, Believers Church Medical College Hospital, Kerala India

***Corresponding author:** Dr. Denny Philip

*Assistant Professor, Believers Church Medical College Hospital, Kerala India

Abstract

Port site complications (PSCs) diminish the advantages of minimally invasive surgeries, increasing patient morbidity and affecting the surgeon's reputation. This study aims to identify the types of complications associated with port sites in laparoscopic procedures, explore their potential causes, and propose preventive measures. In this prospective study, we evaluated 200 patients who underwent laparoscopic surgeries at our centre from April 2022 to March 2024, focusing on port site complications and assessing the significance of various factors.

The mean age of the patients was 42.82 ± 16.24 years and the overall incidence of PSCs was found to be 8.5%. Our analysis revealed a statistically significant relationship between the number of ports used and the incidence of port site complications, with a p-value of 0.0035. Additionally, we found a statistically significant association between Body Mass Index (BMI) and the occurrence of port site complications, with a p-value of less than 0.0001.

These findings underscore the importance of considering the number of ports and BMI as key factors in minimizing the risk of PSCs in laparoscopic surgeries.

Keywords: Minimally Invasive Surgery, laparoscopy, port site complications, port site infection

Introduction

Laparoscopic surgery has gained widespread acceptance in recent years due to its numerous advantages over traditional open surgery. [1]. This minimally invasive technique is increasingly favoured across various surgical specialties in both public and private sectors, even in developing countries like India, where the demand continues to rise [2]. Laparoscopic procedures enable a wide range of surgical operations to be performed with minimal discomfort, reduced operational stress, lower complication rates, and shorter hospital stays compared to conventional open surgeries. [3]. Despite these benefits, it is essential to consider the potential complications associated with laparoscopic procedures in the era of minimally invasive surgery.[4]

Significant complications at laparoscopic port sites (PSCs) have been documented, including trocar site bleeding, infections, nerve injuries, chronic pain, hernias, and less common issues such as persistent discomfort, keloid formations and port site metastasis. Approximately 1.4% of complications occur per 20,000 laparoscopic surgeries. Complications are more common in obese patients, those with difficult abdominal access and in patients with improper fascial closure techniques.[5]. Complications can present either early (within a week after surgery) or later (up to a year post-surgery). Research has examined both immediate and delayed complications, including bleeding, infection, seroma development and metastases.[6]

Literature Review

Laparoscopic cholecystectomy (LC) is the most common laparoscopic surgery associated with port site complications (PSCs). This innovative technique introduces a new set of challenges that were not encountered with traditional open cholecystectomy.[7] Aspiring surgeons, in particular, must be aware of several critical issues: traumatic injuries related to access and the manipulation of laparoscopic instruments, diathermy damage due to coupling, inadvertent exposure of viscera leading to thermal injury, hepatobiliary damage from improper traction, inappropriate use of energy sources, and PSCs.[8] Additionally, the likelihood of complications tends to decrease as surgeons gain experience. However, teaching institutions may see a higher incidence of complications due to the ongoing training and frequent turnover of surgeons at all levels.[9] The primary potential cause of PSCs is obesity. Operating on obese patients necessitates the use of longer trocars, larger skin incisions and provides restricted access to laparoscopic instruments due to denser abdominal wall tissue. Additionally, wound healing is often compromised in obese patients. The incidence of PSCs also increases with the number of ports used.[10]

Materials And Methods

All patients undergoing laparoscopic surgery at Believers Church Medical College Hospital, India, were systematically monitored. The study period spanned from April 1 2022 to March 31 2024, and included a total of 200 cases. The inclusion criteria encompassed patients aged 8 to 80 undergoing laparoscopic surgeries. Exclusion criteria included patients under 8 years old, pregnant women, immunocompromised individuals and cases where laparoscopic surgeries were converted to open surgeries. Port sites were systematically monitored for complications for one year following surgery. Patients provided written informed consent before data collection and recruitment for the research. After completing preoperative evaluations and confirming fitness for anaesthesia, participants were scheduled for surgery. General anaesthesia was administered to all patients and each participant received preoperative antibiotics. Metallic ports were used in most of the cases. Pneumoperitoneum was created using Hasson's open technique. For adults, the commonly used port sizes were 12mm, 10mm and 5mm. The standard 10mm and 12mm ports were used for introducing meshes, sutures, and staplers, as well as for specimen retrieval, while the 5mm ports primarily served as working ports. All ports of size 10 mm and larger than 10 mm were closed in two layers. No. 1 polyglactin sutures were used to close the fascia and skin closure was done with 3.0 nylon sutures.

Post-operative port site complications (PSCs) were systematically monitored within a day, on the third postoperative day, at the subsequent follow-up (within a week), monthly thereafter and via phone calls for up to a year to identify any ongoing issues.

All data were analysed using IBM SPSS ver. 20 software. Data were expressed as numbers and percentages, and frequency distribution was used to tabulate the data. The level of significance was assessed at 5%.

Results and Discussion

This study included 200 patients, consisting of 126 males and 74 females. Patient ages ranged from 15 to 77 years, with the highest incidence of complications occurring in the 41-50 age group, which was not statistically significant ($p > 0.05$). [Table 1]. Port site complications were observed in 17 patients, representing 8.5% of the total cases. These complications occurred in 11 female and 6 male

patients, with no statistically significant difference between genders ($p > 0.05$). [Table 2] The average BMI was 26.3, and a statistically significant correlation ($p < 0.0001$) was found between BMI and the incidence of port site complications. [Table 3]. Laparoscopic cholecystectomy had the highest rate of port site complications, accounting for 47% of the cases in this study.

Among the 17 port-site complications observed, 9 cases (53%) were identified as port-site infections (PSIs) [Table 2]. All of these infections were superficial, affecting only the skin and subcutaneous tissue, with an incidence rate of 4.5%. The umbilical port site was found to be the most common location for these infections. Consistent with existing literature, the umbilical site is recognized as having a higher risk of PSI, highlighting the critical need for preventive measures such as antibiotic prophylaxis, strict adherence to sterile techniques, and the use of specimen bags during tissue extraction.

Table 1

Age Group	Male	Female	Total Participants	Percentage
<20 years	15	12	27	13.50%
21-30	32	13	45	22.50%
31-40	21	27	48	24%
41-50	16	10	26	13%
51-60	23	7	30	15%
>60 years	19	5	24	12%
Total	126	74	200	100
Mean age	42.82			
SD	16.24			

Table 2

Name of surgery	Infections	Bleeding	Hernia	c/c pain	Scar related	Total
Laparoscopic appendectomy (LA)	3	2	0	0	0	5
Laparoscopic cholecystectomy (LC)	5	1	1	0	1	8
Laparoscopic Ventral hernia repair (LUH)	0	0	1	1	0	2
Laparoscopic inguinal hernia repair (LIH)	0	1	0	0	0	1
Diagnostic laparoscopies (LDS)	0	0	0	0	0	0
Others	1	0	0	0	0	1
Total	9	4	2	1	1	17

Table 3

Procedure	BMI Category	Port site complication		Total
		Present	Absent	
Laparoscopic Appendectomy (LA)	Normal	1	29	30
	Overweight	2	10	12
	Obese	2	2	4
Laparoscopic Cholecystectomy (LC)	Normal	1	2	3
	Overweight	3	15	18
	Obese	4	3	7
Laparoscopic Ventral Hernia Repair (LVH)	Normal	0	6	6
	Overweight	1	25	26
	Obese	1	3	4
Laparoscopic Inguinal Hernia Repair (LIH)	Normal	0	40	40
	Overweight	0	29	29
	Obese	1	4	5
Diagnostic Laparoscopies (LDS)	Normal	0	1	1
	Overweight	0	6	6
	Obese	0	1	1
Others	Normal	0	3	3
	Overweight	0	3	3
	Obese	1	1	2

Port site bleeding occurred in four patients (23.5%) as a result of vessel injuries during the insertion of secondary trocars. This bleeding was managed with either bipolar cautery or by applying pressure. To minimize the risk of such complications, secondary trocars should be inserted under direct vision and with prior illumination of the abdominal wall. Additionally, the access site should be thoroughly inspected both during the creation of the port and after the port is removed.

Port site complications were significantly more frequent with larger ports (10 mm). Port site hernias occurred in two patients during the study. The first patient, who had undergone an IPOM Plus procedure, reported severe pain at a 10 mm port in the left lumbar region one week postoperatively. The second patient experienced swelling in the umbilical region six months after surgery, with a prior history of postoperative wound infection at the same port. Any port defects larger than 10 mm in size must be closed with sutures to reduce the risk of port-site hernia development. It is important to note that hernias have been documented at even 5 mm trocar sites, although such cases are rare.

In addition to these findings, one patient developed chronic pain at a 10 mm port in the left lumbar region from an IPOM Plus case. Another patient developed a keloid at the epigastric port site after undergoing a laparoscopic cholecystectomy. No other side effects, such as subcutaneous emphysema, omental entrapments, or metastases to the port site, were observed.

Conclusion

Wound-related complications are less common in laparoscopic surgeries, but port-site complications (PSCs) still occur, including wound bleeding, hematomas, infections, and hernias. In this study, the overall incidence of PSCs was found to be 8.5%. consistent with global data. Infections at the umbilical port were the most frequently observed issue, particularly in overweight patients. The number of ports used also correlated with a higher occurrence of PSCs, with the umbilical port being the most commonly affected. However, most complications were manageable and had minimal impact on patient outcomes. Recent advancements in minimally invasive surgeries, such as robotic procedures that often utilize larger ports of 8mm or more, can lead to an increased incidence of port-site complications (PSCs). Additionally, the absence of direct visual feedback at the port site during

these procedures can further heighten this risk. To minimize the risk of port-site complications, strict adherence to sterilization protocols, precise port placement, careful removal under clear vision and accurate fascial closure are essential.

References

1. Batirov DY, Kh AA, Rakhimov AP, Sheniyaov Sh. S, Rojobov RR. Improving the results of simultaneous laparoscopic surgery in patients with chronic deficiency. *EJMMP*. 2023;3(2):43–5.
2. Wang Y, Yang J-W, Yan S-Y, Lu Y, Han J-G, Pei W, et al. Electroacupuncture vs sham electroacupuncture in the treatment of postoperative ileus after laparoscopic surgery for colorectal cancer: A multicenter, randomized clinical trial. *JAMA*. 2023;158(1):20-27
3. Walk CT, Nowak R, Parikh PP, Crawford TN, Woods RJ. Perception versus reality: A review of narcotic prescribing habits after common laparoscopic surgeries. *J Surg* 2023;283:188–93
4. Shah KK, Galani KJ, Nathwani MT. A study of laparoscopic port site complications – A descriptive study in a tertiary care hospital. *Natl J Physiol Pharm Pharmacol*. (2024; 14(3): 413-417.
5. Gao X, Peng Z, Li E, Tian J. Modified minimally invasive laparoscopic peritoneal dialysis catheter insertion with internal fixation. *Ren Fail*. 2023;45(1)
6. 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*;43(1).
7. Hassler KR, Collins JT, Philip K, Jones MW. *Laparoscopic Cholecystectomy*. StatPearls Publishing; 2023.
8. Mannam R, Sankara Narayanan R, Bansal A, Yanamaladoddi VR, Sarvepalli SS, Vemula SL, et al. Laparoscopic cholecystectomy versus open cholecystectomy in acute cholecystitis: A literature review. *Cureus* 2023;15(9)
9. Alius C, Serban D, Bratu DG, Tribus LC, Vancea G, Stoica PL, et al. When critical view of safety fails: A practical perspective on difficult laparoscopic cholecystectomy. *Medicina (Kaunas)* 2023;59(8):1491
10. Miti C, Busuulwa P, Scott R, Bloomfield-Gadelha H. Primary entry trocar design and entry-related complications at laparoscopy in obese patients: meta-analysis. *BJS Open*. 2023;7(3)