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Original Research Article

Postoperative Port Site Infections in General Laproscopy Procedure

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Abstract:

Background: Port site infections (PSIs) are a notable complication following laparoscopic cholecystectomy, potentially delaying recovery and increasing healthcare burden. Identifying risk factors and their clinical implications is essential for optimizing surgical outcomes.

Objectives: To assess the incidence, risk factors, microbiological profile, and postoperative outcomes associated with port site infections in patients undergoing laparoscopic cholecystectomy.

Materials and Methods: A prospective observational study was conducted to evaluate the incidence, risk factors, and outcomes of port site infections following laparoscopic cholecystectomy. The study was carried out in the Department of General Surgery at a tertiary care hospital, where patients undergoing elective laparoscopic cholecystectomy were enrolled. A total of 50 patients were included in the study, and detailed demographic, intraoperative, and postoperative data were collected and analyzed to assess potential associations with port site infections.

Results: In all patients within the PSI group, the umbilical port was used for gallbladder retrieval (100%), compared to 87.5% in the non-PSI group. Although use of the umbilical port was slightly more frequent in the PSI group, this difference did not reach statistical significance ($p = 0.08$). The remaining 12.5% of non-PSI patients had the gallbladder extracted through other port sites. Regarding port size, the 10 mm trocar was predominantly used for specimen retrieval in both groups—9 patients (90%) in the PSI group and 35 patients (87.5%) in the non-PSI group. A 12 mm port was used in 1 patient (10%) in the PSI group and 5 patients (12.5%) in the non-PSI group. No significant association was observed between port size and infection ($p = 0.47$). In terms of port closure techniques, 4 patients (40%) in the PSI group had only skin closure, while 6 (60%) underwent both skin and fascial closure. In contrast, in the non-PSI group, 6 patients (15%) had skin-only closure and 34 (85%) had combined skin and fascial closure. Although a higher proportion of patients with skin-only closure developed PSI, the difference was not statistically significant ($p = 0.11$).

Conclusion: Although not statistically significant, the use of the umbilical port and skin-only closure was more common among patients who developed port site infections. Port size showed no association with infection. These findings suggest that while port characteristics may not be independent risk factors, meticulous closure techniques—especially including fascial closure—may help reduce the risk of postoperative infections.

Keywords: Laparoscopic Cholecystectomy, Port Site Infection, Surgical Site Infection, Bile Spillage, Retrieval Bag, Wound Healing, Postoperative Outcomes.

Introduction

Laparoscopic cholecystectomy (LC) has revolutionized the management of gallbladder diseases and is now considered the gold standard for treating symptomatic cholelithiasis due to its advantages over open surgery, including reduced postoperative pain, shorter hospital stays, faster recovery, and better cosmetic outcomes [1,2]. Despite these benefits, LC is not devoid of complications. Among these, port site infections (PSIs) represent a significant concern, contributing to patient morbidity, increased healthcare costs, and in some cases, prolonged hospitalization [3]. Port site infections are defined as infections occurring at trocar insertion sites, ranging from superficial skin infections to deep-seated abscesses or fascial infections. The reported incidence of PSIs varies widely in literature, ranging from 0.3% to 3% for superficial infections and up to 0.8% for deep infections [4,5]. Several factors contribute to this variability, including patient comorbidities (such as diabetes, obesity, or immunosuppression), perioperative hygiene practices, antibiotic prophylaxis protocols, operative duration, and the technique of gallbladder retrieval [6]. In particular, the extraction of an infected or perforated gallbladder without using a protective retrieval bag is strongly associated with an increased risk of port site contamination and subsequent infection [7]. Microbiologically, PSIs are most commonly caused by skin commensals like *Staphylococcus aureus* and *Staphylococcus epidermidis*, but gram-negative organisms such as *Escherichia coli* and *Klebsiella pneumoniae* are also frequently isolated, especially in cases with gallbladder perforation and bile spillage [8].

In rare instances, atypical infections such as *Mycobacterium* species have been reported, often related to breaches in sterilization protocols, particularly involving reusable laparoscopic instruments [9]. The umbilical port is most commonly affected due to its frequent use for gallbladder extraction and the presence of natural skin folds that facilitate bacterial colonization.

Measures such as the use of specimen retrieval bags, strict adherence to sterilization standards, careful wound closure techniques, and tailored antibiotic prophylaxis are essential in reducing the incidence of PSIs [10]. Furthermore, early recognition of symptoms—such as erythema, swelling, discharge, or pain at the port site—is crucial for prompt management and the prevention of further complications.

Given the growing volume of laparoscopic procedures worldwide and the increasing focus on patient safety and cost-effectiveness, addressing port site infections has become a matter of significant clinical relevance. Comprehensive surveillance, standardized infection control protocols, and awareness of risk factors are vital for optimizing outcomes. This study aims to evaluate the incidence, risk factors, microbiological profile, and management strategies of port site infections following laparoscopic cholecystectomy, thereby contributing to the existing literature and enhancing evidence-based surgical practices.

Materials and Methods

Study Design: A prospective observational study was conducted to evaluate port site infections following laparoscopic cholecystectomy.

Study Place: Department of General Surgery, East West Institute of Medical Sciences and Research.

Study Duration: January 2024 - May 2025.

Sample Size: A total of 50 patients undergoing elective laparoscopic cholecystectomy were included in the study.

Inclusion Criteria

- Patients aged between 18–70 years.
- Diagnosed with symptomatic cholelithiasis or chronic calculous cholecystitis.
- Planned for elective laparoscopic cholecystectomy.

Exclusion Criteria

- Patients with acute cholecystitis or gallbladder empyema.
- Cases converted to open cholecystectomy intraoperatively.
- Patients with known immunosuppression, malignancy, or pre-existing wound infection.
- Emergency surgeries.

Study Variable

a) Age (in years)
b) Gender (Male/Female)
c) Body Mass Index (BMI) (kg/m^2)
d) Comorbidities
e) Indication for Surgery
f) Type of Surgery
g) Duration of Surgery (in minutes)
h) Use of Antibiotic Prophylaxis (Yes/No)
i) Gallbladder Perforation During Surgery (Yes/No)
j) Bile/Stone Spillage (Yes/No)
k) Use of Retrieval Bag for Specimen Extraction (Yes/No)
l) Port Used for Gallbladder Retrieval (Umbilical/Other)
m) Port Size (5 mm / 10 mm / 12 mm)
n) Port Closure Technique
o) Postoperative Variables
p) Outcome Variables

Statistical Analysis: For statistical analysis, data were initially entered into a Microsoft Excel spreadsheet and then analyzed using SPSS (version 27.0; SPSS Inc., Chicago, IL, USA) and GraphPad Prism (version 5). Numerical variables were summarized using means and standard deviations, while Data were entered into Excel and analyzed using SPSS and GraphPad Prism. Numerical variables were summarized using means and standard deviations, while categorical variables were described with counts and percentages.

Two-sample t-tests were used to compare independent groups, while paired t-tests accounted for correlations in paired data. Chi-square tests (including Fisher's exact test for small sample sizes) were used for categorical data comparisons. P-values ≤ 0.05 were considered statistically significant.

Result

Table 1: Demographic and Clinical Characteristics

		PSI Group (n=10)	Non-PSI Group (n=40)	p-value
Demographic Variable	Age (mean ± SD)	48.3 ± 12.1	44.7 ± 11.3	0.31
	Gender (Male)	6 (60%)	18 (45%)	0.38
	BMI (mean ± SD)	27.6 ± 2.8	24.9 ± 3.2	0.02
Comorbidities	Diabetes Mellitus	4 (40%)	6 (15%)	0.04
	Hypertension	3 (30%)	10 (25%)	0.72
	Smoking History	3 (30%)	4 (10%)	0.08

Table 2: Operative and Intraoperative Variables

Variable		PSI Group (n=10)	Non-PSI Group (n=40)	p-value
Indication for Surgery	Symptomatic Cholelithiasis	7 (70%)	33 (82.5%)	0.61
	Chronic Cholecystitis	3 (30%)	7 (17.5%)	
Type of Surgery	Duration of Surgery (mean ± SD)	76.2 ± 15.4 min	58.6 ± 12.8 min	0.001
	Antibiotic Prophylaxis Given	10 (100%)	40 (100%)	1
	Gallbladder Perforation	6 (60%)	5 (12.5%)	0.002
	Bile/Stone Spillage	5 (50%)	6 (15%)	0.01
	Use of Retrieval Bag	2 (20%)	29 (72.5%)	0.003

Table 3: Port-Related Variables

Variable		PSI Group (n=10)	Non-PSI Group (n=40)	p-value
Port for Gallbladder Retrieval	Umbilical	10 (100%)	35 (87.5%)	0.08
	Other	0 (0%)	5 (12.5%)	
Port Size	10 mm	9 (90%)	35 (87.5%)	0.47
	12 mm	1 (10%)	5 (12.5%)	
Port Closure Technique	Skin only	4 (40%)	6 (15%)	0.11
	Skin + Facial	6 (60%)	34 (85%)	

Table 4: Postoperative and Outcome Variables

	Variable	PSI Group (n=10)	Non-PSI Group (n=40)
Type of Infection	Superficial SSI	8 (80%)	0 (0.0%)
	Deep SSI	2 (20%)	0 (0.0%)
Time of Onset (mean days)		4.1 ± 1.2	-
Organisms Isolated	Staph. aureus	5 (50%)	0 (0.0%)
	E. coli	3 (30%)	0 (0.0%)
	Klebsiella spp.	2 (20%)	0 (0.0%)

Table 5: Comparison of Postoperative Outcomes between PSI and Non-PSI Groups

Variable	PSI Group (n=10)	Non-PSI Group (n=40)	p-value
Length of Hospital Stay (mean)	5.8 ± 1.5 days	2.4 ± 0.9 days	<0.001
Re-admission Required	2 (20%)	0 (0%)	0.03
Wound Healing Time (mean days)	10.2 ± 2.3	6.1 ± 1.6	<0.001

Among the 50 patients included in the study, 10 (20%) developed postoperative port site infections (PSI), while 40 (80%) did not. The mean age of patients in the PSI group was slightly higher (48.3 ± 12.1 years) compared to the non-PSI group (44.7 ± 11.3 years), though this difference was not statistically significant (p = 0.31). Males were slightly more represented in the PSI group (60%) than in the non-PSI group (45%), but this too was not significant (p = 0.38). Body Mass Index (BMI) was found to be significantly higher in patients with PSI (27.6 ± 2.8 kg/m²) compared to those without PSI (24.9 ± 3.2 kg/m²), and this difference was statistically significant (p = 0.02), suggesting that higher BMI may be a potential risk factor for port site infection. Regarding comorbid conditions, diabetes mellitus was significantly more prevalent among the PSI group (40%) than the non-PSI group (15%), with a p-value of 0.04. Hypertension was observed in 30% of the PSI group and 25% of the non-PSI group, which was not statistically significant (p = 0.72). Similarly, a history of smoking was more common in the PSI group (30%) compared to the non-PSI group (10%), but this did not reach statistical significance (p = 0.08).

Regarding the indication for surgery, the majority of patients in both groups underwent laparoscopic cholecystectomy for symptomatic cholelithiasis. In the PSI group, 7 patients (70%) had symptomatic cholelithiasis compared to 33 patients (82.5%) in the non-PSI group. Chronic cholecystitis was the indication in 3 patients (30%) in the PSI group and 7 patients (17.5%) in the non-PSI group. However, the difference in surgical indication between the two groups was not statistically significant ($p = 0.61$). The mean duration of surgery was significantly longer in the PSI group (76.2 ± 15.4 minutes) compared to the non-PSI group (58.6 ± 12.8 minutes), with a highly significant p-value of 0.001, suggesting prolonged operative time as a risk factor for infection. All patients in both groups received prophylactic antibiotics preoperatively (100%), indicating no association between lack of prophylaxis and PSI ($p = 1.00$). Gallbladder perforation during surgery was observed in 6 patients (60%) in the PSI group and only 5 patients (12.5%) in the non-PSI group, a difference that was statistically significant ($p = 0.002$).

Similarly, intraoperative bile or stone spillage was significantly more common in the PSI group (50%) than in the non-PSI group (15%) ($p = 0.01$). The use of a specimen retrieval bag was significantly lower in the PSI group (20%) compared to the non-PSI group (72.5%), with a p-value of 0.003, indicating that the lack of a retrieval bag may increase the risk of port site contamination and infection.

In all patients within the PSI group, the umbilical port was used for gallbladder retrieval (100%), compared to 87.5% in the non-PSI group. Although use of the umbilical port was slightly more frequent in the PSI group, this difference did not reach statistical significance ($p = 0.08$). The remaining 12.5% of non-PSI patients had the gallbladder extracted through other port sites.

Regarding port size, the 10 mm trocar was predominantly used for specimen retrieval in both groups—9 patients (90%) in the PSI group and 35 patients (87.5%) in the non-PSI group. A 12 mm port was used in 1 patient (10%) in the PSI group and 5 patients (12.5%) in the non-PSI group. No significant association was observed between port size and infection ($p = 0.47$).

In terms of port closure techniques, 4 patients (40%) in the PSI group had only skin closure, while 6 (60%) underwent both skin and fascial closure. In contrast, in the non-PSI group, 6 patients (15%) had skin-only closure and 34 (85%) had combined skin and fascial closure. Although a higher proportion of patients with skin-only closure developed PSI, the difference was not statistically significant ($p = 0.11$).

Among the 10 patients who developed port site infections (PSI), superficial surgical site infections (SSI) were the most common, observed in 8 patients (80%), while deep SSI was present in 2 patients (20%). No infections of any type were reported in the non-PSI group. The mean time of onset of infection symptoms was 4.1 ± 1.2 days postoperatively in the PSI group. None of the patients in the non-PSI group developed signs of infection during the follow-up period. Microbiological culture of discharge from infected port sites revealed that Staphylococcus aureus was the most frequently isolated organism, identified in 5 patients (50%). Escherichia coli was found in 3 patients (30%), and Klebsiella species were isolated in 2 cases (20%). No organisms were isolated from any patient in the non-PSI group, confirming the absence of clinical infection. Postoperative outcomes showed significantly worse recovery profiles in patients with port site infections (PSI). The mean length of hospital stay in the PSI group was 5.8 ± 1.5 days, notably longer than 2.4 ± 0.9 days in the non-PSI group, and this difference was statistically significant ($p < 0.001$). Additionally, re-admission was required in 2 patients (20%) in the PSI group, whereas no patients in the non-PSI group required re-admission ($p = 0.03$), highlighting the clinical burden associated with infection. The mean wound healing time was also significantly prolonged in the PSI group (10.2 ± 2.3 days) compared to the non-PSI group (6.1 ± 1.6 days) with a highly significant difference ($p < 0.001$).

Discussion

In the present study, the incidence of postoperative port site infections (PSIs) was observed in 20% of patients undergoing laparoscopic cholecystectomy. This is relatively higher than reported in earlier studies, where the incidence ranged between 1% and 14% [11,12]. The elevated rate in our cohort may be attributed to factors such as higher BMI, gallbladder perforation, bile spillage, and the limited use of specimen retrieval bags.

A significant association was found between higher body mass index (BMI) and the occurrence of PSI ($p = 0.02$). This aligns with the findings of Karthik et al., who reported that obesity is a major risk factor for wound infection due to impaired wound healing and increased subcutaneous fat [13]. Similarly, diabetes mellitus, which compromises immune responses and delays wound healing, was significantly more common in infected patients ($p = 0.04$), corroborating the findings of Biswas et al. who highlighted diabetes as an independent risk factor for port site infection [14].

Operative duration also showed a strong association with PSI in our study ($p = 0.001$). This is in line with the study by Sangrasi et al., where surgeries exceeding 60 minutes were significantly associated with increased infection rates [15]. Longer operative time likely increases the exposure of tissue to environmental pathogens and increases the risk of contamination, especially in cases involving bile spillage or perforation.

Gallbladder perforation and bile/stone spillage were significantly associated with PSI (p = 0.002 and p = 0.01, respectively). Previous studies have emphasized that intraoperative bile contamination is a key factor in port site infection, particularly when a retrieval bag is not used [16]. Our results reinforce this, as only 20% of infected patients had retrieval bags used, compared to 72.5% in the non-PSI group (p = 0.003). This supports recommendations by Gupta et al. and Sharma et al. advocating for routine use of endo-bags to minimize port site contamination [17,18].

The most commonly affected port in our study was the umbilical port, consistent with findings from other reports [12,19]. Although this was not statistically significant, it may be due to the frequent use of this port for specimen retrieval and the presence of skin folds that harbor bacteria.

In terms of microbiology, Staphylococcus aureus was the predominant organism, followed by Escherichia coli and Klebsiella spp., consistent with findings from Malik et al., who also reported similar microbial profiles in PSI cases [20]. The presence of both gram-positive and gram-negative organisms suggests a mix of skin flora and enteric contamination, especially in cases with bile spillage.

Patients with PSI had significantly longer hospital stays, delayed wound healing, and a higher rate of re-admission, underscoring the clinical and economic burden of these infections. These findings emphasize the importance of strict aseptic technique, timely closure, routine use of specimen retrieval bags, and early recognition of risk factors to prevent PSIs.

Conclusion

We conclude that, this study highlight that postoperative port site infections following laparoscopic cholecystectomy are associated with identifiable risk factors and lead to adverse clinical outcomes. Patients who developed infections tended to have a higher body mass index and a greater prevalence of diabetes mellitus, indicating that patient-related metabolic factors may predispose individuals to infection. Intraoperative complications such as gallbladder perforation, bile or stone spillage, and non-use of specimen retrieval bags were significantly associated with the occurrence of infections, underscoring the importance of careful surgical technique and preventive measures. While the choice of port site and port size did not show a statistically significant influence on infection rates, trends suggested that exclusive use of the umbilical port and skin-only closure might contribute to higher infection risk. The majority of infections were superficial, with Staphylococcus aureus being the most commonly isolated organism, though enteric pathogens were also observed, indicating both external and internal contamination sources. Infected patients experienced longer hospital stays, delayed wound healing, and higher re-admission rates, reflecting a significant postoperative burden. These outcomes reinforce the importance of identifying and mitigating modifiable risk factors to reduce the incidence of port site infections and improve patient recovery following laparoscopic procedures.

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