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Prevalence of Port Site Infection in Laparoscopic Surgery in Manipal Teaching Hospital: A Cross-sectional Study

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Abstract

Introduction: Port site infections following laparoscopic surgery, though uncommon, are significant complications. These infections can lead to prolonged hospital stays, increased financial costs, and poor cosmetic outcomes. This study aimed to determine the prevalence of port site infections in laparoscopic surgeries, specifically laparoscopic cholecystectomy, and identify associated factors.

Methods: A prospective cross-sectional study was conducted with 538 adult patients, aged 18-86 years, from 01 December 2021 to 31 May 2024, following Institutional Review Board approval (Reference ID: MEMG/485/IRC). Participants who underwent elective laparoscopic cholecystectomy were included via convenience sampling. All the patients received prophylactic antibiotics with injection cefuroxime 1gm at the induction of anesthesia and 1gm iv bd was prescribed for 2 days followed by oral cefixime 200 mg bd for next five days. Variables analysed included port site infections, site of infected port, age, gender, and intraoperative spillage of stones, bile, or pus.

Results: The study comprised 538 patients, with 367 females (68.2%) and 171 males (31.8%). The median surgical duration was 30 minutes. Thirteen patients (2.4%) developed port site infections: 12 (2.23%) were under 65 years and one (0.18%) was over 65. Infections occurred in 9 females (1.67%) and 4 males (0.73%). Umbilical port infections (10/1.9%) were more common than epigastric port infections (3/0.6%). Most gallbladder extractions (446/82.9%) were performed through umbilical port. No significant associations were found between port site infections and variables such as age, gender, bile spillage, calculi spillage, and duration of surgery (p value=1.00, 1.00, 0.17, 0.47 and 0.57 respectively).

Conclusions: Port site infections after laparoscopic cholecystectomy are infrequent and not significantly influenced by age, gender, bile/calculi spillage, or surgery duration. The preference for umbilical port extraction doesn't significantly affect infection rates. Further research is needed to identify other potential risk factors for these infections.

Keywords: *Cholecystectomy laparoscopic; complications; port site infections.*

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INTRODUCTION

The incidence of infection in laparoscopic surgery is significantly lower compared to open surgery. However, it is not free of septic complications. The studies have documented the port site infections (PSIs) range from 1.4% to 5.8% in laparoscopic procedures.[1][2]

The PSIs in laparoscopic cholecystectomy varies from 0.60-11%, depending on various factors such as surgical technique, patient characteristics, and post-operative care protocols. [3–8] It is a fact that laparoscopic cholecystectomy is associated with fewer port site infections than open cholecystectomy.[9] However now-a-days, with increasing number of cholecystectomies being performed laparoscopically, there is an increasing number of PSIs. Understanding the prevalence of PSIs in laparoscopic cholecystectomy is crucial, because these infections can lead to prolonged hospital stays, increased healthcare costs, and patients' dissatisfaction. In addition, there is lack of evidence regarding PSIs in laparoscopic cholecystectomy in our part of the world.

Hence, we aimed to study the prevalence of PSIs in laparoscopic cholecystectomy and its associated factors in a tertiary care center.

METHODS

This prospective cross-sectional analytical study was conducted in the Department of Surgery of Manipal Teaching Hospital, Pokhara, Nepal from 01 December 2021 to 31 May 2024 after approval from Institutional review board (Reference ID: MEMG/485/IRC). The written and informed consent was taken from all the participants. Pre-operative diagnosis of gall stones and gall bladder polyp was confirmed using biliary ultrasound scan in all cases. All consenting patients who underwent elective laparoscopic cholecystectomy, during the study period were enrolled in the study. A total of 538 patients participated in the study. Convenience sampling technique was used. Patient's whose operations were converted to open procedures, patients who had undergone endoscopic retrograde cholangiopancreatography, stenting were excluded from the study.

All the patients received prophylactic antibiotic with injection cefuroxime 1gm at the induction of anesthesia. In the post operative period, injection cefuroxime 1gm iv bd was prescribed for 2 days followed by oral cefixime 200 mg bd for next five days.

All surgeries were done by surgeons who had more than five years' experience, using four ports, with reusable instruments. The skin was prepared with aqueous povidone iodine. The gallbladder was extracted either from the umbilical or epigastric port. It is the standard practice of our institution to use a retrieval bag in cases with multiple gall stones, spillage of bile or calculi from the gallbladder and empyema gall bladder. Sub-hepatic tube drain (20 or 24 French) was used in cases of subtotal or partial cholecystectomy or acute calculous cholecystitis with dense adhesion. The drain was removed two days after the operation. The umbilical port wound was closed with port closure. The skin wound of all four ports were closed with stapler and covered with sterizone. Wound site dressing was done after three days and repeated in next three to four days. The staplers were removed on 10^{th} day in the absence of infection.

The method of sterilization of surgical instruments were standardized in our study. The instruments were washed with ENZYM (50 cc/20 L), then rinsed with tap water and finally immersed in Formalin or OPA (Cidex ®) for 30 minutes.

Patients were followed up on 7th day, 10th day and one month post- operatively in outpatient department. The port site infections (PSIs) were defined as per Centre for Disease Control and Prevention which has classified surgical site infection into incision-site infection and organ-space infection. The incision-site infection is further subdivided into "superficial" in which only skin and subcutaneous tissue is infected and "deep" where fascia and muscles are infected.[10] In our study incisional category was applicable and has been used.

The presence of purulent discharge, abscess or wound dehiscence were considered as PSIs and antibiotic was started as per culture and sensitivity.

RESULTS

A total of 538 patients were included in the study. Their age ranged from 18-86 years, median age of 48 years, with an interquartile range of 37 to 58 years. The gender distribution included 367 females, accounting for 68.2% of the cohort, and 171 males, making up 31.8%. The median duration of the surgical interventions was 30 minutes, with an interquartile range of 30 to 36 minutes.

Table 1. Overview of Surgical Site Infections (n=538)

Variables		Number/ Percentage
Port Site Infection	Present	13/ 2.4
	Absent	525/ 97.6
Site of Infection	Umbilical	10/1.9
	Epigastric	3/0.6

Factors such as presence or absence of PSIs, site of infected port and intraoperative spillage of calculi or bile were analyzed. In addition, age, gender, duration of surgery and extraction site of gall bladder was also noted.

Data analysis was done in SPSS (version 21.0 for windows). The normality of data was evaluated using Kolmogorov-Smirnov test. Categorical data were presented as number/percentages and evaluated using chi square or Fischer's Exact test whichever was appropriate and numerical data were presented as mean±sd or median IQR and evaluated using student t test or Mann Whittney U whichever was appropriate. P value <0.05 was considered as statistically significant.

Of the total cases, 13 patients (2.4%) experienced port site infections (Table 1). Within this group, 12 patients (2.23%) were under 65 years and one patient (0.18%) was over 65 years. The port site infections were found in 9 female patients (1.67%) and 4 male patients (0.73%). All the PSIs were superficial infections. Among those with port site infections, biliary spillage was observed in 2 patients (0.37%) and calculi spillage in 1 patient (0.18%) (Table 2). The umbilical port site was more frequently associated with infections than the epigastric port site, showing rates of 1.9% versus 0.6% (Table1).

Additionally, the majority of gallbladder extractions were performed through the umbilical port, accounting for 446 cases or 82.9% of the total. In contrast, the gallbladder was removed via the epigastric port in 92 cases, representing 17.1% of the total.

None of the examined variables (age, gender, bile spillage, and calculi spillage) had a statistically significant impact on the occurrence of port site infections following laparoscopic cholecystectomy in this study (Table 2).

Table 2. Analysis of Surgical Site Infections by Age, Gender, Biliary Spillage and Calculi Spillage (n=538)

Variables		Surgical site infection		p value
		Present	Absent	
Age	<65 years	12	477	1.00
	>65 years	1	48	
Gender	Male	4	167	1.00
	Female	9	358	
Bile spillage	Present	2	30	0.17
	Absent	11	495	
Calculi Spillage	Present	1	12	0.47
	Absent	12	513	

Data presented as number/ percentages and analysed by Fischer's Exact Test.

Table 3. Prevalence of port site infections in various biliary disease (n=538)

Diagnosis	Number of cases	Port SSI	Percentage
Symptomatic cholelithiasis multiple calculi	218	6	1.12
Symptomatic cholelithiasis single calculi	113	1	0.19
GB polyps	36	1	0.19
Chronic calculus cholecystitis multiple calculi	99	2	0.37
Chronic calculus cholecystitis single calculi	45	2	0.37
Acute calculous cholecystitis multiple	3		
Mucocele GB single calculi	3		
Mucocele GB multiple calculi	12		
Empyema GB single calculi	2		
Symptomatic cholelithiasis multiple calculi + GB polyp	2		
Symptomatic cholelithiasis single calculi + GB polyp	4		
Perforated GB with multiple calculi	1	1	0.19

The port site infections were noted more in patients with multiple gall bladder calculi as presented in Table 3.

For surgeries lasting less than 30 minutes, the infection rate was 2.86% (9 out of 314 cases) and for surgeries lasting more than 30 minutes, the infection rate was 1.78% (4 out of 224 cases). Despite a slightly higher number of infections in the < 30-minute group, the difference was not statistically significant given the p value of 0.57.

DISCUSSION

Port site infections (PSIs) following laparoscopic cholecystectomy, although infrequent, present significant challenges for patients and healthcare providers.[11][12] This study evaluated the prevalence and associated factors of PSIs among 538 patients undergoing laparoscopic

cholecystectomy. The findings indicate that PSIs affect a small percentage of patients and are not significantly associated with variables such as age, gender, bile spillage, calculi spillage, or the duration of surgery.

The overall prevalence of PSIs in this study was 2.4%, aligning with the lower range of rates reported in the literature, which typically ranges between 0.6% and 6.7%. [4–7] The slightly lower prevalence observed here could be attributed to stringent aseptic measures, prophylactic antibiotic use and sterilization of laparoscopic instruments. All the cases of PSIs were superficial infections involving only the skin and subcutaneous tissue which is in alignment with similar previous study which documented superficial PSIs in 90% of the cases who underwent laparoscopic cholecystectomy.[13] Our findings is also similar to past study which has only reported superficial PSIs following laparoscopic cholecystectomy.[11] It is possible that the use of sterizone which is an anti-microbial silver wound dressing at port site were responsible for less PSIs in our study. All patients who developed port site infections (PSIs) were treated with minimal morbidity.

Infections can originate from either internal (endogenous) or external (exogenous) sources, as the human body hosts a diverse range of microorganisms that can potentially cause infection, especially following surgical procedures. Under certain conditions, a patient's normal bacterial flora may become opportunistic and lead to infection. This can happen in both open surgeries and, to a lesser extent, in laparoscopic procedures.[7] Conversely, external sources can be minimized through meticulous sterilization processes.

The demographic analysis revealed a higher proportion of females (68.2%) compared to males (31.8%), which is consistent with the gender distribution observed in cholecystectomy procedures due to the higher incidence of gallbladder disease in women.[14] However the rate of PSIs were similar across both the gender which is in alignment with the similar past study. [7] Our findings differ from previous research that reported higher rates of PSIs among men compared to women. This discrepancy could be explained by the fact that, in their study, men had more severe biliary disease than women. This included higher rates of acute cholecystitis, obstruction, choledocho-lithiasis, and a greater likelihood of conversion to open surgery, which could have contributed to the increased rate of PSIs in male patients.[15]

Age was not a significant factor in the occurrence of PSIs. The majority of patients with infections were under 65 years of age. This finding is consistent with other studies, which have also reported no significant age-related differences in PSIs rates.[15] The absence of a significant association between age and PSIs suggests that both younger and older patients can benefit equally from the preventive measures implemented during laparoscopic cholecystectomy. The absence of association also suggests that age alone should not be a determining factor in assessing the risk of PSIs. The prevalence of more infection in younger age group might be due to a greater number of patients in this age group in our study. Earlier studies have reported an increased risk of PSIs in older patients. Variations in the reported impact of age on PSIs across studies can be attributed to the differences in how age groups are categorized.[3]

Numerous previous studies have indicated that the port used for gallbladder extraction was linked to a higher number of PSIs compared to

other ports, which aligns with our findings.[11][13][16][17] In our study, the umbilical port was the most frequently infected site, and it was primarily utilized for gallbladder extraction.

Bile spillage during laparoscopic cholecystectomy is a known risk factor for PSIs, as bile can act as a medium for bacterial growth resulting in higher prevalence of PSIs as evidenced in one of the past studies where the PSIs were reported to be 11% which was attributed to skin contamination either with bile or calculi during gall bladder extraction.[8] In our study the biliary contamination was less and thus resulting in less PSIs. Hence, effective measures to contain bile spillage, such as the use of endo-bags and careful handling of the gallbladder, are crucial to minimize infection risks.

Moreover, past studies have emphasized that the formation of an abscess and a statistically significant infection at the port site were strongly linked to the leakage of bile, pus, or stones, which can remain in the abdominal cavity or at the wound site.[13][18]Research has shown that gallstone spillage occurs in 5% to 40% of laparoscopic cholecystectomy procedures.[18] Calculi spillage occurred in only a small number (13/2.41%) of patients, which may have contributed to the lower incidence of PSIs observed in our study. Cholesterol-based stones that escape typically pose a low risk of infection, while pigment stones often harbour live bacteria and can cause infections.[18] Although our study did not perform biochemical analysis of the gallstones, there was no observed difference in PSIs between patients with and without calculi spillage. The possible reason for the lower incidence of PSIs despite spillage could be the use of retrieval bags. These bags prevent direct contact between the port wound and the contents of the infected gallbladder, a method supported by previous studies.[13][17] Recent studies have debated the possibility of contamination of wound site with gall bladder content as a possible source of infections because laparoscopic surgery reduces tissue trauma and these wounds are generally less susceptible to infection.[5]

Extended surgical duration is a risk factor for PSIs in laparoscopic cholecystectomy. Research indicates that the probability of PSIs rises with longer surgery times. The risk of PSIs escalates by about 13% for every extra 15 minutes of operation. This increase is likely due to prolonged exposure to potential contaminants and a higher chance of tissue damage and weakened immune response over

extended periods.[19] Our study contradicts the finding that extended surgical duration leads to a higher chance of tissue damage and weakened immune response. We observed that port site infections (PSIs) were similar in both groups, whether the surgery lasted less than or more than 30 minutes. This could be due to effective infection control measures, such as proper sterilization of instruments and the use of prophylactic antibiotics, which likely minimized the risk of PSIs regardless of the duration. Additionally, the operating room environment and staff adherence to protocols may have contributed to maintaining low infection rates, a conclusion supported by previous studies. [1][20]

There are several limitations to this study. Although it included 538 patients, a larger sample size might yield more robust data and help detect smaller differences in infection rates. Conducting the study at a single center may limit the generalizability of the findings to other settings with different patient populations and

surgical practices. Additionally, variability in patient factors such as immune status, comorbidities, and overall health, which were not evaluated in this study, could have influenced the infection rates. Lastly, the study also did not perform biochemical analysis of gallstones, which could have provided more insight into the types of stones and their potential role in PSIs.

CONCLUSIONS

Port site infections (PSIs) after laparoscopic cholecystectomy are uncommon, with a prevalence of 2.4% in this study, consistent with the lower end of reported rates in the literature. The study did not find a significant link between PSIs and variables such as age, gender, bile spillage, calculi spillage, or surgery duration. The low incidence of PSIs is likely due to effective infection control measures, including proper instrument sterilization, prophylactic antibiotic use, and strict adherence to aseptic techniques.

CONFLICT OF INTEREST

None

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None

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