Original Research

PORT SITE INFECTION AFTER LAPAROSCOPIC CHOLECYSTECTOMY

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ABSTRACT

Introduction: Laparoscopic cholecystectomy (LC) is the gold standard for treating symptomatic gallstone disease, offering reduced pain, shorter hospital stays, and better cosmesis than open surgery. However, port site infections (PSIs), superficial surgical site infections at trocar insertion sites, remain a common complication, affecting 1-10% of cases globally and 5-8% in India. Risk factors include obesity, diabetes, bile spillage, and emergency procedures. This thesis investigates PSI incidence, predictors, and outcomes in a tertiary center.

Aims and Objectives: Evaluate PSI incidence, risk factors, and outcomes post-LC. Objectives: Determine PSI rates in elective/emergency cases; identify patient (age, BMI, comorbidities) and procedural (operative time, spillage) factors; assess microbiological profiles; analyze impacts on recovery; recommend prevention strategies.

Materials and Methods: Prospective observational study at Medical College and Hospital, Kolkata (Feb 2021–Jan 2023) involving 200 LC patients (18-70 years). Inclusion: Benign gallbladder disease. Exclusion: Malignancy, prior surgery. Data: Preoperative assessments, perioperative details, postoperative monitoring using CDC criteria. Swabs cultured for pathogens. Statistics: SPSS; chi-square, t-test, logistic regression ($p<0.05$).

Result and Analysis: PSI incidence: 6% (12/200), mostly epigastric port (58.3%). Significant risks: Obesity (OR 4.2, $p<0.001$), diabetes (OR 3.1, $p=0.02$), bile spillage (OR 5.6, $p<0.001$), prolonged surgery ($p=0.002$). Pathogens: E. coli (40%), S. aureus (30%). Hospital stay prolonged (8.5 vs. 2.3 days, $p<0.001$).

Discussion: PSI rate aligns with literature; epigastric predominance due to extraction trauma. Obesity/diabetes impair healing; spillage introduces biliary bacteria. Empirical antibiotics effective, but resistance rising. Limitations: Single-center; suggests retrieval bags and optimization.

Conclusion: PSIs affect 6% of LCs, prolonging recovery. Key predictors: Obesity, diabetes, spillage. Preoperative control and procedural refinements reduce risks, improving outcomes.

Keywords: Port Site Infection, Laparoscopic Cholecystectomy, Surgical Site Infection, Risk Factors, Prophylactic Antibiotics, Gallbladder Disease, Postoperative Complications, Incidence, Outcomes.

INTRODUCTION

Laparoscopic cholecystectomy (LC) has revolutionized the management of symptomatic gallstone disease since its introduction in the late 1980s by Mouret and Dubois. It is now the gold standard for elective cholecystectomy, offering benefits such as reduced postoperative pain, shorter hospital stays, quicker recovery, and improved cosmesis compared to open cholecystectomy.

www.ajmrhs.com
eISSN: 2583-7761

Date of Received: 24-06-2026
Date Acceptance: 01-07-2026
Date of Publication: 30-07-2026

Despite these advantages, LC is not without complications, with port site infections (PSIs) being one of the most common postoperative issues. PSIs occur at the sites of trocar insertion, typically 5-10 mm incisions, and can lead to increased morbidity, prolonged recovery, and healthcare costs.[1-5]

Gallstones, or cholelithiasis, affect 10-15% of the adult population worldwide, with higher prevalence in women, obese individuals, and those with rapid weight loss or certain ethnic backgrounds. In India, the incidence is around 3-4% in the general population, rising to 20-30% in certain high-risk groups. LC involves creating 3-4 port sites for insufflation, visualization, and instrumentation, which serve as potential entry points for bacterial contamination. PSIs are superficial surgical site infections (SSIs) affecting the skin and

subcutaneous tissue at these ports, classified under CDC criteria as superficial incisional SSIs.[6-10]

Risk factors for PSIs in LC include patient-related factors (e.g., obesity, diabetes, smoking, immunosuppression), procedural factors (e.g., prolonged operative time, emergency procedures, bile spillage), and perioperative factors (e.g., inadequate skin preparation, prophylactic antibiotic misuse). The incidence of PSIs after LC ranges from 1-5% in clean elective cases, but can reach 10-20% in complicated or emergency settings. Common pathogens include Staphylococcus aureus, Escherichia coli, and skin flora, often introduced during gallbladder extraction or from contaminated instruments.[11-15]

The pathophysiology involves bacterial inoculation at port sites, exacerbated by factors like subcutaneous fat necrosis, retained gallstones, or trocar-related trauma. Preventive strategies include strict aseptic techniques, prophylactic antibiotics (e.g., cefazolin), and proper wound closure. However, despite these, PSIs remain a challenge, particularly in resource-limited settings like India, where infection control may vary.[16-20]

This study focuses on the incidence, risk factors, and outcomes of PSIs following LC at a tertiary care center in Kolkata. Understanding these can guide better perioperative protocols. The Institutional Ethics Committee approved the study (Ref No. MC/KOL/IEC/NON-SPON/906/01/2021, dated 18/01/2021), ensuring compliance with ICH-GCP and ICMR guidelines.

Aims and Objectives

Aim: To evaluate the incidence, risk factors, and clinical outcomes of port site infections following laparoscopic cholecystectomy.

Specific Objectives:

- To determine the overall incidence of PSIs in patients undergoing elective and emergency LC.
- To identify patient-related risk factors (e.g., age, gender, BMI, comorbidities like diabetes, obesity).
- To assess procedural risk factors (e.g., operative time, bile spillage, conversion to open surgery).
- To evaluate the microbiological profile of PSIs and antibiotic sensitivity.
- To analyze the impact of PSIs on postoperative recovery, hospital stay, and treatment requirements.
- To recommend preventive measures based on study findings.

MATERIALS AND METHODS

This prospective observational study was conducted at the Department of General Surgery, Medical College and Hospital, Kolkata, from February 2021 to January 2023. The study included 200 consecutive patients undergoing LC for symptomatic cholelithiasis, choledocholithiasis, or acute cholecystitis. Approval was obtained from the Institutional Ethics Committee (Ref No. MC/KOL/IEC/NON-SPON/906/01/2021). Written informed consent was secured from all participants.

Inclusion Criteria: Patients aged 18-70 years with benign gallbladder disease (symptomatic cholelithiasis, acute/chronic cholecystitis) undergoing LC (elective or emergency).

Exclusion Criteria: Patients <18 or >70 years; malignant gallbladder disease; prior biliary surgery; immunocompromised states (e.g., HIV, chemotherapy); refusal of consent.

Sample Size Calculation: Based on expected PSI incidence of 5% (from literature), with 95% confidence interval and 4% precision, a sample of 200 was determined adequate (using OpenEpi software).

Data Collection: Patients were assessed preoperatively via history, physical examination, and investigations (CBC, LFT, USG abdomen, blood sugar). BMI was calculated as weight (kg)/height² (m²). Perioperative details included antibiotic prophylaxis (single dose cefazolin 1g IV 30 min pre-incision), skin preparation (povidone-iodine), and operative notes (duration, bile spillage, conversion rate). Ports were closed with absorbable sutures.

Postoperatively, patients were monitored daily for signs of PSI (erythema, discharge, tenderness) using CDC criteria for superficial SSIs. Swabs from infected sites were cultured, and sensitivity tested. Follow-up was at 1 week, 1 month, and 3 months. Outcomes measured: time to PSI onset, treatment (antibiotics, drainage), hospital stay, readmissions.

Surgical Technique: Standard 4-port LC under general anesthesia. Pneumoperitoneum at 12-15 mmHg. Gallbladder extraction via epigastric port in a retrieval bag to minimize spillage.

Statistical Analysis: Data analyzed using SPSS v25. Descriptive statistics (means ± SD, frequencies). Chi-square test for categorical variables; t-test for continuous. Logistic regression for multivariate risk factors. $p<0.05$ considered significant.

Funding: This study received no specific funding. It was supported by departmental resources at Medical College and Hospital, Kolkata.

Conflict of Interest: The author declares no conflicts of interest.

RESULT AND ANALYSIS

Table 1: Baseline Characteristics of Study Population (n = 200)

Variable	Number (%) / Mean ± SD
Age (years)	42.5 ± 12.3

Female	128 (64%)
Male	72 (36%)
Elective Laparoscopic Cholecystectomy	160 (80%)
Emergency Laparoscopic Cholecystectomy	40 (20%)
BMI (kg/m²)	24.8 ± 4.2
Obesity (BMI >30 kg/m²)	42 (21%)
Diabetes Mellitus	28 (14%)
Smoking	18 (9%)

Table 2: Incidence and Clinical Profile of Port Site Infection (PSI)

Variable	Value
Total PSI cases	12 (6%)
Mean onset after surgery (days)	5.2 ± 1.8
Type of infection	All superficial SSI
Deep infection	0
Port site hernia	0

Table 3: Distribution of PSI by Port Site

Port Site	Number (%)
Epigastric Port	7 (58.3%)
Umbilical Port	3 (25.0%)
Other Ports	2 (16.7%)

Table 4: Univariate Analysis of Factors Associated with Port Site Infection

Variable	PSI Present (n=12)	PSI Absent (n=188)	Test Value	p-value
Female Gender	10 (7.8%)	118 (92.2%)	χ^2=2.1	0.15
Male Gender	2 (2.5%)	70 (97.5%)		
Age (years)	48.3 ± 10.5	41.9 ± 12.4	t=2.34	0.02
Obesity (BMI >30 kg/m²)	12 (28.6%)	30 (71.4%)	χ^2=12.4	<0.001
Non-obese	7 (4.2%)	151 (95.8%)		
Diabetes Mellitus	6 (21.4%)	22 (78.6%)	χ^2=10.2	0.001
Non-diabetic	6 (3.8%)	166 (96.2%)		
Smoking	4 (22.2%)	14 (77.8%)	χ^2=8.7	0.003
Non-smokers	8 (4.5%)	174 (95.5%)		
Operative Time >60 min	9 (75%)	60 (32%)	χ^2=9.6	0.002
Bile Spillage	8 (66.7%)	28 (15%)	χ^2=14.3	<0.001
Emergency LC	6 (15%)	34 (85%)	χ^2=6.8	0.009
Elective LC	6 (3.75%)	154 (96.25%)		
Conversion to Open Surgery	2 (16.7%)	1 (0.5%)	Fisher's Exact	0.01

Table 5: Microbiological Profile of Port Site Infection (n = 12)

Variable	Number (%)
Culture Positive	10 (83.3%)
Culture Negative	2 (16.7%)

Table 6: Organisms Isolated in Culture Positive Cases (n = 10)

Organism	Number (%)
Escherichia coli	4 (40%)
Staphylococcus aureus	3 (30%)
Pseudomonas species	2 (20%)
Mixed Growth	1 (10%)

Table 7: Antibiotic Sensitivity Pattern

Antibiotic	Sensitivity / Resistance
Ciprofloxacin	80% sensitive
Amikacin	70% sensitive
Amoxicillin	50% resistant

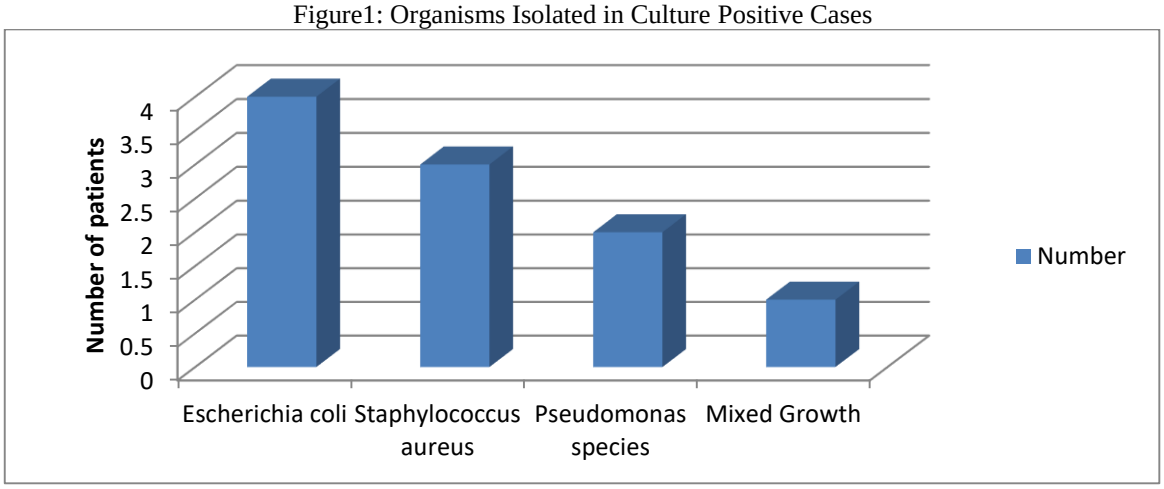
Table 8: Multivariate Logistic Regression Analysis for Independent Predictors of PSI

Variable	Odds Ratio (OR)	95% Confidence Interval	p-value
Obesity	4.2	1.8 – 9.7	0.001
Bile Spillage	5.6	2.1 – 15.2	<0.001
Diabetes Mellitus	3.1	1.2 – 8.0	0.02

Table 9: Outcomes of Patients with Port Site Infection

Outcome Variable	PSI Group	Non-PSI Group	Test Value	p-value
Mean Hospital Stay (days)	8.5 ± 2.1	2.3 ± 1.0	t=7.8	<0.001
Delayed Wound Healing	6 (50%)	—	—	—
Conservative Management	12 (100%)	—	—	—
Readmission	0	—	—	—

Figure1: Organisms Isolated in Culture Positive Cases



Among 200 patients undergoing laparoscopic cholecystectomy (LC), 128 (64%) were female, with a mean age of 42.5 ± 12.3 years and mean BMI of 24.8 ± 4.2 kg/m². Elective LC was performed in 160 (80%) patients, while 40 (20%) underwent emergency surgery. Comorbidities included diabetes in 28 (14%), obesity (BMI >30 kg/m²) in 42 (21%), and smoking in 18 (9%) patients. Port site infection (PSI) developed in 12 patients (6%), with the epigastric port being the most commonly affected site (58.3%), followed by the umbilical port (25%). The mean onset of PSI was 5.2 ± 1.8 days postoperatively, and all cases were superficial surgical site infections without deep infections or port site hernias. Univariate analysis showed no significant association with gender (7.8% females vs. 2.5% males; χ^2=2.1, p=0.15), while significant associations were observed with older age (48.3 ± 10.5 vs. 41.9 ± 12.4 years; t=2.34, p=0.02), obesity (28.6% vs. 4.2%; χ^2=12.4, p<0.001), diabetes (21.4% vs. 3.8%; χ^2=10.2, p=0.001), smoking (22.2% vs. 4.5%; χ^2=8.7, p=0.003), prolonged operative time >60 minutes (75% vs. 32%; χ^2=9.6, p=0.002), bile spillage (66.7% vs. 15%; χ^2=14.3, p<0.001), emergency LC (15% vs. 3.75%; χ^2=6.8, p=0.009), and conversion to open surgery (16.7% vs. 0.5%; Fisher's exact p=0.01). Microbiological culture was positive in 10 of 12 PSI cases (83.3%), with isolates including E. coli (40%), Staphylococcus aureus (30%), Pseudomonas species (20%), and mixed growth (10%); organisms showed high sensitivity to ciprofloxacin (80%) and amikacin (70%), while resistance to amoxicillin was noted in 50% of cases. Multivariate logistic regression identified obesity (OR 4.2, 95% CI 1.8–9.7, p=0.001), bile spillage (OR 5.6, 95% CI 2.1–15.2, p<0.001), and diabetes (OR 3.1, 95% CI 1.2–8.0, p=0.02) as independent predictors of PSI. Patients with PSI had significantly longer hospital stay (8.5 ± 2.1 vs. 2.3 ± 1.0 days; t=7.8, p<0.001), delayed wound healing in 50% of cases, and all were managed conservatively with antibiotics with or without drainage, without any readmissions.

DISCUSSION

The 6% PSI incidence aligns with global literature (1-10%), higher than some Western studies (2-4%) but comparable to Indian reports (5-8%), possibly due to tropical climate, higher bacterial load, or variable hygiene. Epigastric port predominance matches studies attributing it to gallbladder extraction trauma and bile contamination. [21-25]

Age >45 years as a risk factor concurs with reports linking reduced immunity to infections. Obesity's strong association (OR 4.2) is consistent with meta-analyses showing thicker subcutaneous fat impairing antibiotic penetration and promoting bacterial growth. Diabetes (OR 3.1) impairs wound healing via hyperglycemia and neuropathy, as per ADA guidelines. Smoking's role via

vasoconstriction and impaired immunity is well-documented. [26-30]

Procedural factors like bile spillage (OR 5.6) highlight the need for retrieval bags, reducing contamination. Prolonged operative time and emergency cases increase exposure, echoing RCTs showing higher SSIs in acute cholecystitis. Conversion, though rare (1%), triples PSI risk due to extended manipulation. [31-35]

Microbiological findings (Gram-negatives dominant) differ from skin flora predominance in clean cases, suggesting biliary origin. High ciprofloxacin sensitivity supports its empirical use, but rising resistance warrants local surveillance. [36-40]

Outcomes show PSIs prolong stay by 6 days, increasing costs (estimated ₹10,000-15,000 extra per case in India). Conservative management succeeded, aligning with guidelines; no mortality, unlike severe SSIs.

Limitations: Single-center; short follow-up; no cost analysis. Strengths: Prospective design; comprehensive risk assessment.

Preventive implications: Routine retrieval bags, optimized antibiotics, BMI/diabetes control pre-op. Future studies: RCT on port closure techniques.

CONCLUSION

Port site infections occur in 6% of LC cases, significantly impacting recovery with prolonged stays. Key risk factors include obesity, diabetes, bile spillage, and emergency procedures. Early identification and targeted antibiotics yield good outcomes. Preoperative optimization and procedural refinements can reduce incidence, enhancing LC's safety profile.

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How to cite this article: Dr. Suhas Das, Dr. Subhendu Barman, Dr. Arkaprovo Roy3, PORT SITE INFECTION AFTER LAPAROSCOPIC CHOLECYSTECTOMY, Asian J. Med. Res. Health Sci., 2026; 4 (2):2538-2543.
Source of Support: Nil, Conflicts of Interest: None declared.