MAK HILL Publications | Research Journal of Medical Sciences

Research Article
doi: 10.36478/makrjms.2025.2.334.337

OPEN ACCESS

Key Words
Surgical site infections (SSIs), laparoscopic cholecystectomy, risk factors

Corresponding Author
Dr. S.R. Manjunath
Department of General Surgery, CMH Hospital Indiranagar, Bangalore 38, India

Author Designation
[1]Consultant
[2]Senior Specialist

Received: 31 December 2024
Accepted: 15 January 2025
Published: 29 January 2025

Citation: Dr. S.R. Manjunath and Dr. B.P. Vadiraj, 2025. Surgical Site Infection Rates and Risk Factors in Elective Laparoscopic Cholecystectomies: A Prospective Observational Study. Res. J. Med. Sci., 19: 334-337, doi: 10.36478/makrjms.2025.2.334.337

Copy Right: MAK HILL Publications

Surgical Site Infection Rates and Risk Factors in Elective Laparoscopic Cholecystectomies: A Prospective Observational Study

[1]Dr. S.R. Manjunath and [2]Dr. B.P. Vadiraj
[1,2]Department of General Surgery, CMH Hospital Indiranagar, Bangalore 38, India

ABSTRACT
Surgical site infections (SSIs) remain a significant complication following laparoscopic cholecystectomy, despite its status as the gold standard for gallstone disease treatment. Understanding SSI rates and associated risk factors in diverse healthcare settings is essential for improving patient outcomes. To evaluate the incidence of SSIs and identify the associated risk factors in patients undergoing elective laparoscopic cholecystectomy at CMH Hospital, Indiranagar. This prospective observational study included 200 patients who underwent elective laparoscopic cholecystectomy over one year. Demographic, surgical and postoperative data were collected. SSIs were classified as superficial, deep, or organ/space infections per CDC guidelines. Statistical analysis was conducted using SPSS, with p-values <0.05 considered significant. Among the 200 patients, the overall SSI rate was 7.5%. Superficial infections accounted for 5%, deep infections for 1.5% and organ/space infections for 1%. Risk factors significantly associated with SSIs included diabetes ($p<0.05$), obesity (BMI ≥ 30 kg/m^2, $p<0.05$) and prolonged surgery duration (>60 minutes, $p<0.01$). Gram-positive bacteria (60%) were the most common pathogens identified. The study highlights a 7.5% SSI rate in elective laparoscopic cholecystectomy, with diabetes, obesity and prolonged surgery being significant risk factors. These findings underscore the importance of targeted preoperative optimization and stringent infection control measures to minimize SSIs.

INTRODUCTION

Laparoscopic cholecystectomy (LC) is the gold standard treatment for gallstone disease and other benign gallbladder pathologies due to its minimal in evasiveness, shorter hospital stay and quicker recovery compared to open cholecystectomy[1,2]. Despite its numerous advantages, surgical site infections (SSIs) remain a significant concern, as they are associated with increased morbidity, prolonged hospital stay and higher healthcare costs[3]. The global incidence of SSIs after laparoscopic cholecystectomy is reported to range from 2-15%[4,5]. Factors contributing to the development of SSIs include patient-related factors (e.g., diabetes, obesity and advanced age), surgical factors (e.g., duration of surgery, surgeon's expertise), and postoperative care[6,7]. Identifying and addressing these risk factors is critical to minimizing SSIs and improving patient outcomes. The Centers for Disease Control and Prevention (CDC) provides standardized guidelines for defining and classifying SSIs as superficial, deep, or organ/space infections[8]. In laparoscopic cholecystectomy, SSIs are more commonly superficial and involve the port sites, although deeper infections and bile leaks can occur[9,10]. India faces a unique healthcare challenge due to resource limitations, varied patient populations and differences in perioperative practices. A better understanding of SSI rates and their risk factors in local contexts is essential to improve infection control practices and surgical outcomes[11]. This study aims to evaluate the incidence of SSIs and associated risk factors among patients undergoing elective laparoscopic cholecystectomy at CMH Hospital, Indiranagar.

MATERIALS AND METHODS

Study Design: This is a **prospective observational study** conducted to determine the rate and risk factors of surgical site infections (SSI) in patients undergoing elective laparoscopic cholecystectomy.

Study Setting:
- **Location:** CMH Hospital, Indiranagar.
- **Duration:** 1 year.

Study Population:
- **Sample Size**: 200 patients who underwent elective laparoscopic cholecystectomy.

- **Inclusion Criteria:**
- Patients aged ≥18 years.
- Patients undergoing elective laparoscopic cholecystectomy for gallbladder pathology.
- Patients without evidence of pre-existing infection.

- **Exclusion Criteria:**
- Patients with ongoing infection or abscess.
- Emergency cholecystectomies.
- Patients with incomplete follow-up data.

Data Collection:
- **Demographic Information:**
- Age, gender, BMI and comorbidities (e.g., diabetes).

- **Surgical Details:**
- Duration of surgery, ASA score, type of anesthesia, and perioperative prophylaxis.

- **Postoperative Monitoring:**
- All patients were monitored for SSIs for 30 days post-surgery, as per CDC guidelines.
- Surgical sites were inspected during follow-ups or hospital visits.

Definitions:
- **Surgical Site Infection (SSI):** Infections occurring at the surgical site within 30 days post-surgery, classified into:
- **Superficial Infections:** Involvement of skin or subcutaneous tissues.
- **Deep Infections:** Involvement of deeper soft tissues.
- **Organ/Space Infections:** Involvement of any organ or cavity manipulated during surgery.

Procedure:
- **Preoperative Preparation:**
- Patients were given prophylactic antibiotics (e.g., cefazolin 1g IV) 30-60 minutes before surgery.
- Antiseptic skin preparation with chlorhexidine.

- **Surgical Technique:**
- All surgeries were performed using a standardized 4-port laparoscopic technique.
- Pneumoperitoneum was created using CO_2.

- **Postoperative Care:**
- Monitoring for fever, wound redness, swelling, or discharge.
- Patients with suspected SSI underwent swab culture and sensitivity testing.

Outcome Measures:
- **Primary Outcome:** Incidence of SSI (defined as superficial, deep, or organ/space infection).
- **Secondary Outcomes:** Risk factors associated with SSI, including diabetes, BMI, ASA score, duration of surgery, etc.

Statistical Analysis:

- **Descriptive Statistics:** Mean±standard deviation for continuous variables., frequency and percentages for categorical variables.
- **Comparative Statistics:** Chi-square test and Fisher's exact test for categorical data.
- **Significance:** p-value <0.05 was considered statistically significant.
- **Software:** Data was analyzed using SPSS (version 25).

Table 1: Demographic and Clinical Characteristics of Study Population

Parameter	Mean±SD / Frequency (%)
Sample Size	200
Age (years)	45.3±12.7
Gender	Male: 84 (42%)
	Female: 116 (58%)
Body Mass Index (BMI)	27.8±4.2 kg/m²
Diabetes	Yes: 68 (34%)
	No: 132 (66%)
ASA Score	ASA I: 102 (51%)
	ASA II: 72 (36%)
	ASA III: 26 (13%)
Duration of Surgery	58.4±14.8 minutes

Table 2: Classification of Surgical Site Infections (SSIs)

SSI Type	Number of Cases (%)
Superficial Infections	10 (5%)
Deep Infections	3 (1.5%)
Organ/Space Infections	2 (1%)
Total SSI Cases	15 (7.5%)

Table 3: Risk Factors Associated with SSI

Risk Factor	SSI Cases (n=15)	Non-SSI Cases (n=185)	P-Value
Diabetes	9 (60%)	59 (31.9%)	<0.05
Obesity (BMI ≥30 kg/m²)	8 (53.3%)	28 (15.1%)	<0.05
Duration of Surgery (>60 min)	11 (73.3%)	42 (22.7%)	<0.01
ASA Score (≥II)	10 (66.7%)	88 (47.6%)	0.09

Table 4: Outcomes of SSI Cases

Outcome Parameter	Number of Cases (%)
Hospital Stay (days)	7.8±3.1
Antibiotic Change Required	Yes: 12 (80%)
	No: 3 (20%)
Wound Culture Results	Gram-positive bacteria: 9 (60%)
	Gram-negative bacteria: 6 (40%)
Re-operation	Yes: 1 (6.7%)
	No: 14 (93.3%)

Table 5: Prophylactic Antibiotics Usage

Antibiotic	Frequency (%)
Cefazolin	164 (82%)
Combination Regimen	36 (18%)
Antibiotic Timing (<60 min)	190 (95%)

The present study evaluated surgical site infection (SSI) rates and associated risk factors in patients undergoing elective laparoscopic cholecystectomy (LC) at CMH Hospital, Indiranagar. The overall incidence of SSIs was 7.5%, with superficial infections being the most common (5%). These findings are comparable to global reports, where SSI rates after LC range between 2% and 15%[4,5]. However, our rate is slightly higher than some international studies, possibly due to resource limitations and varied perioperative practices in the Indian healthcare setting[11].

Comparison of SSI Incidence: Our observed SSI rate aligns with Ghnnam *et al.* (2013), who reported an 8% incidence of wound infections following elective laparoscopic cholecystectomy[5]. Similarly, a study by Meijer *et al.* (2000) reported SSI rates of 6% for LC, with superficial infections being the most common[4]. However, studies conducted in higher-resource settings, such as those by Anderson *et al.* (2014), have reported lower SSI rates, highlighting the role of strict adherence to infection control protocols in minimizing infection rates[3].

Impact of Risk Factors: The study identified significant risk factors for SSIs, including diabetes (p<0.05), obesity (p<0.05) and prolonged surgical duration (p<0.01). These findings are consistent with Khairy *et al.* (2004), who reported a higher risk of SSIs among diabetic patients undergoing LC[7]. Diabetes contributes to compromised immune function, delayed wound healing and increased bacterial colonization, which explains its association with SSIs. Obesity has also been well-documented as a significant risk factor for SSIs. Khairy *et al.* (2004) and Ghnnam *et al.* (2013) both reported a positive correlation between BMI and wound infection rates[5,7]. In our study, 53.3% of SSI cases involved obese patients, emphasizing the importance of weight management in reducing infection risks. Prolonged surgical duration was associated with an increased SSI risk in 73.3% of cases, consistent with findings from Mangram *et al.* (1999), who identified extended operative time as a critical risk factor for bacterial contamination and tissue damage[6].

Antibiotic Prophylaxis: The study also highlights the importance of antibiotic prophylaxis in preventing SSIs. In our cohort, 95% of patients received antibiotics within 60 minutes of incision, which aligns with best practices outlined by Mangram[6]. The widespread use of cefazolin as a prophylactic agent in our study (82%) is supported by its broad-spectrum activity and efficacy in preventing infections.

Comparison to Indian Studies: Our study's SSI rate of 7.5% is consistent with Agarwal *et al.* (2013), who reported SSI rates ranging from 6-10% in rural Indian settings[11]. Resource constraints, patient comorbidities and variability in surgical and postoperative care protocols likely contribute to these findings.

Limitations: The study's limitations include a single-center design, which may limit the generalizability of the findings. Additionally, the exclusion of emergency cholecystectomies and patients with ongoing infections may underestimate the true burden of SSIs in laparoscopic surgery.

CONCLUSION

This study underscores the importance of identifying and mitigating risk factors for SSIs in laparoscopic cholecystectomy, especially in resource-limited settings. Optimizing perioperative care, including strict glycemic control, weight management and adherence to antibiotic prophylaxis protocols, can significantly reduce infection rates and improve surgical outcomes. Future multicenter studies are warranted to validate these findings and develop region-specific guidelines for infection prevention.

REFERENCES

1. Hunter J.G., 1991. "Laparoscopic cholecystectomy: the standard of care." Annals Surgery., 213: 665-677.
2. Lujan, J.A., *et al.* 1995. Laparoscopic versus open cholecystectomy in the treatment of acute cholecystitis." Annals Surgery, 221: 404-412.
3. Anderson, D.J., K. Podgorny, S.I. Berríos-Torres, D.W. Bratzler and E.P. Dellinger *et al.,* 2014. Strategies to Prevent Surgical Site Infections in Acute Care Hospitals Infec. Control Hosp. Epidemiol., 35: 605-627.
4. Meijer, W.S., *et al.,* 2000. "Surgical site infection in laparoscopic and open cholecystectomy." British, J. Surgery., 87: 1248-1251.
5. Ghnnam, W., *et al.* 2013. "Incidence of wound infection in elective laparoscopic cholecystectomy." International Journal of Surgery, 11: 898-900.
6. Mangram, A.J., T.C. Horan, M.L. Pearson, L.C. Silver and W.R. Jarvis, 1999. Guideline for the prevention of surgical site infection, 1999. Infect. Control Hosp. Epidemiol., 20: 247-278.
7. Khairy, G.A., *et al.* 2004. "Surgical outcomes of laparoscopic cholecystectomy in diabetic patients." Journal of Laparoendoscopic and Advanced Surgical Techniques, 14: 1-5.
8. Horan, T.C., *et al.* 1992. "CDC definitions of nosocomial surgical site infections." Infection Control and Hospital Epidemiology, 13: 606-608.
9. Ahmad, G., *et al.* 2008. "Port-site infection after laparoscopic surgery." British Journal of Surgery, 95: 1028-1034.
10. Ulmer, B.J., *et al.*, 2008. "Bile duct injuries and infectious complications in laparoscopic cholecystectomy." American J. Surgery, 195: 107-113.
11. Agarwal, A., *et al.* 2013. . "Surgical site infections in rural India." J. Infection, Public, Health 6: 140-148.