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# PORT SITE INFECTIONS IN LAPAROSCOPIC SURGERIES: AN ANALYSIS OF CONTRIBUTING FACTORS AND PREVENTIVE MEASURES

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**ABSTRACT** **Introduction:** Port site infections (PSIs) represent a significant complication following laparoscopic surgeries. This paper analyzes 500 cases of laparoscopic surgeries, examining the incidence of PSIs, contributing factors, and the impact of preventative measures such as the use of endobags. Our findings reveal a correlation between the non-use of endobags and higher PSI rates. Minimally invasive laparoscopic surgeries have transformed surgical practice, offering benefits such as reduced hospital stays, lower costs, less pain, and quicker recovery compared to open procedures. However, PSIs remain a notable challenge, affecting patient outcomes and healthcare costs. This study investigates the incidence, risk factors, and preventive strategies for PSIs in laparoscopic surgeries to enhance management and outcomes. **Objectives:** To study nature, prevalence & the various perioperative factors for PSIs in laparoscopic surgeries. **Methods:** This single-center prospective observational study was conducted on 500 patients who had undergone laparoscopic surgery in the Department of General Surgery at GSVM Medical College, LLR & Associated Hospitals, Kanpur, during the study period from October 2022 to October 2024. **Results:** In our study, the PSI rate was 1.2% (6 out of 500 cases). Females between the ages of 30 - 60 were found to be more susceptible to infections at the port. Epigastric ports are the most common sites for port site infections. Patients with diabetes had a higher risk of developing PSI after surgery. The most common causative organism of port site infection was found to be Staphylococcus aureus and E. coli. **Conclusion:** Although PSIs during laparoscopic procedures have very minor side effects, they can still be avoided by properly sterilizing the tools used during the procedure. Contributing factors include procedure length, and diabetes, which increases PSI. Using retrieval bags can reduce infections but may increase operation time and pain.

**KEYWORDS :** Laparoscopic surgeries, Port site infection, Endobag, Sterilization

## INTRODUCTION

PSIs represent a significant complication in laparoscopic surgeries, affecting patient outcomes and increasing healthcare costs. Despite the minimally invasive nature of laparoscopic procedures, PSIs remain a concern due to factors such as contamination during instrument insertion, patient-related risks, and surgical environment challenges. Understanding the contributing factors to PSIs is essential for developing effective preventative measures. This analysis delves into the underlying causes of port site infections in laparoscopic surgeries, exploring both the microbial and procedural aspects that contribute to their occurrence. Additionally, it examines current preventative strategies and proposes evidence-based recommendations to minimize the risk of infection, ultimately improving surgical safety and patient care.

### Aims and Objective

- To study the prevalence of port site infections in cases of laparoscopic surgeries
- To study the various factors leading to port site infection in all laparoscopic surgeries.

## MATERIALS AND METHODS

This single-center prospective observational study was conducted at the Department of General Surgery, GSVM Medical College, LLR & Associated Hospitals, Kanpur, from October 2022 to October 2024. The study included 500 patients aged between 18 - 75 years who had undergone laparoscopic surgery. Both male and female patients were included after obtaining consent from either the patient or their relative. The types of surgeries included cholecystectomy, appendectomy, and hernia repair, encompassing both elective and emergency procedures. Exclusion criteria included patients with malignancies such as Ca gallbladder (Ca GB), Ca colon, and Ca appendix, patients who did not adhere to regular follow-ups, those not willing to enroll in the study, and any laparoscopic surgeries that were converted to open surgeries.

Ethical clearance: The research procedure followed was in accordance with the approved ethical standards of GSVM Medical College, LLR & Associated Hospitals, Kanpur, UP

## RESULTS

Among the 500 patients who underwent these procedures, the PSI rate was 1.2%. Most of the surgeries were performed on patients aged 20-30 years (31.4%), followed by those aged 31-40 years (28%). However, the highest incidence of PSI was observed in the 31-40 age group (50%), followed by the 41-50 age group (33.33%). All six cases of PSI occurred in patients aged between 30-60 years. Of the 500 cases, 384 were females, and 116 were males. Among the females, 4 cases (1.04%) resulted in PSI, whereas 2 cases (1.72%) among the males developed PSI.

The distribution of laparoscopic surgeries performed included 88.2% laparoscopic cholecystectomy, 3.6% laparoscopic appendectomy, 1.2% IPOM, and 4.6% TAPP. Among them all cases of PSIs were found in laparoscopic cholecystectomy surgeries.

**Table 1: Distribution Of The Studied Operated Cases And Psi Based On Their Age**

| Age (in years) | No. of Cases (n=500) | Percentage (%) | No. of Cases of Port Site Infection (n=6) | Percentage of PSI Cases (%) |
|---|---|---|---|---|
| 18-20 | 5 | 1% | 0 | 0 |
| 21-30 | 157 | 31.4% | 0 | 0 |
| 31-40 | 140 | 28% | 3 | 50 |
| 41-50 | 93 | 18.6% | 2 | 33.33 |
| 51-60 | 72 | 14.4% | 1 | 16.67 |
| 61-70 | 31 | 6.2% | 0 | 0 |
| >70 | 2 | 0.4% | 0 | 0 |

The infection rate was notably higher among patients with diabetes (33.33%) and those with both diabetes and hypertension (16.67%). This suggests that comorbid conditions, particularly diabetes, are significant risk factors for developing PSI.

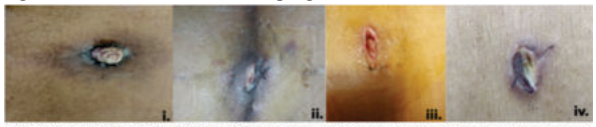


FIG 1:PRESENTATION OF PORT SITE INFECTION : i. swelling at epigastric port ii. wound dehiscence and pus discharge iii.wound gap iv. pus discharge

Among the 500 cases reviewed, 20.2% experienced bile spillage at port site, 15.8% had both gallstone and bile spillage at port site, and

64% had no port site contamination. Specific intraoperative complications included 268 cases of bile spillage without gallstone spillage, 104 cases with both gallstone and bile spillage, 94 cases with dense adhesions, and 36 cases with empyema. Among the six cases of port site infections (PSI), 33.33% were associated with bile spillage, 16.67% with gallstone spillage, 16.67% with dense adhesions, 16.67% with empyema, and 16.67% had no reported complications.

Most surgeries (43.2%) lasted 1 hour or less. However, PSI was most frequently observed in surgeries lasting between 1 hour to 1 hour 29 minutes (33.33%) and those lasting 2 hours or more (33.33%).

Endobags were used in 15.8% of the cases, and none of these cases resulted in PSI. Conversely, all six PSI cases occurred when endobags were not used, suggesting that the use of endobags might reduce the risk of PSI.

Plasma sterilization was used in 47.6% of the cases, and only one PSI case (2.1%) was reported. In contrast, glutaraldehyde was used in 52.6% of the cases, with five cases (9.5%) of PSI reported, indicating a potentially lower infection risk with plasma sterilization.

## DISCUSSION

Laparoscopic methods have supplanted open surgery, revolutionizing the area of surgery. Published evidence indicates that LC is the most effective therapy for cholecystitis [1,2]. Laparoscopic cholecystectomy has several benefits over open cholecystectomy, including less trauma, discomfort, shorter hospital stays, acceptable cosmetic outcomes, and faster recovery.

Laparoscopic surgery can result in port-site infections, which are infrequent but frustrating. Laparoscopic surgeries are less intrusive and have a lower influence on the immune system, making post-operative PSI less prevalent. Despite clean surgical incisions, port-site infections can occur at rates ranging from 1.4% to 6.3%, according to research [3,4]. In a prospective study by Votik and Tsao [4], wound infections were found to be 6%. The research included 873 participants who had laparoscopic surgery. The study reported a 6% PSI following laparoscopic cholecystectomy and 2% after other operations.

In 2004, Hamzaoglu et al. [5] studied over 100 laparoscopic surgery patients. PSI was recorded in 8% of the cases. Further studies by Rooh-ul-Muqim et al. [6], and Memon et al. [7] found infection rates of 4.84%, and 5%, respectively. Karthik et al. [8] reported a PSI rate of 1.8%. The majority of laparoscopic cholecystectomy (LC) patients were female, consistent with previous studies by Kumari and Narain and Khursheed et al. [9,10]. Both studies found a substantial relationship between PSI and female patients, which aligns with current study findings.

Our study involved 500 patients, including 384 (78.6%) females and 116 (21.4%) men. Only 6 individuals (1.2%) suffered port site infections, with 4 females and 2 men developing PSI. All six cases of PSI occurred in patients aged between 30-60 years.

Sharma et al. [11] identified 9 cases of port site infections among 851 patients. Most of these instances occurred in the 40-60 age. Research indicates that older individuals with compromised immunity and co-morbidities are more prone to develop difficulties during laparoscopic surgery.

PSI were predominantly observed at the epigastric port in 83.33% of cases, consistent with findings by Jan and Hamzaoğlu [12,5]. However, Colizza and Tocchi [13,14] reported higher PSI rates at the umbilical port. The frequent retrieval of the gallbladder via the epigastric port likely contributes to this. Our study also found that longer laparoscopic cholecystectomy (LC) procedures, taking over an hour, led to higher PSI rates, a correlation also noted by Jan and Anielski [12,15]. Prolonged surgery increases exposure to air, trauma, and stress, raising the incidence of surgical site infections (SSI) to 83.33% in cases exceeding one hour, aligning with studies by Anvikar and Rao. [16,17]

Certain underlying conditions like smoking and diabetes can weaken the immune system, significantly increasing the risk of surgical site infections (SSI). These conditions also contribute to longer preoperative stays, further heightening SSI risk. In our study, diabetes was the most common underlying conditions among the 1.2% of patients who developed PSI.

When analyzing the causes of port site lesions, we found that, usually, inadequate sterilization of laparoscopic instruments played a major role. The insulation, crevices, and joints of these tools can harbor mycobacterial spores and other organisms, which may later cause infections or port site tuberculosis. Proper cleaning of burnt tissue and clotted blood from instruments is essential, as these can become breeding grounds for bacteria. Ultrasonic technology is highly effective for this purpose. Since tap water is a common source of atypical mycobacteria, it is advisable to clean instruments with autoclaved water or sterile saline, and to ensure they are thoroughly dried afterward.

2% glutaraldehyde is the most widely utilized sterilizing chemical for laparoscopic equipment.

To disinfect and sterilize equipment (hand instruments and ports with trocars), immerse them in the solution for at least 20 minutes and 10 hours, respectively. Changing the solution every 2 weeks or sooner, depending on surgical workload, is necessary. While ethylene oxide gas sterilization is preferable, it may not be available at all facilities. Although higher glutaraldehyde concentrations are suggested, some investigations have found resistance to even higher doses.[18]. Prakash K. Sasmal et al. [18] suggest that acetic acid and orthophthaldehyde can be used as a feasible alternative. To sterilize insulated hand tools, we recommend autoclaving the ports with trocars or using a stronger glutaraldehyde solution. Sterilization and disinfection are time-consuming processes that must be continuously monitored in areas with potential threats.

The study found that routinely removing gallbladders from the epigastric port was the most likely source of epigastric port-site infection.

Mir et al. [19] found that iatrogenic gallbladder perforation, resulting in bile spillage, is the main risk factor for PSI after elective LC in otherwise healthy patients. Taking precautions to prevent spills can significantly reduce morbidity and mortality from PSI.

Taj et al. [20] found 27 (5.48%) incidences of PSI among 492 patients. An umbilical port infection was found in 26 cases (5.28%) after gall bladder removal without endobags, while only 1 case (0.2%) of PSI was found when retrieval bag used. Endobags are recommended by Ali & Siddiqui (2013) [21] and Helle et al. [22] to reduce gallstone spills and port site contamination.

Endobag was used by 15.8% for gall bladder extraction patients in our study. However, 84.2% of the remaining endobag were not used. There were six recorded cases of port site infection when endobag was not used, but none when endobag was used.

Staphylococcus aureus and Escherichia coli were found in 33.33% and 33.33% of the six instances that were studied, respectively, in the Pus culture. Three-thirds of the cases had sterile cultures. It has been discovered that port-site infection, which was caused by implanted stones, is an unusual side effect of laparoscopic cholecystectomy surgery. The discharging sinus was an uncommon side effect of implanted stone-related port-site infection during laparoscopic cholecystectomy, according to Ali & Siddiqui [21]. Rarely do gallstones get implanted in the subcutaneous tissues of the abdominal wall and infected bile occur. At the port site of retrieval, this causes a draining sinus or abscess (Hand 2006; Kumar 2004; Shahzad 2007). [23,24,25] Any feasible method should be used to remove spilled gallstones. Nevertheless, conversion to open surgery is not necessary because the reported complication risk of lost stones is less than 1% (Brockmann 2002, Sathesh-Kumar 2004). [26,27]

### Limitations

The study has a low rate of port site infection (6 out of 500 laparoscopic surgeries).

## CONCLUSION

Laparoscopic surgeries generally have minimal port site complications, offering significant benefits over open surgeries, such as shorter recovery times, less discomfort, and reduced costs. However, PSIs remain a notable concern, affecting patient outcomes and increasing healthcare expenses. Our study found that PSIs are rare in elective laparoscopic cholecystectomy but can be further minimized through careful patient selection and adherence to procedural principles. Key risk factors include female gender, age (30-60 years),

longer procedures, and diabetes. The use of retrieval bags can reduce PSIs but may increase operative time and postoperative pain. Preventing bile spillage from iatrogenic gallbladder perforation is crucial in reducing PSIs. Enhanced sterilization techniques and strict antiseptic measures are recommended to lower infection rates further. Overall, while minimally invasive surgery has reduced infection risks, strict adherence to preventive strategies is essential to maintaining these benefits.

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