Original Article

Incidence of Port Site Infection Following Laparoscopic Cholecystectomy — A Prospective Observational Study

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ABSTRACT

Introduction: *Port site infection (PSI), although rare, is one of the troublesome complications that undermine the benefits of minimally invasive surgery. Laparoscopy has replaced open surgery due to its many advantages, including minimal invasion, less pain, wider field of view, more aesthetic scars, and earlier discharge.* ***Methods and Materials:*** *This prospective observational study was conducted from July to December 2022 in the Department of Surgery of Enam Medical College and Hospital, Savar, Bangladesh. The subjects were 150 patients of both sexes aged 23 to 65 years. As a routine procedure, all patients received the prophylactic broad-spectrum antibiotic ceftriaxone 1 g stat via intravenous infusion at the time of induction of anesthesia. All data were collected in a predesigned form and statistically analyzed.* ***Results:*** *The mean age of studied patients group ranging from 23 to 65 years are 41.6 years. Majority (130/150, 86.66%) of the patients were female. The highest percentage of BMI was recorded (47.3%) between 18.5 and 40 kg/m^2. 42 Patient out of 150 with high BMI (>30Kg/m^2), (28%) faced difficulty in gall bladder extraction leading to spillage of bile and stones. 8 out of 28 developed port site SSI later. Patient with low BMI (<30kg/m^2) also had PSI in 2 cases of ELC. Port Site Infection (PSI) occurred in 10 patients (8 females and 2 males), which constituted 6.66% of the study population. Out of these cases, 1(10%) case was deep seated and rest of the 2 were superficial infection.* ***Conclusion:*** *Special consideration should be taken in chronic deep surgical site infection like port site persistent sinus. Most of the PSIs are superficial which*

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got cured with regular dressing and more common in females.

Keywords: *Port Site Infections, Laparoscopic Cholecystectomy, Minimally Invasive Surgery.*

INTRODUCTION

Port site infections (PSIs), although rare, are one of the troublesome complications that undermine the usefulness of minimally invasive surgery. They not only increase the morbidity of patients but also tarnish the reputation of surgeons. Laparoscopy has replaced open surgery because of its many advantages, including minimal invasiveness, reduced pain, wide field of view, cosmetic scarring, and early discharge from hospital[1]. Despite advances in antibiotics, sterilization techniques, surgical techniques, and operating room ventilation, PSIs are still widely used. This minimally invasive procedure allows surgeons to enter the abdomen and pelvis through a relatively small skin incision and a wide field of view, hence it is called keyhole surgery[2-4]. After a long learning curve, it has become the preferred surgical treatment for many surgeries[5]. Laparoscopic cholecystectomy has become the gold standard for symptomatic cholelithiasis[6]. The incidence of serious complications such as CBD injury, accidental right hepatic artery ligation, and cystic artery bleeding after laparoscopic surgery is approximately 1.4 cases per 1,000 procedures[7]. The incidence of port site infection after elective laparoscopic surgery is approximately 21 cases per 100,000. Infection can be endogenous and/or exogenous, as human hair follicles harbor numerous commensal microorganisms that can cause port site infection during surgery[8]. Elective laparoscopic cholecystectomy (ELC) is associated with fewer postoperative infections (SSIs) than open cholecystectomy[9]. However, LS is associated with many unique complications. One of these complications, which is preventable, is port site infection (PSI). PSIs quickly negate the benefits of LS as patients worry about a slow, excruciating infection and lose confidence in their surgeon. Morbidity increases significantly, hospital stays increase, and patients lose money. The very aim of MAS, to achieve the highest level of cosmesis, can result in unsightly scars, with significant impact on the patient's quality of life. However, the increased incidence of PSI is mainly due to bile or stone leakage during surgery or gallbladder removal via the epigastric or umbilical port[10,11]. Thus, PSI not only increases patient morbidity but also stigmatizes the surgeon's skill. Patient morbidity manifests in the form of fear of complete healing, poor cosmesis, need for prolonged hospital stay or prolonged wound dressing, increased costs, and future incisional hernia. This observational study aimed to evaluate possible risk factors contributing to and mitigating port site complications during elective laparoscopic cholecystectomy.

METHODS & MATERIALS

This prospective observational study was conducted at Dept. of Surgery, Enam Medical College Hospital, Savar, Bangladesh from July to December 2022. Out of 150 patients of both sexes with age group 23 to 65 years. Patients with

symptomatic cholelithiasis proven by clinical and radiological abdominal ultrasonography were included. Patients having gall bladder lump, jaundice, empyema, malignancy, previous laparotomy, abdominal wall skin infection and medical comorbidities like Type2-DM, hepatitis, or taking chemotherapy or HAART or ATT were excluded. These patients underwent elective laparoscopic cholecystectomy in the department of General Surgery at EMCH, Bangladesh. This minimally invasive surgery was performed by qualified specialist laparoscopic surgeons.

Patient information including demographics, clinical details, examinations, date of admission, date of surgery, and SSI-related complications during follow-up were extracted from hospital records. All patients received a prophylactic intravenous injection of the broad-spectrum antibiotic ceftriaxone (1 g) at the time of anesthesia induction. This ceftriaxone injection was administered twice daily for the next 24 hours postoperatively. To avoid visceral injury, all patients underwent pneumoperitoneum via laparotomy. All patients underwent four-port laparoscopic cholecystectomy under general anesthesia. Patients experiencing bile, stone, or pus leakage were given intravenous infusion of metronidazole 500 mg three times a day for 48 hours and ceftriaxone for 48 hours. The drain was removed after 24 hours. Patients were discharged within 36 hours and advised to go to the nearest OPD (outpatient department) for follow-up for suture removal. The sutures were removed on postoperative day 7 and patients were asked to return for follow-up at 2 weeks, 1 month, and 3 months to assess adverse outcomes. All patients with port site complications such as serous or purulent discharge and wound dehiscence had swabs taken for culture and sensitivity testing and were advised to apply a dressing every other day. Patients with deep postoperative wound infections were treated with daily dressings and high-concentration antibiotic therapy. Patients with superficial postoperative wound infections healed within 1 month with appropriate dressings and antibiotic coverage. All patients responded well at follow-up within 6 months.

All data were collected in preformed format and statistical analysis was done. Microsoft Version 21 software was used for data analysis. The data was introduced in Microsoft excel of PC. Descriptive table analysis was done. Chi-square test was used to decide the significance of the association between related variables. $P \leq 0.05$ was considered as statistically significant.

RESULTS

Total 150 patients with demographic variables like sex, age and BMI were analysed. The mean age of the study was 41.6 years. Out of 150, 130 (86.66%) patients were female and 20 (13.33%) were male. 8 females and 2 males had port site infection among the study population **[Table I]**.

Table I: Table showing gender factors associated with development of PSI.

Gender	PSI	Percentage	P Value
Female	8/130	6.1	<0.05
Male	2/20	10	
Total	10/150	-	

Table II: Showing BMI association with Incidence of PSI.

BMI	PSI	Percentage	P Value
BMI <30Kg/m^2	8	80	<0.04
BMI >30Kg/m^2	2	20	
Total	10	100	

The highest percentage of BMI was recorded (47.3%) between 18.5 and 40 kg/m^2. 42 Patient out of 150 with high BMI (>30Kg/m^2), (28%) faced difficulty in gall bladder extraction leading to spillage of bile and stones. 8 out of 28 developed port site SSI later. Patient with low BMI (<30kg/m^2) also had PSI in 2 cases of ELC **[Table II]**.

Table III: Table showing association of PSI with biliary spillage

Spillage (Bile, stone, or pus)	PSI(Number)	Percentage	P Value
YES	9/10	90	<0.05
NO	1/140	0.7	
Total	10/150	-	

Acute cholecystitis cases were mostly kept under observation and conservative treatment and planned for interval cholecystectomy after 6 weeks. 13.33% cases (20/150) were operated in the acute phase and was associated with difficult calot's dissection and spillage of bile and stone during gall bladder dissection from gall bladder fossa of liver. Spillage of bile, stones, or pus during calot's dissection as well as contamination of port sites during gall bladder extraction are an important predictor of port site infection. Such incidence of biliary spillage was reported with 10(6.66%) cases. 10 patients developed PSI after incidence of spillage of bile and stones during gall bladder dissection and specimen extraction **[Table III]**.

Table IV: Table showing incidence of PSI with Acute Vs Chronic cholecystitis.

Diagnosis	PSI	percentage	P Value
Acute Cholecystitis	3/22	13.6	<0.05
Chronic Cholecystitis	7/128	5.4	
Total	10/150		

Overall Port Site Infection (PSI) was reported in 10 patients (8 females & 2 males) of study population which underwent ELC, which constituted 6.66% **[Table IV]**.

Table V: Different type of port site infection

Type of PSI	Number	Percentage	P value
Superficial PSI	9	90	<0.05
Deep PSI	1	10	
Organ/Space PSI	0	00	
Total	10		

Out of these 10 cases (6.66%) operated in acute condition had PSI where 1 case

developed deep SSI and 9 cases (90%) had superficial port site infection. 1 PSI also developed in patients which had no biliary spillage **[Table V]**.

Table VI: Showing incidence of PSI at different sites of port.

Port site	PSI(Number)	Percentage	P Value
Umbilical Port	7	70	<0.05
Epigastric Port	3	30	
Lateral Ports	0	00	
Total	10	-	

As far as the site of port infection was concerned, umbilical PSI was seen in 7 out of 10(70%) and epigastric PSI was seen in 3 cases (30%) **[Table VI]**.

Table VII: Types of bacteria isolated from PSI sites

Type of Bacteria	Species	Numbers
Gram -VE	Enterobacter spp	3(30)
	E. coli	1(10)
Gram+Ve	Staphylococcus aureus spp	2(20)
	Enterococcus spp	1(10)
Mycobacterium tuberculosis	Mixed	1(10)
	Atypical	1(10)
	Typical	0
	No growth	1(10)
Total		10

Swab cultures were sent in all suspected PSI cases in OPD, and report has been shown in Figure 1. It was found that female gender with high BMI, those operated in acute phase, spillage during dissection or specimen extraction via umbilical port site are important predictors of developing port site infection **[Figure I & Table VII]**.

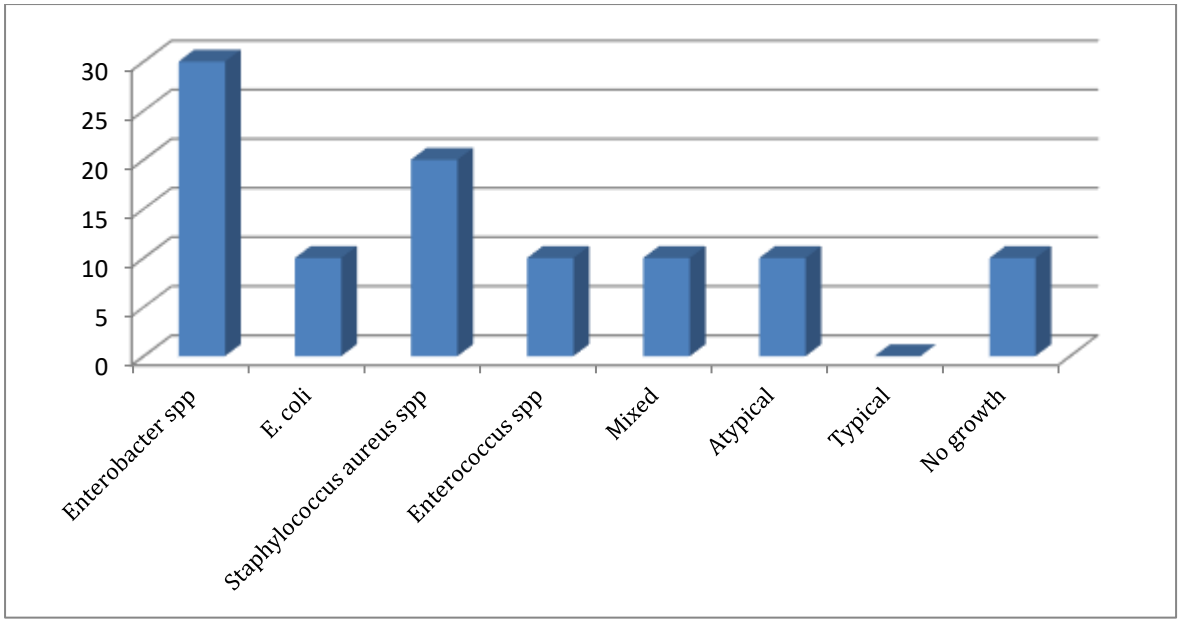

Figure I: Distribution of organism isolated from the swab culture (*n*=10)

DISCUSSION

Although PSI is rare, MAS can be a frustrating complication for both patients and surgeons. Apart from bacterial causes, the rapidly spreading multidrug-resistant nontuberculous mycobacteria disease is an emerging threat to surgery. Strict adherence to regulations regarding cleaning and sterilization of laparoscopic instruments with appropriate sterilants is the best way to avoid complications. The advantages of laparoscopy in reducing PSI are minimally invasive surgery with small incisions, resulting in less blood loss, less pain, and less immunosuppression[16]. The overall incidence of port site infection in our study was about 6.66% (10 out of 150 patients), which is lower than the results of the study reported by Khurshid et al.[17], whose results were 6.7%[18], and whose results were higher than the results of the study by Jasim Saud et al.[18], whose results were lower than our study (2.4%). The differences among the three studies may be due to differences in patient selection, sterilization technique, gallbladder sampling site, and local bacterial flora, which may vary from hospital to hospital and from patient to patient. In our study, we found that patients who underwent elective laparoscopic cholecystectomy were mainly female. Most of the patients with port infections were also female. Laparoscopic cholecystectomy is usually possible as long as the inflammation is limited to the gallbladder. Prolapsed stones are mainly composed of cholesterol and do not pose a significant risk of infection. On the other hand, pigment stones often harbor live bacteria, which may cause subsequent infection if left in the abdominal cavity[19]. However, great care must be taken when performing the surgery, because the inflammation extends to the hepatic hilum, and the normally thin, barely attached tissue surrounding the cystic duct and artery is significantly thickened and edematous, and may not be easily removed by standard blind dissection. isolated[20]. During laparoscopic cholecystectomy, gallstone leakage occurs in 5–40% of procedures[15,20], and intraoperative gallbladder perforation is common (10–40%)[21] and can be caused by traction with forceps or heat. Injury caused by electrosurgery when removing the gallbladder from the bed[19]. Ten acute surgical cases (6.66%) had PSI, one had a deep postoperative wound infection, and nine (90%) had a superficial port site infection. One PSI occurred in a patient who did not experience bile leakage. Leakage of bile, pus, or stones remaining in the abdomen or wound was highly associated with port site infection and local abscess formation[19], with statistical significance (p=0.0001). The foreign body left behind could be a stone, staple needle, or part of the plastic case. In our study, the percentage was lower and maybe due to routine usage of retrieval bag which prevents direct contact of port wound with the content of infected gallbladder. As far as the site of port infection was concerned, umbilical PSI was seen in 7 out of 10(70%) and epigastric PSI was seen in 3 cases (30%). This may be due to the umbilical flora and gall bladder extraction through umbilicus port[24] which indicates that site of gall bladder extraction was the most common site of PSI. Most of the patients presented with PSI in our study were superficial infection. Also, superficial infection is more common than deep infection as reported by study done by Mir, et al. hospital Kashmir 2012 (87.7% for superficial infection compared

with 13.3% for deep infection)[17]. Most of the patients presented with PSI in our study were superficial infection 09/10 patients (90%) compared with 1/10 patients (10%) presented with deep site infection.1 patient (10%) who presented with deep infection in our study as recurrent discharging single sinus at umbilical port. In addition, most laparoscopic instruments have numerous joints and crevices where blood and tissue can collect. Frequent use of instruments without optimal cleaning can lead to contamination with microorganisms such as atypical mycobacteria. The instruments themselves are covered with plastic insulation and have joints that make them poorly sterilized[27]. Rapid changeovers between operations also sacrifice optimal sterilization times. In modern centers, the use of disposable laparoscopic instruments and the application of modern sterilization methods such as (STERRAD), which is the hallmark of low-temperature sterilization, are the gold standard. This review will contribute to the understanding of relevant research on the appropriate treatment of PSI in LS. All cases of PSI, especially atypical mycobacteria, should be reported to know the exact frequency, etiology, and susceptibility patterns to various antibiotics. Macrolides, quinolones and aminoglycosides show promising activity against atypical mycobacteria. Further studies are needed to find appropriate guidelines for the diagnosis and treatment of this emerging problem.

Conclusion:

There is a significant association of PSI with spillage of bile, stones, or pus, with the site of port for gallbladder extraction, high BMI and surgery in acute cholecystitis condition. Special consideration should be taken in chronic deep port site infection like sinus. Most of the PSIs are superficial and more common in females.

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