Original Article

Incidence of Port Site Infection in Laparoscopic Cholecystectomy

DOI: dx.doi.org

Shaffat Sabbir Khan[1*], Md Sakeef Rahman[2], Sabbir Ahmed Khan[3], Subinoy Krishna Paul[4]

Received: 10 July 2024
Accepted: 15 August 2024
Published: 25 August 2024

Published by:
Sheikh Sayera Khatun Medical College (SSKMC), Gopalganj, Bangladesh

*Corresponding Author

ABSTRACT

Introduction: *Surgical infections are physically, socially, and financially stressful. It prolongs the patient's stay in the hospital and harms the hospital and the attending surgeon. For gallstone disorders, laparoscopic cholecystectomy is considered the gold standard of care.* ***Methods & Materials:*** *This study was a prospective observational type. 100 patients of age group above 20 years of both sexes, were admitted to the department of surgery, Dhaka Medical College Hospital. Laparoscopic cholecystectomy was done in all cases. Data was processed and analyzed with the help of the computer program SPSS and Microsoft Excel.* ***Results:*** *In this study, the maximum number of patients (44%) was between 30-39 years of age groups, with a mean value of 42.7 ± 6.19 years. Intraoperative complications levels, 12 patients developed hemorrhage from primary port site, followed by 13 patients developed bradycardia. Spillage of bile and/or gallstones generally occurs in 9.0% of patients, because of gallbladder perforation. It is evident that, among 12 patients who developed hemorrhage from the primary port site, a total of 5 patients developed purulent discharge from the site, redness or heat was found in 4 patients, and tenderness and localized swelling were found in a total of 3 patients.* ***Conclusion:*** *Port site infection is not uncommon after laparoscopic cholecystectomy. In this study incidence of port site infection was 6.0%. The best way to avoid complications from laparoscopic surgery is by meticulous handling of*

(The Insight 2023; 6(2): 226-234)

1. *OSD, DGHS, Dhaka, Bangladesh*
2. *Registrar, Department of Casualty, Sir Salimullah Medical College Mitford Hospital, Dhaka, Bangladesh*
3. *Principal & Head of Department, Department of Urology, Uttara Adhunik Medical College, Dhaka, Bangladesh*
4. *Unit Head, Department of Casualty, Dhaka Medical College Hospital, Dhaka, Bangladesh*

tissue and careful dissection of the Gallbladder.

Keywords: *Port site Infection (PSI), Pneumoperitoneum, Laparoscopic cholecystectomy.*

INTRODUCTION

A less invasive surgical technique called laparoscopic cholecystectomy is used to remove a damaged gallbladder. Since the early 1990s, this method has effectively taken the place of the open method for routine cholecystectomies[1]. Currently, cholecystitis (acute or chronic), symptomatic cholelithiasis, biliary dyskinesia, acalculous cholecystitis, gallstone pancreatitis, and gallbladder masses/polyps can all be treated with laparoscopic cholecystectomy[2]. The indications for an open cholecystectomy are the same. The most effective treatment for gallbladder cancer cases is typically an open cholecystectomy. Gallstones affect about 20 million people in the United States. Approximately 300,000 cholecystectomies are performed on these individuals each year. Between 10% and 15% of people have gallstones without any symptoms. Twenty percent of these have biliary colic symptoms. About 1% to 4% of the 20% of patients who have symptoms will experience complications, such as acute cholecystitis, gallstone pancreatitis, choledocholithiasis, or gallstone ileus[3]. As people age, gallstones become more common, and women are more prone than men to have gallstones. Gallstones affect 5% of males and 20% of women between the ages of 50 and 65. Gallstones are mostly made up of cholesterol (75%), with pigment making up the remaining 25%[4]. The clinical signs and symptoms of gallstones are the same regardless of their composition. A paradigm shift in the way that modern medical treatment is approached has been brought about by laparoscopic surgery (LS), often known as minimal access surgery. Patients and doctors alike find it popular because of its early return to work, reduced pain, better aesthetics, and early postoperative recovery. From cholecystectomies and appendectomies to several other sectors, its use has expanded. But LS comes with a unique set of challenges. While rare, port site infection (PSI) is one of the annoying side effects that negate the advantages of minimally invasive surgery[5]. An earlier study found that the incidence of complications following laparoscopic surgery is 4.72%, with the port site problem accounting for the majority of these cases. The most common (3.2%) was port site infection, followed by port site bleeding (0.6%)[6]. Infection can be caused by several factors, including the age of the patient, comorbidities, the timing and method of establishing the port, the placement of the port, and the type of lesion. In certain situations, the patient's bacterial flora may become opportunistic and cause infection[7]. In less than 30 minutes, there was no infection rate, according to the study by Lilani et al.[8]. When surgeries were continued for two hours or more, there was a notable rise in SSIs. Prophylactic antibiotics, obesity, and drains do not influence the incidence of surgical site infections after laparoscopic cholecystectomy[9]. The type of wound, however, has a significant role in infection. According to the CDC's 2015 SSI criteria, wounds are categorized as either clean, clean-contaminated, contaminated, unclean, or infected. A wide range of microorganisms that might cause infections

reside in the human body. Patients' natural commensal microbial flora may cause infection when the host systemic immunity is reduced by disease, medicine, or alterations of skin or mucous membrane integrity related to surgical injury. The PSIs in LS show up as seropurulent discharge from the port sites accompanied by signs of an organ/space infection or surrounding skin inflammation[10]. In the port site, three different kinds of surgical site infections could happen. The first type of surgical site infection is superficial, affecting mainly the skin and subcutaneous tissues, and it usually manifests 30 days after surgery. Second, a deep surgical site infection affecting deep soft tissues, such as muscles and fascia, down to the incision, may appear 30 days following surgery[11]. Thirdly, organ/space SSI: any organ or place other than the incision that was opened or moved during surgery that becomes infected[12]. A port site infection (PSI) not only increases patient morbidity but also tarnishes the surgeon's reputation. PSIs continue to be prevalent even with advancements in the fields of antimicrobial agents, sterilization, surgery, and operating room ventilation. A previous study found that the incidence of port site infection is 4.5%; however, male patients showed greater rates, 8/89 (8.9%), than female patients. The umbilical port is more likely to experience port site infections (PSI); the infection rate may vary depending on the port used to remove the material. To avoid concealed malignant cells, unintentional content spills, and wound infection, the diseased material should be evacuated in an endobag. The study aimed to determine the incidence of port site infection in laparoscopic cholecystectomy in tertiary care hospitals. To find out the relationship between the port site infection and socio-demographic characteristics of patients, to find out the influencing factors and microbial organisms responsible for laparoscopic port site infection and to observe the common site for port site infection was included among specific objectives.

METHODS & MATERIALS

This prospective observational study was conducted at the department of Surgery in Dhaka Medical College Hospital, Dhaka for a twelve-month period, starting from 15th March 2019 to 15th March 2020 following approval of the protocol. Patients of 20 to 60 years of age of both sexes, undergone laparoscopic cholecystectomy in DMCH were included in this study. Patients with ASA physical status I (A normal healthy patient) and II (A patient with mild systemic disease) were also included in the inclusion criteria. Whereas, patients with age < 20 years or >60 years, with skin infections, history of peritonitis, bleeding disorders, patients with empyema, acute pancreatitis, choledocholithiasis, history of previous cardiovascular, respiratory problems, other comorbid conditions- CKD, COPD, IHD etc, patients on whom laparoscopic surgery converted into open surgery were excluded from the study. A standard guideline was followed during post-operative management. All patients followed for at least 2 months. A structured questionnaire was used for data collection and collected data were analyzed by using Microsoft Excel and the statistical software SPSS-2015.

RESULTS

Table I: Demographic characteristics of patients (*n*=100)

Demographic characteristics of patients	Number of patients	Percentage (%)
The age range of the patients		
20-29	10	22.23%
30-39	44	85.22%
40-49	32	61.79%
50-60	14	30.72%
Sex of the patients		
Male	38	0.38%
Female	62	0.62%
Mean ± SD 42.7 ± 6.19		
Distribution of patients according to residence		
Rural	32	65.87%
Urban	68	134.11%
Socioeconomic Status of Patients		
High Class	20	0.20%
Middle Class	42	0.42%
Poor Class	38	0.38%
p-value=0.565		

The table shows the age distribution of the patients. In this study, the maximum number of patients (44%) were between the 30-39 years age group, next (32%) were between the age group of 40-49 years, with a mean value of 42.7 ± 6.19 years. Out of 100 cases, 38% cases were male and 62% were female. The male-to-female ratio was 0.6:1. Here, large numbers of respondents came from urban areas 68.0%, followed by rural areas 32.0%. The *p*-value is 0.565. So the result was not statistically significant. Socioeconomically patients are grouped into three classes. Among the patients, the middle class is 42% comprising the major percentage of the patients, which is followed by the poor class 38% and remaining upper class 20%.

Table II: Distribution of participants according to intraoperative complications (*n*=100)

Intraoperative complications	Frequency	Percentage (%)
Intraoperative complications		
Hemorrhage from primary port site	12	12
Vascular Injury	1	1
Visceral injury	0	0
Bradycardia	13	13
Gall bladder perforation	9	9

The table shows the intraoperative complications. Twelve patients developed hemorrhage from the primary port site, followed by 13 patients who developed bradycardia. Spillage of bile and/or gallstones generally occurs in 9.0% of patients, because of gallbladder perforation. The postoperative assessment of the surgical site is evident from the table that, a total of 5 patients developed purulent discharge from the site, redness or heat was found in 4 patients, and tenderness and localized swelling were found in a total of 3 patients. In this study, 94 cases had healthy wounds with good healing.

Table III: Distribution of participants according to the characteristics of wound site, location and type of port site infection, type of organisms (*n*=100)

Variables	Frequency	Percentage (%)
Characteristics of wound site		
Healthy wound with good healing	94	94
Purulent discharge from the site	5	5
Tenderness and localized swelling *Multiple respondents	3	3
Redness or heat	4	4
Location of port site infection		
Umbilical port	2	33.3
Epigastric port	4	66.7
Lateral port	0	0
Total	6	100
Type of port site infection		
Superficial infection	5	83.3
Deep site infection	1	16.7
Total	6	100
Type of organisms		
Mycobacterium tuberculosis	3	50
Staphylococcus auras	2	33.33
E. coli [drug resistant]	1	16.67

The distribution of cases according to location of port site infection shows that 4 patients (66.7%) developed an infection at the epigastric port and 2 patients (33.3%) developed an infection at the umbilical port. The distribution of cases according to the type of port site infection shows regarding the type of port site infection, 5/6 patients (83.3%) developed a superficial infection and 1/6 patients (16.7%) developed a deep site infection. The distribution of type of organisms according to type of port site infection. Regarding the type of port site infection, 3/6 patients (50%) developed a *Mycobacterium tuberculosis* infection, 2/6 patients (33.33%) developed *Staphylococcus auras* infection, and 1/6 patients (16.67%) developed *E. coli* (drug resistant) infection.

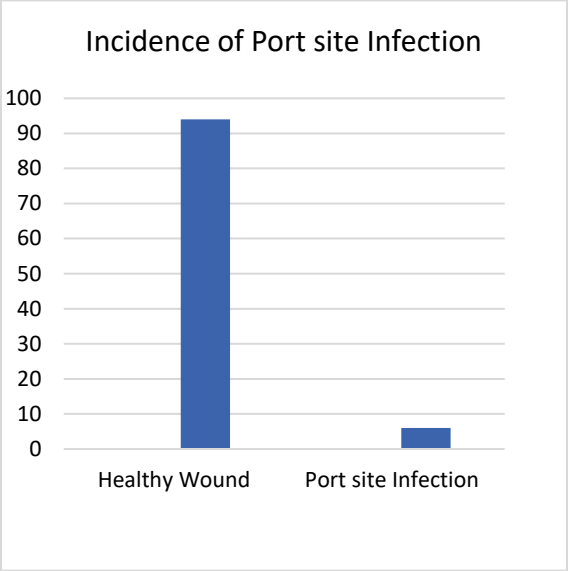

Figure 1: Incidence of port site infection in laparoscopic Cholecystectomy (*n*=100)

The figure shows the incidence of port site infection in laparoscopic Cholecystectomy. In this study incidence of port site infection was 6.0%.

Table IV: Different factors associated with port site infection (*n*=100)

Variables	Total number of patients (n=100)	Number of port-site infections (n=6)	Percentage (%)	p-value
Age				
<40 year	54	2	3.7	0.304
>40 year	46	4	8.6	
Sex				
Male	38	3	7.8	0.539
Female	62	3	4.8	
Spillage				
Present	9	4	44.5	0.004
Absent	91	2	2.1	

Table IV shows the different factors associated with the development of port site infection in laparoscopic cholecystectomy. On univariate analysis, the significant risk factors were the elderly age, male sex, and spillage of bile, and stones during the operation. The chi-square test of the relationship between the different factors and variables was done.

DISCUSSION

Demographic results show maximum numbers of patients (44%) were between 30-39 years age groups, with a mean value of 42.7 ± 6.19 years. According to the residence of the patients, socioeconomically patients are grouped into three classes. Among the patients, the middle-class group is 42% comprising the major percentage of the patients, followed by the poor class 38% and the remaining upper class 20%. Findings consistent with the result of another study showing that out of a total of 1340 patients who underwent laparoscopic cholecystectomy, only 889 patients were included, their ages ranged from 20-65 years and the mean age was 43.1 years, PSI was found in 40/889 patients (4.5%). In the current study, out of 100 cases, 38% cases were male and 62% were female. In other studies, in 32/800 female patients, the percentage of the PSI was 4% and in 8/89 male patients, the percentage was 8.9%. There is an association between male gender and infection, with a p-value of 0.03 [13]. In present study, large numbers of respondents came from urban areas 68.0%, followed by rural areas 32.0%. The *p*-value is 0.565. Considering the intraoperative complications, 12 patients developed hemorrhage from the primary port site, followed by 13 patients who developed bradycardia. Spillage of bile and/or gallstones generally occurs in 9.0% of patients, because of gallbladder perforation. It is evident from this study that, a total of 5 patients developed purulent discharge from the site, redness or heat was found in 4 patients, and tenderness and localized swelling were found in a total of 3 patients. In this study, 94 cases had healthy wounds with good healing. According to the site of port infection, 4 patients (66.7%) developed an infection at the epigastric port and 2 patients (33.3%) developed an infection at the umbilical port. Regarding the type of port site infection, 5/6 patients (83.3%) developed a superficial infection and 1/6 patients (16.7%) developed a deep site infection. In this study port site infection commonly occurred in epigastric locations. Similar observation noted that port site infection was noticed in 32 patients (80%) in the epigastric port six patients (15%) in the umbilical port and only two patients (5%) at the lat-

eral port (p=0.0001), which is statistically significant for the association between epigastric port and SSI[14]. Study was done in governmental medical college in India which also shows high association between epigastric port and infection was 88.2%[13]. In the study of Hamzaoglu I et al., showed infection in the umbilical port more than epigastric port, and this related to umbilical flora and gall bladder extraction through the umbilicus in single port surgery which indicates that the site of gall bladder extraction was the most common site of PSI[15]. The incidence of port site infection in my study is about 6% which was lower than the results of a study done by Khurshid, et al. in an Indian hospital in Kashmir in 2012, their results were 6.7% and higher than the results of study done by Jasim Saud, et al. which performed in AL Basrah general hospital 2010, their result was lower than our (2.4%)[14,16]. Another study reported that port site infection rate was recorded in 40/889 procedures (4.5%). The common site was epigastric port 32/40 (80%). Most of the PSI were superficial infections 77.5%[17]. On univariate analysis the significant risk factors were the elderly, sex, and spillage of bile, and stones during operation. In this study spillage of bile and/or gallstones generally occurs in 9.0% of patients, because of gallbladder perforation, and spillage was a significant factor for port-site infection. Previous studies demonstrated, that concerning spillage of bile, stones, or pus, 24/80 patients (30%) developed infection while spillage occurred during their operations and 16/809 patients (1.9%) developed infection despite no spillage occurred. P value was 0.0001[13]. In the current study spillage occurred in 9% of patients. Almost similar findings from other studies revealed that spillage occurred in 80 operations which represents 8.9% of the total sample (889). Twenty- four patients with spillage presented with port site infection (30%) and only 16 patients (1.97%) developed PSI from 809 cases without statistically significant spillage (p=0.0001)[16]. Another study was done in Taj Surgery Hospital in Pakistan for three years 2009-2012 showing the relation between port site infection and intraoperative spillage during laparoscopic cholecystectomy in 5.3% of perforated cases[18]. In our study, the percentage was higher maybe due to lack of usage of retrieval bag which prevents direct contact of port wound with the content of infected gallbladder. Most of the patients presented with PSI in the present study were superficial infections 5/6 patients (83.3%) compared with 1/6 patients (16.7%) presented with deep site infection. Also, superficial infection is more common than deep infection as reported by a study done by Mir, et al. at a tertiary care hospital in Kashmir in 2012 (87.7% for superficial infection compared with 13.3% for deep infection[19]. According to culture and sensitivity test, Acid fast bacilli test, and genexpart report *Mycobacterium tuberculosis* infection 3/6 (50%), *Staphylococcus auras* infection 2/6 (33.33%), and drug-resistant *E. coli* infection 1/6 (16.67%). A similar type of study was reported by Mumtaz km naser at the Department of Surgery, Al-Kindy Medical College, Baghdad University, Baghdad, Iraq that, an organism associated with port site infection were *Mycobacterium tuberculosis* (6/40) 15%, *E.coli* (10/40) 25%, *Staphylococcus aureus* (8/40) (20%)[13]. Another study reported nine patients (22.5%) presented with deep infection as recurrent discharging single or multiple sinuses.

Limitations of the Study:

It was a single-center study with a small sample size. Only patients admitted to DMCH were taken for the study. So, this will not reflect the overall picture of the country. A large-scale study needs to be conducted to reach a definitive conclusion.

Conclusion:

In this investigation, it was discovered that the incidence of port site infection (PSI) was 6.0%. The epigastric port is frequently impacted because the gallbladder was removed through it, and there is a strong correlation between port site infection and the leakage of pus, stones, or bile. Apart from bacterial causes, a new danger to the surgical community is the rapidly spreading drug-resistant organisms. Given that *Mycobacterium tuberculosis* may be the source of a persistent deep surgical site infection, extra care should be given. The majority of superficial port site infections are more frequent in women. When the laparoscopic instruments are cleaned and sterilized according to strict guidelines using the proper sterilizing agent, the complications can be avoided effectively.

Recommendation:

It is necessary to handle tissue with great care and dissect the gallbladder carefully to avoid iatrogenic perforation and spills. In the event of a spill, every attempt should be made to recover the gallbladder using Endobag, extract the gallstones, and irrigate the gallbladder fossae and port site with regular saline. Laparoscopic instruments and aseptic precautions need to be adequately sterilized.

Ethical approval: The study was approved by the Institutional Ethics Committee.

REFERENCES

1. *Kapoor T, Wrenn SM, Callas PW, Abu-Jaish W. Cost analysis and supply utilization of laparoscopic cholecystectomy. Minimally invasive surgery. 2018;2018(1):7838103.*
2. *Strasberg SM. Tokyo guidelines for the diagnosis of acute cholecystitis. Journal of the American College of Surgeons. 2018 Dec 1;227(6):624.*
3. *Blythe J, Herrmann E, Faust D, Falk S, Edwards-Lehr T, Stockhausen F, Hanisch E, Buia A. Acute cholecystitis–a cohort study in a real-world clinical setting (REWO study, NCT02796443). Pragmatic and observational research. 2018 Oct 25:69-75.*
4. *Kose SH, Grice K, Orsi WD, Ballal M, Coolen MJ. Metagenomics of pigmented and cholesterol gallstones: the putative role of bacteria. Scientific reports. 2018 Jul 25;8(1):11218.*
5. *Lei QC, Wang XY, Zheng HZ, Xia XF, Bi JC, Gao XJ, Li N. Laparoscopic versus open colorectal resection within fast track programs: an update meta-analysis based on randomized controlled trials. Journal of clinical medicine research. 2015 Aug;7(8):594.*
6. *Deng Y, Zhang Y, Guo TK. Laparoscopy-assisted versus open distal gastrectomy for early gastric cancer: A meta-analysis based on seven randomized controlled trials. Surgical oncology. 2015 Jun 1;24(2):71-7.*
7. *Mehrabi A, Hafezi M, Arvin J, Esmaeilzadeh M, Garoussi C, Emami G, Koessler-Ebs J, Mueller-Stich BP, Buechler MW, Hackert T, Diener MK. A systematic review and meta-analysis of laparoscopic versus open distal pancreatectomy for benign and malignant lesions of the pancreas: it's time to randomize. Surgery. 2015 Jan 1;157(1):45-55.*
8. *Chittawar PB, Franik S, Pouwer AW, Farquhar C. Minimally invasive surgical techniques versus open myomectomy for uterine fibroids. Cochrane Database of Systematic Reviews. 2014(10).*
9. *Esposito C, St. Peter SD, Escolino M, Juang D, Settimi A, Holcomb III GW. Laparoscopic versus open inguinal hernia repair in pediatric patients: a systematic review. Journal of Laparoendoscopic & Advanced Surgical Techniques. 2014 Nov 1;24(11):811-8.*
10. *Hamzaoglu I, Baca B, Böler DE, Polat E, Özer Y. Is umbilical flora responsible for wound infection after laparoscopic surgery?. Surgical*

Laparoscopy Endoscopy & Percutaneous Techniques. 2004 Oct 1;14(5):263-7.

11. *Francis NK, Mason J, Salib E, Allanby L, Messenger D, Allison AS, Smart NJ, Ockrim JB. Factors predicting 30-day readmission after laparoscopic colorectal cancer surgery within an enhanced recovery programme. Colorectal disease. 2015 Jul;17(7):O148-54.*
12. *Lilani SP, Jangale N, Chowdhary A, Daver GB. Surgical site infection in clean and clean-contaminated cases. Indian journal of medical microbiology. 2005 Oct 1;23(4):249-52.*
13. *Al-Naser M. Port Site Infections After Laparoscopic Cholecystectomy [Internet]. Ijmrhs.com. 2020 [cited 26 April 2020].*
14. *Chuang SC, Lee KT, Chang WT, Wang SN, Kuo KK, Chen JS, Sheen PC. Risk factors for wound infection after cholecystectomy. Journal of the Formosan Medical Association= Taiwan yi zhi. 2004 Aug 1;103(8):607-12.*
15. *Hamzaoglu I, Baca B, Böler DE, Polat E, Özer Y. Is umbilical flora responsible for wound infection after laparoscopic surgery?. Surgical Laparoscopy Endoscopy & Percutaneous Techniques. 2004 Oct 1;14(5):263-7.*
16. *Yi F, Jin WS, Xiang DB, Sun GY, Huaguo D. Complications of laparoscopic cholecystectomy and its prevention: a review and experience of 400 cases. Hepato-gastroenterology. 2012 Jan 1;59(113):47-50.*
17. *Shindholimath VV, Seenu V, Parshad R, Chaudhry R, Kumar A. Factors influencing wound infection following laparoscopic cholecystectomy. Tropical gastroenterology: official journal of the Digestive Diseases Foundation. 2003 Apr 1;24(2):90-2.*
18. *Yanni F, Mekhail P, Morris-Stiff G. A selective antibiotic prophylaxis policy for laparoscopic cholecystectomy is effective in minimising infective complications. The Annals of The Royal College of Surgeons of England. 2013 Jul;95(5):345-8.*
19. *Den Hoed PT, Boelhouwer RU, Veen HF, Hop WC, Bruining HA. Infections and bacteriological data after laparoscopic and open gallbladder surgery. journal of Hospital Infection. 1998 May 1;39(1):27-37.*