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Original Research Article

Bile spillage and bacterobilia as risk factors for surgical site infection after laparoscopic cholecystectomy: a prospective study at tertiary care hospital

Rekha Porwal, Aakanksha Soni, Amit Singh*, Shruti K. Somani, Poornima Sagar

Department of General Surgery, J.L.N. Medical College Ajmer, Rajasthan, India

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***Correspondence:**
Dr. Amit Singh,
E-mail: dr.amit5280@gmail.com

ABSTRACT

Background: Surgical site infection (SSIs), a significant postoperative complication, can lead to considerable patient's morbidity and mortality.
Methods: The study was conducted in the Department of Surgery, J.L.N. Medical College and Hospitals, Ajmer from January 2017 to September 2018. The study population constituted cases of cholelithiasis diagnosed by ultrasonography that underwent laparoscopic cholecystectomy and fulfilling the inclusion and exclusion criteria. Surgical site infection was graded according to Southampton grading system.
Results: The overall frequency of SSI infection in laparoscopic cholecystectomy was 6%. The occurrence of surgical site infection in patients with bacterobilia was 14.28% which was found to be statistically significant. The SSIs in patients with gall bladder content spillage was found to be statistically insignificant.
Conclusions: The frequency of SSI was more in patients with bacterobilia. The gallbladder content spillage does not lead to an increased occurrence of SSI.

Keywords: Surgical site infection, Laparoscopic cholecystectomy, Bacterobilia, Bile spillage

INTRODUCTION

Surgical site infection (SSIs), a significant postoperative complication, can lead to considerable patient's morbidity and mortality. Preventing postoperative infection is an essential factor in improving the outcome of surgical procedures. Surgical site infection is defined as the infection occurring within 30 days post-surgery (in the absence of an implant or prosthesis) or one year in the presence of prosthesis.[1]

The laparoscope was introduced in the late 1980s and at present, laparoscopic cholecystectomy (LC) has become the standard treatment for symptomatic cholelithiasis. The main advantages of laparoscopy are less postoperative pain, smaller incision and shorter hospitalization[2]. Although laparoscopic cholecystectomy is less invasive little is known about the impact of laparoscopy on the risk of SSIs. Various factors may be associated with surgical site infection in laparoscopic cholecystectomy like method of disinfection of the laparoscopic instrument, micro–damages to the reusable instruments, bacterobilia, gallbladder content spillage, antibiotics etc.

Bacterobilia is not found in healthy individuals, since daily excretion of bile helps to flush out whatever organisms enter the biliary tract, but the percentage of bacterobilia increases to 3% in patients with gallstones and to ≈30% in patients with common duct stones.[2] Bacterobilia is a risk factor for poor post-operative outcome; if it can be recognized before surgery, patients who do not require prophylactic antibiotics can be identified.

Cholecystectomy is one of the most common abdominal surgical procedures in the world. In most cases, it is performed without major risk for serious complication, although positive bile culture, bile leakage and intra-operative contamination may lead to SSI. Postoperative infection prolongs time in hospital and has a negative impact on recovery and healthcare costs. Port site infection (PSI) is an infrequent surgical site infection that complicates laparoscopic surgery but has a considerable influence in the overall outcome of LC.

Infection could be intrinsic and/or extrinsic as the human body enables the survival of a wide variety of microorganisms with potential for infection as a result of surgical intervention. Patient's bacterial flora may become opportunistic and cause infection in special circumstances. This can occur in both open surgeries and to a lesser extent in laparoscopic one.

METHODS

This cross sectional observational study was conducted at Department of Surgery, J. L. N. Medical College and Hospitals, Ajmer during the period from January 2017 to September 2018.

Study population

The study population constituted cases of cholelithiasis diagnosed by ultrasonography that underwent LC and fulfilling the inclusion and exclusion criteria. All patients more than 18 years and less than or equal to 70 years with symptomatic cholelithiasis were included in this study. Cholelithiasis was proven by ultrasound.

Sample size

100 patients were included in the studied in accordance with the inclusion and exclusion criteria.

Exclusion criteria

Patients older than 70 years, acute cholecystitis, evidence of cholangitis and/or obstructive jaundice and biliary pancreatitis, previous biliary tract surgery or previous endoscopic retrograde cholangiopancreatography, evidence of diabetes mellitus, conversion to open cholecystectomy and patients with immuno-suppressed conditions like HIV, taking immunosuppressive drugs etc. were excluded from the study.

Methodology

Written informed consent was taken by all patients. Pre-operative work up was done with detailed clinical history and examination such as all routine investigation like hemogram, coagulation profile, blood sugar fasting, liver function tests and other pre-operative investigations required for general anaesthesia were done.

Ultrasound abdomen was done to document cholelithiasis before surgery for each patient and followed up for a period of one month post-operatively.

Assessment of SSI

Postoperative superficial, deep incisional soft tissue SSI and intra-abdominal abscess (organ or space SSI) was assessed by Southampton Grading system (Table 1).

Table 1: Southampton grading system.

Grade	Appearance
0	Normal healing
I	Mild bruising or erythema
Ia	Some bruising
Ib	Considerable bruising
Ic	Mild erythema
II	Erythema plus other signs of inflammation
IIa	At one point
IIb	Along wound
IIc	Around wound
III	Clear or serosanginous discharge
IIIa	At one point
IIIb	Along wound
IIIc	Large volume
IV	Pus
Iva	At one point
IVb	Along the wound
V	Deep or severe wound infection

Data analysis

To collect required information from eligible patients a pre-structured pre-tested Performa will be used. For data analysis Microsoft excel and statistical software SPSS version 20. Will be used and data will be analyzed with the help of frequencies, figures, proportions, measures of central tendency, appropriate statistical test.

RESULTS

A total of 100 patients were included in the study. Out of 100 patients, 13 (13%) were male patients, rest all patients were female (87%). One male patient developed surgical site infection as opposed to 5 female patients (total six patients developed SSI). Fischer's exact test was used to analyse the association of SSI with respect to gender. P value was calculated as 0.576 which is statistically not significant according to the conventional criteria of $p<0.05$ (Figure 1).

All the patients operated were divided into groups according to their ages. Patients who were less than 30 years were included in group A. Group B consisted of patients between 30-39 years of age. Group C consisted of patients between 40-49 years of age. Rest were included in group D. Youngest patient operated was 21

years of age while the oldest was 70 years of age. Mean age was 37.70±10.26 years. Most of the patients belonged to group B (40%) followed by group A (22%) and group C (22%) (as shown in Figure 2). Least number of patients belonged to group D (16%). None of the patients in group A developed SSI. Most cases of SSI belonged to group D. Frequency of SSI was higher in group D. While 1 patient in group B and 1 patient in group C developed SSI. Analysis showed that the association of age with surgical site infection was statistically significant with a p value of 0.006 (Figure 2).

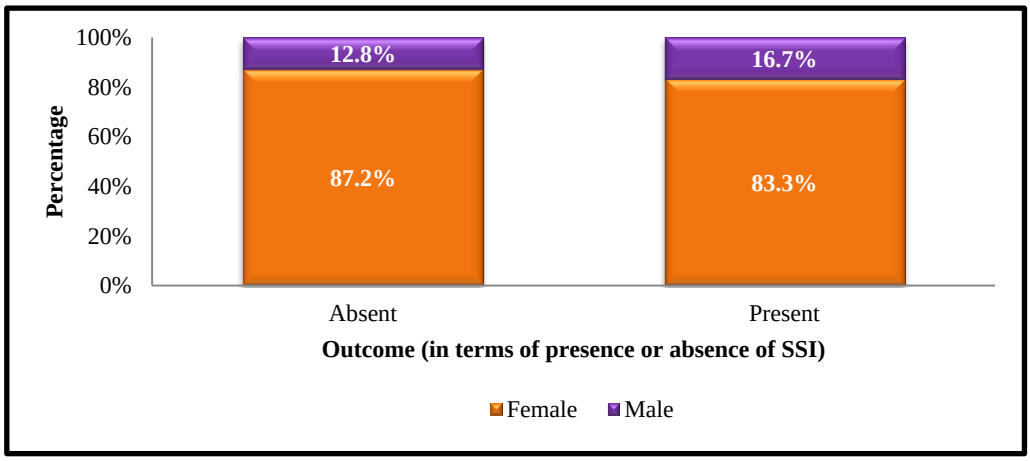

Figure 1: Distribution of SSI according to gender.

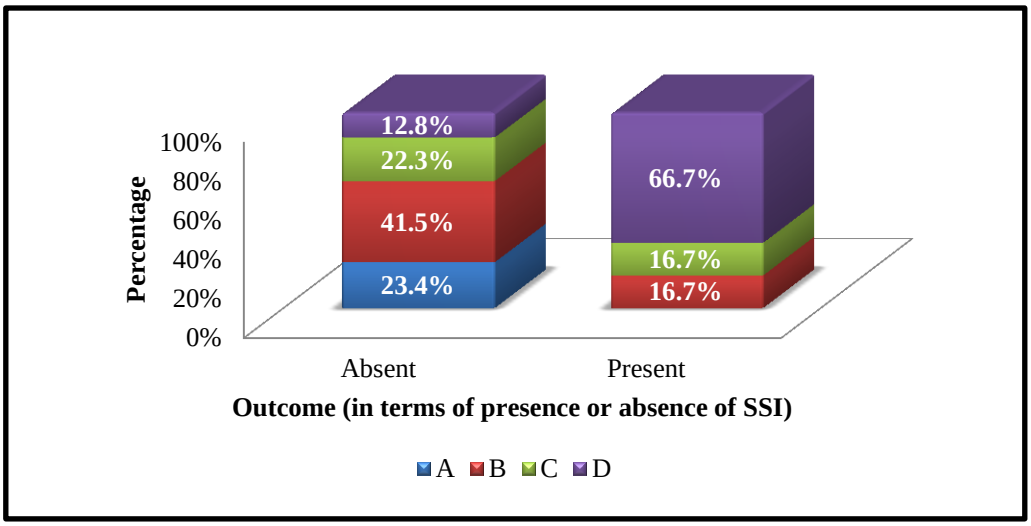

Figure 2: Percentage of patients with surgical site infection in various age groups [A (age<30 years), B (age 30-39 years), C (age 40-49 years), D (age>49 years)].

A total of 6 patients out of 100 i.e., 6% patients developed SSI. Organism profile of the culture from surgical site showed mono-microbial infection: 66.7% patients showed *E. coli*, 16.7% showed *Pseudomonas*, 16.7% patients showed *Staphylococcus aureus* and one of the culture reports was contaminant (Table 2).

Surgical site infection was graded according to the Southampton grading system. Three patients developed mild erythema, two patients developed mild bruising and serosanguineous discharge was present in one patient (Table 3).

The bile culture was taken in intra-operative period just after the extraction of gallbladder in all the patients. The bile culture was positive in 28 patients out of 100 i.e., 28%. Four patients developed surgical site infection among these 28 patients. Hence the occurrence of surgical site infection in these patients with bacterobilia is 14.28%. Fisher's exact test was used to find the statistical significance. The p value obtained was 0.03 ($p<0.05$) (Table 4).

Total 16 patients developed gallbladder content spillage of bile, mucus, pus with or without stone spillage. Out of these 16 patients 11 patients had bile spillage and 3 developed mucus spillage. None of the patients had pus

spillage grossly. .Out of 16 patients who had gallbladder perforation only 1 developed SSI, i.e., these spillages associated with surgical site infection in only 16.67% patient. One patient with bile spillage developed SSI. Fisher's exact test was used to calculate the p value which came out to be 0.586 (Table 5). Hence, there is no statistically significant difference in occurrence of SSI in patients with gallbladder content spillage.

Table 2: Organism grown in culture from surgical site.

			SSI		Total
			Absent	Present	
SSI Organism	A (Absent)	Count	93	0	93
		%	98.9	0.0	93.0
	C (Contaminant)	Count	1	0	1
		%	1.0	0.0	1.0
	S (*Staphylococcus aureus*)	Count	0	1	1
		%	0.0	16.7	1.0
	P (*Pseudomonas*)	Count	0	1	1
		%	0.0	16.7	1.0
	E (*E. coli*)	Count	0	4	4
		%	0.0	66.7	4.0
Total		Count	94	6	100
		%	100.0	100.0	100.0

Table 3: Type of SSI according to Southampton grading system.

Type of SSI (acc to Southampton grading system)	SSI present	%
Ic (mild erythema)	3	50.00
Ia (some bruising)	2	33.33
3a (serosanginous discharge at one point)	1	16.67
Total	6	100.00

Table 4: Relation of bacterobilia with respect to SSI.

			SSI		Total
			Absent	Present	
Bile culture	A (Absent)	Count	70	2	72
		%	74.5	33.3	72.0
	E (*E .coli*)	Count	17	4	21
		%	18.1	66.7	21.0
	G (Gram negative)	Count	1	0	1
		%	1.1	0.0	1.0
	K (*Klebsiella*)	Count	5	0	5
		%	5.3	0.0	5.0
	P (*Pseudomonas*)	Count	1	0	1
		%	1.1	0.0	1.0
Total		Count	94	6	100
		%	100.0	100.0	100.0

Table 5: Distribution of SSI in patients with gallbladder content spillage.

			SSI		Total
			Absent	Present	
GB content spillage	Absent	Count	79	5	84
		%	84.04	83.33	84
	Present	Count	15	1	16
		%	15.9	16.67	16
Total		Count	94	6	100
		%	100.0	100.0	100.0

DISCUSSION

In recent years laparoscopy has become a preferential technique for cholecystectomy. It is performed more than the classic surgery in most hospital. As per the study conducted by Jawein et al the laparoscopy-attributable mortality reaches 0.5%, morbidity 4% and surgical site infection rates following this procedure range between 0.1 to 2%.[4] According to this study, the risk of acquiring SSI after cholecystectomy is lower when using a laparoscope compared to classical operation procedure.[4] Various factors associated with SSIs in laparoscopic cholecystectomy needs to be evaluated and definitive measures to be taken to decrease the morbidity associated with this procedure.

In our study, out of 100 patients only 13% patients were males. Similarly, In other studies conducted by Suri et al the male to female ratio was 3:1.[5] Considering the data from all these studies, laparoscopic cholecystectomies are being done with nearly three times higher frequency in females than in males which correlates with the demography and etiopathogensis of the disease and is reflected in our study also but with a higher ratio. However, the exact female to male ratio may vary from region to region.

Most of the patients in our study belonged to age group between 30-39 years of age. Similar findings were seen in the study conducted by Suri et al.[5] Most of their patients belonged to the 3rd and 4th decades of life. In our study most of the patients with surgical Site Infections belonged to group D and none of the young patients (group A) developed SSI and a statistically significant association is found between the surgical site infections and age. In the study conducted by Ahmad et al the mean age of male and female patients with symptomatic cholelithiasis were 46.20±10.88 years and 45.95±10.14 years respectively with an overall mean age of 46.13±10.65 years.[6]

In our study the bile culture was positive in 28 patients out of 100 i.e., 28%. The rate of bile culture positivity was similar to other studies, namely. Suri et al also noted positive bile culture in 17.3% patients.[5] Ahmad et al noted a higher incidence of bacterobilia 58.58%.[6]

In our study we found that the occurrence of surgical site infection was more in patients with bacterobilia, we found statistically significant association between bacterobilia and SSI. This is possibly due to translocation of bacteria during extraction of the gallbladder. But the organism profile in the bile and surgical sites were different. However, Koc et al noted that in the patients who developed a septic complication, the bile cultures were negative and hence there was no correlation between bile microbiology and the postoperative infective complications.[7] The result in our study can be explained as the patients with bacterobilia have some degree of low immunity and they are more prone for infections elsewhere. Valceanu et al also showed in their study that the patients with proven presence of bacteria within the bile are peculiarly prone to developing infectious complications, especially with a high rate of wound infections.[8] However, the organism profile in our study does not match the one in the surgical site. Hazra et al also showed no significant difference in the rate of positive bile culture and SSI between male and female.[9]

Koc et al noted infected bile in 10.87% much lower than our study.[7] The high incidence of positive cultures was noted by Suri et al, 40% respectively but these studies included acute cholecystitis as well.[5] In our study only chronic cases were included hence no comment can be made on link between acute cholecystitis and bacterobilia.

Hazra et al studies the frequency of gallstone cultures with age and found no statistically significant difference in bile culture with age.[9] While in our study we conclude that the susceptibility for developing a biliary infection increases with age. Similar finding was noted by Valceanu et al they concluded that in patients over 50 years, the rate of positive bile cultures is higher than 70%.[8]

Accidental gallbladder perforation during LC is on the rise because of increased attempts at minimally invasive surgery. In our study 16 patients (16%) developed gall bladder perforations with content spillage. This is low in comparison to the study conducted by Koc et al i.e., 41.3% patients respectively.[7]

CONCLUSION

The overall frequency of SSI infection in laparoscopic cholecystectomy was 6%. The SSIs in patients with content spillage was 16.67%. The Gallbladder content spillage does not lead to increase occurrence of SSI. The frequency of SSI was more in patients with bacterobilia. The occurrence of SSI is significantly higher in patients with bacterobilia.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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