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Port Site Infections following Laparoscopic Cholecystectomy

Prof. Dr. Jishan Ahmed[1], Dr. Ritika Verma[2]
[1](Professor and Head of Department, Department of General Surgery, Assam Medical College and hospital/ Srimanta Shankardeva University of Health Sciences, India)
[2](Junior Resident, Department of General Surgery, Assam Medical College and hospital/ Srimanta Shankardeva University of Health Sciences, India)

Abstract:
Background*: Port site infection (PSI), although infrequent in laparoscopic surgeries, is a significant cause of morbidity and discontentment in patients. PSI has a considerable influence in the overall outcome of laparoscopic cholecystectomy. The aim of this study is to evaluate the port site infection and its associated risk factors in patients undergoing laparoscopic cholecystectomy.*
Materials and Methods*: A hospital based prospective observational study was conducted on 178 patients who underwent laparoscopic cholecystectomies and followed up for six months postoperatively. Factors such as gender, BMI of the patients, site of infected port, type of microorganism, acute versus chronic cholecystitis, type of infection (superficial or deep infection) and intraoperative spillage of stones, bile or pus were analyzed in our study.*
Results*: Port site infection was recorded in 9/178 procedures (5.06%), higher rates were observed in female patients 7 out of 116 (6.03%) and patients with BMI >25kg/m2 (10.53%). It was higher in cases of acute cholecystitis 4/25 (16%). It was also high in cases where spillage of bile, stones or pus occurred 7/9 (77.78%). Umbilical port was more susceptible to infection (55.56%) and procedures which took longer time to operate. Most of the port site infections were superficial infections with gram positive bacteria.*
Conclusion: *There is a marked association of port site infection with spillage of bile, stones, or pus, with the port site and with acute cholecystitis. Laparoscopic port site infections are not very common in elective laparoscopic cholecystectomy and can be further minimized by correct selection of patients, and strictly following basic principles of sterilization and asepsis apart from meticulous surgical technique.*
Key Word*: Port site infection, Surgical site infection, Laparoscopic cholecystectomy, Cholecystitis.*

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I. Introduction

Minimally invasive surgery, notably laparoscopic surgery is a modern surgical technique in which surgeries of the abdomen are performed through small incisions. Laparoscopic cholecystectomy (LC) is now the gold standard treatment for gallstone diseases and is the commonest operation performed laparoscopically worldwide, after the introduction of this procedure by Mauret in 1987 in France. Scrupulous knowledge of the surgical anatomy of the anterior abdominal wall alongwith necessary precaution adopted during placing and removing trocar and cannulas at the port sites is crucial while performing a laparoscopic surgery.

One of the drawbacks related with laparoscopic surgery is port site infection, which results in significant increase in hospital stay, morbidity, financial loss to the patient and bad cosmetic outcome which becomes disappointing for the patient. With the increase in number of laparoscopic cholecystectomies performed, there is an increase in number of cases with port site infection, although this is entirely preventable. The active surveillance for port-site infections in laparoscopic surgery remains a challenge, due to day care setting/early discharge[1]. An important aspect in preventing port site complications is the adoption of the standardised sterilization protocol both for the port site area and the surgical instruments used. The Centers for Disease control & prevention according to the National Nosocomial Infections Surveillance (NNIS) system categorised Surgical Site Infection (SSI) into incision site infection and organ space infection.[2] The incision site infection is further categorized into superficial and deep infection. Superficial refers to only skin and subcutaneous tissue infection whereas deep refers to fascia and muscle involvement. The main aim of this study is to evaluate the port site infection and its associated risk factors in patients undergoing laparoscopic cholecystectomy.

II. Material And Methods

This hospital based prospective observational study was carried out on patients of Department of General Surgery at Assam Medical College and Hospital, Dibrugarh from 1st June 2020 to 31st May 2021. A total 178 adult subjects (both male and females) of aged ≥ 18, years were in this study.

Study Design: Hospital based prospective observational study.

Study Location: Department of General Surgery, Assam Medical College and Hospital, Dibrugarh

Study Duration: one year from 1st June 2020 to 31st May 2021.

Sample size: Patients who underwent laparoscopic cholecystectomy and who fulfilled the inclusion criteria were included in the study. After considering the inclusion and exclusion criteria 178 patients were taken for this study.

Subject & Selection method- All patients above 18 years who underwent laparoscopic cholecystectomy during the study period were included in the study.

Inclusion criteria:

1. All patients male and female from 18 years and beyond.
2. All patients on whom laparoscopic cholecystectomy was performed for gallstone diseases

Exclusion criteria:

1. Laparoscopic surgery converted to open surgery.
2. History of previous laparoscopic surgery.
3. Port formation at previous operative scar site, previous midline incision or paramedian incision.
4. Patient with immuno-compromised status. (HIV, hepatitis)

Procedure methodology

After taking proper consent, data was recorded including history, clinical examination and investigations. In all patients preoperative preparation was done by shaving of the body part and complete bath prior to surgery using antiseptic soap. Antibiotic regime comprised of two doses of intravenous 3rd generation cephalosporin (ceftriaxone) on the day of surgery. The operations were conducted under general anaesthesia with endotracheal intubation. Antiseptic skin preparation was applied from the nipples to the symphisis pubis, with the drapes positioned such that the full costal margin and the lower border of the sternum are within the sterile operative field. The pneumoperitoneum was safely established by an open cut-down (Hasson's) procedure in supra or infra umbilical region. A reusable metal trocar was used to insert a 10mm cannula as the optical port. The 10 mm ports were closed in two layers and the 5mm ports in single layer. The rectus sheath was closed with polyglactin (No. 1) suture while the skin was closed with monofilament polyamide (3-0) suture. All laparoscopic instruments were sterilized by 2% glutaraldehyde solution with a contact time of 20 minutes. Before surgery, all the instruments were washwarm with saline. The patients were asked to come for follow-up at OPD at 1st week, 1st month, 2nd month and 6th month postoperatively. During follow-up, a general examination of the patient was done followed by clinical inspection of the wound site. Any infection found was noted down and the data gathered was analysed.

Statistical analysis

All the data were compiled and analysed on Microsoft excel. Statistical analysis was done using SPSS software version 16 (Statistical package for social science) and data were presented with the help of frequencies (%), proportions and Mean±SD.

III. Result

In present study of 178 patients undergoing laparoscopic cholecystectomy, majority of the cases were in the age group of 31-40 years (33.71%) followed by 29.78% patients in age group of 18-30years, 19.66% patients in age group 41-50 years, 11.24% patients in age group 51-60years and 5.62% patients in age group 61-70 years.. The mean age of presentation was 38.58. 34.83% patients were male and 65.17% were female, with a ratio of male to female 1:1.87.

Table no 1: Shows port site infection in patients according to sex

SEX	COMPLICATIONS	
	n	*%*
Male(n=62)	2	3.23
Female(n=116)	7	6.03
TOTAL(n=178)	9	5.06

Table no 1 shows 2 out of 62 (3.23%) male and 7 out of 116 (6.03%) female patients developed port site infection.

Table no2 : Shows port site infection in patients according to BMI

BMI (Kg/m^2)	COMPLICATIONS	
	N	*%*
<25(n=121)	3	2.48
>25(n=57)	6	10.53
TOTAL(n=178)	9	5.06

Table no2 shows overweight patients with BMI more than 25 had more (10.53%) occurrence of port site infection compared to patients (2.48%) with BMI less than 25.

Table no3: Shows port site infection in patients according to pre-operative clinical diagnosis of gallbladder.

CONDITION	COMPLICATIONS	
	N	*%*
Acute cholecystitis (n=25)	4	16
Chronic cholecystitis(n=153)	5	3.26
TOTAL(n=178)	9	5.06

Table no3 Shows with respect to the clinical diagnosis of gallbladder before the operation, 4/25 patients (16%) developed PSI when operated during an acute attack of cholecystitis and 5/153 patients (3.26%) after elective surgery for chronic cholecystitis.

Table no4: Shows port site infection in relation to spillage of content in peritoneal cavity

RETRIEVAL OF SPECIMEN (SPILLAGE OF CONTENT)	PATIENTS		COMPLICATIONS	
	N	*%*	*N*	*%*
Yes	38	21.35	7	77.78
No	140	78.65	2	22.22
TOTAL	178	100.00	9	100.00

Table no4 During retrieval of specimen there are chances of spillage of bile, stones, pus and infective materials into the peritoneal cavity. 7 patients (77.78%) developed complications, in whom spillage of content was seen in peritoneal cavity during operation.

Table no 5: Shows port site infection in different port site

PORT INVOLVED	NUMBER OF PATIENTS	PERCENTAGE *(%)*
Umbilical	5	55.56
Epigastric	4	44.44
Lateral	0	0
Total	9	100

Table no 5 Shows port site infection was most frequently encountered at umbilical port in 5 cases (55.56%) followed by epigastric port in 4 cases (44.44%).

Table no 6: Shows port site infection according to duration of surgery

Duration of Operation (minutes)	PATIENTS		COMPLICATIONS	
	N	*%*	*N*	*%*
<70	137	76.97	3	33.33
>70	41	23.03	6	66.67
TOTAL	178	100.00	9	100.00

Table no 6 For the purpose of our study 70mins was taken as the cut-off time for comparision of complication. Out of 137 patients operated within 70 mins, 33.33% (3 out of 9) patients developed port site complications. In 31 patients with operative time more than 70 mins, 66.67% (6 out of 9) developed port-site complications.

Table7: Shows different types of microorganism associated with port site infection

MICROORGANISM	NUMBER OF PATIENTS (n=178)	PERCENTAGE *(%)*
Enterobacter spp	3	33.33

E.coli	1	11.11
Staphylococcus aureus	4	44.44
Enterococcus spp	1	11.11
Total	9	100

Table no 7 In our study most common organism was Staphylococcus aureus (44.44%), followed by Enterobacter spp (33.33%), Enterococcus spp. (11.11%) and E. coli (11.11%).

Image1- Port site infection in epigastric port

Image2- Epigastric port site infection after conservative treatment

IV. Discussion

In this study, port site infection was the seen in 9 patients comprising 5.06% of the 178 patients following laparoscopic cholecystectomy. Our study had comparable incidence values to the studies by Kumar SS *et al*[3], Den-Hoed PT *et al*[4] and Al-Naser MKH *et al*[5], who observed a PSI of 5.7%, 5.3% and 4.5% respectively. Mir *et al*[6] reported a PSI of 6.7% in patients after laparoscopic cholecystectomy. The primary risk factors in his study was presumed to be the use of reusable trocars and iatrogenic gallbladder perforation leading to spillage of bile.

In our study, majority of the cases undergoing laparoscopic cholecystectomy were in the age group of 31-40 years (33.71%).

34.83% patients were male and 65.17% were female, with incidence of PSI more commonly encountered in female (7 out of 9 patients). This is comparable with another study done by Saini S *et al*[7] which included 138 (69.0%) females and 62 (31.0%) males, PSI occurred in 13(6.5%) of which 8 were female (61.54%) and 5 were male (38.46%).

In our study, based on BMI, patients were categorized into two groups with BMI <25 Kg/m^2 and other having BMI of 25Kg/m^2 and above. Overweight patients with BMI more than 25 Kg/m^2 had more (10.53%) occurrence of port site infection compared to patients (2.48%) with BMI less than 25 Kg/m^2. Similar findings were reported in studies by Mudgal MM *et al*[8],who found that patients with BMI >25 Kg/m^2 (15.3% and 12.7%) had more complications compared to BMI <25 Kg/m^2 (4.50%). Maharaul HH *et al*[9], in their study found 4% and 8% complications with BMI >25 Kg/m^2 compared to 2% and 2.6% in patients with BMI <25 Kg/m^2.

With respect to the preoperative clinical diagnosis of gallbladder disease, 4/25 patients (16%) developed PSI when operated during an acute attack of cholecystitis and 5/153 patients (3.26%) after elective surgery for chronic cholecystitis. On comparing with study done by Al-Naser MKH *et al*[5], from 764 patients who were operated for chronic cholecystitis, 27 patients (3.5%) developed PSI, whereas out of 125 patients who were operated during acute cholecystitis, 13patients (10.4%) got infected. This reflected that infection more frequently affected patients when operated during acute phase than in chronic phase.

During retrieval of specimen from port site, there are possibilities of spillage of bile, stones, pus and infective materials into the peritoneal cavity which may occur due to iatrogenic perforation of gallbladder during surgery secondary to traction applied by grasping forceps or because of electro-surgical thermal injury during removal of the gallbladder from its bed[75]. In our study, 7 patients (77.78%) developed complications, in whom spillage of content was seen in peritoneal cavity during operation. Al-Naser MKH *et al*[5] in their study, found that 60% (24 out of 40 cases of PSI) complications were present in patients with spillage of content. In another study by Maharaul HH *et al*[9], similar findings were reported with 80% complications in patients with spillage of content in the peritoneal cavity during retrieval of specimen.

All port site infections recorded were superficial infection involving the skin and the subcutaneous tissues presenting with redness, pain and discharge, most commonly in the umbilical port

(55.56%) followed by epigastric port (44.44%). This may be related to umbilical flora in the former and gall bladder extraction through epigastric port in the latter case. Similar results were reported by the study by Ravindranath GG *et al*[10], where umbilical infections (52.4%) were more common followed by epigastric (38.31%).

Operating time was another factor that was studied. For the purpose of our study 70mins was taken as the cut-off time for comparision of complication. Out of 137 patients operated within 70 mins, 33.33% (3 out of 9) patients developed port site complications. In 31 patients with operative time more than 70 mins, 66.67% (6 out of 9) developed port-site complications. Yadav D *et al*[11], in their study, discussed about the influence of duration of surgery in creating port site infections. They found that 54.17% patients with operative time more that 70 mins and 5.79% patients with operative time less than 70 mins developed port site ccomplications. Increased duration of the laparoscopic cholecystectomy was accredited as a risk factor for port site infection by Mir *et al*[6].

Microbiological study of culture of port discharge was done. Organism found on culture from port sites were Staphylococcus aureus (44.44%), followed by Enterobacter spp (33.33%), Enterococcus spp. (11.11%) and E. coli (11.11%). Port site infection in all the cases were managed conservatively by antibiotics, removal of stitch and antiseptic dressing with betadine ointment. Atul K *et al* remarked that proper sterilization of instruments is the most crucial step in prevention of PSI.[12]

V. Conclusion

Laparoscopic surgery is the mainstay of treatment for many surgical conditions in the present era and is considered as the gold standard procedure for certain type of surgeries. However, complications are still reported at the different laparoscopic port sites. This study was an attempt to assess the port site infection and its risk factors following laparoscopic surgeries, so that they can be minimized. However, port site complications like PSI can be prevented by maintenance of strict asepsis, adherence to safety methods during trocar placement, utmost care during surgery to avert spillage, use of specimen bag for extraction, meticulous technique of closure of the port site and wound care.

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