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Research Article

Port Site Infections after Elective Laparoscopic Cholecystectomy at a Tertiary Care Centre of Jharkhand: A Prospective Observational Study

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Abstract

Introduction: Laparoscopic cholecystectomy is the gold standard treatment for symptomatic gallstone disease. However post-operative complications of elective laparoscopic cholecystectomy could not be ignored. Port site infection is one of the most common complications after laparoscopic surgeries.

Materials and Methods: 251 Patients of both sexes with age group 23 to 65 years having symptomatic gall stone disease were studied. A prospective observational study was performed in the Department of General Surgery of Tata Main Hospital in collaboration with Manipal Tata Medical College, Jamshedpur, Jharkhand. The study was conducted from September 2022 to April 2023. Ethical clearance was obtained from the Institutional Ethics Committee and all relevant data were retrieved from hospital records. Routinely all the patients were given prophylactic broad spectrum antibiotics Ceftriaxone 1g stat by intravenous infusion at the of induction of an anaesthesia. Post-operatively all patient received ceftriaxone 1gm twice daily for 24. Metronidazole 500 mg added thrice daily intravenous infusion for 72 hours in case of spillage of bile or stone or pus and those with acute cholecystitis. All data were collected in preformed format and statistical analysis was done.

Results: The mean age of studied patients group ranging from 23 to 65 years are 41.6 years. Majority (220/251, 87.64%) of the patients were female. Majority of the patients were in the BMI range of 18.5-40kg/m^2 (47%). Spillage of bile and gall Stones, umbilical port approach, high BMI and surgery in acute phase are associated with high incidence of port site infection; such incidence of biliary spillage was reported with 20(7.96%) cases. Port Site Infection (PSI) was occurred in 13 patients (11 females and 2 males), which constituted 5.17% of the study population. Out of these cases, 1(7.6%) case was deep seated and rests 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 got cured with regular dressing and more common in females.

Keywords: Port site infections; Elective laparoscopic cholecystectomy; Minimally invasive surgery

Introduction

Laparoscopy has replaced open methods due to having many advantages like minimally invasive, less painful, wide vision, better cosmetic scar, and early discharge [1]. First laparoscopic procedure came into existence in the eighth decade of 19th century 1910 by Jacobus from Sweden [2,3]. This minimally invasive procedure allowed the surgeon to enter the abdomen and pelvis by making a relatively small incision on the skin and wide area of vision and that's why it is known as keyhole surgery [4]. With long learning curve it became the surgical treatment of choice for many operations [5]. As far as the laparoscopic

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cholecystectomy is considered, it has become the gold standard treatment for symptomatic gall stone disease [6]. The incidence rate of major complications like CBD injury, accidental right hepatic artery ligation, bleeding from cystic artery following laparoscopic surgery is around 1.4 per 1,000 procedures [7]. Incidence of port site infection after elective laparoscopic surgery is documented to be around 21 per 100,000 cases. Infection could be intrinsic and/or extrinsic as the human body harbours numerous commensal microorganisms in hair follicle having potential for causing port site infection because of any surgical intervention [8]. Elective Laparoscopic Cholecystectomy (ELC) is associated with fewer Surgical Site Infection (SSI) than open cholecystectomy [9]. However, increasing incidence of PSI rate is mostly related to spillage of bile or stones intraoperatively or during gall bladder extraction via epigastric or umbilical port [10,11]. Thus, PSI doesn't increase morbidity of patient only but also it increases stigmata upon surgeon's capability. Patient's morbidities appear in the form of apprehension of complete cure, bad cosmetic result, prolonged hospital stay or need of longer wound dressing, increasing cost and future incisional hernia. Present observational study had aim to evaluate the possible risk factors responsible for port site complications and its mitigation in elective laparoscopic cholecystectomy. There are three types of surgical site infection at port sites which is superficial SSI, deep SSI and third type organ or space SSI [12-14]: (a) Superficial surgical site infection occurs within 30 days post-surgery and involves only skin and subcutaneous tissues and the patient at least has one of the following: (i) purulent discharge from the superficial incision. (ii) Organism isolated from aseptically obtained culture of fluid or tissue from superficial incision. (b) Deep SSI presents after 30 days of operation which involves deeper tissues like fascia and muscles. The patients have at least two of the following' findings: (i) purulent discharge from depth of incision, (ii) wound dehiscence, and (iii) a localised abscess. (c) The third type is organ/space SSI which needs re-exploration [15].

Materials and Methods

This prospective observational study included 251 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 T2DM, hepatitis, or taking chemotherapy or HAART or ATT were excluded. These patients underwent elective laparoscopic cholecystectomy in the department of General Surgery at Tata Main Hospital in collaboration with Manipal Tata Medical College, Jamshedpur, and Jharkhand. This minimally invasive surgery was performed by qualified specialist laparoscopic surgeons. The time-period was eight months from September 2022 to April 2023. The data of patient's details like demographic details, clinic details, investigations, date of admission, date of surgery and complication related to SSI in follow up period were collected from hospital records. Ethical permission was obtained from the Institutional Ethics Committee. NABH protocol followed. Pre-anaesthetic fitness and countersigned filled consent forms were cross checked. All patients had received prophylactic broad spectrum antibiotic ceftriaxone 1gm iv infusion 1 hour before induction of anaesthesia. This ceftriaxone injection was given twice daily post-operatively for next 24 hours. Pneumoperitoneum was created by using open technique in all aiming to avoid visceral injuries. Four port technique laparoscopic cholecystectomy was performed in all under general anaesthesia. Gall bladder specimens were removed from umbilical port in 151 cases and via epigastric port in 100 cases using retrieval bags. Sub-hepatic ADK drain 20F was placed after giving lavage in dissection area especially in the cases having biliary or stones or pus spillage during calot's triangle dissection and gall bladder separation from gall bladder fossa. After removing canula, port sites were washed thoroughly with jet of normal saline using 10ml syringes. Patients with incidence of spillage of bile or stone or pus were given metronidazole 500mg intravenous infusion thrice daily for 48 hours and ceftriaxone for 48 hours. Drains were removed after 24 hours. Patients were discharge within 36 hours and advised for follow up in upcoming OPD (outpatient department) for suture removal. Stitches were removed on 7th postoperative day and asked to come for follow up further follow up at 2-week, 1 month and 3 months to known unwanted consequences. Swabs were taken for culture and sensitivity in all patients who presented with port site complications like serous or purulent discharge and wound dehiscence and advised for alternate day dressing. Patients with deep SSI got admitted for daily dressing and higher antibiotics. Patients with superficial SSI cured in one month with good dressing and antibiotic coverage. Deep SSI cases required local exploration, debridement, daily dressing, and good antibiotic coverage proven by culture and sensitivity reports. Deep SSI cases taken two and half month for complete cure. Few cases with persistent discharging sinus diagnosed by sinogram wound explored in main operating room under general anaesthesia. Wound was left open to heal by secondary intension by granulation tissue formation. Sinus tract specimen sent for histopathological reporting with special comments for any tubercular granuloma as well as for biopsies for Polymerase Chain Reaction (PCR). All patients responded well within six months of follow-up.

Factors affecting outcomes of ELC like demography (including age, gender, and BMI), acute versus chronic cholecystitis, post-operative port site complications like site of infected port, type of Microorganism & type of infection (superficial or deep infection) and intraoperative spillage of stones, bile or pus were analysed in our sample. The method of sterilization used in our sample was washed the instruments by ENZYM (50cc/20L), then rinse with tap water, finally emersion in Formalin or OPA for 30 minutes. All data were collected in preformed format and statistical analysis was done. MINITAB Version 13 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≤0.05 was considered as statistically significant.

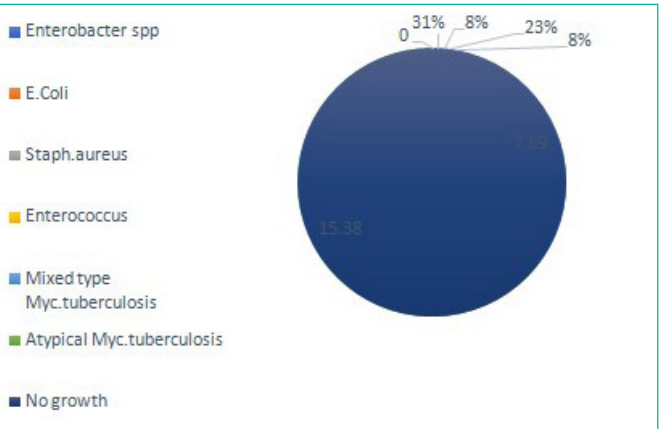

Figure 1: Distribution of organism isolated from the swab culture (N=13).

Results

Statistical data 251 patients with demographic variables like sex, age and BMI were analysed. The mean age of the study was 41.6 years. Out of 251, 220(87.64%) patients were female and 31(12.36%) were male. 11 females and 2 males had port site infection in study population (Table 1).

The highest percentage of BMI was recorded (47.0%) between 18.5 and 40 kg/m^2. 71 Patient out of 251 with high BMI (>30Kg/m^2), (28.28%) faced difficulty in gall bladder extraction leading to spillage of bile and stones.10 out of 71 developed port site SSI later. Patient with low BMI (<30kg/m^2) also had PSI in 3 cases of ELC (Table 2).

Acute cholecystitis cases were mostly kept under observation and conservative treatment and planned for interval cholecystectomy after 6 weeks. 13.54% cases (34/251) 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 20(7.97%) cases. 13 patients developed PSI after incidence of spillage of bile and stones during gall bladder dissection and specimen extraction (Table 3).

Overall Port Site Infection (PSI) was reported in 13 patients (11 females & 2 males) of study population which underwent ELC, which constituted 5.17% (Table 4).

Out of these 3 cases (8.82%) operated in acute condition had PSI where 1 case developed deep SSI and 2 cases (66.6%) had superficial port site infection. 1 PSI also developed in patients which had no biliary spillage (Table 5).

As far as the site of port infection was concerned, umbilical PSI was seen in 10 out of 13(76.92%) and epigastric PSI was seen in 3 cases (23.07%) (Table 6).

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 1& Table 7).

Table 1: Table showing gender factors associated with development of PSI (N=251).

Gender	PSI	Percentage	P Value
Female	11/220	5.00	
Male	2/31	6.45	
Total	13/251	-	<0.05

Table 2: Showing BMI association with Incidence of PSI.

BMI	PSI	Percentage	P Value
BMI <30Kg/m^2	10	76.9	
BMI >30Kg/m^2	3	23.07	
Total	13		<0.04

Table 3: Table showing association of PSI with biliary spillage.

Spillage (Bile, stone, or pus)	PSI(Number)	Percentage	P Value
YES	12/20	60	
NO	1/231	0.4	
Total	13/251	-	<0.05

Table 4: Table showing incidence of PSI with Acute Vs Chronic cholecystitis.

Diagnosis	PSI	percentage	P Value
Acute Cholecystitis	3/34	8.82	
Chronic Cholecystitis	10/217	4.60	
Total	13/251		<0.05

Table 5: Different type of port site infection

Type of PSI	Number	Percentage	P value
Superficial PSI	12	66.66	
Deep PSI	1	33.33	
Organ/Space PSI	0	00.00	
Total	3		<0.05

Table 6: Showing incidence of PSI at different sites of port.

Port site	PSI(Number)	Percentage	P Value
Umbilical Port	10	76.92	
Epigastric Port	3	23.07	
Lateral Ports	0	00	
Total	13	-	<0.05

Table 7: Types of bacteria isolated from PSI sites.

Type Of Bacteria	Species	Numbers
Gram -VE	Enterobacter spp E. coli	4(30.76) 1(7.69)
Gram+Ve	Staphylococcus aureus spp Enterococcus spp	3(23.07) 1(7.69)
Mycobacterium tuberculosis	Mixed Atypical Typical No growth	1(7.69) 2(15.38) 0 1(7.69)
Total		13

Discussion

The morbidity like PSI is a social stigma on surgeon's capability. Port site infection doesn't increase only psychological stress of patients but also financial burden, and incisional hernia. However, after the advent of laparoscopic technique SSI got reduced with respect to open surgeries. The advantage of laparoscopic in reducing PSI is because of its minimally invasive procedure like small incision, less blood loss, less pain, and less immune suppression [16]. The overall incidence of port site infection in our study is about 5.17% (13 patients out of 251 population) which was lower than results of study published by Khurshid, et al, in 2012, and their results was 6.7% [17] and higher than results of study done by Jasim Saud, et al, their result was lower than our study (2.4%) [18]. The differences among the three studies may be due to differences in patient selection, sterilization technique, sites of gall bladder extraction and local bacterial flora which could be different from hospital to another and, patient to patient. In our study, we found that patients underwent elective laparoscopic cholecystectomy were predominantly females, also most of our port site infection patients were females. This finding contrasts with a previous study [18]. Our study patients operated during acute phases are more at risk to develop infection. This resembles another study [9]. Both studies show the significance of acute phase with PSI. This is due to increased probability of friability of gall bladder, perforation of gallbladder and spillage of bile, stones, or pus because of difficult dissection, tensely distended gallbladder with thickened oedematous wall [19]. As long as the inflammation is limited to gallbladder, laparoscopic cholecystectomy is usually feasible. However, the inflammation extends to the porta-hepatis, great care must be taken in proceeding with operations, as normally thin minimally adhesive tissue that invest cystic duct and artery is markedly thickened and

oedematous and may not readily separated by usual blind dissection [20]. Laparoscopic cholecystectomy is associated with spillage of gallstones in 5% to 40% [15,20] of procedures and perforation of gallbladder during surgery occur frequently at a rate of 10% to 40% [21] and may occur secondary to traction applied by grasping forceps or because of electro-surgical thermal injury during removal of the gallbladder from its bed [19]. Escaped stones composed primarily of cholesterol that pose little threat of infection, however, pigment stones frequently harbour viable bacteria and may potentially lead to subsequent infections if allowed to remain in the peritoneal cavity [19]. In our study spillage occur in 20 operations which represent 7.9 % from the total sample (251). Thirteen patients with biliary spillage presented with port site infection (65%) and only 1 patient (0.4%) develop PSI from 251 cases without spillage. Spillage of bile, pus or stones which can be retained inside the abdomen or in the wound is highly associated with port site infection and localised abscess formation [19] which was statistically significant (p=0.0001). Foreign body retained could be stones, clips, or parts of plastic sheath. Another study conducted over three years 2009-2012 show relation between port site infection and intraoperative spillage during laparoscopic cholecystectomy in 5.3% of perforated cases [22]. 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. Port site infection was noticed in 3 patients (23%) in epigastric port and ten patients (77%) in umbilical port (p=0.0001), which is statistically significant for the association between umbilical port and SSI. This may be due to the umbilical flora and gall bladder extraction through umbilicus port surgery [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 12/13 patients (92.30%) compared with 1/13 patients (7.6%) presented with deep site infection.1 patients (7.6%) who presented with deep infection in our study as recurrent discharging single sinus at umbilical port. Two of these were infected with atypical mycobacterium species, one patient had retained stone in deep layers where infection was mixed, and one patient had retained foreign body (plastic sheath of a laparoscopic instrument) inside deep layers of falciform ligament where no growth of bacteria was obtained. There is another explanation for the source of atypical mycobacterium is the use of tap water for rinsing nonsterile laparoscopic instruments after and deeping into 2% glutaraldehyde may re-introduce mycobacterium [25] to the instrument and then to the wound. Also sharing of laparoscopic instruments with other department like urology or surgical oncology has observed as another source of infection sometimes [26]. The instruments itself covered by plastic insulation and presence of joints make its sterilization insufficient [27]. Also, the rapid turnover between operations is at the expense of optimum sterilization time. In advanced centres, the golden standard is to use a disposable laparoscopic instrument, use of advanced sterilization methods such as (STERRAD) “which is a trademark for low-temperature sterilization.

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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