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CLINICO - PATHOLOGICAL STUDY OF PORT SITE INFECTION IN LAPAROSCOPIC SURGERY

General Surgery

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KEYWORDS

INTRODUCTION:

- Laparoscopic surgery involves the use of reusable metallic or disposable plastic trocars inserted through small skin incisions or ports made on the skin away from the site of surgery. This ports form the portal of entry to perform the surgical procedure by means of specially devised instruments and telescope. It has gained popularity due to better aesthesis, lesser pain, early ambulation and discharge from the hospital with early return to work, minimizing the financial burden to the patient. This is because of the combination of advancement in technology with the increasing acceptance of MAS(Minimal access surgery) by patients, which has led to the expansion of the horizon of LS.
- LS, however, has its package of unique complications. One such complication, which is preventable although, is the port site infection (PSI). PSI soon erodes the advantages of LS, with the patient becoming worried with the indolent and nagging infection and losing confidence on the operating surgeon.
- There occurs a significant increase in the morbidity, hospital stay and financial loss to the patient. The whole purpose of MAS to achieve utmost cosmesis is turned into an unsightly wound, and the quality of life of patients is seriously affected..
- PSI is a type of SSI but limited to LS.
- According to the definitions developed by the United States Centre for Disease Control (CDC), SSIs were categorized into[25]: (1) Superficial SSIs which involve skin and subcutaneous tissue; (2) Deep SSIs which involve fascia and muscle layers; and (3) Organ/Space SSIs.
- Wounds are classified as (as per CDC criteria for SSI 2015)[25]: (1) Clean (2) Clean- Contaminated; (3) Contaminated and (4) Dirty or Infected.
- Most of the surgical procedures done by laparoscopy belong to Classes 1 and 2 wounds. The human body hosts a variety of microbes which can cause infections. When the host systemic immunity is suppressed due to any disease, medications or disruptions of the integrity of the skin or mucous membranes secondary to surgical insult, patients' own commensal microbial flora may cause infection. The PSIs in LS manifest in the form of seropurulent discharge from the port sites with surrounding skin inflammation or symptoms related to the organ/space infection.

MATERIALS AND METHODS

- A retrospective study was conducted by the Department of General Surgery of Narayan Medical College & Hospital, Jamuhar, Bihar. The study duration was from August 2019 to August 2022. Informed written consent forms were obtained from each patient before participation. Patients who underwent laparoscopic cholecystectomies during this period were included in our study. All the patients were given broad spectrum antibiotics (Ceftriaxone vial 1 g twice daily by intravenous infusion) at the induction of aesthesia.
- All operations were done by experienced surgeons, using four ports procedures, with reusable instruments; gallbladder was extracted from the epigastric port in all operations, without using retrieval bag. Sub-hepatic tube drain was used in most of the patients and removed next day after the operation. Stitches were removed 7th day postoperatively without the presence of infection. Swabs were taken for culture and sensitivity in all patients who developed PSI. Exploration under general anaesthesia was done for patients with chronic deep site infections, presented with persistent discharging sinus, wound debridement was done and the wound was left open to heal by secondary intention. Excisional biopsies for chronic discharging sinuses had been done and sent for histopathological studies & tissue samples examined for polymerase chain reaction (PCR).
- All patients responded well within six months of follow-up. Patient's whose operations were converted to open procedures and those with a history of chronic co-morbid conditions were excluded from the sample to minimize bias in the study. For the same reason, and to avoid iatrogenic complications of beginner surgeons, we collect the data of experienced surgeons who have good documentation and postoperative follow-up. Factors as gender, 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 sample.
- The method of sterilization used in our sample was washing the instruments by ENZYM (50 cc/20 L), 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. The data was introduced in Microsoft excel. Descriptive 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 :

- A total of 60 patients were included in the final analysis. The age range of the study participants was 24 to 67 years with a mean age of 44.6 years. Majority (45/60, 75%) of the patients were female. Acute cases were mostly kept under observation and conservative management. 14% cases (8/60) were operated in the acute phase. Spillage of bile, stones or pus is an important predictor of infection, such incidence was reported with 45/60 (75%) cases. Epigastric site infection (PSI) was reported in 38 patients, which constituted 63% of the study population while Umbilical port site infection was reported in 22 cases (37% of the population). All the factors known to predispose a person to infection have been checked for association and report has been shown in table 1. It was found that female gender, those operated in acute phase, spillage during surgery and site of port are important predictors of developing port site infection.

Table 1: Table showing association of various factors with development of PSI (N = 60)

FACTOR.	NO. OF CASES DEVELOPING PSI.	P VALUE
GENDER Female.	45/60	< 0.05
Male.	15/60.	< 0.05
CONDITION Acute.	8/60.	< 0.05
Chronic.	52/60	< 0.05
SPILLAGE Yes.	17/60.	< 0.05

No.	43/60.	< 0.05
PORT SITE		
Epigastric.	38/60.	< 0.05
Umbilical.	22/60.	< 0.05

DISCUSSION:

- The rate of PSI after laparoscopic cholecystectomy is lower than that of open cholecystectomy because laparoscopic procedures are minimally invasive technique and have less impact on the immune system than an open one [12]. The differences among the three studies may be due to differences in environment, population and sterilization technique which could be different from hospital to another and there may be rapid turnover on the expense of adequate sterilization.
- In our study, we found the majority of patients underwent laparoscopic cholecystectomy were females, also most of our port site infection patients were females. This finding is in contrast to a previous study [14]. Also, perforation of gallbladder during operation was more in males than in females [15]. The explanation of this is not so clear but we can say that male gender tolerates more pain than female (by questioner). Our study patients operated during acute phase are more at risk to develop infection. This is similar to another study [7]. Both studies show the significance of acute phase with PSI. This is due to increased probability of perforation of gallbladder and spillage of bile, stones, or pus as a result of difficult manipulation, tensely distended gallbladder with thickened oedematous wall [16]. 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 [17]..
- Laparoscopic cholecystectomy is associated with spillage of gallstones in 5% to 40% [11,17] of procedures and perforation of gallbladder during surgery occur frequently at a rate of 10% to 40% [18] 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 [16]. 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 [16]. 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 abscess formation [16] which was statistically significant in our study. 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 [19]. In our study, the percentage was higher maybe due to lack of usage of retrieval bag which prevent direct contact of port wound with the content of infected gallbladder. This may be due to the fact that the epigastric port is the site of gallbladder extraction therefore this port will be in direct contact with inflamed gallbladder. Another study showed high association between epigastric port and infection [20] and in another study, shows surgical site infection in umbilical port more than epigastric port and this related to umbilical flora and gall bladder extraction through umbilicus in single port surgery [21] which indicates that site of gall bladder extraction was the most common site of PSI.

Risk factors for PSIs :

- A number of contributing factors are somewhat re- sponsible for the emergence of postoperative PSIs.
- Antibiotics always may not be the answer to this problem. Thus, using them irrationally, as is often done will only result in the emergence of multidrug resistant microbes.
- Preoperative stay in hospital: Lilani et al[10] reported a significant increase in the incidence of SSIs with preoperative stay of more than 2 d for open surgical procedures.
- Duration of operation: The study by Lilani et al[10] reported a nil infection rate in surgeries of less than 30 min duration. There was a significant increase in SSIs for operations of prolonged duration for two hours or more.
- Other factors: Factors like surgery in acutely inflamed organs adversely affect the rate of PSIs[20,22]. The risk of SSIs increases in patients with a history of nicotine or steroid usage, diabetes, malnutrition, long preoperative hospital stay, preoperative colonization of nares with Staphylococcus aureus, or perioperative blood transfusion[29,30].
- PSIs may depend upon the port through which the specimen is extracted. The infected specimen should be removed in an endobag in order to prevent wound infection and accidental spillage of contents or occult malignant cells. An improvised endobag can be prepared from a simple drain bag which is easy to make, cheap, readily available and disposable[17].

Microbial flora causing PSIs in LS :

- PSIs occur due to exposure of surgical wound to microbes which may be from an endogenous or exogenous source. The source of endogenous flora usually is from the patient's skin, mucous membranes or any of the viscera. The exogenous flora may be from any contaminated sources present in the sterile surgical field including surgeon and team, instruments, room air, etc[31].
- PSIs are of two broad varieties based on the timing when they are present. The more common type manifests early, within a week of the surgical procedure. Gram positive or negative bacteria are the usual offending organisms which are contracted from the native skin or infected surgical site. They usually respond well to the commonly used antimicrobial agents. The other variety is caused by rapid growing atypical mycobacterium species, which has an incubation period of 3 to 4 wk. They show a poor response to the usual antimicrobial agents[33].

Mycobacterial isolates: Several reports have established the role of rapid growing mycobacteria (RGM), particularly M. fortuitum and M. chelonae which together have been termed as M. fortuitum-chelonae complex that is known to cause disease in humans as well as animals[36]. The endospores of this non- tuberculous mycobacterial (NTM) complex are usually considered saprophytes which colonize in sewage, soil and even tap water. This often cause localized skin infections 3-4 wk post-surgery[37,38]. The NTM complex can cause disseminated disease in immunosuppressive diseases. These atypical mycobacteria have a predilection to involve the skin and subcutaneous tissue. M. chelonae and M. abscessus have similar characteristics, and hence together were addressed as M. chelonae/ abscessus group. Vijayaraghavan et al[39] reported an outbreak of laparoscopic PSIs due to M. chelonae at their center. They had 145 PSIs in 35 patients in a period of 6 wk. The contaminating source was found to be the water being used for washing instruments after chemical disinfection[39]. A series of eight cases of port site tuberculosis after laparoscopy was reported by Ramesh et al[40] from India, caused by M. tuberculosis..

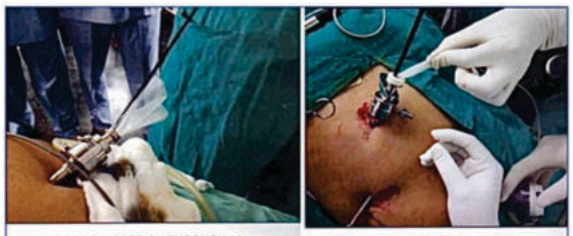
Non-mycobacterial isolates:

Kownhar et al[34] reported superficial SSIs as the most common in both MAS and open surgical procedures, with Staphylococcus aureus as the most common isolate. They studied the SSIs and found various common bacteria isolated as Staphylococcus aureus (37%) and Pseudomonas aeruginosa (37%), followed by Klebsiella pneumonia (8%), Acinetobacter spp. (3.2%), Proteus spp. (4.8%), Escherichia coli (4.8%), Citrobacter freundii (1.6%), Edwardsiella tarda (1.6%) and Enterococcus faecalis (1.6%). Klebsiella sp. is the most common offending organism in deep SSIs irrespective of the surgical approach[34].

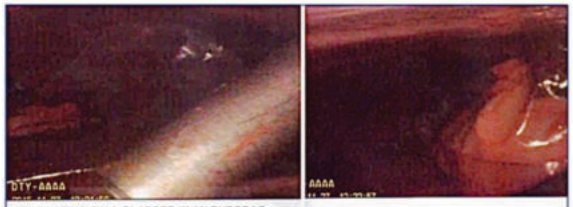
Extraction through endobag:

[Table/Fig-1]: Showing simple drain bag being used as an endobag.

[Table/Fig-2]: Folding of endobag.



[Table/Fig-3]: Endobag being inserted through the 10mm port into the peritoneal cavity.



[Table/Fig-4]: Placing and extracting the gallbladder in an endobag.

[Table/Fig-5]: Placement of stones into the endobag followed by extraction of gall bladder.

[Table/Fig-6]: Showing spillage of contents in the endobag, preventing port site contamination.

CONCLUSION:

- PSI, although infrequent, can be a frustrating complication in MAS, both for the patient as well as the operating surgeon. Leaving aside the bacterial causes, the emerging rapid growing multidrug resistant non-tub- erculous mycobacteria are a new threat to the surgical fraternity. Strictly abiding by the commandments of cleaning and sterilization of the laparoscopic instruments, with the appropriate sterilizing agent, the complication can be best avoided.
- This review is likely to aid in understanding the relevant studies regarding the appropriate management of PSIs in LS. All the cases of PSI, especially of the atypical mycobacterium should be notified to know the exact incidence, etiology and the sensitivity pattern to various antibiotics. Macrolides, quinolones and aminoglycosides do show promising activity against the atypical mycobacterium. Further research is needed to find out appropriate guidelines for the diagnosis and treatment of this emerging problem.

Ten commandments for preventing PSI

(1) Use of disposable trocars and instruments, and adequate availability of properly sterilised reusable trocars to cover all the surgical procedures in a day;
(2) Use of autoclavable laparoscopic hand instruments;
(3) Use of instruments with good ergonomics, limited joints and facility for proper cleaning of the debris collected in its crevices;
(4) A proper cleaning of the instrument is best achieved by ultrasonic technology. Use of autoclaved water for cleaning the instruments after dismantling;
(5) Proper guidelines should be followed regarding the concentration, contact time and cycles of use for instrument sterilization with liquid sterilizing agents;
(6) Use of plasma sterilizer or ethylene oxide in between the consecutive surgery for instrument sterilization;
(7) Avoiding inter-departmental sharing of instruments, such as using instruments used for gynecological or urological procedures;
(8) Avoiding spillage of bile or gut content in the operative area or the port site;
(9) Use of non-porous specimen retrieval bags for retrieving the specimen; and
(10) Thorough irrigation and cleaning of the port site before wound closure.

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