Available online at **www.ijmrhs.com**

ISSN No: 2319-5886

International Journal of Medical Research & Health Sciences, 2017, 6(6): 132-137

Port Site Infections After Laparoscopic Cholecystectomy

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ABSTRACT

Background: *Port site infection (PSI) is an infrequent surgical site infection that complicates laparoscopic surgery but has a considerable influence in the overall outcome of laparoscopic cholecystectomy. The aim of this study was to evaluate factors that influence PSI after laparoscopic cholecystectomies and to analyze which of these factors can be modified to avoid PSI in a trail to achieve maximum laparoscopic advantages.* ***Methods:*** *A prospective descriptive qualitative study conducted on patients who underwent laparoscopic cholecystectomies. Swabs were taken for culture & sensitivity in all patients who developed PSI. Exploration under general anaesthesia, for patients, had deep surgical site infections and wound debridement was done, excisional biopsies had been taken for histopathological studies, and tissue samples for polymerase chain reaction for detection of mycobacterium tuberculosis was done. All patients were followed up for six months postoperatively. 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.* ***Results:*** *Port site infection rate was recorded in 40/889 procedures (4.5%), higher rates were observed in male patients 8/89 (8.9%), in acute cholecystitis 13/125 (10.4%), when spillage of bile, stones or pus occurred 24/80 (30%), and at epigastric port 32/40 (80%). Most of the PSI were superficial infections 77.5% with non-specific microorganism 34/40 (85%).* ***Conclusion:*** *There is a significant association of port site infection with spillage of bile, stones, or pus, with the port of gallbladder extraction and with acute cholecystitis. Especial consideration should be taken in chronic deep surgical site infection as mycobacterium tuberculosis could be the cause. Most of the PSIs are superficial and more common in males.*

Keywords: Port site infection, Surgical site infection, Laparoscopic cholecystectomy, Cholecystitis

INTRODUCTION

Laparoscopic surgery also termed as minimally invasive surgery, was first presented in the eighth decade of 20thcentury, shortly after that it became the surgical treatment of choice for many operations [1]. Now the laparoscopic cholecystectomy is the gold standard treatment for symptomatic gallstones [2]. Its advantages include decreased hospital stay postoperatively, earlier return to work, decreased post-operative pain [3], minimum surgical incisions and so better cosmetic results and lesser postoperative complications. So, it not only supplanted open cholecystectomy but also more or less ended attempts for the non-invasive management of gallstones, such extracorporeal shock wave, and bile salt therapy [4]. Generally, most of the surgical procedures may end with complications. One of these complications is surgical site infection (SSI). 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 [5]. 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 [6]. It is a fact that laparoscopic cholecystectomy associated with fewer SSI than open cholecystectomy [7]. However now-a-days, with increasing number of performed laparoscopic cholecystectomies, there is an increasing number of port site infection, although it occurs infrequently, but it has significant influence on overall outcomes of laparoscopic cholecystectomy and its final results like delay in return to work, increase cost and bad cosmetic results which become disappointing for both patient and surgeon. There are three types of surgical site infection which can occur in port site [8-10]: First is superficial surgical site infection occurring within 30 days post-surgery and involves only skin and subcutaneous tissues and the patient at least has one of the following: a) purulent discharge from the superficial incision. b) organism isolated from aseptically obtained culture of fluid or tissue from superficial incision. The second type is deep surgical site infection which may be

presented after 30 days of operation and involves deep soft tissues including fascia and muscles deep to the incision. The patient has at least two of the followings: a) purulent drainage from deep incision, b) dehiscence of the deep incision, and c) an abscess. The third type is organ/space SSI where infection involves any organ and spaces other than the incision which was opened or manipulated during surgery [11].

PATIENTS AND METHODS

In this prospective descriptive qualitative study conducted at Al-Kindy teaching hospital, from 1st of January 2012 to 31st of December 2014 (36 months) period, patients who underwent laparoscopic cholecystectomies were included in our study, all had been given broad spectrum antibiotics (ceftriaxone vial 1 g twice daily by intravenous infusion)at the of induction of anaesthesia, in addition with metronidazole 500 mg three times daily intravenously for 24 hours postoperatively, and for period of five days for those with acute cholecystitis. 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). In patients proved to have TB, anti TB-therapy was given orally (Ethambutol 800-1200 mg daily, rifampicin 600 mg daily, isoniazid 300 mg daily and pyrazinamide 1000-1500 mg daily) for nine months. 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. Their experience was estimated by their period of laparoscopic work (at least 10 years), their number of operating procedures and duration of procedures (20-90 minutes). 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 washed the instruments by ENZYM (50 cc/20 L), then rinse with tap water, finally emersion in Formalin or OPA (Cidex ®) for 30 minutes.

Statistical analysis

All data were collected in preformed format and statistical analysis was done. The data was introduced in PC. MINITAB version 13 software was used to analyze data. Descriptive statistic "tables" were used to displays variables. Chi-square test was used to decide the significance of the association between related variables. $P \leq 0.05$ was considered as a cut of point.

RESULTS

Out of total 1340 patients who underwent laparoscopic cholecystectomy, only 889 patients were included in our study, their ages ranged (20-65 years) mean age 43.1 years, PSI was found in 40/889 patients (4.5%). Regarding gender, in 32/800 female patients, 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, p-value 0.03. as in Table 1.

Table 1 The incidence of PSI in relation to gender

Gender	Infected/Total	Percentage (%)	P value
Male	8/89	8.90	0.03
Female	32/800	4	
Total	40/889	-	

Regarding the status of gallbladder before the operation, 13/125 patients (10.4%) were operated during an acute attack and 27/764 patients (3.5%) were suffering from chronic cholecystitis. P value was 0.001, i.e., there is a significant association between infection and acute cholecystitis as shown in Table 2.

Table 2 Incidence of PSI in relation to the clinical diagnosis of the gallbladder pre-operatively

Condition	Infected/Total	Percentage (%)	P value
Chronic cholecystitis	27/ 764	3.5	0.01
Acute cholecystitis	13/ 125	10.4	
Total	40/ 889	-	

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 i.e., the spillage can be regarded as a risk factor in the development of PSI (Table 3).

Table 3 Incidence of PSI in relation to spillage of bile, stones, or pus during operation

PSI	Infected/total	Percentage (%)	P value
With spillage	24/80	30	0.0001
Without spillage	16/809	1.9	
Total	40/889	-	

According to the site of port infection, 32 patients (80%) developed an infection at the epigastric port, six patients (15%) developed an infection at the umbilical port and only two patients (5%) developed an infection at the lateral ports. P value was 0.0001, which is highly significant and site of gallbladder extraction could be a cause of PSI (Table 4).

Table 4 Incidence of PSI in different port sites

Port site	No.	Percentage (%)	P value
Umbilical port	6	15	0.0001
Epigastric port	32	80	
Lateral port	2	5	
Total	40	-	

Regarding the type of port site infection, 31/40 patients (77.5%) developed a superficial infection and 9/40 patients (22.5%) developed deep site infection as in Table 5.

Table 5 Types of PSI

PSI	Number	Percentage (%)
Superficial infection	31	77.5
Deep site infection	9	22.5
Total	40	-

About results of swabs culture and PCR of tissue samples, 18 patients (45%) were infected by Gram –ve bacteria, 10 patients (25%) were infected by Gram +ve bacteria, 3 patients (7.5%) were infected with mixed infection, 3 patients (7.5%) whose results were chronic inflammation with no growth and six patients (15%) were infected by mycobacterium species, Table 6.

Table 6 Type of microorganism associated with post laparoscopic cholecystectomy

Type of Infection	Microorganism	Microorganism	No. of cases
Non-specific infection 34/40 (85%)	Gram -ve 18 (45%)	*Enterobacter* spp. 14(35%)	40 cases
		E. coli 10 (25%)	
	Gram +ve 10 (25%)	*Staphylococcus auras* spp. 8 (20%)	
		Enterococcus spp. 2 (5%)	
	Mixed 3 (7.5%)		
	No growth 3 (7.5%)		
Specific infection (*Mycobacterium tuberculosis*) 6/40 (15%)	Atypical 3 (7.5%)		
	Typical 3 (7.5%)		

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 incidence of port site infection in our sample is about 4.5% (40 patients from 889) which was lower than results of study done by Khurshid, et al. in Indian hospital of Kashmir in 2012, their results was 6.7% [13] and higher than 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]. 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 (800 patients 90%) from 889, also most of our port site infection patients were females 32 patients from 40 patients. If we compare with another study that was done in Al-Basrah hospital which included 369 patients, 301 (81.57%) of them were females and 68 (18.43%) were males and PSI occur in 11 patients (2.98%),

7 females (63.63%) and 4 males (36.36%) [14]. In both studies, although number of female is higher than males but after statistical analysis we found the p-value of male gender is significant (0.03) i.e., associated with higher incidence PSI. Also, perforation of gallbladder during operation 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). From a total number of 889 patients, we found 764 patients had chronic cholecystitis before operation and 125 were operated during the acute phase, 27/764 patients (3.5%) were operated during the chronic phase of cholecystitis and developed PSI and 13/125 patients (10.4%) were operated during acute inflammation and got infected. i.e., infection was more commonly affecting patients during acute phase than with chronic phase. It's p=0.001. In comparing with other study done in DHQ (Divisional Headquarters Teaching Hospital) Mirpur-Kashmir show 7.1% PSI in their sample, 65% of cases were during the acute phase and 35% were in chronic cases [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]. In our study spillage occur in 80operations which represent 8.9% from the total sample (889). Twenty-four patients with spillage presented with port site infection (30%) and only 16 patients (1.97%) develop PSI from 809 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 abscess formation [16] which was statistically significant (p=0.0001). Foreign body retained could be stones, clips, or parts of plastic sheath. Another study done in Taj surgery hospital in Pakistan for 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. Port site infection was noticed in 32 patients (80%) in epigastric port and six patients (15%) in umbilical port and only two patients (5%) at the lateral port (p=0.0001), which is statistically significant for the association between epigastric port and SSI. 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. Study was done in governmental medical college in India which also shows high association between epigastric port and infection (88.2%) [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. Most of the patients presented with PSI in our study were superficial infection 31/40 patients (77.5%) compared with 9/40 patients (22.5%) presented with deep site infection. Also, superficial infection is more common than deep infection as reported by study done by Mir, et al. at tertiary care hospital of Kashmir 2012 (87.7% for superficial infection compared with 13.3% for deep infection) [13]. Nine patients (22.5%) who presented with deep infection in our study as recurrent discharging single or multiple sinuses (seven at epigastric port, two at umbilical port and one at lateral port). Three of these were infected with atypical mycobacterium species, three were infected with typical mycobacterium tuberculosis, one patient had retained stone in deep layers where infection was mixed, other patient had retained foreign body (plastic sheath of a laparoscopic instrument) inside deep layers of falciform ligament where no growth of bacteria was obtained and only chronic granulomatous reaction with chronic inflammatory cells was found and a patient had abscesses deep in the abdominal wall between epigastric and lateral port which were sterile. By taking detailed history, one of the patients infected with mycobacterium species has close relative (her husband who was changing her dressing) working in hospital of infectious disease. There is another explanation for the source of mycobacterium is the use of tap water for rinsing laparoscopic instruments after complete sterilization to rinse glutaraldehyde may re-introduce mycobacterium [22] to the instrument and then to the wound. Also sharing of laparoscopic instruments with other department like urology has observed as another source of infection sometimes [23]. The instruments itself covered by plastic insulation and presence of joints make its sterilization insufficient [24]. 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

system, using gas plasma technology, quick, safe and efficient elimination of toxic residue from devices" or use ethylene oxide. Another technique is to keep instruments 24 hours in formalin gas chamber [25].

CONCLUSION

There is a significant association of PSI with spillage of bile, stones, or pus, with the port of gallbladder extraction and with acute cholecystitis. Special consideration should be taken in chronic deep surgical site infection as mycobacterium tuberculosis could be the cause. Most of the PSIs are superficial and more common in males.

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