e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2023; 15(12); 1977-1982

Original Research Article

Port Site Infections: Investigate the Occurrence and Various Risk Factors in India

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Received: 25-09-2023 / Revised: 23-10-2023 / Accepted: 26-11-2023
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Conflict of interest: Nil

Abstract:

While rare, port site infection (PSI) is one of the annoying side effects that negate the advantages of minimally invasive surgery. It not only increases the patient's morbidity but also damages the surgeon's reputation. PSIs continue to be prevalent even with advancements in the fields of antimicrobial agents, sterilisation, surgery, and operating room ventilation. There are several factors that contribute to the risk of port site infection, namely those connected to the patient, surgery, and facility. The purpose of this study is to estimate the burden of SSIs and the risk variables that have contributed. One of India's biggest public hospitals undertook a prospective observational cross-sectional study. During the study period, 91 patients experienced surgical site infections (SSI) after 1236 laparotomies; this represents a 7.36% incidence of SSI. The age range of 41–50 years old accounted for 2967% of cases. Diabetes (42.85%) was the most common comorbidity observed, followed by hypertension (25.27%), dyslipidemia (29.67%), smoking (28.57%), and BMI 25–30 kg/m2 (3846%). In most cases, the surgical time was longer than two hours (52.74%) and the ASA score was 2 (56.04%). The most common uses of PSI were for cholecystectomy (33.33%), appendectomy (13.18%), and diagnostic procedures (10.98% each). The three types of SSI that were found were organ/space, deep incisional, and superficial (n = 52, 57.14%, n = 20, 21.97%, and n = 9, 9.89%). The majority of wounds (42.85%) were clean, with clean contaminated wounds (17.58%), contaminated wounds (13.18%), and dirty or infected wounds (4.39%) following. E. Coli (17.58%) was the most frequently isolated organism, followed by Pseudomonas (12.08%) and Streptococcus (19.98%). The best way to prevent PSI complications is to closely adhere to the sterilisation protocols of the surgical instruments using the right sterilising agent, even though there is currently no consensus in the literature about PSI therapy.

Keywords: Port site infection; Sterilization; Risk Factors, Laparoscopic Surgeries

Introduction

The ability to cure diseases surgically and reduce surgical invasiveness has been granted to surgeons by the swift advancement of health care technology (Leaper and Edmiston, 2017). Surgical infections were a major contributor to the global disease burden (Sasmal et al., 2015). Surgical site infections (SSIs) are described as "infections that occur after surgery at the site of incision, organ, or space (Control CfD and Prevention, 2017)" by the Centres for Disease Control and Prevention (CDC).

Since its introduction, laparoscopic procedures have grown in acceptance and are currently the norm for a variety of surgical procedures (Lei et al., 2015). With promising results, laparoscopic techniques have been used in a variety of surgeries, from more complex ones like radical prostatectomy to more straightforward ones like cholecystectomies (Chaudhary et al., 2023). They have many benefits, including quicker healing, improved cosmesis, and less discomfort following surgery, but they are not without drawbacks (Andersen, 2019). A group of persistent, bothersome, and unresponsive to treatment consequences specific to laparoscopic surgeries are called port-site infections (PSIs) (Woldemicael et al., 2019). The benefits of laparoscopic surgeries are quickly undermined by PSI, as patients lose trust in the operating surgeon and are anxious about the persistent infection. According to Khan et al. (2019), there is a noticeable rise in hospital stays, morbidity, and patient financial loss.

According to Khan et al. (2020), the PSI rate is higher in developing nations than it is in industrialised ones. In 2019, SSI post-discharge surveillance was conducted for elective clean and clean-contaminated surgical operations; 15% of cases were reported in low- and middle-income countries (LMICs) (Tripathi et al., 2022). According to Samaranayake et al. (2020), there is a strong correlation between patients with PSIs and longer hospital stays, slower wound healing, pain, discomfort, permanent impairment, and even death. Surgery, patients, microbiological, and environmental factors are among the many risk factors associated with PSI that have a complicated relationship (Mondal et al., 2023). The vulnerability of any wound to infection is influenced by numerous factors. According to Woldemicael et al. (2019), these variables include wound class, wound infection, length of operation, and pre-existing disease. Extremes in age, cancer, metabolic disorders, malnourishment, immunosuppression, smoking, distant site infection, emergency procedures, and an extended period of hospitalisation prior to surgery are additional factors (Sattar et al., 2019). The morbidity, mortality, and healthcare costs associated with PSIs may be reduced with careful and targeted identification of the factors that may put a particular patient at higher risk of infection as well as the gaps in currently available preventive options. PSIs continue to present challenges in healthcare management. The purpose of the current study was to investigate different risk variables for surgical site infections at a hospital.

The morbidity, mortality, and healthcare costs associated with PSIs may be reduced with careful and targeted identification of the risk factors for infection in a given patient as well as the gaps in the present preventive measures. PSIs continue to present challenges in healthcare management. The current study set out to investigate a number of port site infection risk factors in a tertiary medical facility.

Material and Methods

The current investigation was a prospective observational study carried out in the general surgery department of Tieten Medicality in Thane, India, and was hospital based. The two-year study period ran from January 2021 until December 2022. It was approved by the institutional ethical committee to conduct the study. Patients with port site infections following non-traumatic exploratory laparotomies performed throughout the study period were included in this study.

Inclusion Criteria: Patients between the ages of 18 and 70 who experienced port site infections after a non-traumatic exploratory laparotomy and were willing to take part in the current study met the inclusion criteria.

Exclusion Criteria: Patients having exploratory laparotomies due to traumatic causes are excluded. Patients undergoing immunosuppressive medications, chemotherapy, or radiation therapy. those who previously had skin infections. Patients underwent surgery apart from the hospital.

Patients were informed about the trial in their native tongue, and their signed agreement was obtained before they could participate. The following information was recorded: sociodemographic details, clinical details, blood transfusion, prophylactic antibiotic use, preoperative hospital stay, type of anaesthesia, nature of surgery, intraoperative findings, ASA score, duration of surgery, present examination findings, post-operative course, and routine investigations (wound swab culture and sensitivity, blood sugar, CBC, RFT, LFT). Co-morbidities that were linked to the condition included immunosuppressive illnesses of any kind, diabetes, hypertension, renal disease, thyroid abnormalities, and bronchial asthma.

If any one of the following conditions was met, wound infection was diagnosed: Substantial or nonpurulent discharge from the location accompanied by indicators of inflammation, pus discharge from the incision, and wounds that were purposefully opened by the surgeon because of localised collection. The microbiology department received the wound sample and used it for culture and sensitivity testing. After obtaining the swab culture and sensitivity data, the antibiotic was adjusted if needed. Follow-up was maintained until the PSI was cleared.

SPSS 20.0 was used for data analysis after Microsoft Excel was used for data collection and compilation. Descriptive statistics were used in the statistical analysis.

Results

Incidence of PSI was 7.36% during the study period, with 1236 laparotomies performed and 91 patients experiencing port site infections. The age group of 41–50 years old accounted for the majority of instances (29.67%), followed by 51–60 years old (21.97%). The study participants' average age was 50.4 ± 8.24. Cases by men (64.83%) exceeded those by women (35.16%). Diabetes (42.85%) was the most common co-morbidity seen, followed by hypertension (25.27%), dyslipidemia (29.67%), smoking (28.57%), and BMI 25–30 kg/m^2. In most cases, the surgical time was longer than two hours (52.74%) and the ASA score was 2 (56.04%).

Table 1: Demographics of the patients and port site infections related factors of patients

Characteristic	No. of patients (n=91)	Percentage
Age group (years)		
≤30	12	13.18%
31-40	16	17.58%

41-50	27	29.67%
51-60	20	21.97%
61-70	16	17.58%
Gender		
Male	59	64.83%
Female	32	35.16%
Co-morbidities		
Diabetes	39	42.85%
BMI >25 kg/m^2	35	38.46%
Dyslipidaemia	27	29.67%
Smoking	26	28.57%
Hypertension	23	25.27%
Chronic obstructive pulmonary disease	17	18.68%
Coronary artery disease	6	6.59%
ASA grade		
I	10	19.98%
II	51	56.04%
III or more	30	32.96%
Duration of operation (Hours)		
<1 hr	17	18.68%
1-2 hr	26	28.57%
2 hr	48	52.74%

In the current investigation, cholecystectomy procedures had the highest rate of SSI (33.33%), followed by laparoscopy (9.89%), open appendicectomy (13.18%), and diagnostic procedures (10.98%).

Table 2: Type of Surgery with respect to number and percentage

Surgery	No. of patients (n=91)	Percentage
Cholecystectomy	30	33.33%
Appendectomy	12	13.18%
Diagnostic	10	10.98%
Laparoscopy	9	9.89%
Hernia repair	7	7.69%
Oophorectomy	7	7.69%
Gastric banding	5	5.49%
Orchiopexy	4	4.39%
Ovarian cystectomy	4	4.39%
Tubal ligation	2	2.19%
Herniorrhaphy	1	1.09%

The surgical wounds of PSI patients were classified as clean, clean contaminated, and contaminated. Of these, the majority of wounds (42.85%) were classified as clean, followed by clean contaminated (17.58%), contaminated (13.18%), and dirty or infected (4.39%). In the current investigation, the most prevalent PSI was superficial (57.14%), followed by deep (21.97%) and organ space (9.89%).

Table 3: PSI related characteristics

Characteristic	No. of patients (n=91)	Percentage
Type of wound (NHSN-2020)		
Clean	39	42.85%
Clean contaminated	16	17.58%
Contaminated	12	13.18%
Dirty or infected	4	4.39%
Type of SSI or PSI (NHSN-2020)		
Superficial SSI	52	57.14
Deep SSI	20	21.97
Organ space SSI	9	9.89%

The study found that E. coli accounted for 17.58 percent of all isolates. Other common isolates were Pseudomonas sp. (12.08 percent), Streptococcus sp. (10.98 percent), Klebsiella sp. (9.89 percent), MRSA (7.69 percent), Acinetobacter sp. (4.39 percent), Helicobacter sp. (1.09 percent), and Providentia sp. (1.09 percent). Thirty-two cases (35.16%) showed no increase.

Table 4: Bacterial isolates from PSI cases

Bacterial Isolates	No. of patients (n=91)	Percentage
No growth	32	35.16%
E. coli	16	17.58%
Pseudomonas sp.	11	12.08%
Streptococcus sp.	10	10.98%
Klebsiella sp.	9	9.89%
MRSA	7	7.69%
Acinetobacter sp.	4	4.39%
Helicobacter	1	1.09%
Providentia	1	1.09%

Discussion

The probability of PSI incidence is influenced by a number of circumstances, therefore integrative approaches that prioritise pre-, intra-, and postoperative care for all parties involved are necessary for preventative actions. There are several multimodal preventative intervention programmes that have been developed, based on guidelines, surgical safety checklists, and surgical site care bundles. The ideal PSI reduction is still a challenge even with a number of procedural breakthroughs (Andersen, 2019; Chaudhary et al., 2023). PSI is a complex disorder that can arise from a variety of patient risk factors, including comorbidities, age, obesity, smoking, immunosuppression, malnutrition, cancer, and the kind of wound contamination (Ghosh et al., 2017). Primary infections typically manifest five to seven days after surgery and are more dangerous. The majority of PSIs are simple infections that simply affect the skin and subcutaneous tissue, however they can occasionally become necrotizing infections. Samaranayake et al. (2020) state that pain, warmth, soreness, swelling, erythema, and pus production are the usual symptoms of an infected surgical wound.

In the study by Prakash et al. (2018), there was a 25.34% incidence of SSI or PSI, with 18.42% deep SSI and 81.58% superficial SSI. The most common age group was 41 to 60 years old, and 63.2% of cases were females and laparotomies. The common pathogens were Escherichia coli, Vancomycin, and carbapenem-sensitive Staphylococcus aureus and Klebsiella pneumoniae. A strong correlation was shown between the development of SSI, the usage of povidone iodine alone, the presence of a drain, and the existence of pre-morbid analysis. According to Sheeba Mariyam et al. (2021), the PSI rate should range from 3% to 6.7%. Escherichia coli was the most often isolated organism (17.58%, 16/91). Laparoscopic cholecystectomy was the most often performed procedure linked to PSI, while Escherichia coli and Staphylococcus aureus were the most frequently detected pathogens (Sheeba Mariyam et al., 2021). According to Krishna and Samarasam (2017), PSI rates were associated with longer surgical times, more pre-operative hospital stays, surgical wound classes, and ASA (American Society of Anesthesiology) ratings > 2. According to Madhusudhan et al. (2016), patients who required blood transfusions, were older, male, diabetic, anaemic, underweight, overweight, hypertensive, and had a longer hospital stay were the groups most likely to experience surgical site infections (SSIs).

Compared to elective procedures, surgical site infections were more common in emergency situations (Chaudhary et al., 2023). When it came to surgical site infections, Staphylococcus aureus was the most often isolated pathogen. Infections at the surgical site were mostly caused by multidrug-resistant organisms (Samaranayake, et al 2020). Agrawal and Singh's (2014) study found that the incidence of SSI was 15.7% (59/375). The SSI rate was 5.7% for elective procedures and 28.6% for emergency surgeries. It was discovered that SSI rose linearly with ageing. A longer surgical time, the use of drains, a higher preoperative stay, the presence of a remote site infection, and an increase in the class of wound (dirty > clean) were additional important factors.

It was discovered that the most frequent organism causing SSI during abdominal surgeries was E. coli. Post-operative patients have an extremely high incidence of SSI, particularly in underdeveloped nations. Depending on the location and kind of operation, port site infection frequencies ranging from 1% to 8% have been documented (Sasmal et al., 2015). Risk indices, patient frailty, advanced age, co-morbidities, and difficult surgical procedures were all found to be risk variables that were consistently linked to PSI. Similar to the findings by Ghosh et al. (2017) and Bhattacharjee et al. (2015), Sheeba Mariyam et al. (2021) reported that the presence of comorbidities such as diabetes, hypertension, and anaemia was found to have a higher risk for PSI. Diabetes mellitus was prevalent in around 42.85% of the participants in the current study who acquired PSI.

The risk of superficial surgical site infections might be raised by a number of risk factors and peri-operative features. Diabetes mellitus, hypoxemia, leucopenia, hypothermia, smoking, immunosuppressive drug usage or long-term steroid, malnourishment, wounds contaminated with Mycobacterium fortuitum, and inadequate skin cleanliness are significant host variables (Madhusudhan et al., 2016). Environmental and peri-operative factors include shaving the operating site, poor operative sterile technique, delayed or early initiation of antimicrobial prophylaxis, inadequate intra-operative antimicrobial prophylaxis dosing, surgical personnel colonised or infected, poor operating room air quality, prolonged hypotension, contaminated instruments or environment, and inadequate wound care after surgery (Sattar et al., 2019). The consequences of PSI will affect patients and healthcare systems more profoundly as its incidence rate rises. A multifaceted strategy is needed to prevent PSI, focusing on risk factors relating to the patient as well as the procedure during the pre-, intra-, and post-operative phases.

Conclusion

Although they are seldom fatal, port-site infections are a bothersome side effect that reduces the advantages of laparoscopic surgery. Treatment refractory delayed PSIs produced by multidrug-resistant mycobacteria exist, whereas early PSIs caused by skin commensals are very easily treated. Strong sterilisation that switches from traditional glutaraldehyde-based methods to gas and plasma sterilisation may lessen the occurrence of these problems. A comprehensive microbiological work-up of the patients is necessary for the management of delayed PSIs. After elective or emergency abdominal surgeries, there were a few high-risk factors identified for port site infections: BMI > 25, co-morbidities like diabetes, smoking, dyslipidemia, surgery lasting longer than two hours, and appendicectomy. Preoperative evaluation, intraoperative care, postoperative monitoring, and assessment of high-risk factors are crucial in preventing post-surgical stress injury (PSI).

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