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A Study of Risk Factors of Surgical Site Infection in One Center: A Cross-Sectional Study

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A Study of Risk Factors of Surgical Site Infection in One Center: A Cross-Sectional Study

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Abstract: Introduction: Infection of a wound during the thirty days after surgery is considered a surgical site infection (SSI). Because of lack of large studies or documented guidelines for SSI after surgery, we aimed to study risk factors and comorbidities that may lead to SSI. Methods: A cross-sectional study was conducted in one month (May, 2023) included 111 patients. All patients underwent to either abdominal or urological surgeries. Inclusion criteria were: patients aged 18 or older, any type of abdominal or urological open surgery, and no documented history of infection at surgical site infection. Results: we found 24 (21.6 %) patients out of 111 developed SSI after surgery. Male predominance was clear in this study. The number of patients with age 40 years or less was 60 (54 %) and 10 of them developed SSI (14.2 %). Patients who stayed more than 24 hour of preoperative at hospital were less in number than patients who did not (36.9% vs. 63%; p=0.002) respectively. Patients with emergency procedure were 12 patients (10.8 %) in contrast to 99 patients (89.1 %) who underwent a planned surgery (p-value= 0.003). Conclusion: our study revealed a higher incidence of SSI after surgery. Older patients with comorbidities, preoperative stay, emergency surgery, male sex are all correlated to the developing SSI.

Keywords: surgical site infection; emergency surgery; infection

Introduction

Suspected surgical site infection (SSI) is termed for any infection take place in the first 30 days after a surgical procedure. It is categorized to two: superficial SSI, which involves only the skin and underlying subcutaneous tissue, and deep SSI, which involve invade the fascia and the muscle (1).

Many factors contribute to SSI such as underlying diseases, burns, hospital environment, or even the patient's flora (2).

Nowadays, SSIs are considered a serious complication that occurs after any surgical procedure for about 2%. In addition, SSIs are classified in third rank among common nosocomial infections, next to the urinary tract and respiratory tract infections (3–4).

Important patient-related factors increasing the risk of an SSI include pre-existing infection, malnutrition, obesity, low serum albumin, elderly, smoking, and immunosuppression (diabetes mellitus, irradiation). Surgery-related factors include contaminated surgeries, emergency surgeries, prolonged procedures, substandard sterilization, inadequate handling of instruments, and inadequate antiseptic surgical site preparation. Physiological conditions that predispose to an

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increased incidence of SSI include multi-trauma, hemodynamic instability, shock, massive blood transfusions during the procedure, and postoperative hypothermia, hypoxia, and hyperglycemia. Other independent predictors of SSI include abdominal surgeries, contaminated or dirty procedures, and three or more diagnoses upon hospital discharge (1).

For this, we conducted a cross-sectional study for one month in one center to see the incidence and the risk factor of SSI after abdominal and urological surgeries.

Material and Methods

A prospective cross-sectional study was performed in a tertiary hospital from May 1, 2023 to May 31, 2023 (one month). All data was extracted from the records after it was approved by the ethics committee.

Inclusion criteria were: age 18 or older, any type of abdominal or urological open surgery, and no documented history of infection at surgical site infection.

Exclusion criteria were: patients under age 18 years, onset surgical site infection after day 30, incomplete data, patients who are immunocompromised or taking drug or any steroid, repeated surgical procedure, and other types of surgeries like head, thoracic, etc.

Firstly, all patients underwent full examination with a detailed history.

Details such as age, gender, comorbidities (diabetes mellitus, hypertension, obesity, and smoking), and type of surgery (emergency, elective) were all studied.

Investigations such as blood tests, urinalysis, abdominal ultrasound, chest x-ray, and upright position abdominal x-ray were all studied according to the patients' status. Vital signs including: blood pressure, heart rate, pulse, respiratory rate, and temperature were all taken and documented. After surgery, signs and symptoms of surgical site infection such as: fever, edema, discharge, redness, and warmth were noticed after 24 hours of surgery. SSI was diagnosed clinically by the physician or the same surgeon. Wounds were classified clean, clean contaminated, contaminated, dirty.

Patients with signs and symptoms of SSI were evaluated by complete blood count, CRP, sample f discharge for culture. Then, an appropriate antibiotic was introduced according to the culture. Our data were processed and analyzed using IBM SPSS Statistics for Windows, version 23. P-value of less than 0.05 was considered statistically significant.

Results

We had 134 patients. Only 111 patients had a completed data were included. The others either some data were missed or they had incomplete data. Total number of males was 62 (55.8%) patients, whereas the number of females was 49 (44.1%). In this study, we had only 15 (24.1%) male patients who developed surgical site infection (SSI). In contrast, 9 (18.3%) female patients developed SSI. P-value was insignificant as shown in Table 1.

The total number of patients who were 40 years old or younger was 60 (54 %) and only 10 (16.6%) patients developed SSI. Patients whose age older than 40 years were 51 (45.9 %) and only 18 (16.2 %) patients had SSI. Here, there was a statistically significant (Table 1).

We had two types of procedures: emergency and elective. In this study, we had twelve cases which were emergent. Eight of twelve patients (66.6%) had later SSI. On the other hand, 99 of cases (89.1%) were elective surgeries and only two patients (2 %) developed SSI after 24 hours of surgery. P-value was statistically significant (0.003).

In term of hospital stay, we had 70 patients (63 %) were admitted only 24 hours or less before surgery. Out of the seventy patients, ten of them developed SSI (14.2 %). Patients who were admitted more than 24 hours in the hospital before surgery were 41 (36.9 %) and only 10 patients (24.3 %) of them had SSI. P-value here was significant.

According to wound classification, we had 54 patients who had clean wound. Five of them demonstrated SSI later. Clean-contaminated wound number was 31 patients. Only eight (25.8 %) of the cases had SSI. Sixteen patients had contaminated surgical wound and nine patients (56.2 %) had SSI. Dirty wounds were in 10 patients out of 111. Three patients developed later SSI. The results were not statistically significant.

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Table 1. Factors associated with SSI.

Variable	Total Participants	Surgical Site Infection		P-Value
		Yes	No	
Gender				
Male	62 (55.8%)	15 (24.1%)	47 (75.8%)	0.6
Female	49 (44.1%)	9 (18.3%)	40 (81.6%)	
Age (years)				
≤40	60 (54%)	10 (16.6%)	50 (83.3%)	0.01
>40	51(45.9%)	18 (16.2%)	33 (29.7%)	
Type of procedure				
Emergency	12 (10.8%)	8 (66.6%)	4 (33.3%)	0.003
Elective	99 (89.1%)	2 (2 %)	87 (87.8%)	
Wound Classification				
Clean	54 (48.6%)	5 (9.2%)	49 (90.7%)	
Clean-contaminated	31 (27.9%)	8 (25.8%)	23 (74.1%)	0.03
Contaminated	16 (14.4%)	9 (56.2%)	7 (43.7%)	
Dirty	10 (9%)	3 (30%)	7 (70%)	
Hospital stay before surgery				
≤24 hours	70 (63%)	10 (14.2%)	50 (71.4%)	0.002
>24 hours	41 (36.9%)	10 (24.3%)	31 (7.5%)	

In term of comorbidities, we studied just four factors. We had 14 patients (12.6 %) who had hypertension and only six of them (42.8%) developed SSI (Table 2).

Diabetes mellitus was the second most common comorbidities in our study (19) patients after smoking (22) patients. Nine (47.3 %) and eleven (50 %) patents diagnosed with SSI later, respectively.

Obesity was another important risk factor for SSI. Seventy patients had obesity and 8 of them suffered from SSI (Table 2).

Table 2. Comorbidities that may increase the incidence of SSI.

Comorbidities	Total Number of Patients	No. of Patients with SSI
Hypertension	14 (12.6 %)	6 (42.8 %)
Diabetes Mellitus	19 (17.1 %)	9 (47.3 %)
Obesity	17 (15.3 %)	8 (47 %)
Smoking	22 (19.8 %)	11 (50 %)

Discussion

In this study, we had 134 patients in total and only 111 cases were studied according to our inclusion criteria. In May, 2023 we performed a cross-sectional study to demonstrate the risk factors

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to the surgical site infection. In accordance to the literature, surgical site infection is considered a real problem for both patients and doctors. Many previous studies tried to evaluate and assess the risk factors and how to avoid them. This may reduce in costs and increase the perioperative care and post-surgery.

Our study concentrated on abdominal and urological surgeries. The overall proportion of SSI in this study was 21.6 %. A study done by Allegranzi et al also reported that abdominal surgeries are commonly done and have high rates of SSIs (5).

We had 55.8 % of patients were males and 44.1 % were females patients. Our study showed no statistically significant for SSI occurrence and its association with gender as a risk factor. A study done by Shanmugam et al. reported almost equal occurrences among females (52%) and males (48%) (6).

Increasing age is associated with a greater likelihood of certain chronic conditions and delayed healing which is most probably the cause of the increased incidence in higher age groups (7).

We had in this study patients with age 40 years or younger were the most (60 patients), whereas patients with age older than 40 were 51 years. The occurrence of SSI according to the age was 10, and 18 patients' respectively. There was a statistical significant.

Most of the surgeries were done electively (89.1 %). Only two patients (2%) developed SSI. Emergent surgeries found in 12 patients, and 66.6 % of them developed SSI. Another study showed SSI rates to be higher in emergency procedures (8).

In another study done by Dessie et al., SSIs were reported in 61.7% of emergency cases and 38.3% of elective cases (9).

The same has been cited in most of the studies done earlier on SSIs. Tabiri et al. also reported that emergency cases had a higher number of SSIs (23.8%) as compared to elective cases (7.4%) (10).

Regarding the relationship between SSI and wound classification, we found 54 patients had clean wounds and only 9.2 % of them developed SSI. Thirty-one patients had clean-contaminated wounds and 25.8 % of them had SSI later. Patients with contaminated or dirty wounds developed SSI 56.2 % and 30 %, respectively.

As found in previous studies, hospital stay has a negative impact on SSI incidence. Patients who admitted more than 24 hours had SSI (24.3 %) which is a higher incidence than patients who admitted 24 hours or less before procedure. There is a statistical significance (p-value= 0.002).

Co-morbidities, such as obesity, smoking, hypertension, and diabetes mellitus, are other approved risk factors for developing SSI. Morbid obesity has been correlated with prolonged wound healing which is a known risk factor for deep SSIs (11).

Table 2 shows comorbidities that may increase the proportion of SSIs.

Conclusion

Our study demonstrated a higher incidence of SSI after abdominal and urological surgeries. Emergency surgery, elderly patients, long hospital stay, male gender, and contaminated wound are considered to raise the risk for SSI. More large and multicentric studies are required to see the real number of patients and to expect the most significant risk factors for SSI after surgery.

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