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Original Research Article

A Prospective Analysis of the Risk Factors for Surgical Site Wound Infection and Related Complications

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Abstract

Aim: The aim of the present study was to assess the incidence and associated comorbidities which influence the surgical site wound infection.

Material & Methods: A prospective study was conducted in Department of Microbiology. Total 200 patients operated for general surgical procedures in between the periods of 12 months were included for the present study.

Results: The incidence rate of Surgical Site Infections (SSIs) increased with age, ranging from 22.50% in the 18-29 age group to 35% in those aged 60 and above. The incidence of SSIs was higher among males (26.66%) than females (25%). The incidence rate of Surgical Site Infections (SSIs) showed a positive correlation with increasing BMI, from 20% in underweight subjects to 33.33% in obese subjects. Subjects from urban areas had a higher incidence rate of SSIs (30%) compared to those from rural areas (20%). The rate of SSIs was higher in subjects undergoing elective surgeries (30.47%) compared to emergency surgeries (20%). Subjects who were obese had an SSI rate of 43.33%. Among subjects with diabetes, 60% developed SSIs, and among those with anaemia, 37.50% developed SSIs.

Conclusion: Our study provides valuable insights into the risk factors associated with SSIs, including age, BMI, and comorbidities. Future research should focus on longitudinal studies to understand the temporal relationship between these factors and SSIs. Interventions targeting these risk factors could potentially reduce the incidence of SSIs.

Keywords: Infection rate, Risk factors, SSI

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Introduction

Surgical site infection (SSI) is defined as an infection that occurs in surgical patients at the incision site within 30 days after surgery if there is no implant or within one year if there is an implant. [1,2,3] It is a potential complication associated with any type of surgical procedure. [4,5] It is commonest nosocomial infections after Urinary tract infections (UTI), responsible for increasing cost, substantial morbidity and occasional mortality related to surgical operations and continue to be major problem even in hospital with most modern facilities and standard protocols of pre operative preparation and antibiotic prophylaxis. [6,7] SSI rate has varied from a low of 2.5% to a high of 41.9%.[6] Pathogens that cause SSI are acquired either endogenously from the patient's own flora or exogenously from contact with operative room personnel or the environment. SSIs remain a major cause of morbidity and death among the operated patients and continue to represent about a fifth of all healthcare-associated infections. [8] Although at least 5% of patients develop an SSI after surgery. [9] SSI rate varies from 1.5% to 20% in various hospitals. [10]

A plethora of patient and procedure-related factors have been strongly associated with the occurrence of SSI over the past decades. [11] Advanced age, poor nutritional status, increased body mass index (BMI), smoking, remote infections, and administration of immunosuppressive medication are amongst the most common patient-related risk factors for the occurrence of SSI. On the other hand, prolonged operative time, contaminated wound status, prophylactic administration of antibiotics, and emergency nature of surgery are among the most common procedure-related risk factors. [11,12]

SSIs can be attributed to several endogenous factors, i.e., age and weight of the patient, co-morbidity, immune status etc. and several exogenous factors, like, preoperative hospital stay, preoperative prophylactic measures, type of wound and surgery, sterilization of instruments etc. [13] To improve the patient outcome and to minimize the economic burden, it becomes necessary to decrease the rate of SSI. In the past few years, important advances have been achieved in the field that may have had an impact on the reduction of SSIs. [14] These include more effective surgical sterilization procedures, laminar flow, high-efficiency particulate absorbing (HEPA) filters, ultraviolet radiation, air renewal, humidity control, differential temperature and air pressure, particle count, surface colony count and antibiotic prophylaxis. [15-18]

Hence the aim of the study was to assess the incidence and associated comorbidities which influence the surgical site wound infection.

Material & Methods

A prospective longitudinal study was conducted in Department of Microbiology, Government Medical College, Bettiah, Bihar, India. Total 200 patients operated for general surgical procedures in between the periods of 12 months were included for the present study.

Exclusion Criteria

- Stitch abscesses were excluded from this study.

Methodology

Informed written consent was taken from the participants for the study. Data were collected from the data sheet which included basic demographic details of the patient, data of underlying disease status, nature of surgical procedure (elective or emergency), wound class and presence of drain etc. Wound infection was diagnosed if any one of the following criteria was fulfilled within thirty days of operation: serous or non-purulent discharge from the wound, pus discharge from the wound, serous or non-purulent discharge from the wound with signs of inflammation (oedema, redness, warmth, raised local temperature, fever > 38°C, tenderness, induration) and wound deliberately opened up by the surgeon due to localized collection (serous/purulent). For the classification of the type of the wound CDC (centers for disease control and prevention) criteria were used. According to the CDC criteria type of the wound is class I- clean, class II- clean contaminated, class III- contaminated, class IV- dirty. [19] Weight and height were measured by using standardized technique by trained investigators as suggested by Jelliffe. [20] Weight was measured with standard digital weighing machine. Height was measured using calibrated fixed scales while the subject stood bare feet. Classification of nutritional status was done by using body mass index (BMI). BMI was derived by dividing one's weight in kilograms by the square of height in meters. Weight disorders were assessed on the basis of BMI. [21]

Statistical Analysis

Data entry and analysis was done in software Epi info version 7.0. Chi square was used to identify association of the risk factor with outcome. P-value e <0.05 was considered to be statistically significant.

Results

Table 1: Age-Related Incidence Rates of Surgical Site Infections

Age Group	Number of Subjects	Number with SSIs	Incidence Rate (%)
18-29	40	9	22.50
30-39	46	11	23.91
40-49	50	11	22
50-59	44	12	27.27
≥ 60	20	7	35

The incidence rate of Surgical Site Infections (SSIs) increased with age, ranging from 22.50% in the 18-29 age group to 35% in those aged 60 and above.

Table 2: Gender and SSIs

Gender	Number of Subjects	Number with SSIs	Incidence Rate (%)
Male	120	32	26.66
Female	80	20	25

The incidence of SSIs was higher among males (26.66%) than females (25%).

Table 3: SSI Incidence Rates across Different BMI Categories

BMI Category	Number of Subjects	Number with SSIs	Incidence Rate (%)
Underweight (<18.5)	20	4	20
Normal (18.5-24.9)	80	15	18.75
Overweight (25-29.9)	64	18	28.125
Obese (≥30)	36	12	33.33

The incidence rate of Surgical Site Infections (SSIs) showed a positive correlation with increasing BMI, from 20% in underweight subjects to 33.33% in obese subjects.

Table 4: Incidence of SSIs by Geographical Area and Incidence of SSIs by Type of Surgery

Area	Number of Subjects	Number with SSIs	Incidence Rate (%)
Urban	120	36	30
Rural	80	16	20
Type of surgery			
Emergency	105	32	30.47
Elective	95	19	20

Subjects from urban areas had a higher incidence rate of SSIs (30%) compared to those from rural areas (20%). The rate of SSIs was higher in subjects undergoing elective surgeries (30.47%) compared to emergency surgeries (20%).

Table 5: Incidence of SSIs by Comorbidities and Other Factors

Factor	Number of Subjects	Number with SSIs	Incidence Rate (%)
Obesity	30	13	43.33
Diabetes	10	6	60
Anemia	80	30	37.50

Subjects who were obese had an SSI rate of 43.33%. Among subjects with diabetes, 60% developed SSIs, and among those with anaemia, 37.50% developed SSIs.

Discussion

SSIs are associated with elevated healthcare costs, prolonged hospitalization, and increased mortality rates. [22] Various factors contribute to the risk of developing SSIs, including patient- specific factors such as age, comorbidities like obesity and diabetes, and hospital factors such as the experience level of the surgical team. [23-25] Moreover, SSIs are a hidden burden in healthcare, often manifesting after the patient's discharge. [26] Currently, available data suggest that SSIs increase the length of hospital stay, readmission rate, morbidity, mortality, and financial burdens for individuals and communities. Patients with an SSI have approximately 7–11 additional postoperative hospital-days, 2–11-times higher risk of death. [27,28]

The incidence rate of Surgical Site Infections (SSIs) increased with age, ranging from 22.50% in the 18-29 age group to 35% in those aged 60 and above aligning with previous research that suggests older age is a risk factor for SSIs. [29] The incidence of SSIs was higher among males (26.66%) than females (25%). The incidence rate of Surgical Site Infections (SSIs) showed a positive correlation with increasing BMI, from 20% in underweight subjects to 33.33% in obese subjects. Subjects from urban areas had a higher incidence rate of SSIs (30%) compared to those from rural areas (20%).

The rate of SSIs was higher in subjects undergoing elective surgeries (30.47%) compared to emergency surgeries (20%). This could be because emergency surgeries often involve more complex procedures and are performed under time constraints, which may increase the risk of contamination and infection. [30] Subjects who were obese had an SSI rate of 43.33%. Among subjects with diabetes, 60% developed SSIs, and among those with anaemia, 37.50% developed SSIs. National Academy of Science [31] reported higher rate of infection in patients with Diabetes mellitus which is similar to our study. Prolonged preoperative hospital stay was found to be associated with higher rate of infection. Prolonged preoperative hospital stay leads to colonization with antimicrobial resistant micro organisms and itself directly affects patient's susceptibility to infection either by lowering host resistance or by providing increased opportunity for ultimate bacterial colonization.

Conclusion

Our study provides valuable insights into the risk factors associated with SSIs, including age, BMI, and comorbidities. Future research should focus on longitudinal studies to understand the temporal relationship between these factors and SSIs. Interventions targeting these risk factors could potentially reduce the incidence of SSIs.

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