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Original Research Article

A Prospective Evaluation of the Incidence and Associated Comorbidities Which Influence the Surgical Site Wound Infection

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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 longitudinal study was conducted in Department of Microbiology, ANMMC, Gaya, Bihar, India. Total 100 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 25% in the 18-29 age group to 30% 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 (30.76%) compared to emergency surgeries (18.75%). Subjects who were obese had an SSI rate of 46.66%. 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

Introduction

Most authors accept that surgical site infection (SSI) is one of the worst complications that a patient can experience after an intervention. Many important aspects are affected by these infections, including mortality, morbidity, changes in prostheses, functional dependence and lawsuits as well as the associated costs of a prolonged hospital stay and increased total health care, social and labour costs. A multitude of studies worldwide focus on this issue from different scientific perspectives, refining the definitions of SSI parameters and risk factors as well as increasing our knowledge of what factors are important contributors to SSIs and how to control them at a clinical level. [1–3]

In the past few years, important advances have been achieved in the field that may have had an impact on the reduction of SSIs. [4] 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. [5–8] However, other factors, such as decreased length of hospital stay, and more aggressive interventions performed on patients with worse clinical conditions, probably contribute to an increased incidence of SSIs.

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. [9] Although at

least 5% of patients develop an SSI after surgery. [10] SSI rate varies from 1.5% to 20% in various hospitals. [11]

A plethora of patient and procedure-related factors have been strongly associated with the occurrence of SSI over the past decades. [12] 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. [12,13]

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, ANMMC, Gaya, Bihar, India. Total 100 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. [14] Weight and height were measured by using standardized technique by trained investigators as suggested by Jelliffe. [15] 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. [16]

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	20	5	25
30-39	23	5	21.73
40-49	25	5	20
50-59	22	6	27.27
≥ 60	10	3	30

The incidence rate of Surgical Site Infections (SSIs) increased with age, ranging from 25% in the 18-29 age group to 30% in those aged 60 and above.

Table 2: Gender and SSIs

Gender	Number of Subjects	Number with SSIs	Incidence Rate (%)
Male	60	16	26.66
Female	40	10	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)	10	2	20
Normal (18.5-24.9)	40	7	17.50
Overweight (25-29.9)	32	9	28.125
Obese (≥30)	18	6	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	60	18	30
Rural	40	8	20
Type of surgery			
Emergency	52	16	30.76
Elective	48	9	18.75

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 (30.76%) compared to emergency surgeries (18.75%).

Table 5: Incidence of SSIs by Comorbidities and Other Factors

Factor	Number of Subjects	Number with SSIs	Incidence Rate (%)
Obesity	15	7	46.66
Diabetes	5	3	60
Anemia	40	15	37.50

Subjects who were obese had an SSI rate of 46.66%. 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. [17] 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. [18-20] Moreover, SSIs are a hidden burden in healthcare, often manifesting after the patient's discharge. [21] 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. [22,23]

The incidence rate of Surgical Site Infections (SSIs) increased with age, ranging from 25% in the 18-29 age group to 30% in those aged 60 and above aligning with previous research that suggests older age is a risk factor for SSIs. [24] 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 (30.76%) compared to emergency surgeries (18.75%). 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. [25] Subjects who were obese had an SSI rate of 46.66%. Among subjects with diabetes, 60% developed SSIs, and among those with anaemia, 37.50% developed SSIs. National Academy of Science [26] 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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