

## Prevalence and Factors Associated with Surgical Site Infection among Surgical Patients in a General Hospital in Chattogram City, Bangladesh

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**Abstract:** Surgical Site Infection (SSIs) remain a major cause of postoperative morbidity worldwide. This descriptive cross-sectional study was conducted among 167 surgical patients at Chattogram General Hospital, Bangladesh, from September to December 2016 to assess the prevalence and determinants of Surgical Site Infections (SSIs). Data were collected using a pre-tested semi-structured questionnaire and analyzed using appropriate statistical methods. The prevalence of SSIs was 17.0%. Significant host-related factors included age, education, Body Mass Index, glycemic status, nutritional status, Erythrocyte Sedimentation Rate (ESR), and fever, while gender showed no significant association. Procedure-related factors such as prolonged hospital stay, duration of surgery, type of incision, cadre of surgeon, antibiotic use, presence of septic focus, and wound contamination were significantly associated with SSIs. However, type of operation and sutures materials were not associated. The findings highlight the multifactorial nature of SSIs and emphasized the need for strengthened infection prevention and control strategies in resource-limited settings.

**Keywords:** Surgical Site Infection, Prevalence, Risk Factors, Hospital Stay, Surgical Procedure, Bangladesh.

## INTRODUCTION AND BACKGROUND

Surgical Site Infections (SSIs) remain a major concern for patient safety, contributing to prolonged hospitalization, increased healthcare costs, and higher morbidity rates in hospitals worldwide (WHO, 2016). Surgical Site Infections (SSIs) are responsible for a significant proportion of hospital-acquired infections and remain a major challenge for patient safety and quality healthcare worldwide (WHO, 2016).

Evidence shows that inadequate sterilization, poor hand hygiene, and improper wound care practices are major contributors to the development of surgical wound infections in hospital settings (Centers for Disease Control and Prevention, 2017). Effective infection prevention and control measures in surgical wards can significantly reduce the incidence of SSIs and improve postoperative outcomes for patients (WHO, 2016).

Surgical wound infection, commonly known as Surgical Site Infections (SSIs), is one of the most frequent healthcare-associated infections occurring in hospitals worldwide. Surgical Site Infections (SSIs) are considered a major global public health problem and remain among the most common complications following surgical procedures. These infections develop at or near the surgical incision within 30 days after surgery, or up to 90 days when an implant is involved, and they significantly increase patient morbidity, mortality, and healthcare costs (Allegranzi, *et al.*, 2016).

Approximately 0.5% to 3% of patients undergoing surgery will experience infection at or together to the surgical incision site. Compared with patients undergoing surgery who do not have a Surgical Site Infection (SSIs), those with a Surgical Site Infection (SSIs) are hospitalized approximately 7 to 11 days longer (Jesica, 2023).

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In many developing countries, including Bangladesh, the prevalence of surgical wound infections remains relatively high due to limited healthcare resources, overcrowded hospitals, poor infection control practices, and inadequate sterilization procedures. The World Health Organization (2023) reports that approximately 11% of patients undergoing surgery in low-and middle-income countries develop surgical site infections. In Africa, up to 20% of women who have a caesarean section contract a wound infection, compromising their own health and their ability to care for their babies. But surgical site infections are not just a problem for poor countries. In the United States, they contribute to patients spending more than 400000 extra days in hospital at an additional cost of US\$ 900 million per year (WHO, 2023).

In surgical wards, infections may occur through several routes such as contaminated surgical instruments, inadequate sterilization, improper hand hygiene among healthcare workers, poor postoperative wound care, and environmental contamination within hospital settings (Horan, 2008). Patient-related factors such as weakened immunity, poor nutritional status, diabetes, or other chronic diseases also increase susceptibility to infection (Teferi, 2025).

Understanding the routes through which surgical wound infections occur is essential for improving infection prevention and control strategies. Identifying common sources and transmission pathways can help healthcare providers and hospital administrators implement effective interventions to reduce infection rates and improve patient safety. Therefore, this study aims to assess the possible routes of surgical wound infection in the surgical ward of a selected general hospital in Chattogram City, Bangladesh.

## **MATERIALS AND METHOD**

### **Study Design and Setting**

This study employed a descriptive cross-sectional design and was conducted at Chattogram General Hospital in Bangladesh from September to December 2016.

### **Population and Sampling**

The study enrolled 167 eligible respondents (102 males and 65 females) aged 20-60 years and above using non-randomized convenience and purposive sampling techniques. The inclusion criteria comprised adult surgical patients attending Chattogram General Hospital who provided informed consent. Patients who refused to provide consent, those with mental health disorders, or those who were otherwise incapacitated were excluded from the study.

### **Data Collection Procedure**

Data were collected using a pre-tested, semi-structured, and interviewer-administered questionnaire, which was subsequently modified based on the pilot study findings to ensure validity and reliability. The questionnaire was designed to capture comprehensive information, including socio-demographic characteristics, patient knowledge and practices related to surgical site infections (SSIs), details regarding surgical instruments, types and causative organisms of SSIs, risk factors associated with infection, preventive measures, clinical sign and symptoms, treatment modalities, awareness of infection control, and care-seeking behaviors. The instrument was administered by trained data collectors who ensured standardized interviewing techniques and maintained patient confidentiality throughout the data collection process.

### **Ethical Consideration**

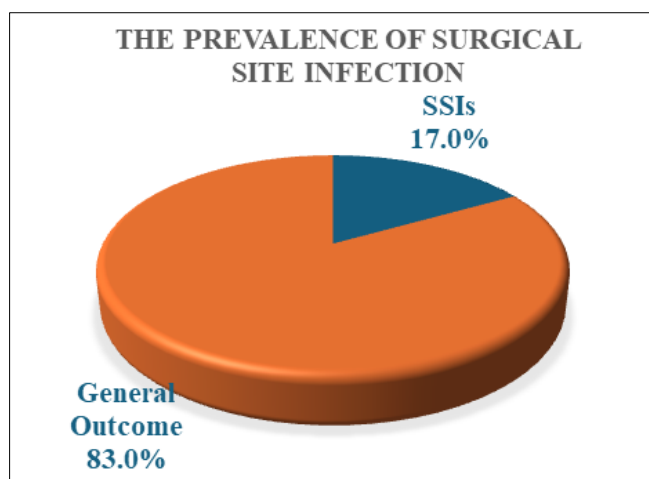
The study strictly maintained respondent anonymity and confidentiality throughout the research process. Participation was entirely voluntary, and informed consent was obtained from all participants prior to data collection. As the study involved a non-interventional survey, the investigators adhered to the exemption guidelines for minimal-risk research while ensuring compliance with ethical principles outlined for human subjects. All procedures were conducted in accordance with standard ethical practices to protect participants' rights, privacy, and welfare.

### **Data Analysis**

The collected data were carefully checked for completeness, coded, and entered into SPSS version 25.0 for statistical analysis. Descriptive statistics including frequencies, percentages, and means  $\pm$  standard deviations (SD), were used to summarize the socio-demographic characteristics of respondents and key study variables. Where appropriate, cross-tabulations were performed to explore patterns and relationships between variables. All analyses were conducted with attention to data accuracy, ensuring the reliability and integrity of the results.

## **RESULTS**

The study found out that of the 167 patients who underwent major surgical procedure in Chattogram General Hospital, 28 (17.0%) had Surgical Site Infection (SSIs).



**Figure 1: The Prevalence of Surgical Site Infection**

In this study, the majority of participants were male (103, 61.7%). Regarding age distribution, the largest proportion of respondents were aged 30-40 years (42, 25.1%). In terms of educational attainment, 55 participants (33.0%) had completed secondary education. Nearly half of the participants (77, 46.1%) had a normal Body Mass Index (BMI). With respect to clinical indicators 86 respondents (51.5%) had normal Random Blood Sugar (RBS) levels, while a substantial proportion (122, 73.0%) exhibited elevated Erythrocyte Sedimentation Rate (ESR). Concerning presenting symptoms, 72 participants (43.0%) reported experiencing fever. Additionally, the majority of participants (103, 61.7%) were found to have a normal nutrition status. The detailed distribution of these characteristics is presented in the table below.

**Table 1: Factors Associated with Surgical Site Infection, (N = 167)**

Variables	Category	Frequency (n)	Percentage (%)
Gender	Male	103	61.7
	Female	64	38.3
Age in years	Less than 20	12	7.2
	20-30	30	18.0
	30-40	42	25.1
	40-50	35	21.0
	50-60	26	15.5
	More than 60	22	13.2
Education	No schooling	23	13.7
	Primary	42	25.1
	Secondary	55	33.0
	Higher secondary	30	18.0
	Graduate and above	17	10.2
Body Mass Index (BMI)	Underweight	32	19.2
	Normal	77	46.1
	Overweight	38	22.7
	Obese	20	12.0
Random Blood Sugar (RBS)	High	58	34.7
	Normal	86	51.5
	Decreased	23	13.8
Erythrocyte Sedimentation Rate (ESR)	Increased	122	73.0
	Normal	45	27.0
Temperature	Elevated	72	43.0
	Normal	60	36.0
	Decreased	35	21.0
Nutritional Status	Over nutrition	41	24.5
	Normal	103	61.7
	Under nutrition	23	13.8

According to the findings of this study, 106 patients (63.5%) had a hospital stay of more than 10 days. With regard to the qualification of the operating surgeons, 60 procedures (36.0%) were performed by consultants. In terms of operative characteristics, 67 surgeries (40.1%) lasted between 1-2 hours. Caesarian section accounted for 63 cases (37.7%) of the surgical procedure. Nearly half of the operations (83, 49.7%) involved a midline incision. Regarding antibiotic use, ceftriaxone was administered intra-operatively and post-operatively in 64 cases (38.3%). In addition, 106 patients (63.5%) received multifilament sutures. Most procedures were conducted under aseptic conditions (123, 73.7%), while 96 patients (57.5%) presented with dirty wounds. The detailed distribution of these variables is presented in the table below.

**Table 2: Hospital and Health Service-Related Factors, (N=167)**

Variables	Category	Frequency (n)	Percentage (%)
Duration of Hospital Stay	Less than 10 days	61	36.5
	More than 10 days	106	63.5
Qualification of Surgeon	Medical Officer	12	7.2
	Registrar	28	16.7
	Consultant	60	36.0
	Assist/Associate Professor	35	21.0
	Professor	32	19.1
Duration of Operation in Hours	Less than 1	55	33.0
	1-2	67	40.1
	2-3	28	16.7
	3 and above	17	10.2
Name of Operation	Explorative Laparotomy	34	20.4
	Caesarian Section	63	37.7
	Appendectomy	23	13.7
	Cholecystectomy	18	10.8
	Hernioplasty	12	7.2
	Colorectal	8	4.8
	Thyroidectomy	6	3.6
	Incision and Excisions	3	1.8
Types of Incision	Midline	83	49.7
	Pfannenstiel	36	21.5
	Kocher	22	13.2
	McBurney	26	15.6
Types of Antibiotics Used (Inter-operatively & post-operatively)	Ceftriaxone	64	38.3
	Cefixime	38	22.7
	Cefuroxime	25	15.0
	Flucloxacillin	19	11.4
	Ciprofloxacin	10	6.0
	Metronidazole	7	4.2
	Gentamycin	4	2.4
Type of Sutures Used	Monofilament	61	36.5
	Multifilament	106	63.5
Septic Focus	Surgical Site	123	73.7
	Other Site	44	26.3
Cleanliness of the Wound Site	Clean	14	8.4
	Contaminated	57	34.1
	Dirty	96	57.5

The study identified several host-related factors significantly associated with Surgical Site Infection (SSIs) among the participants. This included age, level of education, Body Mass Index (BMI), Random Blood Sugar (RBS), Erythrocyte Sedimentation Rate (ESR), body temperature, and nutritional status. In contrast, gender was not found to have a statistically significant association with the occurrence of SSIs. The detailed distribution and statistical relationships of these variables are presented in the table below.

**Table 3: Relationship between the Host Factors and Surgical Site Infection**

Variables	Category	Frequency (N)	Surgical Site Infection		P-Value*
			Frequency (n)	Percentage (%)	
Gender	Male	103	17	16.5	0.076
	Female	64	11	17.2	
Age in Years	Less than 20	12	2	16.7	0.001
	20-30	30	3	10.0	
	30-40	42	5	11.9	
	40-50	35	11	31.4	
	50-60	26	3	11.5	
	More than 60	22	4	18.2	
Education	No schooling	23	5	21.7	0.052
	Primary	42	4	9.5	
	Secondary	55	9	16.3	
	Higher secondary	30	6	20.0	
	Graduate and above	17	4	23.5	
Body Mass Index (BMI)	Underweight	32	6	18.7	0.003
	Normal	77	3	3.9	
	Overweight	38	7	18.4	
	Obese	20	12	60.0	
Random Blood Sugar (RBS)	High	58	18	31.0	0.001
	Normal	86	4	4.6	
	Decreased	23	6	26.0	
ESR	Increased	122	22	18.0	0.052
	Normal	45	6	13.3	
Temperature	Elevated	72	14	19.4	0.051
	Normal	60	8	13.3	
	Decreased	35	6	17.1	
Nutritional Status	Over nutrition	41	3	7.3	0.051
	Normal	103	10	9.7	
	Under nutrition	23	15	65.2	

\*P-Value <0.05 was considered as significant

According to the present study, Surgical Site Infection (SSIs) was significantly associated with several procedure and care related factors, including duration of hospital stay, qualification of the surgeon, duration of operation (in hours), types of incision, types of antibiotics used (both inter-operatively & post-operatively), presence of septic focus, and cleanliness of the wound site. However, no significant association was observed between SSIs and the types of operation or the type of suture used. The detailed findings are presented in the table below.

**Table 4: Relationship between Hospital and Health Service-Related Factors and SSIs**

Variables	Category	Frequency (N)	Surgical Site Infection		P-Value*
			(n)	(%)	
Duration of Hospital Stay	Less than 10 days	61	7	11.4	.003
	More than 10 days	106	21	19.8	
Qualification of Surgeon	Medical Officer	12	2	16.6	.002
	Registrar	28	5	17.8	
	Consultant	60	10	16.6	
	Assist/Associate Professor	35	6	17.1	
	Professor	32	5	15.6	
Duration of Operation in Hours	Less than 1	55	8	14.5	0.052
	1-2	67	10	14.9	
	2-3	28	6	21.4	
	3 and above	17	4	23.5	
Name of Operation	Explorative Laparotomy	34	5	14.7	0.078
	Caesarian Section	63	12	19.0	
	Appendectomy	23	3	13.0	
	Cholecystectomy	18	3	16.6	
	Hernioplasty	12	2	16.6	

Variables	Category	Frequency (N)	Surgical Site Infection		P-Value*
			(n)	(%)	
	Colorectal	8	1	12.5	
	Thyroidectomy	6	1	16.6	
	Incision and Excisions	3	1	33.3	
Types of Incision	Midline	83	11	13.2	0.004
	Pfannenstiel	36	7	19.4	
	Kocher	22	5	22.7	
	McBurney	26	5	19.2	
Types of Antibiotics Used (Inter-operatively & post-operatively)	Ceftriaxone	64	11	17.1	0.051
	Cefixime	38	6	15.7	
	Cefuroxime	25	4	16.0	
	Flucloxacillin	19	3	15.7	
	Ciprofloxacin	10	2	20.0	
	Metronidazole	7	1	14.2	
	Gentamycin	4	1	25.0	
Type of Sutures Used	Monofilament	61	10	16.3	0.086
	Multifilament	106	18	16.9	
Septic Focus	Surgical Site	123	22	17.8	0.023
	Other Site	44	6	13.6	
Cleanliness of the Wound Site	Clean	14	3	21.4	0.052
	Contaminated	57	10	26.3	
	Dirty	96	15	10.4	

\*P-Value <0.05 was considered as significant

## DISCUSSION

The present study revealed that, among 167 patients who underwent major surgical procedures at Chattogram General Hospital, 28 (17.0%) developed Surgical Site Infection (SSIs). This prevalence is slightly higher than that reported in a study conducted in the South-Western region, which documented an overall SSI incidence of 16.4% (Lubega, 2017). It is also notably higher compared to findings from Nigeria, where the prevalence of Surgical Site Infection (SSIs) was reported to be 14.5% (Olowo-okere, 2019). In contrast, studies conducted in Ethiopia have demonstrated comparatively lower prevalence rates, including 7.8% reported by Azeze & Bizuneh (2019) and 9.4% reported by Gedefaw (2018). The relatively higher prevalence observed in the current study may be attributed to contextual factors related to the study setting, particularly its position within a lower tier of the healthcare system, where limitations in resources, infrastructure, and infection prevention practices may contribute to an increased risk of postoperative infections.

The study demonstrated that the prevalence of Surgical Site Infection (SSIs) was highest among participants aged 40-50 years (31.4%). With respect to educational attainment, individuals with graduate-level education and above exhibited a higher prevalence (23.5%). Clinically, a markedly elevated prevalence was observed among obese participants (60.0%), those with increased Random Blood Sugar (RBS) level (31.0%), raised Erythrocyte Sedimentation Rate (ESR) (18.0%), and elevated body temperature (19.4%). Furthermore, participants with poor nutritional status showed the highest proportion of SSIs (65.2%). These findings are consistent with previous studies that have reported a higher burden of Surgical Site Infection (SSIs) among patients with similar demographic and clinical characteristics. Notably, comparable evidence has further demonstrated that gender is not significantly associated with the occurrence of SSIs (Degbey, *et al.*, 2021). These findings of the present study are also consistent with those of another study, which reported a higher incidence of Surgical Site Infection (SSIs) among male patients with individuals with elevated fasting blood glucose levels (Lakoh *et al.*, 2022). Additionally, Van Niekerk (2021) identified elevated body temperature as a significant risk factor for the development of SSIs.

According to the present study, the prevalence of Surgical Site Infection (SSIs) was highest among patients who had a hospital stay exceeding 10 days (19.8%), were operated on by registrar (17.8%), and underwent procedures lasting 3 hours or more (23.5%). A higher prevalence was also observed in relation to type of incision (19.2%), use of Gentamycin (both intra-operatively and post-operatively) (25.0%), presence of septic foci at the surgical site (17.8%), and contaminated wound classification (26.3%). Notably, comparable evidence has further demonstrated that the type of operation and the type of suture materials used are not significantly associated with the occurrence of SSIs. These findings are consistent with existing literature, which indicates that prolonged hospital stay, extended duration of surgery, inadequate or inappropriate antibiotic use, and wound contamination are significant contributors to the development of SSIs. Prolonged hospitalization and operative time may increase the risk of microbial exposures and wound contamination, thereby predisposing patients to infection (Degbey *et al.*, 2021). Furthermore, the findings are in agreement with a study conducted

in Sierra Leone, which reported that longer preoperative hospital stay and increased duration of surgery were significantly associated with SSIs (Lakoh *et al.*, 2022). Additionally, the type of antibiotic used was identified as an important factor influencing the risk of Surgical Site Infection (SSIs).

## CONCLUSION

Surgical Site Infection (SSIs) remain a significant public health concern, contributing substantially to postoperative morbidity and healthcare burden. The present study identified multiple host and procedure-related factors associated with the occurrence of SSIs. This included age, level of education, anthropometric measures (Body Mass Index), glycemic status, nutritional status, erythrocyte sedimentation rate, and presence of fever. In addition, clinical and procedural factors such as duration of hospital stay, cadre of the surgeon, duration of the procedure, type of incision, antibiotic use, septic site, and wound classification were found to be associated with SSIs.

These findings underscore the multifactorial nature of SSIs and highlight the need for comprehensive, context-specific infection prevention and control strategies to reduce their incidence and associated complication.

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