

The Incidence and Risk Factors Associated with Surgical Site Infections

Inuganti Gopal¹, Bhabani Patnaik², Sumita Tripathy³

¹Assistant Professor, Department of General Surgery. SLN Medical College and Hospital, Koraput, Odisha

²Assistant Professor, Department of Microbiology. SLN Medical College and Hospital, Koraput, Odisha

³Associate Professor, Dept. of Pathology, MCH Keonjhar, Odisha, India

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Corresponding author: Dr. Inuganti Gopal

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Abstract

Background: Surgical Site Infections (SSI) is considered to be one of the leading healthcare associated infections in developing nations. However, there is a significant improvement in surgical techniques, but SSI is one of the main causes of hospital acquired infections. The key factors that are associated with SSI include age, gender, immunity level, obesity, diabetes, and alcohol use. In addition to this, the factors like hyperglycaemia, pre-existing remote body site infection and tobacco consumption is having a significant impact on improvement of risk related to SSI. In the current scenario, the risks like BMI, smoking, blood transfusion and pre-existing chronic disease are also increasing the risk of SSI. The prevention approach for SSI is requiring bundle action which systematic attention to multiple risk factors to improve the patient's defence by minimizing the bacterial contamination.

Aim: To determine the incidence and risk factors associated with SSI in hospitals.

Method: The study is based on the non-concurrent cohort and conducted at SLN Medical College and Hospital, from January 2021 to December 2021. The medical college is offering specialised services for patients and performing the actions against the infection surveillance. The data that has been collected from the sources of hospital is stored in the excel sheet and exported to SPSS version 26.0 software that has helped to analyze the desired outcome for the study. Moreover, the prior approval was taken from the hospital authority for access the database. Data was analyzed applying independent t-test, ANOVA and logistic regression.

Results: There were 70.6% female and mean age of the patients was 54.3 years. Moreover, the mean duration of the surgery was 1.6 hours. 568 patients were diagnosed with SSI with incidences of 3.4%. Moreover, infection culture was performed on 177 patients and *Staphylococcus aureus* and *Escherichia coli* were found to be the main microorganisms causing SSI. Moreover, the multivariate analysis has suggested the significance of 5%.

Conclusion: The study has analyzed different culture, and most prevalent microorganism factors were *Staphylococcus aureus* and *Escherichia*. The study concluded that it is essential to analyze the risk of developing SSI in patients undergoing general surgery and implementation of the measures to minimize the infection.

Keywords: General Surgery, Surgical Wound Infection, Surgical Site Infection, Risk

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Background

Surgical Site Infections (SSI) is considered to be one of the leading healthcare associated infections in developing nations [1]. However, there is a significant improvement in surgical techniques and using the best infection prevention strategies, but SSI is one of the main causes of hospital acquired infections. SSI is a potential complication associated with surgery procedure [2]. According to analysis, approximately 2-6% of surgical patients worldwide have developed SSI. However, the developing nations are having higher rates of SSI as compared to developed nations [3]. The incidents of SSI in USA were 2.6%, Germany 2.9% and France had 2.7% SSI. On the other hand, the SSI in China was 4.6%, Africa 11-16% and Ethiopia had 13.6% patients [4].

SSI varies as per the procedure used by the hospitals. Orthopaedic and cardiac has the highest risk followed by intra-abdominal surgeries [5]. The past studies have suggested that the risk of SSI increases the length of hospital stay, readmission rate, morbidities, mortality, and financial burden for the individual and communities [6]. The key factors that are associated with SSI include age, gender, immunity level, obesity, diabetes, and alcohol use [7]. In addition to this, the factors like hyperglycaemia, pre-existing remote body site infection and tobacco consumption is having a significant impact on improvement of risk related to SSI [8]. The consideration of intra-operative techniques, type of wound, use of emergency surgical procedure and prolonged duration of surgery is also causing the issues related to the SSI [9].

The major consequences of SSI are increase in the cost of treatment, higher recovery time and development of other health problems [10]. However, the care workers are using the prevention methods for minimizing the effects of the SSI but lack of strategic monitoring and changes in the

treatment process could affect the health of the individual [11]. The early adoption of nursing intervention can help in minimizing the effects of SSI and postoperative complication in patients [12]. In the current scenario, the risks like BMI, smoking, blood transfusion and pre-existing chronic disease are also increasing the risk of SSI [13]. The prevention approach for SSI requires bundle action with systematic attention to multiple risk factors that support in minimizing the bacterial contamination [14]. For good patient preparation aseptic practices and attention to surgical procedure is required to minimize the impact of SSI on patient [15].

Aim

To determine the incidence and risk factors associated with SSI in hospitals.

Methods and Material

This is a non-concurrent cohort study, performed in SLN Medical College and Hospital, from January 2021 to December 2021. The hospital offers ambulatory care and has a Hospital Infection Control Service (HICS).

The medical team of the health care setting is offering the care and providing the required support to the patients that are admitted for surgery or are under observation after the surgery. The surgical and interventional approach of the hospital care staff involves the analysis of the recovery of the patients after 30 days. NHSN surgical procedure were followed for one year after the major surgery. The process is considered for analyzing the affect on skin, tissue and organs. The inclusion criteria of the study were involving the patient with general surgery aged 18 years and more and staying 24 hours in hospital. The exclusion criteria of the study were patients who were admitted for less than 15 hours and aged less than 18 years. The consideration of NHSN performed for analyzing the key makers for

care workers that involve in the operation and surgical approaches. Moreover, the data has been collected from the database of the hospital by taking the prior approval of the management. The collected data was stored in excel and exported to SPSS version 26.0 software for farther analysis

and achieving the desired outcome of the study. Data was analyzed applying independent t-test, ANOVA and logistic regression.

Results

Table 1: Bivariate analysis

Variables	SSI (No)		SSI (Yes)		OR*	95% CI+	P value
	N	%	N	%			
Gender							0.001
Female	11.436	96.7	362	3.3			
Male	4.98	95.4	206	4.6	1.4	1.1-1.8	
Age							0.543
Under 54 years	7.69	97.6	230	2.4			
Above 54 years	8.98	95.6	338	4.4	1.4	1.3-1.9	
Length of hospital stay							0.001
<24 hours	9.47	97.2	217	2.8			
>24 hours	6.87	95.9	351	4.1	2.4	2.0-2.9	
Duration of surgery	1.9 hours		2.2 hours		1.4	1.6-1.7	0.001
ASA index							
1	5.37	98	109	2			
2	8.48	96.7	321	3.3	1.7	1.4-2.3	0.001
3	1.83	96.7	138	3.3	3.3	2.7-4.9	0.001
WC							
Clean	9.74	97.8	259	2.2			
CI-	5.68	96.8	186	3.2	1.3	1-1.3	0.014
Contaminated	1.34	93.3	97	6.7	2.8	2.1-3.6	0.001
Dirty infection	330	93.7	26	6.3	2.9	1.8-4.2	0.001
Emergency surgery							0.001
Yes	14.66	96	520	4			
No	820	94	48	6	1.10	1.3-2.6	
Use of anaesthesia							0.001
Yes	8.69	97	263	3			
No	7.89	96	305	4	1.6	1.2-1.6	
Use of implant							0.687
Yes	13.36	95	487	5			
No	3.19	96	81	4	0.8	0.7-1.2	

There were 70.6% female and mean age of the patients was 54.3 years. Moreover, the mean duration of the surgery was 1.6 hours. 568 patients were diagnosed with SSI with incidences of 3.4%

Table 2: Final logistic

Variables	OR*	95% CI	P-value
Length of stay >24hours	1.8	1.6-2.7	0.001
Duration of surgery in hours	1.4	1.2-1.6	0.001
PCSW			
Clean contaminated	1.6	1.2-1.8	0.001
Contaminated	2.8	2.1-3.6	0.001
Dirty	1.9	1.2-3.1	0.001
ASA index			
2	1.6	1.3-1.8	0.001
3	2.4	1.9-3.2	0.001
4/5	2.0	1.1-3.6	0.031

The final logistics outcome of the study suggested that infection culture was performed on 177 patients and *Staphylococcus aureus* and *Escherichia coli* were the main microorganisms causing SSI. Moreover, the multivariate analysis has suggested the significance of 5%.

Discussion

The current study provides information about the issues of SSI and it has been carried out that surgical procedure was performed to 70.6% female and mean age of the patients was 54.3 years. Moreover, the mean duration of the surgery was 1.6hours. 568 patients were diagnosed with SSI with incidences of 3.4%. Moreover, the infection culture was performed on 177 patients and *Staphylococcus aureus* and *Escherichia coli* were the main microorganisms causing SSI. Moreover, the multivariate analysis has suggested the significance of 5%. According to analysis, the incidence of 3.4% was found in the patients and the incidence rate that was observed in the study which suggest the presence of different epidemiological surveillance system of the patient [16].

However, the low incidences of SSI were found in the current study as the data involve the orthopaedic patients. This shows non-performance of PDS impact on the actual SSI rate [17]. The factors that have influenced the risks of SSI involve the duration of stay in hospital, duration of

surgery, ASA and PCSW. Moreover, the wound class and duration of surgery were statically associated with SSI for cardiac, neck or head surgeries. The hospital stay of more than 24 hours is the major problems for the patients and increases the issues related to SSI. Additionally, the duration of surgery has also shown the significant association with SSI and influenced the post-surgical complications [18]. According to study of Carvalho et al., (2017) [19], 251 patients were included for analysing the issues of SSI and 50.2% of the participants were female and mean age was 38 ± 16.30 years. According to analysis, 21.1% participants were identified with SSI and AHR of the patients considered as per the standards of the American society was ≥ 3 , = 2.26; 95%CI = (1.03–4.93). In addition to this, the postoperative antibiotic prescription was 3.2; 95%CI = (1.71–6.01). The study has identified the contaminated-wound that was 7.9; 95%CI = (4.3–14.60) and emergency surgery 2.8; 95% CI = (1.16–6.80). Moreover, the study has analyzed and considered the duration of operation which was ≥ 2 h and co morbidity was 2.52; 95%CI. Apart from this, the independent predictors were considered for analyzing the SSI and it was carried out that (11.6%) patients returned to operation room.

Moreover, the study of Misha Chelkeba and Melaku (2021) [20] found that incidence of SSI was 3.6%. The major factors that have

increased the risk of SSI were duration of stay more than 24 hours and cleaning, duration of surgery and use of the equipment. Moreover, ASA index *Staphylococcus aureus* and *Escherichia coli* were identified. [21] This shows the non-performance of PDS impact on the actual SSI rate. The factors that have influenced the risks of SSI were duration of stay in hospital, ASA, PCSW, and duration of surgery. Moreover, duration of surgery and wound class were statically related with SSI for cardiac, neck or head surgeries.

Conclusion

The overall incidence of SSI in current study was 3.4%. The key risk factors were length of stay, surgery and these were classified as ASA 2, 3, 4/5. The study has analyzed different culture and most prevalent microorganism factors were *Staphylococcus aureus* and *Escherichia*. The study concluded that the risk of developing SSI should be analyzed in patients undergoing general surgery and implementation of the measures to minimize the infection.

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