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A STUDY ON SURGICAL SITE INFECTION (SSI) AND ASSOCIATED FACTORS IN TERTIARY CARE HOSPITAL OF NORTH INDIA

General Surgery

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ABSTRACT

Background: Surgical site infections (SSI) are the most common nosocomial infection and frequently cause morbidity and mortality among inpatients of hospitals. The incidence varies from hospital to hospital. Several factors affect the development of SSI. **Objectives:** To study the incidence of Surgical Site Infections and associated risk factors in the surgical wards of a tertiary care hospital in Lucknow. **Material and Methods:** It was a hospital based study done on 200 patients who underwent various surgeries in the General Surgery department of Career Institute of Medical Sciences, Lucknow. Duration of study was 3 months ie. Oct-December 2019. A predesigned and pretested proforma was used to collect the data. Surgical sites were examined and graded. Culture and sensitivity testing was done on infected wounds. Data was analysed using SPSS 17 software. **Results:** Among the 200 patients 40 developed surgical site infections giving a cumulative incidence of 20%. Out of 40 SSIs 20 were grade 3 infections and responded to change in antibiotic guided by antibiogram. 20 patients developed grade 4 infection and some of them had constitutional symptoms like fever. SSIs were found more commonly among the aged, males, underweight and overweight, anaemics, diabetics, hypertensives, patients with longer pre-operative waiting time, with multiple blood transfusions and without antibiotic prophylaxis. Age, Sex, BMI, Diabetes mellitus, Blood transfusion and pre-operative waiting had univariate statistical significance. **Conclusion:** The incidence of SSI is high. Gender, extremes of BMI, diabetes mellitus and blood transfusion are the important risk factors for it.

KEYWORDS

Risk factors, Surgical site infections.

BACKGROUND:

Surgical site infections (SSI) frequently cause morbidity and mortality among inpatients of hospitals. They account for a considerable proportion of nosocomial infections among hospital inpatients. Hence they can act as surrogate markers for nosocomial infections. For surgical patients, SSIs are the most common nosocomial infection and they have been shown to be the leading cause of operation-related adverse events.[1,2] Several studies have demonstrated an increased length of hospitalization and the associated financial implications for patients with SSI compared with noninfected patients having similar surgical procedures.[3-5]

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. However, the period of greatest risk remains the time between opening and closing the operating site.[6]

Total quality management in hospitals is gaining emphasis these days. Control of postoperative complications is an essential component of total quality management. In this context it becomes important to determine the prevalence of surgical site infections, assess the magnitude of the problem and provide a rationale to set priorities in infection control in the hospitals. Not many studies are done in India in this direction. Hence the present study had been undertaken.

AIM AND OBJECTIVES:

1. To study the incidence of Surgical Site Infections in the surgical wards of a tertiary care hospital in Lucknow.
2. To identify the risk factors for the development of SSIs.

MATERIAL AND METHODS:

It was a hospital based study done on 200 patients who underwent various surgeries in the General Surgery department of Career Institute of Medical Sciences, Lucknow. Duration of study was 3 months ie. Oct-December 2019. Following patients were included in the study:

- Elective surgeries
- Those who stayed for at least seven days post-operatively.

Exclusion criteria was:

- Grossly contaminated or infected wounds/procedures.

Following the surgical procedure, surgical sites were examined on postoperative day 3 and every 3 days thereafter. Wounds were graded on the following scale: grade 1= normal healing; grade 2 = suture line erythema < 1cm; grade 3 = suture line erythema > 1cm; grade 4 = frank, purulent drainage.[7] Four surgeons did the grading for all the subjects. Cultures were obtained on all wounds determined to be infected or as otherwise clinically indicated. Grade 3 or 4 wounds were considered infected. Wounds from which a positive culture was obtained in the setting of physical signs of infection (i.e., fever, inflammation) were also considered infected. Antibiogram was prepared from culture sensitivity reports to evaluate the sensitivity pattern of organisms. Demographic characteristics like age and sex were noted. Variables like BMI, co-morbid conditions, prophylactic antibiotic use, blood transfusion, and preoperative waiting period were compared in the infected and non-infected groups. Statistical analysis was done using Microsoft Excel, SPSS 17 software. Those risk factors that were univariately significant using chi-square analysis at $p < 0.05$ were entered into binary logistic regression equation to evaluate the risk of each factor when adjusted for other factors.

RESULTS:

During the study period 200 patients underwent various surgeries in the general surgery department of Career Institute of Medical Sciences, Lucknow. Among them abdominal surgeries constituted majority (70%) followed by limb surgeries. Others category included thyroid surgeries, lipoma and other tumour excisions [Table 1].

Among the 200 patients 40 developed surgical site infections giving a cumulative incidence of 20%. Out of 40 SSIs 20 were grade 3 infections and responded to change in antibiotic guided by antibiogram. 20 patients developed grade 4 infection and some of them had constitutional symptoms like fever.

The age of study subjects ranged between 18 years to 67 years. Majority (48.75%) of them belonged to 18-30 years group. Out of 129 patients in this group 9 got infected. 21 patients were more than 50 years and among them 15 (37.5%) developed surgical site infection. It was found that the frequency of SSI increased with age and this was statistically significant [Table 2]. There were 130 (65%) males and among them 30 got infected. Among the 70 women 10 developed SSI. This difference in incidence was statistically significant.

Majority of the study subjects (130-65%) had normal BMI. Among them 10 developed SSI. Out of 30 underweight patients 20 (67%) developed SSI. Of the 40 overweight patients 10 developed infection of their surgical sites. This difference was found to be statistically significant [Table 2]. Anaemia, hypertension and diabetes mellitus were the three co-morbid conditions studied. Haemoglobin of 13 and 12 gm% were considered as the cut off points for the diagnosis of anaemia in men and women respectively. Those with less than 10gm% were considered severely anaemic and these were the ones who received maximum blood transfusions. Among 40 anaemic patients who underwent surgery 25 (62.5) developed SSI.

Among the 200 study subjects 52 (26%) patients received blood transfusions. Per operative transfusions accounted for major share of these transfusions. Eight patients who did not receive any transfusion developed SSI. 4 patients received more than 3 units of blood and all of them developed infections [Table 2]. Majority (128-64%) of the patients were operated within 48h of admission and among them 08(20%) developed SSI. 37 (18.5%) waited for more than a week to undergo surgery and among them 12(30%) developed SSI. The difference was statistically significant [Table 2].

The parameters which had univariate statistical significance were; Age, gender, BMI, Co morbid conditions: Anaemia, Hypertension and Diabetes mellitus, Blood transfusion, pre-operative waiting and prophylactic antibiotic usage. These were entered into multivariate analysis. Gender, Extreme BMI, Diabetes mellitus and Blood transfusion remained independent predictors of surgical site infection in multivariate analysis. Anaemia, Hypertension and Prophylactic antibiotic usage did not show statistical significance [Table 2].

Organisms isolated from the SSIs showed resistance to all groups of antibiotics used in the surgery department of our hospital. Tetracycline encountered majority of the resistance followed by erythromycin and ampicillin. However these three antibiotics are not regularly used in our hospital. The commonly used antibiotics like Amikacin, Cephalexin and Cefotaxime also encountered resistance and this is a matter of concern.

Table 1: Distribution Of Surgeries According To Site

Surgical site	No %
Abdominal	140(70%)
Limbs	35(17.5%)
Others	25 (12.5%)
Total	200(100)

Table 3: Organism Associated With SSI

Organism	Frequency of SSI No.	%
Staph Aureus	20	57.14
Pseudomonas	12	34.2%
Klb. Pneumonia	10	28.5%
Citrobacter	6	17.1%
E Coli	5	14.2%
Proteus	5	14.2%

Table : Factors Associated With SSI

Factors	SSI	No SSI	Univariate	Multivariate	
	No %	No %	P value	OR (95%CI)	P value
Age group years					
18-30	09(22.5)	120(75)	<0.000	1.0	
31-40	10(25)	30(18.75)		1.06	0.65
41-50	06(15)	04(2.5)		1.02	0.30
>51	15(37.5)	06(3.75)		1.26	0.47
Gender					
Male	30(75)	100(62.5)	0.001	1.0	0.003
Female	10(25)	60(37.5)		0.43	
Body mass					
<18.5	20(50)	10(6.25)	0.000	1.0	
18.5-25	10(25)	120(75)		0.37	0.006
>25	10(25)	30(18.75)		1.56	0.02
Co morbid conditions					
Anemia Yes	25(62.5)	15(10.7)	<0.000	1.25	0.97
No	15(37.5)	125(89.2)		1.0	
Hypertension	18(45)	05(3.7)	<0.000	1.13	0.45
	22(55)	135(96.4)		1.0	
Diabetes Yes	24(60)	10(7.1)	<0.000	1.23	<0.000
No	16(40)	130(92.8)		1.0	
Blood transfusion					
None	08(20)	140(87.5)	<0.000	1.0	
1-3 units	28(70)	20(12.5)		2.02	0.004
>3 units	04(10)	00(0.0)		6.26	0.02
Pre-operative waiting period					
<2 days	08(20)	120(75)	<0.000	1.0	
2-7 days	20(50)	15(9.3)		1.06	0.21
>7 days	12(30)	25(15.6)		1.16	0.43
Prophylactic antibiotics					
Yes	05(12.5)	20(12.5)	0.0375	1.0	
No	35(87.5)	140(87.5)		1.08	0.41

DISCUSSION:

The present study was carried out in 200 patients who underwent various surgeries (namely Appendicectomy, Hernia operation, Laparotomy, Mastectomy, Amputation, Cholecystectomy and Nephrectomy).

The rate of SSI varies greatly worldwide and from hospital to hospital. The rate of SSI varies from 2.5% to 41.9% as per different studies.[4,6] The present study shows SSI rate 20% which is almost comparable with rate of SSI reported by Syed Mansour Razavi (17.4%).[8] A lower rate of infection is reported by Anvikar AR et al (6.1%).[2]

The rate of SSI increases with the increase in age. In the current study a higher proportion of SSI was found among the subjects older than 50 years. This is comparable to other studies.[8,12-15] This is due to poor immune response, existing co morbidities in old patients and reduced compliance with treatment.[8]

Co morbid conditions like anaemia, diabetes and hypertension were the significant risk factors for SSI. Diabetes remained significant predictor in multivariate analysis. National Academy of Science also reported higher rate of infection in patients with Diabetes mellitus which is similar to our study.[13] Comparable results were found in various studies involving different surgical procedures.[14]

A prolonged pre-operative hospital stay with exposure to hospital environment has been shown to increase the risk of SSI.[6] Comparable findings were found in the present study. Anvikar A.R. and Lilani S.P. also reported higher rate of SSI in patients with prolonged preoperative hospital stay.[6,7] Prolonged preoperative hospital stay leads to colonization with antimicrobial resistant microorganisms and itself directly affects patient's susceptibility to infection either by lowering host resistance or by providing increased opportunity for ultimate bacterial colonization.[8]

CONCLUSION:

The incidence of SSI was high. Age, gender, BMI, Co morbid conditions like Anaemia, Hypertension and Diabetes mellitus, Blood transfusion, pre-operative waiting and prophylactic antibiotic usage were risk factors for SSI.

Staphylococcus aureus was the most common organism associated with SSI. Majority of the SSIs were resistant to multiple antibiotics.

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Recommendations:
1. Surveillance mechanisms should be developed for the control of SSI.
2. Institutional antibiotic policy should be developed.
3. Quality control exercises should become a routine and Medical auditing should be done periodically.
4. Training of Nursing staff, technicians in postoperative wards regarding maintenance of strict aseptic environment needs emphasis. Concepts of barrier nursing and task nursing can go a long way in tackling SSI.

Limitations:
As it is a single centre study with a relatively small study population, results cannot be generalized to the entire population. Culture was done for only few bacteria because of operational feasibility.

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