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A prospective observational study of surgical site infections in clean and clean contaminated surgeries in a tertiary care hospital

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***Abstract*---**Introduction: Surgical Site Infections [SSIs] have plagued surgeons since time immemorial. Infection is encountered by all the surgeons; by nature of their craft, they invariably impair the first line of host defences, the cutaneous or the mucosal barrier. The entrance of microbes into the host tissues is the initial requirement for infection. Materials and Methods: This was a prospective observational study conducted at tertiary care teaching hospital over a period of two years from May 2019 to April 2021 with the approval of the hospital ethics committee. Universal sampling was employed for the study duration. List of surgeries was received from operation theatre on daily basis. From this list only clean and clean contaminated surgeries were selected. Data regarding demographic details, type of surgery performed, whether emergency or planned surgery, the duration of surgery, surgical antibiotic prophylaxis given, duration of preoperative stay, presence of co morbid conditions and the duration of post op stay was collected. Results: Total 2382 clean and clean contaminated surgeries were included in the study. Out of these 98 patients developed SSI. The incidence of SSI was 2.05%. There were 1298 (54.50%) male patients, out of which 18 (0.69%) developed SSI. While out of 1084 (45.50%) female patients 80

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(3.70%) developed SSI. The age of the patients in the study ranged from 18 years to 75 years. Out of 98 patients who developed SSI, 42 were in the age group of 21-30, 26 were between the age group of 31-40, 16 were between the age group of 41-50, 8 were between the age group of 51 to 60 and 6 patients were above 60 years of age. The incidence of SSI in planned surgery was 1.64%, while the incidence in emergency surgery was 3.08%. Conclusion: Regular surveillance of SSI with feedback of appropriate data to the stakeholders is desirable to reduce SSI rate. Post patient discharge, surveillance of SSI is challenging but it needs to be addressed by infection control team to identify cases of SSI accurately.

***Keywords*---**Surgical Site Infections, antibiotic, infection control.

Introduction

Surgical Site Infections [SSIs] have plagued surgeons since time immemorial. Infection is encountered by all the surgeons; by nature of their craft, they invariably impair the first line of host defences, the cutaneous or the mucosal barrier.[1] The entrance of microbes into the host tissues is the initial requirement for infection.

SSIs are the second most common cause of nosocomial infections. It has been estimated that SSI develops in at least 2% of hospitalized patients undergoing operative procedures, although this is a likely underestimate because of incomplete post discharge data, other data indicate that SSIs develop following 3-20% of certain procedures.[2]

The common pathogenic bacteria in surgical site infections include Staphylococci, Pseudomonas, Streptococci, Enterococci, E. coli, Klebsiella, Enterobacter, Citrobacter, Acinetobacter, Proteus and S. aureus. S. aureus is present as a normal flora, can be isolated upto 60% from nose and can be readily transmitted from person to person.[3] Surgical site infection is the index of the health care system of any hospital. With the increase in incidence of nosocomial infections and multidrug resistance, a meticulous and periodic surveillance of various hospital acquired infections is called for.[4,5]

This study was conducted in a tertiary care hospital to determine the prevalence of surgical site infections and associated factors in clean and clean contaminated surgeries. The Microbiological profile of these surgical site infections was also studied.

Materials and Methods

This was a prospective observational study conducted at tertiary care teaching hospital over a period of two years from May 2019 to April 2021 with the approval of the hospital ethics committee.

Inclusion criteria: Adult patients (age ≥18 years) who underwent clean OR clean contaminated surgeries (classified as per Centre for Disease Control (CDC) guidelines) either elective or emergency surgical procedures from general surgery, gynecology /obstetric and orthopedic departments.

Exclusion criterion: Contaminated and dirty surgeries as per the CDC guidelines were excluded.

Methodology

Methodology of surgeries was received from operation theatre on daily basis. From this list only clean and clean contaminated surgeries were selected. Data regarding demographic details, type of surgery performed, whether emergency or planned surgery, the duration of surgery, surgical antibiotic prophylaxis given, duration of preoperative stay, presence of co morbid conditions and the duration of post op stay was collected.

All the patients included in the study were monitored in the ward for the development of signs and symptoms of SSI by infection control nurse and microbiologist on a daily basis during the patient's hospital stay. Post-operative monitoring of patient was done for 30 days for surgeries without implant and for 1 year for surgeries with implant. OPD dressing register was maintained in all surgical OPDs.

Any sign of SSI was looked for when the patient came post-operative to the OPD for dressing. Also, a call was made to all patients 30 days after surgery to ensure that SSI has not developed. SSI was diagnosed based on CDC guidelines. Surgeons were instructed to report and fill up SSI reporting form whenever there was suspicion of SSI. Samples from these patients were then collected by aspiration or with the help of sterile swab from the affected site with full aseptic precautions and sent immediately for processing to the microbiology laboratory. In the laboratory standard procedures were followed for identification of the infecting organism. Antibiotic susceptibility test was performed by Vitek II as per CLSI guidelines.

Statistical analysis

Data was entered in excel sheet and analyzed using SPSS version 17. Categorical variables have been expressed as frequencies and percentages.

Results

Total 2382 clean and clean contaminated surgeries were included in the study. Out of these 98 patients developed SSI. The incidence of SSI was 2.05%. There were 1298 (54.50%) male patients, out of which 18 (0.69%) developed SSI. While out of 1084 (45.50%) female patients 80 (3.70%) developed SSI. The age of the patients in the study ranged from 18 years to 75 years. Out of 98 patients who developed SSI, 42 were in the age group of 21-30, 26 were between the age group of 31-40, 16 were between the age group of 41-50, 8 were between the age group of 51 to 60 and 6 patients were above 60 years of age. The incidence of SSI

in planned surgery was 1.64%, while the incidence in emergency surgery was 3.08%.

Table 1: Characteristics of the participants

Characteristics		Total Number of patients (2382)	Total Number of cases with SSI (98)	Total Number of cases without SSI (2284)
Gender	Male	1298 (54.50)	18 (0.69)	1280 (99.31)
	Female	1084 (45.50)	80 (3.70)	1004 (96.30)
Age (in years)	18-20	430 (18.05)	6 (0.70)	424 (99.30)
	21-30	648 (27.30)	42 (3.24)	648 (96.76)
	31-40	639 (26.83)	26 (2.03)	613 (97.97)
	41-50	384 (16.12)	16 (2.08)	368 (97.92)
	51-60	281 (11.80)	8 (2.08)	273 (98.58)
	>60	290 (12.17)	6 (1.03)	284 (98.97)
Operation category	Planned	1770 (74.31)	56 (1.58)	1714
	Emergency	616 (25.86)	42 (3.40)	574

Table 2: Analysis of Surgical site infections (N=98)

		N (%)
Department	Obstetrics and Gynecology	40 (61.22)
	General Surgery	20 (20.41
	Orthopedics	18 (18.37)
Surgical antibiotic prophylaxis stopped within 24 hrs	Yes	70 (79.60)
	No	20 (20.4)
Duration of surgery	≤60 min	14 (14.29)
	>60 min	84 (85.71)
Prosthesis	Yes	14 (18.28)
	No	84 (85.71)
Comorbid Conditions	Yes	14 (18.28)
	No	84 (85.71)
Diagnosis of SSI	During hospital stay	62 (63.27)
	After the discharge	36 (36.73)
Post-operative stay in days	≤7	24 (24.49)
	>7	74 (75.51)
Post-Operative day of SSI event		
	≤5	18 (18.37)
	6-10	48 (49)
	11-15	18 (18.37)
	16-20	4 (4.08)
	21-25	4 (4.08)
	26-30	2 (2.04)
	>30	4 (4.08)
Comorbid conditions	Yes	34 (34.7)

	No	64 (65.31)
Resuturing	Yes	6 (6.12)
	No	52 (93.88)

Table 3: Causative organism of SSIs

S.No	Causative organism	Number
1	E.coli	26
2	S.Aureus	24
3	CONS	12
4	E.faecalis	10
5	E.Cloacae	10
6	K.pneumonia	10
7	A.baumannii	6

Discussion

The present study was conceptualized and conducted to determine the incidence of SSI in clean and clean contaminated surgeries over a period of one year. The incidence of SSI in India ranges from 4.04 % to 30 %. In our study the incidence of SSI in clean and clean contaminated surgeries was 2.05% (98/2382). In a similar study by Madhusudan et al the incidence of SSI was 12%, which is higher than our study. They had included 242 surgeries in their study. In another study which was conducted in Mumbai, the incidence was 3.03% in clean surgeries and 22.41% in clean contaminated surgeries. Our SSI rate was lower than other studies. We could achieve this with regular surveillance of SSI, in depth root cause analysis and strict implementation of infection control practices.[6]

In present study, the incidence of SSI in females was 3.70% and in males the incidence was 0.69%. Female preponderance in our study could be due to a greater number of infections occurring in obstetrics and gynecology surgeries. Similar preponderance in females was reported by Jain et al. In their study out of 108 females who underwent surgery 8 (7.4%) developed SSI.[7] In another Indian study in Mysore by Shetty NH et al significant proportion of males developed SSI compared to females. According to Berard and Gandon sex is not a pre determinant of the risk of SSI.

There was high incidence of SSI in emergency surgeries (3.40%) as compared to planned surgeries (1.58%). Misha et al also reported more SSI in emergency surgeries. In their study out of 84 planned surgeries 8 (9.52%) developed SSI, while out of 167 emergency surgeries 45 (26.95%) developed SSI. This could be due to the fact that in emergency procedures there was compromise on pre-operative skin preparation.[8]

In our study out of all surgeries, maximum SSI was reported from obstetrics and gynaecology (61.22%, n=60) followed by general surgery (20.41%, n=20) and orthopedics (18.37%, n=18).[9]

The most common isolate in our study is Escherichia coli followed by Staphylococcus aureus. Similar observations were also reported by Patel et al and Misha et al. Jain et al reported Coagulase negative Staphylococcus and Escherichia coli as predominant isolates while Madhusudan et al, from Puducherry, isolated Staphylococcus aureus most commonly from their study on surgical site infection. This variation in bacterial flora could be due differences in study setting and population.[10]

Conclusion

In our study association of the type of surgery, age and gender with SSI was observed. Due to SSI, post-operative stay in the hospital was increased. With good surveillance system we could diagnose SSI cases even after the discharge from the hospital. Regular surveillance of SSI with feedback of appropriate data to the stakeholders is desirable to reduce SSI rate. Post discharge surveillance of SSI is challenging and it should be addressed by infection control team for accurate mapping of SSI.

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