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Original Research Article

Surgical Site Infections (SSI) and factors associated in a private tertiary care teaching hospital in Raichur, Karnataka, India

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ABSTRACT

Background: Prevention of Surgical site infection (SSI) remains a focus of attention because wound infections continue to be a major source of expense, morbidity, and even mortality. Three quarters of deaths of surgical patients with SSIs are attributed to nosocomial infections, nearly all of which are organ/space infections. The objective of the present study was to estimate the incidence of SSI and to study the various risk factors associated with SSI.
Methods: This is a prospective study of 180 eligible cases eligible subjects, who underwent various surgeries in the department of General Surgery after applying inclusion and exclusion criteria. The study conducted at the Navodaya Medical College Hospital and Research Centre, Raichur. The tenure for the study was April 2017 to June 2017. Data was collected using pretested proforma. Data was analysed using SPSS version 16. Chi-square test and multiple logistic regression was applied to know the association between various risk factors and occurrence of SSI.
Results: Among 180 patients 33 (18.33%) developed surgical site infections (SSI). Among 33 SSIs 25 (75.76%) were grade 3 and 8 (24.24%) were grade 4 infections. SSIs were found more commonly among patients over 50 years, diabetics, HIV infected patients, patients with longer duration of surgery and associations with these factors were found statistically significant.
Conclusions: The incidence rate of SSI was quite high, and its end results will have a greater impact on patients as well as on healthcare systems. Prevention of SSI requires multipronged approach targeting both patient related and procedure related risk factors in pre- operative, intra-operative, and post-operative period.

Keywords: Navodaya Medical College Hospital and Research Centre, Raichur, Risk factors, Surgical site infections

INTRODUCTION

Surgical site infection (SSI) can be defined as an infection that is present up to 30 days after a surgical procedure if no implants are placed and up to one year if an implantable device was placed in the patient.[1] SSIs are one of the most commonly occurring nosocomial infections and are of significant concern in association with major surgeries. In low and middle-income countries (LMICs) more than 1 in 10 people who have surgery get SSIs. People's risk of SSI in LMICs is 3-5 times higher than in high income countries.[2] Within the country incidence varies from hospital to hospital as standard protocol of preoperative preparation, antibiotic prophylaxis, surgical techniques, hospital infection control facility varies from hospital to hospital. Factors causing surgical site infection are multifarious. Several studies have identified the main patient-related (endogenous risk factors) and procedure-related (external risk factors) factors that influence the risk of SSI. The rate of surgical wound infections is strongly influenced by operating theatre quality, too.[3]

SSIs complicate an estimated 7, 80,000 operations in the United States each year, and are the second most common hospital associated infection. SSIs are the frequent cause for morbidity, mortality among post-operative patients, prolongs the hospital stay and also account for economic burden.[4] SSIs threaten the lives of millions of surgical patients each year and contribute to the spread of antibiotic resistance.[2] Severity of SSI ranges from superficial skin infection to life-threatening sepsis.[4] Various factors such as malnutrition (obesity, weight loss), diabetes, uraemia, jaundice, immunosuppressive conditions (cancer, AIDS, steroids, chemotherapy, radiotherapy), poor surgical technique, poor hand washing technique, poor antisepsis and inadequate air infiltration in operating theatre increases the risk of development of SSI.[5]

A range of precautions taken before, during and after surgery will definitely reduce the risk of SSIs. The 2016 World Health Organization (WHO) Global guidelines for the prevention of SSI are evidence based and unique in that they are the first global guidelines of this sort and are based on systematic reviews and present information in support of actions to improve practice.[2]

As identifying factors influencing SSI and addressing those factors to reduce the incidence of SSI needs high priority, present study was conducted with the following objectives: 1) To estimate the incidence of SSI. 2) To study the various risk factors associated with SSI.

METHODS

This is a prospective study of 180 eligible cases, who underwent various surgeries in the department of General Surgery after applying inclusion and exclusion criteria. The study conducted at the Navodaya Medical College Hospital and Research Centre, Raichur. The tenure for the study as April 2017-June 2017.

Inclusion criteria

- All the patients who underwent various Elective surgeries in the department of General Surgery during the study period.

Exclusion criteria

- Grossly contaminated or infected wounds/procedures (primary SSI).

Data collection

Data was collected using pretested proforma which included detailed history, clinical examination and investigations. Before conducting the study ethical committee approval from the institution was taken and written informed consent was obtained from the study subjects.

Statistical analysis

Data was entered in Microsoft excel and was analysed using SPSS version 16. Results were expressed in percentages. Chi -square test and multiple logistic regression were applied to know the association between various risk factors and occurrence of SSI.

RESULTS

Among 180 patients 33 (18.33%) developed surgical site infections (SSI) (Figure 1).

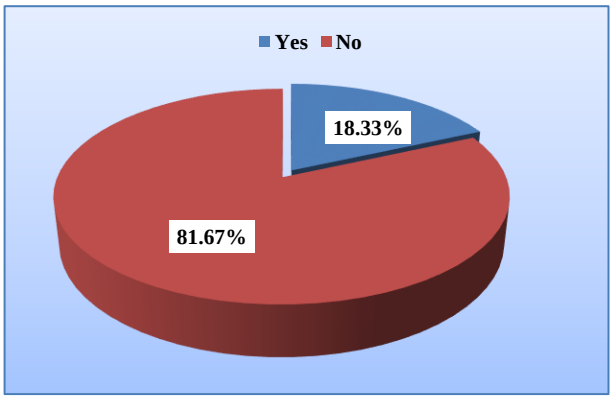

Figure 1: Incidence of Surgical Site Infection (SSI).

Among 180 study subjects abdominal surgeries (Appendectomy, Cholecystectomy and Hernioplasty) constituted more (55%), limb Surgeries (Trendelenberg's Procedure for varicose veins) 0.6% and other Surgeries (44.4%) included Hemithyroidectomy, Jaboulay's procedure for hydrocele, Excision of Fibroadenoma breast, Modified Radical Mastectomy, Excision of lipomas and sebaceous cyst (Figure 2).

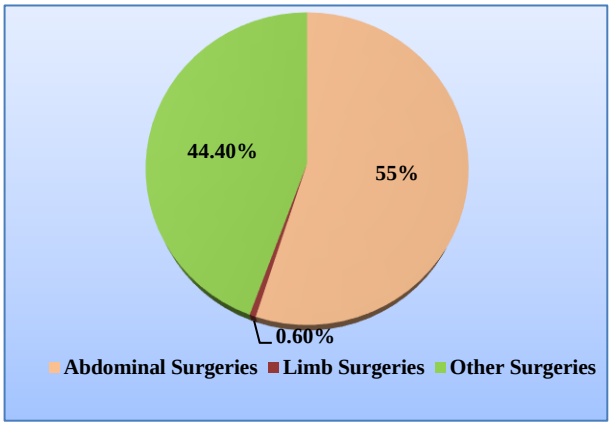

Figure 2: Distribution of patients based on the type of surgeries.

Among study subjects majority (62.5%) were in the age group of 21-30 years, males 56.7% and females 43.3%. SSIs were found more commonly among patients over 50 years (64.7%), diabetics (75%), HIV infected patients

(60%), patients with longer duration of surgery (65.4%) and associations with these factors were found statistically significant on univariate analysis and multiple logistic regression with p-value <0.05.

Table 1: Association of various factors with SSI.

Factors	SSI		Chi-square Test	Multiple logistic regression	
	Present N (%)	Absent N (%)	p-value	Adjusted Odds Ratio (95%CI)	p-value
Age group in years (N)					
21-30 (112)	9 (8)	103 (92)	0.02	1	
31-40 (35)	6 (17.1)	29 (82.9)		1.1 (1.05-1.25)	0.03
41-50 (16)	7 (43.9)	9 (56.1)		1.2 (1.15-1.35)	0.02
>50 (17)	11 (64.7)	6 (35.3)		1.5 (1.2-1.8)	0.01
Sex (N)					
Male (102)	19 (18.6)	84 (81.4)	0.01	1.0	0.1
Female (78)	14 (17.9)	63 (82.1)		0.8 (0.7-1.0)	
Co-morbid conditions					
Diabetes Mellitus					
Yes (24)	18 (75)	6 (25)	0.001	1.54 (1.34-1.64)	0.001
No (156)	15 (9.6)	141 (90.4)		1	
Hypertension					
Yes (23)	13 (56.5)	10 (43.5)	0.01	1.23 (1.00-3.09)	0.1
No (157)	20 (12.7)	137 (87.3)		1	
HIV					
Yes (5)	3 (60)	2 (40)	0.0001	2.02 (1.77-4.80)	0.0001
No (175)	30 (17.1)	173 (82.9)		1	
Duration of surgery					
Normal Duration (154)	16 (10.4)	138 (89.6)	0.001	1	0.003
Prolonged Duration (26)	17 (65.4)	9 (34.6)		1.6 (1.2-2.0)	

Table 2: Association between duration of Surgery and Incidence Rate of SSI.

Type of Surgeries	Duration of surgery	N	SSI	Infection rate (%)
Appendectomy	60 min	40	8	25
	>60 min	10	7	70
Cholecystectomy	120 min	1	0	0
	>120 min	0	0	0
Hernioplasty	90 min	42	3	7.1
	>90 min	6	4	66.7
Trendelenberg's Procedure for varicose veins	120 min	2	0	0
	>120 min	0	0	0
Hemithyroidectomy	120 min	2	0	0
	>120 min	0	0	0
Jaboulay's procedure for hydrocele	60 min	43	4	9.3
	>60 min	7	3	42.9
Excision of Fibroadenoma breast	45 min	8	0	0
	>45 min	0	0	0
Modified Radical Mastectomy	120 min	7	1	14.3
	>120min	3	3	100
Excision of lipomas	30 min	5	0	0
	>30 min	0	0	0
Excision of sebaceous cyst	30 min	4	0	0
	>30 min	0	0	0

On univariate analysis hypertension (56.5%) and male gender (18.6%) also showed higher incidence of SSI and found statistically significant but on multiple logistic regression association with these factors was not statistically significant (Table 1).

The current study showed a positive association between increase in duration of surgery and rate of SSIs. Increase in duration of surgery is associated with increased incidence of SSI when compared to normal duration of surgery. In modified radical mastectomy, where surgery is prolonged SSI rate was 100%, where as in normal duration it was 14.3%.

Similarly, in prolonged Appendectomy, Hernioplasty and Jaboulay's procedure for hydrocele SSI rates were 70%, 66.7% and 42.9% when compared to 25%, 7.1% and 9.3% in normal duration of these surgeries respectively (Table 2).

Among 33 SSIs 25 (75.76%) were grade 3 and 8 (24.24%) were grade 4 infections (Figure 3).

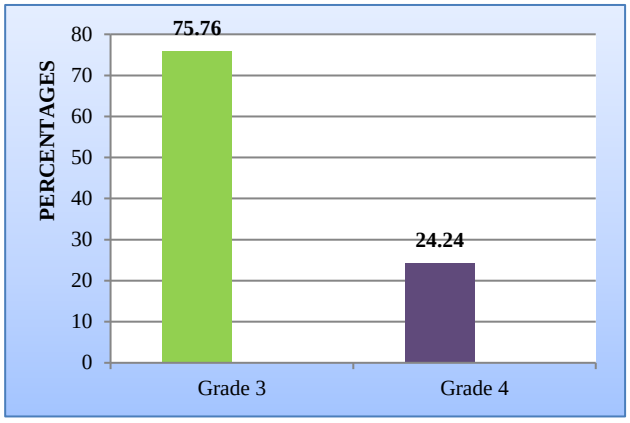

Figure 3: Grading of SSIs.

All the Grade 4 SSIs and out of 25 Grade 3 SSIs 8 were sent for culture and sensitivity as they were not responding to treatment. Staphylococcus aureus was found to be the most common organism associated with SSI. Other organisms include *Escherichia coli*, Klebsiella and *Pseudomonas aeruginosa*. Grade 3 SSI responded to change of antibiotic according to antibiogram. But among Grade 4 SSIs 6 were resistant to multiple antibiotics commonly used in our hospital (Ceftriaxone, cefataxime, Metrogyl, gentamycin and amikacin) and responded to Piperacillicin and Tazobactam.

DISCUSSION

In the present study 18.33% developed SSI where as in the studies done in Mysore by Setty et al 66%, in Gujarat by Sachin et al 16.0% and in New Delhi by Kumar et al 12.5%.[1,6,7] In a study conducted by Singh et al on surgical site infection rates in 6 cities of India, it was found to be 4.2%.[8] Similar result was found in a Meta-Analysis of 84 prospective observational studies conducted in Mainland China, where the average incidence of SSI was found to be 4.5%.[9]

In the present study incidence of SSI was slightly more among males compared to females this was in consistent with the study done in Pune by Shahane et al but in study done in Mysore incidence was markedly higher among males (29.1%) than females (10%).[6,10] Percentage of subjects developed SSI was more among individuals aged above 50 years and among diabetics. Similar association was found in studies conducted by Setty et al, Sachin et al and Akhter et al in Mumbai.[6,7,11] In a systematic review on Risk factors associated with SSI, conducted in India, Median SSI incidence was 3.7% and thirteen studies considered diabetes as a risk factor in multivariable analysis.[12]

Incidence of SSI in the present study was more among Hypertensives this is in consistent with the study done in Mysore.[6] Length of operation was considered prolonged where duration of surgery was more than 75th percentile of duration of the specific operation being performed.[7] Same criteria was applied in the current study and SSI rate was more with longer duration of surgery. Similar results were found in study done in Gujarat.[7] Sixteen studies showed higher rate of SSI in prolonged duration of surgery in a systematic review of risk factors for SSI conducted by Korol et al.[12]

Staphylococcus aureus was found to be the most common organism associated with SSI. Similar results were found in the studies conducted by Setty et al in Mysore and by Akhter et al in Mumbai but in study conducted by Sachin et al in Gujarat Escheria. coli was the most common organism associated with SSI followed by Staphylococcus aureus and Klebsiella species.[6,7,11] In the present study SSI rate was highest in appendectomy followed by modified radical mastectomy, Jaboulay's procedure for hydrocele and Hernioplasty. In a study conducted by Akhter et al SSI rate was highest in cholecystectomy.[11]

CONCLUSION

The incidence of SSI was high in the present study. Under univariate analysis age more than 50 years, males, longer duration of surgery, co-morbid conditions like diabetes mellitus, HIV infection and hypertension were found as risk factors for increased rate of SSI. On multiple logistic regression except gender and hypertension all other risk factors remained significant. Staphylococcus aureus was the most common organism associated with SSI and majority of grade 4 SSIs were resistant to multiple antibiotics.

Recommendations

Controlling both possible endogenous and exogenous risk factors will definitely help in reducing the incidence of

SSI. Some of the measures such as developing surveillance mechanisms, institutional antibiotic policy and training regarding maintenance of strict aseptic environment for nursing staff and technicians in postoperative wards need to be emphasized. Concepts of barrier nursing and task nursing are also important components in tackling SSI.

The recommendations mentioned in The 2016 World Health Organization (WHO) Global guidelines for prevention of SSI such as in patients undergoing any surgical procedure, hair should either NOT be removed or, if absolutely necessary, should only be removed with a clipper, shaving is strongly discouraged at all times, whether preoperatively or in the operating room and Surgical Antibiotic Prophylaxis (SAP) should be administered within 120 min before incision, while considering the half -life of the antibiotic when indicated etc should be followed in order to reduce SSIs.

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