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Original Research Paper

Surgery

"A STUDY ON INCIDENCE AND RISK FACTORS FOR SURGICAL SITE INFECTIONS FOLLOWING ABDOMINAL SURGERY"

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ABSTRACT **Introduction:** SSI are described as infections that develop in a surgically created wound. SSI is most commonly reported hospital acquired infection, particularly, abdominal surgeries have high incidence of developing SSI leading to significant morbidity and financial burden by increasing hospital stay, re-operation, readmission, limitation of quality of life and loss of daily wages, which would eventually increase the cost of health care specially in rural setting. Incidence of SSI in India ranges from 1.6%to38%.This variation of incidence is due to difference in characteristics of hospital population, differences in clinical procedures, infection control measures, hospital environment. **Aim:** To determine incidence of and risk factors for superficial-SSI after abdominal surgeries at K.R. Hospital, Mysore. **Method:** A prospective study was conducted including 108 patients who underwent abdominal surgeries at K R Hospital between September 2020 and august 2021. Outcomes of study of association between risk factors and SSI will be calculated using Chi square test with 95% confidence-interval. **Result:** Result will be reported once the study completes. Taking into the consideration of variables significantly associated with SSI like, diabetes mellitus, preoperative anaemia, preoperative hypo-albuminemia, smoking, higher ASA score, perioperative blood transfusion,drainplacement,surgery-duration>2hours,woundclass,emergency/elective surgery.

KEYWORDS : Superficial SSI; Mortality; BMI, diabetes mellitus; hypoalbuminemia; anaemia;

INTRODUCTION

Surgical site infection is defined as the infection of surgically created wound. They usually occur within 30 days after surgical procedure. These infections may be superficial or deep involving the organ space [1].SSI is the most frequently reported Hospital acquired infection in lower and middle income countries. The level of risk is significantly higher than developed countries [2].The overall incidence of SSI in lower and middle income countries is 11.8% [3]. In united states, SSI was third most common nosocomial infection previously in 2018-2019,has now been reported as most common nosocomial infection[4].Approximately 77% of deaths of surgical patients with SSI reported to be related to the infection and majority resulted from serious infections involving multi organs[5,6,13].

In Europe, the incidence of SSI varied from 0.6% to 9.5% depending on the type of procedure[7].In Japanese,7.6% of patients who underwent surgical procedure developed SSI[8].In China the cumulative incidence of SSI is 4.6%[9].In India surgical site infections are one of the leading causes of morbidity and mortality. SSI rate in India widely varies and depending on setting , ranges from 1.6% to 38%[10,11].This variability can be due to differences in the characteristics of the hospital population, clinical procedures, infection control measures and hospital environment. Approximately 70% of the population lives in rural areas, where accessibility of quality health care is lacking [12].Data on SSI rates is mainly based on information obtained from tertiary centres located in urban areas. SSI data coming from rural hospitals of India is lacking. Hence results may not reflect true magnitude of SSI burden. Abdominal surgical wounds have high chance of developing SSI [26].Mortality due to which is just a tip of the iceberg. The other submerged problems include, increased hospital stay, re-operation, re-admission, limitation of quality of life ,loss of daily wages, it tremendously impact negatively on patients wellbeing ,financial and social catastrophe for the families[27].Thus inflating the cost of health care especially in rural setting. Health care cost is almost twice that of costs for patient without SSI. There is increased relative risk of death for patients with SSI. The findings of this study will not only help to determine the burden of SSI in rural India ,but also helps to design strategies for infection control and provision of quality health care services to people who access resource constrained rural hospitals of India.

METHODS STUDY SETTING

The present study was conducted in the Dept. of General surgery, Mysore medical college and research institute, Mysore, from September 2020 to August 2021. 108 operated cases in general surgery department were included in this study. Patients were included in the study only after written informed consent for the same. All the patients in the study received prophylactic antibiotics at the time of induction of surgery. Pre-operative antibiotics are known to decrease incidence of SSI cases [30, 31, 32]. Certain risk factors like – age, gender, diabetes mellitus ,pre op anaemia, pre op hypoalbumineimia, smoking, perioperative blood transfusion, drain placement, surgery duration >2 hours, type of surgical wound, elective or emergency surgery.

1. Swabs were obtained from the post-operative infected wounds and processed by the conventional microbiological methods.

2. Antimicrobial susceptibility testing was done by Kirby-Bauer disc diffusion method and interpretation was done according to CLSI (Clinical and laboratory institute) guidelines.

3. CDC criteria were used to define the type of surgical wound i.e. Class I- Clean, Class II-Clean contaminated, Class III-

Contaminated, Class IV- Dirty[23].

4. The statistical significance of the relative importance of various parameters affecting SSI has been tested using Chi square test at 95% confidence level ($p < 0.05$).

STUDY DESIGN

This study is cohort type of Observational Prospective study.

Sampling Technique And Sample Size

In total, 108 random patients who underwent abdominal surgery during the study period were included in the study. Subjects were continued to receive antibiotics for >1week of post-operative period.

Data Collection Method And Tools

The data was collected in three phases .In 1st phase, data was collected in preoperative period. In 2nd phase, during the operation and in 3rd phase, from the day after surgery till post op day 30.

In the 1stphase information regarding, age, gender, BMI, diabetes mellitus, preoperative diagnosis, preoperative hypoalbumineimia, preoperative anaemia, type of surgery i; e. emergency or elective, was collected. In 2nd phase, information regarding intra op blood transfusion, wound class, duration of surgery, drain placement was collected. In 3rd phase, each patient was followed up for 30 days, during which wound was inspected at the time of 1st dressing and every 3 days thereafter.

Superficial surgical site infection was diagnosed if it was confined to skin and subcutaneous tissue with any one of the following criteria, as per CDC definition fulfilled: 1) purulent drainage, with or without laboratory confirmation, from the superficial incision; 2) organisms isolated from an aseptically obtained culture of fluid or tissue from the superficial incision; 3) at least one of the following signs or symptoms of infection: pain or tenderness, localized swelling, redness, or heat and superficial incisions deliberately opened by surgeon, unless incision is culture-negative; and 4) diagnosis of superficial incisional SSI by the surgeon or attending physician[14].

Statistical Analysis

Frequencies of the variables under study was derived to check completeness of data. Magnitude was expressed in percentages. The cumulative incidence rate of SSI was estimated. Relative risk (RR) was calculated for different risk factors to test the association of SSI with predictor variables. RR>1 with the 95% confidence interval was taken as significant. Chi-square test was used to calculate the P value. P value <0.05 was considered as significant.

ETHICAL CONSIDERATION

An approval from Institutional Ethical committee was obtained before conducting the present study. Patients and/or relatives who needed any medical assistance were further appropriately managed in the department of surgery.

RESULTS

In total, 108 patients who underwent abdominal surgery during the study duration at K R Hospital Mysore.

Superficial surgical site infection was detected in 52 out of 108 patients (48%) (Fig 8). The age of study subjects ranged from 18 years to 85 years. The mean age of study population was 50 ± 2 years. SSI was significantly higher in patients >50 years of age. Relation between SSI & risk factors is tabulated in Table 1

Risk Factors For SSI

Co-morbid Illness

About 22 study subjects had diabetes, and 11 had anaemia and 31 had pre op hypoalbuminemia. The SSI rate for these subjects was 68.2%, 63.6%, and 83.90%, respectively. Diabetes and pre op hypoalbuminemia were found to be significantly associated with development of superficial SSI, where as pre-operative anaemia was not significant for the same. {DM-RR=2.83&CI=1.05-7.66, ANAEMIA-RR=2.02& CI=0.556-7.35, HYPOALBUMINIMIA-RR=10.2 &CI=3.5-29.6}. (Fig 1,2 &4)

Body Mass Index

The study subjects were stratified according to BMI. Among the 108 subjects, 9 were underweight, 72 had normal BMI, 23 were pre-obese /overweight, and 4 were obese. The rate of superficial SSI among these BMI groups was 33.3%, 45.80%, 60.90%, and 50.00%.And the p value of the study for BMI was 0.482.Thus BMI was not found to be significantly associated with development of superficial SSI.

Operative Duration

The operative duration was >2 h in 64 study subjects. Out of which 62.55% study subjects had superficial SSI with p value of 0.001.And 44 study subjects had operative duration of < 2 hours, of which,27.3% subjects had superficial SSI. Hence duration of surgery has a significant impact on superficial SSI. {RR-4.44, CI=1.9-10.2}

Wound Class

Among the 108 study subjects, 25 had clean wound, 26 had clean contaminated wound, 23 had contaminated wound and 34 had dirty wound. The superficial SSI rates in these groups were 28.00%, 26.9% 78.3%, 58.80% respectively. The SSI rate in contaminated and dirty cases was significantly higher. Hence the type of the wound was significant for the development of superficial SSI with p value of 0.001 (RR & CI for class1-3.67,1.2-11.1,class 2-3.87,1.28-11.6,class 3-0.39,0.119-1.32 respectively).

Emergency Versus Elective Surgery

The superficial SSI rate in elective surgery cases was 22.8% and in emergency surgery cases was 54.65%.Incidence of SSI is more significant in emergency surgical wounds. (RR 1.74, CI 0.67–4.5)

DISCUSSION

In this study, most of the study subjects were in middle age group (30–60 years) and there was male preponderance. The SSI rate found in this study was 48%. This was higher than the other similar studies performed in India [15-17]. This higher rate of SSI could be due to the rural setup of this study, where the patients usually present late in the course of disease, have significant co-morbidities and lack of sanitation. This study has showed no association between SSI and BMI grading of underweight, pre obese, and obese .Prior studies have shown association between obesity and SSI.[28,29]Co-morbid illnesses, such as diabetes, and hypoalbuminemia have been shown to have high risk of developing SSI in the previous studies[18,19]and the same was confirmed in this study. This could be attributed to impaired wound healing in the affected subjects. But Anaemia was show to have minimal effect on SSI this may be because of less number of subjects with anaemia in the study and, the range of the heamoglobin levels to define the anaemia was on the higher side.

In agreement with other studies, this study found that length of surgery >2 h doubles the risk of developing SSI. The increasing length of surgery can lead higher risk of SSI due to desiccation of tissues, increased bacterial exposure and decreased level of prophylactic antibiotic in the tissues [20].In addition, use of drains has been reported to be associated with increased risk of SSI, which was confirmed by this study. Hence the general use of drains is discouraged [21].

Surgical wound classification has been the predictor of developing SSI [22]. Previous studies have shown higher risk

of SSI in contaminated and dirty wounds [26, 11]. Similar findings are echoed in this study. This is explained by the higher bacterial load in contaminated and dirty wounds as compared with clean and clean contaminated wounds [24]. Studies have shown emergency surgery to be associated with significantly higher SSIs [25] , the same results have been extracted from this study.

The SSI rate was higher in this study. Better preoperative optimization, stringent quality control measures and training of hospital staff is needed to reduce the incidence of SSI in this hospital. This study shows higher than normal SSI rate. It also identifies preoperative risk factors contributing to SSI. Early involvement of primary care physicians for optimization of known risk factors in patients planned for surgery can reduce the morbidity and cost of treatment. The strength of the study was that it was studied with robust methodology and medical comorbidities were included in the study.

SSI incurs heavy financial burden on patients and healthcare establishments. SSI surveillance system need to be more active and aggressive. Primary care physicians can contribute to the surveillance system and help in early detection and to know real burden of SSI. This would further strengthen the existing surveillance system, antibiotic policy, training, and quality control in low resource setting hospitals.

The limitation of the study was that it was a single department study for duration of 1 year with less number of cohort. It calculates cumulative incidence rather than actual incidence rate of SSI. Other known factors associated with SSI, such as preoperative shaving, antibiotic use, and hospital stay, age, gender, smoking history were not studied. Any inherent selection bias could not be completely ruled out.

CONCLUSION

Superficial SSIs are a major nosocomial infections based on this local institutional study. SSI incidence is higher than the other reported studies. Diabetes mellitus, pre-operative anaemia, pre- operative hypoalbuminemia, higher BMI, blood transfusions, use of drains, prolonged operative time, contaminated or dirty wound class, and emergency surgery were significantly associated with superficial SSI. Better preoperative optimization of comorbidities, quality healthcare, and robust surveillance is needed for SSI prevention and management.

Table 1: Relation Between SSI And Studied Risk Factors

				SSI
		No (56)	Yes (52)	Relative Risk (95% CI)
BMI Classified	Underweight	6	3	1.692 (0.39-7.29)
	Normal	39	33	Reference
	Overweight	9	14	0.544 (0.209-1.42)
	Obesity	2	2	0.846 (0.113-6.34)
DM	No	49	37	Reference
	Yes	7	15	2.83 (1.05-7.66)
ANEMIA	No	52	45	Reference
	Yes	4	7	2.02 (0.556-7.35)
HYPOALBUMINEMIA	No	51	26	Reference
	Yes	5	26	10.2 (3.5-29.6)
WOUND	1	18	7	3.67 (1.2-11.1)
	2	19	7	3.87 (1.28-11.6)
	3	5	18	0.397 (0.119-1.32)
	4	14	20	Reference
DURATION	≤ 2	32	12	Reference
	>2	24	40	4.44 (1.9-10.2)
SURGERY	Elective	17	5	Reference
	Emergency	39	47	2.404 (1.08-5.3)

Table 2: Descriptive Statistics

		Frequency	Percent
DM	No	86	79.6
	Yes	22	20.4
ANEMIA	No	97	89.8
	Yes	11	10.2
HYPOALBUMINEMIA	No	77	71.3
	Yes	31	28.7
DRAINS	No	14	13
	Yes	94	87
DURATION	≤2	44	40.7
	>2	64	59.3
WOUND	1	25	23.1
	2	26	24.1
	3	23	21.3
	4	34	31.5
SURGERY	Elective	22	20.8
	Emergency	86	79.7
SSI	No	56	51.9
	yes	52	48.1

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