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Original Research Article

Incidence and determinants of the surgical site infection: a hospital based longitudinal study

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ABSTRACT

Background: Surgical site infection (SSI) is one of the common nosocomial infections and associated with increased length of hospital stay, hospital cost, patient morbidity and mortality.
Methods: A prospective longitudinal study was conducted at a tertiary care centre of Ahmadabad city. Total 480 patients operated for general surgical procedures between the periods of January 2016 to June 2016 were included for the present study. Data were collected from the data sheet which included basic demographic detail of the patient, diagnostic criteria and associated risk factors. Data entry and analysis was done in software Epi info version 7.0. Chi square was used to identify association of the risk factor with outcome. P-value <0.05 was considered to be statistically significant.
Results: In present study, 9.4% of the patients had SSI. The risk factors associated with SSI were age (18.3% versus 7.1%), diabetes (25.5% versus 7.6%), type of anaesthesia (general = 13.6% versus regional=7.1%), type of surgery (emergency = 21.7% versus elective = 7.3%), duration of surgery (17.9% versus 7.2%), type of wound (dirty = 28.4% versus clean = 2.99%), pre-operative hospital stay (27.3% versus 3.3%) and presence of drain (15.2% versus 7.2%).
Conclusions: Our study emphasizes that age, type of surgery and wound, preoperative hospital stay, co-morbidity and drain have definite correlation with SSI. A standard infection surveillance protocol needs to be practiced stringently in an attempt to reduce the SSI rate.

Keywords: Infection rate, Risk factors, SSI

INTRODUCTION

Surgical Site Infection (SSI) is one of the common types of nosocomial infection found in indoor patients. SSIs are associated with increased length of hospital stay, hospital cost, patient morbidity and mortality. Thus, it not only has poor patient outcome, but also has adverse impact on economic burden.[1,2] Kirkland et al found in their study, that SSIs lead to prolongation of hospitalization by a median of 6.5 days, which in its turn leads to extra economic burden of $ 3089 to the hospital economy.[3]

SSIs can be attributed to several endogenous factors, i.e., age and weight of the patient, co-morbidity, immune status etc. and several exogenous factors, like, preoperative hospital stay, preoperative prophylactic measures, type of wound and surgery, sterilization of instruments etc.[4]

Despite of better knowledge of pathophysiology of the disease, standard preoperative, peroperative and

postoperative protocols, antibiotics and sterilization techniques, SSIs remain to be a major problem in hospital practice.[5] SSI rate varies from 1.5% to 20% in various hospitals.[6] To improve the patient outcome and to minimize the economic burden, it becomes necessary to decrease the rate of SSI. A standard wound surveillance system and prophylactic protocol may improve the scenario. Present study is aimed to know the rate of SSI in our hospital and the magnitude of impact of various risk factors attributable to SSI. This may help in preparing hospital protocol to reduce the SSI.

METHODS

A prospective longitudinal study was conducted at a tertiary care centre of Ahmadabad city. Total 480 patients operated for general surgical procedures between the periods of January 2016 to June 2016 were included for the present study. Data were collected from the data sheet which included basic demographic details of the patient, data of underlying disease status, nature of surgical procedure (elective or emergency), wound class and presence of drain etc. Wound infection was diagnosed if any one of the following criteria was fulfilled within thirty days of operation: serous or non-purulent discharge from the wound, pus discharge from the wound, serous or non-purulent discharge from the wound with signs of inflammation (oedema, redness, warmth, raised local temperature, fever > 38°C, tenderness, induration) and wound deliberately opened up by the surgeon due to localized collection (serous/purulent). Stitch abscesses were excluded from this study.[1,7] For the classification of the type of the wound CDC (centers for disease control and prevention) criteria were used. According to the CDC criteria type of the wound is class I- clean, class II- clean contaminated, class III- contaminated, class IV- dirty.[8] Weight and height were measured by using standardized technique by trained investigators as suggested by Jelliffe.[9] Weight was measured with standard digital weighing machine. Height was measured using calibrated fixed scales while the subject stood bare feet. Classification of nutritional status was done by using body mass index (BMI). BMI was derived by dividing one's weight in kilograms by the square of height in meters. Weight disorders were assessed on the basis of BMI.[10] Informed written consent was taken from the participants for the study. Data entry and analysis was done in software Epi info version 7.0. Chi square was used to identify association of the risk factor with outcome. P-value <0.05 was considered to be statistically significant.

RESULTS

In the present study, total 480 patients were enrolled after the operation. The demographic detail of these patients was described in Table 1. The mean age and standard deviation of the study population was 40.1±20.74 years and 60% were men. Among all the enrolled patients, almost 1/3 was pre obese and 12 % were obese. Almost 10 % had diabetes, habit of smoking and alcohol. Eighty five percent surgeries were elective in nature. When cases were grouped by wound classification, there were 48.7% clean, 21.1% clean contaminated, 13.3% contaminated and 16.9% dirty wounds. Pre-operative hospital stay of the participants was 3.1±2.01 days. In the present study overall infection rate was 9.4%.

Table 1: Characteristics of the participants.

Variable	No (%)
Age	
0-24	171 (35.6%)
25-49	143 (29.8%)
≥ 50	166(34.6%)
Sex	
Male	288 (60%)
Female	192 (40%)
BMI (kg/m^2)	
<18.5	42 (8.8%)
18.5-24.99	234 (48.8%)
25-29.99	144 (30%)
30-34.99	54 (11.2%)
≥ 35	6 (1.2%)
Diabetes	
Present	47 (9.7 %)
Absent	433 (90.3%)
Smoking	
Present	66 (13.7%)
Absent	414 (86.3%)
Alcohol	
Present	48 (10%)
Absent	432 (90%)
Type of the surgery	
Elective	411 (85.7%)
Emergency	69 (14.3%)
Type of anesthesia	
General anesthesia	282 (58.8%)
Spinal and other anesthesia	198 (41.2%)
Duration of the surgery	
< 1 hour	180 (37.5%)
1-2	222 (46.2%)
≥ 2 hours	78 (16.3%)
Type of the wound	
Clean	234 (48.7%)
Clean contaminated	101 (21.1%)
Contaminated	64 (13.3%)
Dirty	81 (16.9%)
Pre-operative bed stay	
< 5 days	360 (75%)
≥ 5 days	120 (25%)
Presence of drain	
Yes	132 (27.5%)
No	348 (72.5%)

Table 2: Association of the risk factor with SSI.

Variable	SSI present (45)	SSI absent (435)	P value
Age (years)			
0-24	09 (7.1%)	117 (92.9%)	0.03
25-49	13 (12.04%)	130 (87.96%)	
≥ 50	23 (18.3%)	143 (81.7%)	
Sex			
Male	26 (9.03%)	262 (90.97%)	0.87
Female	19 (9.9%)	173 (90.1%)	
BMI (kg/m^2)			
<18.5	5 (11.9%)	37 (88.1%)	0.42
18.5-24.99	17 (7.3%)	217 (92.7%)	
25-29.99	15 (10.4%)	129 (89.6%)	
≥30	8 (13.3%)	52 (86.7%)	
Diabetes			
Present	12 (25.5%)	35 (74.5%)	<0.0001
Absent	33 (7.6%)	400 (92.4%)	
Smoking			
Present	7 (10.6%)	59 (89.4%)	0.89
Absent	38 (9.2%)	376 (90.8%)	
Alcohol			
Present	5 (8.3%)	43 (91.7%)	1.00
Absent	40 (9.3%)	392 (90.7%)	
Type of anesthesia			
General anesthesia	38 (13.6%)	244 (86.4%)	0.0004
Regional anesthesia	07 (3.5%)	191 (92.5%)	
Type of the surgery			
Elective	30 (7.3%)	381 (92.7%)	0.0003
Emergency	15 (21.7%)	54 (78.3%)	
Duration of the surgery			
< 1 hour	13 (7.2%)	167 (92.8%)	0.02
1-2 hours	18 (8.1%)	204 (91.9%)	
≥ 2 hours	14 (17.9%)	64 (72.1%)	
Type of the wound			
Clean	7 (2.99%)	227(97.01%)	0.0000
Clean contaminatec	5 (4.95%)	96 (95.05%)	
Contaminate	10 (15.6%)	54 (84.6%)	
Dirty	23(28.4%)	58 (71.6%)	
Pre-operative bed stay			
< 5 days	12 (3.3%)	348 (96.7%)	0.0000
≥ 5 days	33 (27.3%)	87 (72.7%)	
Presence of drain			
Yes	20 (15.2%)	112 (84.8%)	0.01
No	25 (7.2%)	323 (92.8%)	

Table 2 shows, gender of the participants, habit of smoking and alcoholism, Body mass index (BMI) did not show any statistical association with SSI. As the age increased, there was an increase in rate of SSI as 18.3% of the participants whose age was more than 50 years had SSI as compared to 12% between the age 25-49 years and 7.1% in the participants younger than 25 years. This difference was found to be statistically significant. Diabetes was significantly more associated with SSI, as 25.5% diabetics had SSI but it was found only in 7.6% in non-diabetic group. We found a significantly higher rate of SSI in emergency operations compared to routine elective surgeries, (21.7% versus 7.3%; P <0.05). General anesthesia was more associated with SSI (13.6%) as compared to spinal anesthesia (3.6%) and the difference was found to be statistically significant. As the pre-operative hospital stay and duration of the surgery increased, there was significant increase in the rate of SSI in the participants. As per wound classification, infection rate was more with dirty wound (28.4%) than clean wound (2.99%) and this difference was found statistically significant. Present study showed significantly higher rate of wound infection in patients who had drain (15.2%) than those who did not have one (7.2%).

DISCUSSION

Present study was hospital based prospective longitudinal study conducted at tertiary care centre of Ahmadabad city with objective to identify the incidence rate and risk factors associated with SSI. In this study, out of 480 patients, 45 (9.4%) developed the SSI. This finding is comparable to the studies conducted in Pakistan (7.3%) and Nepal (7.3%).[11,12] But it was lower than 13.7% and 16 % which was documented by Satyanarayan V et al and Patel Sachin M et al in their study respectively.[7,13]

Present study showed correlation between the age and the rate of SSI. As the age increased the rate of SSI also increased. Similar finding was also documented by Kamat U et al in their study.[14] This might be due to compromised immune status and existing co-morbidities in old patients along with lower treatment compliance in them.[13,15]

Our study revealed that there was no association of the gender of the patients with SSI. This is in agreement with finding of the other studies.[11,13,14,16,17]

In the present study, relationship of the obesity and SSI was not observed. This is in concordance with finding of Razavi SM, but in contradiction to that reported by Waisbren E et al, where, obese patients had 5 times higher risk for SSI than non-obese patients (odds ratio = 5.3; 95% CI, 1.2 - 23.1; p = 0.03).[14,18]

SSI was observed in 25.5% of diabetic patients and only 7.6 % in non-diabetic patients. This difference was found to be statistically significant. A similar result was also documented in other studies.[11,13,17,19] Movic JM et al mentioned in their study that smoking had not any association with SSI.[17] We also found similar results in our study.

We observed that longer duration of surgery was significantly more associated with SSI than shorter

duration surgery. Similar finding was documented in various studies.[7,16,20] Type of the anesthesia also had significant association with the SSI as it was more observed with general anesthesia than regional anesthesia. This is in agreement with finding of Patel SM et al.[13]

This can be explained with the fact that surgeries performed under general anesthesia are usually major ones and tend to last longer as compared to that performed under regional anesthesia, which increases the chance of SSI as prolonged duration of operation results in increased exposure of operation site to air, prolonged trauma and sometimes blood loss.[21] Lilani SP and Tripathy BS, mentioned in their article, that, prolonged duration of surgery leads to the onset of fatigue of hospital staff , resulting in a decline of aseptic measures and an increase in pollution in the operation theatre which enhances the probability of SSI.[1,22] This study showed, surgical site infection rate increased from clean to dirty wound. Similar results were observed in other studies.[7,14,16]

We found a significantly higher rate of SSI in emergency operations as compared to routine elective surgeries (24.1% versus 12.7%; $P < 0.05$). Similar findings were mentioned in other studies, 25. 2 % versus 7.6 %, 11.9% versus 4.4 % and 7.9 versus 2.7%.[7,9,10] Many other authors have also drawn the same conclusion in their studies.[14,16,23,24] Higher rate of SSI in emergency surgery may be explained by the fact that such patients are inadequately prepared (control of diabetes), breech in sterilization protocol, pre-existing infection and reduced immunological status of patient.[25] Also, most of emergency operations involve contaminated areas such as the bowel and the perianal region and have dirtier wound.[13,19]

Our study documented that pre-operative bed stay was a contributory factor for SSI, as longer the pre-operative hospital stay, higher was the rate of SSI. Patel SM, Kamat US and Razavi SM also documented similar findings in their study.[13,14,16] Significantly higher rate of SSI was observed in patients with drain as compared to those without drain in our study. Shahane VD also observed similar finding.[20] In contradiction to this Maksimovic J did not observed same finding.[17]

CONCLUSION

In this study, total 45 (9.4%) patients suffered from SSI. The risk factors associated with SSI were age, diabetes, type of anesthesia, type and duration of surgery, type of wound, pre-operative hospital stay and presence of drain.

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