Study of Surgical Infection in a Tertiary Care Hospital

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ABSTRACT

Introduction: Surgical site infection is a common post-operative problem causing significant post-operative morbidity and mortality, prolonged indoor stay and adds between 10% and 20% to hospital cost. In India, rate of surgical site infections in various set-ups had been reported to be 4.2-21%. Current study aimed to record the incidence of surgical site infection in present set up in both elective and emergency cases and to assess the possible risk factors and analyze the measures to prevent surgical site infection.
Material and Methods: The present prospective study was conducted in the post graduate Department of General Surgery, Rohilkhand Medical College, Bareilly, from 1 November 2017 to 31 October 2018 to determine the incidence of surgical site infections and to assess the risk factors associated with the surgical site infections. Samples were processed for microbial flora and antibiotic sensitivity.
Results: Incidence of surgical site infections in present study was 13%. In elective surgeries it was 7.1% while in emergency surgeries it was 26.7%. Incidence was higher in patients with diabetes, smokers and obese patients. Highest incidence was present in dirty wounds. Incidence was lower in patients who have shorter pre operative hospital stay and underwent surgery for shorter duration. In most of the cases surgical site infections occured on post-operative day 7. Patients with SSI had longer mean duration of hospital stay as compared to those who did not have SSI. Staphylococcus aureus was the most common organism isolated followed by E. Coli.
Conclusion: We reported a significant association of SSI with type of procedure (open and emergency), diabetes, obesity, smoking, duration of preoperative hospital stays, ASA physical grade, duration of surgery, duration of drains and type of wound according to wound classification.

Keywords: Antibiotics, Incidence, Organisms, Risk Factors, Surgical Site Infection.

INTRODUCTION

Surgical site infection is a common post-operative problem causing significant post-operative morbidity and mortality, prolonged indoor stay and adds between 10% and 20% to hospital cost.[1] In India, rate of surgical site infections in various set-ups had been reported to be 4.2-21%.[2] CDC (Centers for Disease Control and Prevention) classified SSI into 3 categories-superficial incisional, deep incisional and organ/space specific.[3] Further surgical wounds are classified into 4 categories- clean, clean contaminated, contaminated and dirty.[4] Microbiological techniques like culture media for identification of organisms and disk diffusion method for antibiotic sensitivity rely on growing organisms for identification and take 48 to 72 hours, which allows time for infection to develop if empirical treatment is not employed immediately.[5] Inspite of the availability of newer antibiotics, emerging antimicrobial resistance has now become an increasing problem in the treatment of many surgical site infections throughout the world. Resistance flourishes whenever antibiotics are misused and dispensed for wrong duration and in altered dosage against the guidelines. Surveillance of SSI with assessment of possible risk factors leading to SSI has been shown to be an important component of strategies to reduce SSI risk.[6] The present study has been conducted to study the incidence of surgical site infection in present set up in both elective and emergency cases and to assess the possible risk factors and analyze the measures to prevent surgical site infection.

MATERIAL AND METHODS

The present prospective study was conducted in the post graduate Department of General Surgery, Rohilkhand Medical College, Bareilly, from 1 November 2017 to 31 October 2018 to determine the incidence of surgical site infections and to assess the risk factors associated with the surgical site infections. A Cohort of 100 patients those fulfilling the inclusion criteria and not falling under the domain of exclusion criteria were selected to participate in the study after obtaining a valid consent in their language. All patients received injectable third generation cephalosporin one hour before the incision. Patients were classified according to American Society of Anaesthesiologists Physical Status Classification System. The general principles of surgery were followed in entire cases such as minimum tissue handling and maintenance of adequate haemostasis. Drains were used whenever necessary. Skin closure with suture material or skin staples was done. Neosporin ointment was used for local application and wound was covered with adhesive dressing. Injectable Cephalosporins (3rd generation), Amikacin and Metronidazole were continued in the post-operative period for 5 days. Then the patient received oral antibiotics till stitch removal. For the patients with surgical site infection,

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the plan of antibiotic coverage changed according to culture and sensitivity report. The wound was inspected for any evidence of infection starting from 48 hours after surgery day till discharge and then followed up in OPD till 1 month of post-operative period. The patients were classified into clean, clean contaminated, contaminated and dirty, based on the degree of microbial contamination developed by the US National Research Council group. Wound swab was sent to the clinical microbiology laboratory for Gram stain and routine culture methods. No culture was obtained for anaerobes, viruses or fungi. Post-operative day of occurrence of SSI was documented and infection was managed with antibiotics according to culture and sensitivity with regular dressing and drainage of pus. In some cases, treatment involved opening the sutures, evacuating pus and cleansing the wound followed by secondary suturing after few days.

STATISTICAL ANALYSIS

Data for patient demographics, clinical information, underlying disease, surgical procedures, antimicrobials used, infecting pathogens and their antimicrobial susceptibility patterns and evidence of SSI was collected on a pre-designed proforma and was used for evaluation of result. The data were entered on a Microsoft Excel spreadsheet and imported into Statistical Package for Social Sciences (SPSS) version 22 for statistical analysis. The Chi square test was used to compare the variables. The p-value <0.05 was considered to be significant.

RESULTS

Out of total 100 cases (70 elective and 30 emergency) enlisted in the study, a total of 13 patients (13%) developed surgical site infection (table-1). 5 (7.1%) patients out of 70 posted for elective surgeries developed SSI, while 8 (26.7%) out of 30 posted for emergency surgeries developed SSI. Mean age with SSI was 46.7 ± 11.9 years which was little bit smaller than that of patients without SSI (47.1 ± 16.3 years). Majority constituted males (57%). Though Incidence of SSI in males (14.1%) was higher as compared to females (11.6%), yet this difference was statistically not significant. Out of 100 patients, 12 (7 elective and 5 emergency) were diabetics. Among elective cases 57.1% cases with diabetes developed SSI (p value=<0.001) while among emergency cases 80% cases with diabetes developed SSI (p value=<.003) (fig-1). Incidence of SSI was highest in obese patients (all of the 3 obese patients eventually had SSI) followed by overweight patients (38.9%). Statistically, this difference was found to be significant. Most patients (78%) were non-smokers. Incidence of SSI among smokers was 36.4% as compared to 6.4% among non-smokers (fig-2). This difference was found to be statistically significant. Most patients were classified into ASA class 1 (79%) and rest 21% into ASA class II. Incidence of SSI in ASA class I patients was 6.32% and that in ASA class II patients was 38%. This difference between the two groups was found to be significant (P=<0.001). Among elective procedures incidence of SSI was highest in open nephrolithotomy (50%) followed by open cystolithotomy (33.3%). Incidence of SSI in mesh hernioplasty for incisional hernia, open prostatectomy and open cholecystectomy was 25%, 14.3% and 5% respectively. Incidence of SSI was highest in emergency laparotomy for ruptured liver abscess and emergency laparotomy followed by right hemicolectomy with ileo transverse anastomosis for carcinoma colon though both of them were represented by

Variable	No. of cases no	Percentage %	Elective no	Percentage %	Emergency No	Percentage %
No surgical site infection	87	87	65	92.9	22	73.3
Surgical site infection	13	13	5	7.1	8	26.7

Table-1: Incidence of Surgical Site Infection

S. No	Pathogen	Total cases with SSI (n=13) N	Total cases with SSI (n=13) %	Elective cases with SSI (n=5) N	Elective cases with SSI (n=5) %	Emergency cases with SSI (n=8) N	Emergency cases with SSI (n=8) %	Sensitivity to most common antibiotics
1	E.coli	5	38.5	1	20	4	50	Meropenem
2	Staphylococcus aureus	6	46.2	2	40	4	50	Piperacillin/Tazobactam
3	Pseudomonas	1	7.7	1	20	0	0	Cefoperazone+Sulbactam
4	Klebsiella	1	7.7	1	20	0	0	Meropenem

Table-2: Distribution of SSI cases according to pathogen isolated

S.No	ASA Class	Total	Total case: Surgical Site Infection (n=13) N	%	Total case: No Surgical Site Infection (n=87) N	%	Elective case: Surgical Site Infection (n=5) N	%	Elective case: No Surgical Site Infection (n=65) N	%	Emergency case: Surgical Site Infection (n=8) N	%	Emergency case: No Surgical Site Infection (n=22) N	%
1	I	79	5	6.3	74	93.7	2	40.0	54	83.0	3	37.5	20	90.9
2	II	21	8	42.9	13	57.1	3	60.0	11	17.0	5	62.5	2	9.1
			‘χ^2’=14.80; p=<0.001*				‘χ^2’=5.38; p=0.020*				‘χ^2’=9.35; p=0.002*			

Table-3: Association between ASA class of Surgery and Surgical Site Infection

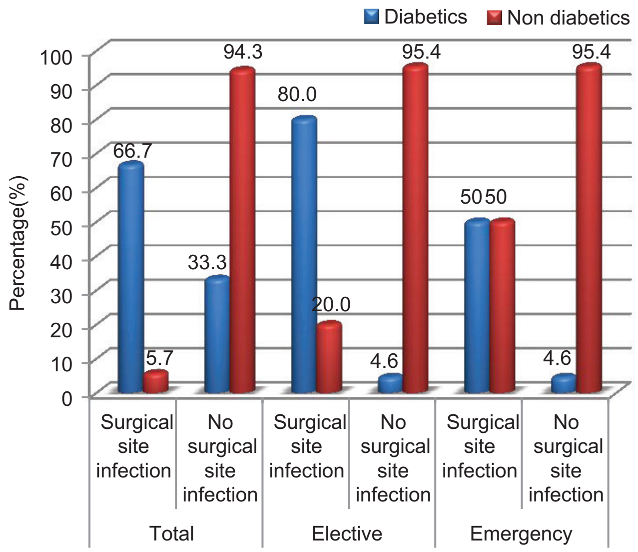

Figure-1: Association between diabetes and surgical site infection

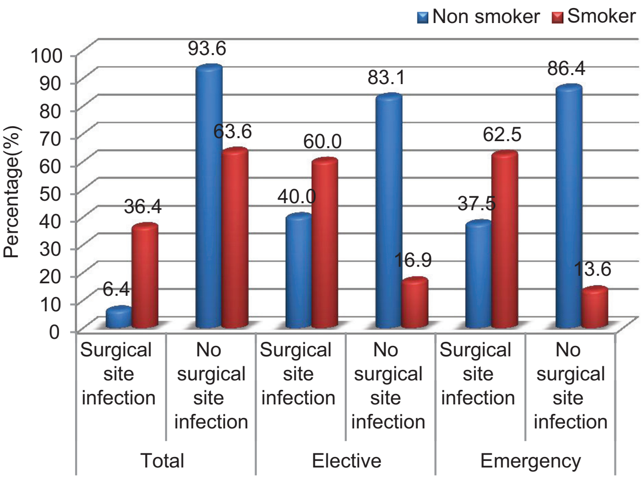

Figure-2: Association between smoking habit and surgical site infection

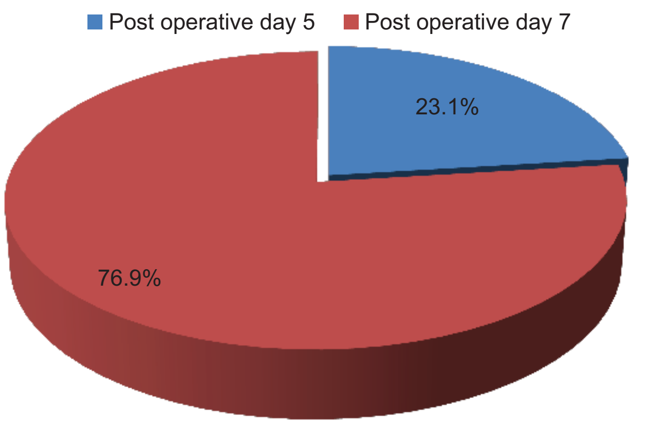

Figure-3: Association of SSI with post-operative day of occurrence

1 case only. Incidence of SSI in emergency laparotomy for intestinal obstruction or intestinal perforation followed by ileostomy was 50%. Exploratory laparotomy for intestinal perforation followed by primary repair had 20% SSI rate while incidence of SSI in emergency laparotomy followed by resection and anastomosis for intestinal obstruction was 16.7%. Highest incidence of SSI was found in dirty wounds (50%), while 40% of contaminated wounds had SSI. SSI rate in clean contaminated wounds was 27.8% while clean wounds had no SSI at all. Statistically this difference was also found to be significant. Patients with only 1-day preoperative stay at hospital has incidence of 12% of SSI in contrast to 17.6% incidence of SSI in patients with >=2 days preoperative stay in hospital (p=0.531). Incidence of SSI was 11.9% among those who underwent surgery within 12 hours of shaving whereas incidence of SSI in those who underwent shaving >=12 hours prior to surgery had incidence of 25% of SSI (p=0.292). The duration of surgery was 1-2 hours for rest 18 cases. Incidence of SSI was 6.1% among those with duration of surgery <1 hour and 44.4% among those with duration of surgery 1-2 hours. Upon evaluation, this difference was found to be statistically significant (p=<.001). Drains were placed in 70 cases. Out of these 70 patients, in 48 patients drains were kept for 1-4 days while in rest 22 patients they were kept for >4 days. SSI was present in 4% of cases in which drains were placed for 1-4 days in contrast to 50% cases in which drains were removed after 4 days (P<0.05). Staphylococcus aureus was the most common organism isolated (46.2%) followed by E. Coli (38.5%). Pseudomonas and Klebsiella accounted for 1 (7.7%) each. Staphylococcus aureus was highly sensitive to piperacillin/tazobactam, while E coli was found to be highly sensitive to meropenem. Pseudomonas was most susceptible to cefoperazone+sulbactam while klebsiella was most susceptible to meropenem (table-2). Patients with SSI had longer mean duration of hospital stay (9.86+-1.22 days) as compared to those who did not have SSI (6.56 ± 0.81). The association between SSI and post-operative hospital stay was found to be statistically significant.

DISCUSSION

Upon evaluation of the risk factors responsible for SSI, mean age of patients in group developing SSI (46.7+-11.9) was slightly smaller as compared to that in group of patients who did not develop SSI (47.1 ± 16.3). However, this association was not found to be significant ($\chi2=3.143$; p=0.755). This may be due to inadequate representation of different age groups. Kaye et al (2005)[7] reported that patients greater than 65 years are more likely to develop SSI. In present study, diabetes as a comorbidity was found to be a significant risk factor for development of SSI. Martin Emily T et al (2016)[8] also found diabetes as an independent risk factor for SSIs for multiple surgical procedure types and also confirmed an association between both pre- and post-operative hyperglycaemia and SSI. Ashar Ata et al (2010)[9] also concluded that post-operative hyperglycaemia may be the most important risk factor for SSI. In our study, high BMI and obesity was found to be an important risk factor for SSI with incidence being highest in obese patients. Winfield RD et al (2016)[10] also documented that obesity is associated with increased risk of SSI overall, specifically in clean and clean-contaminated abdominal procedures. In our study, smoking was reported to be significantly associated with a higher risk of SSI. Nolan MB et al (2017)[11] reported that current smoking is associated with the development of SSI, and smoking on the day of surgery is independently associated with the development of SSI (fig-3). Within ASA grade I and II, a significant association of SSI was found with ASA grade II (table-3). Khan M et al (2010)[12] also in their study concluded that higher grades of ASA have strong influence on rates of SSI in both clean and clean contaminated cases. In our study, laparoscopic procedures had no SSI at all. Laparoscopic procedures have been reported to have minimal to nil SSI rate. In various case series reported, the series reporting minimal SSI rate included laparoscopic procedures mostly (Tang et al, 4.3%).[13] Rate of SSI was higher in emergency surgeries (26.7%) undergoing exploratory laparotomy as compared to only 7.1% in elective surgeries. Sorenson LT et al (2005)[14] has also stated that wound dehiscence is more likely to occur when peritonitis with a large intraperitoneal load and bacteraemia is present preoperatively. In present study, rate of SSI was highest in dirty wounds followed by contaminated and clean contaminated wounds. Clean wounds had no SSI. Ortega G et al (2012)[15] also reported similar results in accordance with the present study. Our study has also reported significant association between SSI and longer duration of Pre-Operative stay in hospital in elective cases. Pedroso-Fernandez et al (2016)[16] also reported same association. In our study, significant association was found between the incidence of SSI and prolonged duration of surgery. Sahu et al. (2009)[17] also found a significant association between duration of surgery and SSI rate. In our study, significant association was found between SSI and duration of drains placed. According to Mujagic E et al (2019)[18], the duration of drainage, number and type of drains as well as their location were significantly associated with SSI. In our study, Staphylococcus aureus was the most common organism isolated (46.2%) followed by E. Coli (38.5%). Pseudomonas and Klebsiella accounted for 1 (7.7%) cases with SSI each. Maheshwari et al. (2013)[19] found Staphylococcus Aureus to be the most common isolate in accordance with present study. In our study, cases eventually developing SSI were shown to have a prolonged post-operative stay in hospital >=7 days and other post-operative complications including increase in morbidity and expenditure on treatment. Badia JM et al (2017)[20] also reported that SSI leads to financial burden and negative impact on patient's quality of life.

CONCLUSION

The present study has been conducted to study the incidence of surgical site infection in present set up in both elective and emergency cases and to assess the possible risk factors and analyze the measures to prevent surgical site infection. Surveillance of SSI with assessment of possible risk factors leading to SSI has been shown to be an important component of strategies to reduce SSI risk. It helps both individual hospitals and national health care planners in setting programme priorities, monitoring effects of different preventive actions and in setting goals for their infection control efforts. In present study, overall incidence of SSI was 13%. The incidence of SSI in elective surgery was 7.1% while in emergency surgery it was 26.7%. In different local environments, the identification of contributory risk factors is difficult and may be environment specific. We reported a significant association of SSI with type of procedure (open and emergency procedures), diabetes, obesity, smoking, duration of pre operative hospital stays, ASA physical grade, duration of surgery, duration of drains and type of wound according to wound classification.

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