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Surgical site infection in emergency and elective patients and it's major risk factor in resource limited tertiary care center: A multicentric study

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Abstract---Postoperative surgical site infection (SSI) is major threat for surgeons. In this study, we measure the incidence of SSI in emergency and elective surgical patients and evaluation of any significant relation to anemia, hypoalbuminemia, Diabetes mellites, alcohol and tobacco user. This study was a prospective comparative study of 200 patients, studied during a twelve-month duration who were admitted and operated in our departments. Data collected including demographic profile and presence of SSI up to 30 postoperative days. In this prospective study of 200 patients (100 patients in each emergency and elective surgical case) surgical site infection was present in 17% (n=34) of patients, out of 34 SSI patients 64.7% (22 Patients) were male and 35.3% (12 Patients) were female. SSI was present in 73.5% and 26.5% of emergency and elective surgical cases respectively. Emergency and elective surgical cases

were compared in SSI and non SSI cases and data showed a statistically significant difference ($\chi^2= 9.0716$, P value .00256). Patients having SSI were compared with non SSI for anemia, hypoalbuminemia and diabetes mellitus data showed statistically significant difference ($\chi^2=66.6$, P value < 0.00001 , $\chi^2=78.5$, P value < 0.00001 and $\chi^2 =61.7$, P value < 0.00001 respectively). In this study, SSI was common in males and significantly higher in comorbid conditions like anemia, hypoalbuminemia, and diabetes mellitus as compared to uneventful postoperative patients. Addictions (tobacco and alcohol user) were not found a significant risk factor for SSI.

Keywords---SSI, anemia, hypoalbuminemia, diabetes mellitus, surface surgery.

Introduction

Surgical site infection occurs in approximately 2% of hospitalized patients who undergo surgical procedures, this data may be underestimated due to incomplete postsurgical discharge data [1,2]. While Other data signify that SSI occurs in 3% to 20% of certain procedures, and its incidence may be higher in certain high-risk patients. SSI has significant morbidity, long term disabilities due to poor wound healing and overt tissue destruction. SSI causes significant morbidity and long term disabilities which increase the economic cost and burden on health care system. A study cited an € 814 to €6,626 increase in cost per patient in the UK while in the US, an estimated cost increases by \$1.8 billion a year [3,4]. It is contrary to some surgeon's belief and perception that SSI have the trivial infection and benign course. SSI is an infection that occurs inside operative field following a surgical procedure. The Centers for Disease Control and Prevention (CDC) in United State standardize its definition as the presence of inflammatory signs or pus discharge arising within 30 day of surgical incision that was primarily closed constituting a Surgical site infection. The CDC classifies the wound, focused primarily on the degree of contamination likely to be present during the operation in Class I procedures(clean) , Class II procedures (clean-contaminated), Class III (contaminated) and Class IV (dirty-infected) procedures [5,6,7]. The risk of SSI varies with the nature of the operative procedure and clinical characteristics of the patients going to surgical intervention.

SSI occurs due to the interplay of inoculation of bacteria, the virulence of bacteria, microenvironment of the surgical site and host defense. micro-organisms are introduced into the surgical wound at the time of the operative procedure. The majority of these microorganisms are endogenous flora that comes from the patient himself while occasionally the pathogenic micro-organisms are exogenous acquired from an exogenous source like- surgical equipment, implants or gloves, the air in the operating room or even medications administered during surgery [8].

Materials and Methods

This study was a prospective comparative study of 200 patients studied during a twelve-month duration (January 2021 to December 2021). Patients with age 10 year and above, who underwent elective and emergency surgeries in the Department of General Surgery, Midnapore Medical College and Hospital, west Bengal, India, Department of General Surgery and Department of Pediatric Surgery, Uttar Pradesh University of Medical Sciences Saifai, Etawah, Uttar Pradesh, India, giving necessary consent, within 1 month of post-operative period, were included in the study. Patients with surgical implants, patients on chemotherapy, immunosuppressant and steroid therapy, and patients having incomplete data or follow-up were excluded. Ethical clearance was taken from all the institutes before conducting the study. Patients were evaluated for the development of clinical signs and symptoms of surgical site infections. Investigations like complete blood count, total leucocyte count, differential leucocyte counts, liver function test, kidney function test, s. electrolyte, random blood sugar, and swab from wound site for culture sensitivity (C/S) performed in each case. Demographic data, type of surgery (emergency or elective), Presence of anemia, diabetes, hypertension, obesity, hypoproteinemia in patients, type of wound (clean, contaminated or dirty), type of SSI were noted in each case. Data was compiled on an excel sheet and compared by using chi-square test.

Results and Discussions

Of 200 post operative subjects (100 emergency cases and 100 were elective post operative cases) 17% (n=34) of patients developed SSI during 12-month study duration. Of these 34 SSI patients 64.7% (22 Patients) were male and 35.3% (12 Patients) were female. Of these SSI patients 73.5% (25 Patients) cases were emergency post operative cases while 26.5% (9 Patients) were elective post-surgical case. The emergency and elective postoperative patients who developed SSI, 73.33% (22 Patients) and 26.67% (8 Patients) were abdominal surgery respectively and 75% (3 Patients) and 25% (1 Patients) were surface surgery respectively. Overall Incidence of SSI observed was 17 cases/100 subject-year. Incidence of SSI in emergency and elective surgical procedures was 25case/100 subject-year and 9 case/100 subjects-year respectively. The relative risk of developing SSI were compared in emergency and elective post surgery patients and it was found 2.78. Relative risk of developing SSI in abdominal surgery were compared with surface surgery in emergency and elective postoperative patients and it was found 0.41 and 5.2 respectively. Statistically significant difference was seen in Emergency and elective post-surgery cases having SSI when compared with non SSI emergency and elective post-surgery cases. (X^2 value=9.0716, P value <0.0026). Abdominal surgery were compared with surface surgery in SSI and non SSI patient, data showed statistically significant difference. (X^2 value 11.97, P value<0.00054) (Table-1).

Table-1 SSI & non SSI patient's distribution by type of admission and type of surgery

	Type of Surgery	Abdominal surgery	Surface surgery
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SSI 34(4.17%)	Emergency 25(73.5%)	22(73.33%)	3(75%)
	Elective 9(26.5%)	8(26.67%)	1(25%)
Non SSI 166 (66.83%)	Emergency 75(45.18%,)	42(44.68%)	33(45.83%)
	Elective 91(54.82%)	52(55.32%)	39(54.17%)
N=200	X ² = 9.0716, P value = .002596		X ² = 11.97, P value = .000541

In our study in SSI patients anemia was present in 55.9% patients (19 patients), hypoalbuminemia was present in 52.9% patients (18 patients) and Diabetes Mellitus was present in 44.2% of patients (15 patients). There was statistically significant difference found between SSI and non SSI post-operative patients who had anemia(X²= 66.6, P value<0.0001), hypoalbuminemia (X²=78.52, P value<0.0001)and diabetes mellites (X²=61.68, P value<0.0001) (Table 2).

Table:2 SSI major hematological risk factor

	Type of admission	Anemia	No Anemia	Hypoalbuminemia	No hypoalbuminemia	Diabetes mellitus	No Diabetes mellitus
SSI (n=34)	Emergency Surgery (25)	19(100%)	6(40%)	17(94.4%)	8(50%)	12(80%)	13(68.4%)
	Elective Surgery (9)	0	9(60%)	1(5.6%)	8(50%)	3(20%)	6(31.6%)
NON SSI (n=166)	Emergency Surgery (75)	5	70	2(2/3=)	73(73/163=)	2(2/3=)	73(73/163=)
	Elective Surgery (91)	2	89	1(1/3=)	90(90/163=)	1(1/3=)	90(90/163=)
		X ² = 66.6033, P value < 0.0001		X ² = 78.5169, P value < 0.0001		X ² = 61.6833. P value < 0.0001	

In our study, alcohol addiction was observed in 44.11% (15 Patients) patients, tobacco users were 35.29% (12 Patients) patients and no addiction was observed in 20.59% (7 Patients) patients. SSI in emergency and elective surgery for alcoholic (X²=2.380, P Value=0.123) and tobacco (X²=0.9158, P Value=0.338) addicts were compared with non-addiction patients, data were not significant Table-3

Table:3 Addiction habit in in SSI patients

Type of admission	Alcoholic user	Tobacco user (chewer/Smoker)	No addiction
Emergency (25 Patients)	13(86.7%)	10(83.3%)	2(28.6%)
Elective Surgery (9 Patients)	2(13.3%)	2(16.7%)	5(71.4%)

In SSI pts, pain were present 47.05% (16 Patients) and tenderness were present 50% (17 Patients) at surgical site. fever were present 23.52% (8 Patients), tachycardia were present 32.35% (11 Patients), discharge were present in all patients (100%), wound gap were present 73.53% (25Patients) and wound dehiscence were present 32.35% (11 Patients) (Table-4).

Table:4 Symptomatology in SSI

Patient(n=34)	Pain	tenderne ss	Fever	Tachycard ia	Dischar ge	Wound Gap	Wound Dehiscen ce
Elective Surgery (9)	3(18.7%)	2(11.8%)	1(12.5 %)	2(18.2%)	9(26.5%)	5(20%)	2(18.2%)
Emergency surgery (25)	13(81.3 %)	15(88.2%)	7(87.5 %)	9(81.8%)	25(73.5 %)	20(80 %)	9(81.8%)

In our study, purulent discharge from the wound was present in 47.06% of patients (16 Patients), serous discharge seen in 38.24% of patients (13 Patients), bilious discharge in 8.82% (3 Patients), bloody and fecalith mixed discharge was seen in 2.94% patients (1 Patients) each. Out of these SSI patients on the culture of discharge from a wound no organism was detected in 52.94% of (18 Patients) patients, Staphylococcus was cultured from 23.53% of patients (8 Patients), gram negative E.coli in 20.59% of patients (7 Patients) and Streptococcus was cultured in 2.94% of patients (1 Patients). In our study suture material used was polypropylene in 47.06% of (16 Patients) patients, poly-galectin acid in 20.59% (7 Patients) and polydioxanone in 17.65% of (6 Patients) patients, who developed SSI. Secondary suturing was performed in 61.77% of (21 Patients) patients and wound debridement was used in 20.59% of patients (7 Patients).

SSI is devastating condition despite advancements of infection control, new and modern sterilization technique, the evolution of effective antibiotics and safe surgical technique [9]. Minimal invasive technique has decreased risk of superficial and deep SSI but space/organ specific SSI remain unchanged [10]. In our study of 200 patients overall SSI was 17% which is similar to study in Uganda SSI in emergency patients were 16.4% [11]. In the study of S.Giri et al., B.Mawalla et al. and Mundhada AS et al. overall SSI rate in Nepal, Tanzania and India was 23% , 26% and 32% respectively which was higher than that found in our study[12,13,14]. In the study of Y. Fan, Z. Wei, W. Wang et al. , S.J.Jeong et al. and D. Ac'in-Gandara et al. of the overall SSI rate in mainland China which is at 4.5% , in the Seoul, South Korea were 3.3% and in the US at 2-3% respectively. [15,16,17]. The low infection rate in developed countries as compared to developing countries may be due to good working conditions and good patient's health condition. Prolong Surgery time, loos of blood, use of drain exposed body tissue to outer environment causing bacterial contamination and patients general resistance are causes for SSI [14]. In our study , of 34 SSI cases, male were 64.7% (22 Patients), females were 35.3% (12 Patients) and male to female ratio was 1.8:1. In the study of Tan LT, Shiang F in 248 patients, they found no significant difference of incidence found in gender, Similar finding was

also found in Mundhada AS, Tenpe S. study [8,14]. No general consensus or mixed consensus persists regarding incidence of SSI and sex [18,19,20]

In this study 73.5% of cases (25 Patients) were emergency and 26.5% of cases (9 Patients) were elective, who developed SSI. Our study showed high rate of SSI as compared to Tan LT, Shiang F study 19.4% elective cases and 15.4 % emergency cases developed SSI. In study of Lubega A, Joel B study, SSI in emergency cases was 16.4% [8,11]. In this study surface SSI was observed in 11.8% cases (4 Patients) while deep seated SSI was 88.2% (30 Patients) which was higher than Lubega A, Joel B study in which superficial SSI was 5.9% whereas deep and organ specific SSI accounted for 47.1% cases each [11]. In our study, statically significant association ($X^2= 66.6$, P value<0.0001) was found between anemia and SSI which was similar to Lubega A, Joel Bin study in Uganda . In our study, statically significant association was seen between hypoalbuminemia and development of SSI ($X^2=78.52$ P value <0.0001) which is similar to Alkaaki A, Al-Radi OO et.al study (P<0.001) in Saudi Arabia and Lubega A, Joel Bin study in Uganda [1,11]. In this study, diabetes mellites was found having statically significant association ($X^2=61.68$ P value <0.0001) for development of SSI which is similar to Alkaaki A, Al-Radi OO et.al study conducted (P<0.024) in Saudi Arabia [1]. In this study alcoholic and tobacco (chewer or smoke) addiction were not significant which was similar to Lubega A, Joel Bin study (smoking p value 0.438 and alcohol 0.805) while in Alkaaki A, Al-Radi OO et.al study (P value=0.004) significant association was found between alcohol and tobacco addiction and SSI [11,1]. In this study, in 52.9% of cases no organism detected in culture from wound discharge while staphylococci, E.coli and streptococci were detected in 23.5% (8 Patients), 20.6% (7Patients) and 2.9%(1 Patients)cases of SSI respectively. In the study by Mundhada AS, Tenpe S , Staphaylocoocus , E. coli, Pseudomonas and K. pneumonias were detected in culture of wound discharge in 29% , 21% , 19% and 15% cases of SSI respectively[14].In Lubega A, Joel B study Klebsiella pneumoniae, Staphylococcus aureus, E. coli and Pseudomonas was detected in 50% , 27.8% , 11.1% patients in wound discharge culture [11]. In our study of SSI patients, used suture material were nonabsorbable polypropylene in 47.06% (16 Patients) as compared to absorbable poly-galectin in 20.59% cases(7Patients) and polydioxanone in 17.65% cases(6 Patients). In the study of S.Giri,B. P. Kandel,S.Pant, the risk of SSI was high with absorbable suture as compared to nonabsorbable suture material[12].

Conclusion

In our study 17% (n=34) of patients developed SSI which was more common in male. SSI were common in emergency surgical patient and patients who went for abdominal surgery as compared to elective surgical procedures.. Premorbid condition like anemia, hypoalbuminemia, diabetes mellites were significant risk factor. Addiction (alcohol and tobacco user) was not established as significant risk factor.

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