Original Article

Surgical Site Infection

Surgical Site Infection-A Six Months Prospective Study in General Surgery Unit

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ABSTRACT

Objective: To find out the incidence of SSI in Allama Iqbal Memorial Teaching Hospital, Sialkot and identify the risk factors to avoid or minimize the effects of risk factors on development of SSI so as to lessen the burden and improve healthcare.

Study Design: Prospective cohort study

Place and Duration of Study: This study was conducted at the Busiest Unit of General Surgery, Allama Iqbal Memorial Teaching Hospital, Sialkot from December 2017 to April 2018.

Materials and Methods: Total 861 cases who had surgery were studied. All patients were followed pre-operatively, operatively and post operatively, from the date of discharge to thirty days post operatively to see the outcomes of the surgery.

Results: Total 861 cases were studied pre-operatively, operatively and post operatively and 63 cases were found to developed surgical site infection. The most important factors indentified like age, gender, residence, ASA score, wound classification, type and duration of surgery and their association with SSI was found out. Significant relation was found for age, residence, presence of risk factors, ASA score, previous surgery, wound classification, duration of surgery, type of surgery, and use of pre-op antibiotics whereas insignificant relation was found for gender and length of pre-op stay in hospital. Most infective organisms which were isolated include E.coli, Staph. aureus and P. aureginosa.

Conclusion: SSI is a recognized problem both for the surgeons and the patients. Identification of risk factors and their eradication to minimum level after adopting strategies in order to decrease physical, economical and treatment burden to ensure better healthcare.

Key Words: Surgical site infection, Preoperative, Risk factors, Contamination, Nosocomial infection

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INTRODUCTION

Nosocomial infection like surgical site infection (SSI) occurs in surgical operations or later[1] which is accounting for the 10-40% of all nosocomial infections[2,3]. Globally SSI rates have been found to be from 2.5% to 41.9%[2,4], even in western countries clean surgery cases and intra abdominal surgery cases developed SSI ranging from 2 to 5% to 20% respectively[5] but it also varies from case to case and even more high in certain high risk patients. Various countries has various incidence rate like Africa (2.5 to 30.9%)[6], Ethiopia (10.9 to 75%)[7]. But SSI remains a substantial cause of morbidity, prolonged hospital stay and increased rate of mortality.

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SSI is not only endangering the patient's health and life but also put a lot of burden on patient's family and society.

Despite all measures globally in developing and developed countries pre-op preparation and antibiotic prophylaxis life saving operations still are associated with high incidence of infection rates and mortality even as appendectomies[4]. Still there are few countries where none of the study has been occurred like Hawassa Referral Hospital of Ethiopia and Uganda, and even in developing countries like Pakistan data is not available to predict the exact percentage of incidence of SSI. The risk of SSI development is affected by various factors like wound classification (clean, clean contaminated, contaminated and dirty), degree of wound contamination, pre-operative preparation of procedures like shaving, and co-morbidity factors like diabetes and obesity[8]. Microbically majority of the organisms which were separated in many studies were staphylococcus auerus, E.Coli, Klebsiella, Pseudomonas and enterobacter spp[9].

MATERIALS AND METHODS

The study was conducted in a surgical unit at Allama Iqbal Memorial Teaching Hospital, Sialkot from December 2017 to April 2018**.** Total 861 cases who had

surgery were studied. All patients were followed pre-operatively, operatively and post operatively, from the date of discharge to thirty days post operatively to see the outcomes of the surgery.

The patients included in the study fulfilled the inclusion criteria. Written consent for participation in the study was obtained, and complete history and physical examination was done. Data was collected regarding socio-demographics, past medical history, previous treatment record, pre-operative preparation, co-morbidity, operative procedures, classification of operation, duration of surgery and post operative care.

Exclusion Criteria: Incomplete data, other specialties units, privately operated cases and those cases that left against medical advice.

Laboratory procedures: Those patients who developed SSI, exudates from the wounds were collected using sterile swabs and shifted to lab within 15 minutes of collection.

Statistical analysis: Descriptive statistics (count and %), bivariate analysis (risk factors for SSI), Multivariate regression methods, Odds ratio (OR) 95% CI, was analyzed in SPSS version 20. P-value of 0.005 was accepted as statistically significant.

RESULTS

Demographics: Details of 861 patients were obtained who underwent surgeries like cholecystectomy, appendecetomy, haemorridectomy, hernioplasty, parotidectomy and mastectomy.

The mean age of the patient was 37.5 years. In our study 399 (46.3%) were male and 462 (60.7%) were female, 762 (88.5%) cases were belonging to rural and 99 (11.4%) from urban areas. Age group which was commonly involved was below 20-40 years (23%) then more than 60 years (10%) and 1-20 years (12%) in descending order.

Table No. 1: Bivariate logistic regression analysis for factors associated with SSI (N=861)

Sr. No.	Variables	SSI		Crude OR	95% CI	P-value
		Yes N (%) 63(7.3%)	No N (%) 798(92.6%)			
1	Age in years					
	1-20	12(19.0%)	120(15.0%)	1.978	0.907-4.313	
	20-40	23(36.5%)	452(56.6%)	3.887	2.016-7.496	0.001
	40-60	10(15.8%)	135(16.9%)	2.670	1.179-6.048	
2	Gender					
	Male	30(7.5%)	369(92.4%)	0.946	0.566-1.581	0.833
	Female	33(7.14%)	429(92.8%)			
3	Residence					0.006
	Rural	40(63.4%)	628(78.6%)	2.124	1.238-3.646	
	Urban	23(36.5%)	170(21.3%)			
4	ASA Score					
	<1	89(12.6%)	192(24.0%)	2.178	1.020-4.654	0.044
	>1	55(87.3%)	606(75.9%)			
5	Pre-op stay					
	<7days	25(39.6%)	320(40.1%)	0.953	0.566-1.604	0.855
	>7days	38(60.3%)	478(59.8%)			
6	Risk factors					
	Yes	12(19.0%)	272(34.0%)	2.198	1.152-4.192	0.017
	No	51(80.9%)	526(65.9%)			
7	Prev surgery					
	Yes	10(15.8%)	63(7.8%)	0.454	0.220-0.936	0.032
	No	53(84.1%)	735(92.1%)			
8	Duration of surgery					
	15min	7(11.1%)	330(41.3%)	0.543	0.000-1	
	½ hour	8(12.6%)	251(31.4%)	0.777	0.000-1	0.000
	1hour	10(15.8%)	150(18.7%)	0.264	0.000-1	
	2hour	12(19.0%)	67(8.3%)	0.982	0.000-1	
9	Wound class					
	Clean	12(19.0%)	598(%)	38.206	17.367-84.050	0.000
	Clean contaminated	10(15.8%)	120(%)	9.200	3.958-21.382	
	Contaminated	18(28.5%)	50(%)	2.130	0.991-4.577	
10	Pre-op Antibiotic					
	>1hr	59(93.6%)	580(72.6%)	0.133	0.41-0.429	0.001
	<1hr	4(6.3%)	218(27.3%)			
11	Type of Surgery					
	Elective	20(31.7%)	598(74.9%)	6.428	3.694-11.188	0.000
	Emergency	43(68.2%)	200(25.0%)			

Table No. 2: Multivariate logistic analysis of predictors for SSI (N=861)

Sr. No.	Variables	SSI		Crude OR (95% CI)	Adjusted OR (95% CI)	P-value
		Yes N (%) 63(7.3%)	No N (%) 798(92.6%)			
1	Age in years					
	1-20	12(19.0%)	120(15.0%)	1.978(0.907-4.313)	0.506(0.232-1.102)	0.086
	20-40	23(36.5%)	452(56.6%)	3.887(2.016-7.496)	0.257(0.133-0.496)	0.000
	40-60	10(15.8%)	135(16.9%)	2.670(1.179-6.048)	0.374(.165-0.848)	0.019
2	Residence					
	Rural	40(63.4%)	628(78.6%)	2.124(1.238-3.646)	0.471(0.274-0.808)	0.006
	Urban	23(36.5%)	170(21.3%)			
3	ASA Score					
	<1	8(12.6%)	192(24.0%)	2.178(1.020-4.654)	0.459(0.215-0.981)	0.044
	>1	55(87.3%)	606(75.9%)			
4	Risk factors					
	Yes	12(19.0%)	272(34.0%)	2.198(1.152-4.192)	0.455(0.239-0.868)	0.017
	No	51(80.9%)	526(65.9%)			
5	Prev surgery				2.201(1.068-4.536)	0.032
	Yes	10(15.8%)	63(7.8%)	0.454(0.220-0.936)		
	No	53(84.1%)	735(92.1%)			
6	Dura. of surgery					
	15min	7(11.1%)	330(41.3%)	0.543(0.000-1)	0.3848(1.461E-011-1.013E-010)	0.000
	½ hour	8(12.6%)	251(31.4%)	0.777(0.000-1)	0.5782(2.271E-011-1.472E-010)	0.000
	1hour	10(15.8%)	150(18.7%)	0.264(0.000-1)	0.1209(4.980E-011-2.937E-010)	0.000
	2hour	12(19.0%)	67(8.3%)	0.982(0.000-1)	0.3249(3.249E-010-3.249E-010)	0.000
7	Wound class			38.206(17.367-		
	Clean	12(19.0%)	598(74%)	84.050)	0.026(0.012-0.058)	0.000
	Clean	10(15.8%)	120(15%)	9.200(3.958-	0.109(0.047-0.253)	0.000
	contaminated	18(28.5%)	50(6.2%)	21.382)	0.470 (0.218-1.009)	0.053
	Contaminated			2.130(0.991-4.577)		
8	Pre-op					0.001
	Antibiotic	59(93.6%)	580(72.6%)	0.133(0.41-0.429)	7.517(2.333-24.219)	
	>1hr	4(6.3%)	218(27.3%)			
	<1hr					
9	Type of Surgery					
	Elective	20(31.7%)	598(74.9%)	6.428(3.694-	0.156(0.089-0.271)	0.000
	Emergency	43(68.2%)	200(25.0%)	11.188)		

The incidence of SSI found in our cases was 63 out of 861 hence giving rise 7.31%, 45 cases of SSI were diagnosed during hospitalization while 15 got infection after discharge from the hospital. Cases of SSI ranged from superficial to deep seated infections. The strains which were isolated from the infection sites include E.coli (60%) > Staph. aureus (22%) > P. aureginosa (5%) and others (15%) in order of priority.

Analysis for finding association between various risk factors and SSI development was performed which showed significant and non significant association as shown in Table 1 & 2.

DISCUSSION

One of the most significant complications of surgical patients is development of surgical site infection. One of the leading causes of morbidity and mortality in various regions of China is still SSI where incidence varies from 13.0% to 18.0% and they are considered as 25.0% of nosocomial infections[10] which is much higher incidence as compared to many other countries[11]. The incidence of SSI in our study setting was 7.3%. Age Group: In few studies, it was found to be very high i.e. >65 years as compared to <65 years[12][13]. while in our study rate of SSI was found to be very high in between 20-29 years.

This association is statistically significant as compared to other age groups.

Preponderance: There was a marginal preponderance of male patients for developing SSI as compared to female patients[14] but in our study there was marginal preponderance of female 33(52.3%) as compared to male 30 (47.6%) cases which were consistent with the study performed in Aligarh[15]

Demographic distribution of residence of the patients as the risk factor showed 40/628 who developed SSI

belongs to rural area. On detailed bivariate regression and multi variate analysis showed significant relation.

American society of Anesthesiology (ASA) score evaluation is also a good predictor of SSI. Incidences had been found higher in ASA III, V as compared to ASA II, I which matched with other studies [16].

Preoperative stay for more than 7 days leading to contamination and colonization of infective pathogens and increase the risk of SSI[1] in our study 25 patients (39.6%) developed SSI whose stay was up to seven days and 38 patients (60.3%) stay was more than seven days. Pre-op stay more than seven days increase the risk of developing SSI by 22.44 times as compared to less than seven days which was in line with other studies[17] but on detailed analysis bivariate regression did not show any significant relation with SSI. Each day of extra hospitalization add

10 times more risk of acquiring SSI and has been confirmed by studies in Aurangabad, Mumbai, Hyderabad and Orrisa[18]

Risk factors: SSI are related more to risk factors like diabetes, cancer, operation duration, use of drain, catherization which are responsible for the trigging of SSI [19]. In our study all risk factors as mentioned above were considered. 12 (19%) patients with risk factors for developing SSI while 51 (80.9%) did not develop any SSI.

Duration of Surgery: Operation time more than two hours has been positively associated with SSI due to increase exposure of wound to operation theater environment[20][10][4]– which was also quite consistent with our study showing a stepwise rate of nosocomial infection associated with SSI..

Wound classification: Another important predictor of SSI showed that incidence of SSI was found to be more in contaminated wounds as compared to clean and clean contaminated wounds. Rate of developing infection was highest in contaminated wounds 18 (28.5%) followed by clean contaminated wounds 10 (15.8%) and least with clean wounds 12 (19.0%). Similar was noted in Aurangabad, clean contaminated 10.6% and clean 4%[18][21].

Microorganisms which were isolated many strains of bacteria from the exudates (E. coli, Stap. aureus, P. aureginosa) from infected surgical sites. In another study Staph aureus was commonest microorganism, more than third were MRSA[22][23].

Pre-op antibiotics have been known to reduce the incidence of developing SSI[18]. Time of pre- op antibiotics, first dose of antibiotics before one hour of skin incision was found to be an independent predictor for development of SSI. It was in accordance with first dose of antibiotic given before one hour of skin incision has increased SSI by 14 times as compared to first dose after one hour of skin incision which was consistent with another study where it was 11 times as compared to our study[24], before one hour tissue concentration was not adequate but still it was independent predictor for development of SSI. When this was analyzed as association with SSI, it showed significant association[25].

Emergency vs. elective: Incidences were high in the emergency cases as compared to elective cases (20/43) [26], the results were consistent with our study where elective 20 (31.7%) and emergency cases 43 (68.2%) developed SSI

CONCLUSION

Surgical site infections are still a recognized dilemma for the surgeons and the patients. Pre- existing disease, wound classification, wound contamination are still considered to be important risk factors for SSI, which can never be completely eradicated. These may be managed properly once appeared to reduce the physical, economical and treatment burden thus adopting strategic measures to ensure healthcare in community.

Author's Contribution:

Concept & Design of Study:	Sajid Hussain
Drafting:	Sajid Hussain
Data Analysis:	Anila Farooq, Rabbia Shabbir
Revisiting Critically:	Sajid Hussain
Final Approval of version:	Sajid Hussain

Conflict of Interest: The study has no conflict of interest to declare by any author.

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