Original Article

Evaluation of Surgical Site Infections and Patterns of Microorganisms involved in Emergency Laparotomy in TUTH

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Abstract: Emergency laparotomy is a commonly performed operative procedure in emergency setting. Various factors like preoperative Haemoglobin, low BMI, Diabetes and duration of surgery increases incidence of Surgical Site Infection postoperatively. Surgical Site Infection can increase operative morbidity and length of hospital stay. This study was conducted to determine the rate of surgical site infection in emergency laparotomy and the microorganisms involved, their drug sensitivity and their association with preoperative and intraoperative conditions. The study is a prospective observational study which was conducted at the Department of General Surgery, Tribhuvan University Teaching Hospital, in N=179 patients (120 male patients and 59 female patients) undergoing emergency laparotomy from July 2022 to June 2023. Patients undergoing emergency laparotomy were enrolled and observed intraoperatively and during the postoperative period. Hemoglobin level < 11gm/dl and BMI < 18.5 was considered as low Hamoglobin and Underweight respectively. Duration of surgery and type of wound were noted intraoperatively. In postoperative period wound, SSI was noted and culture/sensitivity of wound/swab was observed. SSI and the microorganisms involved in SSI, drug sensitivity and its association with preoperative conditions like BMI, Haemoglobin, Diabetes and the duration of surgery were studied. Statistical analysis was performed with SPSS version 26, SSI was clinically diagnosed in 29 patients among 179 patients who underwent emergency laparotomy giving an incidence rate of 16.2%. Among SSI cases 21 (72.4%) were superficial SSI, while 7 (24.1%) were deep SSI and 1(3.4%) was Organ Space SSI. Identifiable Risk factors were contaminated and dirty wound, BMI <18.5, diabetes mellitus, anemia, and duration of surgery > 2 hrs. The mean age of the patients was 42.08 ±19 years. SSI was present in 6.5% of clean contaminated, 25% of contaminated and 23.2 % of dirty wounds. Patients with Anaemia, diabeties, underweight or exposed to increased duration of surgery are at risk of SSI. E.coli is the most common organism isolated at our center and sensitive to Levofloxacin in most cases.

Keywords: SSI, Duration of Surgery, Diabetes, Emergency Laparotomy

1. INTRODUCTION

An emergency laparotomy is a major operation that involves opening the abdomen. It is commonly performed for infections due to perforated or inflamed bowel, obstruction or internal bleeding. There are several other conditions that can also require emergency laparotomy, such as perforations or infections in the gall bladder or appendix, and abdominal injuries due to trauma [1]. Infections caused by an invasive surgical procedure that occurs in the wound are commonly referred to as surgical site

infections (SSIs). SSI is clinically characterized as an infection that occurs within 30 days of surgery (or within a year if an implant is left in place after the procedure) and affects either the incision or deep tissue at the site of the surgery [2]. Surgical site infection are classified into superficial, deep and organ space according to Centre for control of disease [3], Superficial SSI involves skin and subcutaneous tissue only with either erythema, pain, local edema or pus discharge. Deep SSI involve deep soft tissues (fascia and muscle) with purulent discharge not extending into the organ space, symptoms of fever ,pain and tenderness leading to wound dehiscence or opening by a surgeon. Organ space infection involves any part of the operation opened or manipulated with purulent drainage. SSIs are the most common infections associated with health care settings. Many factors influence surgical wound healing and determine the potential for infection. These include patient-related (endogenous) and process/procedural-related (exogenous) variables that affect a patient's risk of developing an SSI. Some variables are obviously not modifiable, such as age and gender. However, other potential factors can be improved to increase the likelihood of a positive surgical outcome, such as nutritional status, tobacco use, correct use of antibiotics and the intraoperative technique [4]. Incidence of SSI also seems to be associated with BMI of the patient [5], preoperative Hameoglobin [6],Diabetes mellitus [7,8] , duration of surgery[9] and increasing age of the patient [10]. When a viscus, such as the large bowel, is opened, tissues are likely to be contaminated by numerous organisms. For example, *Enterobacteriaceae* and anaerobes can cause SSI after colorectal surgery. Most common organism associated with SSI in laparotomies are Escherechia coli, Klebsiella pneumonia in different studies[11,12].Contamination of wound site and pathogenicity of microorganisms, balanced against the host's immune response will determine the occurrence of SSI .The organism which causes SSI—are usually derived from the endogenous environment, that is the patient skin or opened viscus. Surgical instrument or theatre environment will contaminate the site during operation leads to exogenous causes of SSI. Hematogenous spread of organisms from distant sources of infection can rarely cause SSI by attachment to the prosthesis or other implant left in the operative site. The infection prevention and control practices of SSI are therefore aimed at minimizing the number of pathogens at surgical site [13]. Wound infections or SSI are common postoperative complications among surgical patients. To correctly classify the cleanliness and condition of wounds, the CDC has established classification definitions composed of four classes of surgical wound .Class 1 (clean wounds) are uninfected and no inflammation is present, Class 2 wounds (clean contaminated) wounds lack unusual contamination and enter respiratory, alimentary, genital or urinary tracts under controlled conditions, Class 3 (contaminated wounds) results from insult to sterile technique or leakage from the gastrointestinal tract into the wound and finally Class 4 (dirty infected wounds) that results from microorganisms present in perforated viscera or the operative field [2]. The type of wound also dictates the presence of microorganisms at surgical sites. For instance, operations on sterile sites have less than 2%, whereas, SSI will occur more than 10% after operations in "contaminated" or "dirty" sites [3]. Resistance patterns of Surgical Site Infection-associated bacteria vary globally, depending on the region, local epidemiology reports, and susceptibility testing methodology. Bacterial resistances pose a challenge and complicated the SSI treatment [4].Most of the data on drug resistance were obtained from high-income countries. However, there are limited reports on the prevalence and incidence of resistant bacteria causing SSI, especially from developing countries. Therefore, this study aimed at assessing the bacterial profile and antimicrobial susceptibility patterns of isolates among patients diagnosed with surgical site infection at TUTH, Kathmandu. The study is to guide surgeons with use of antibiotics at our center preoperatively that would prevent SSI postoperatively. Moreover, hospital guidelines on antibiotic use among surgical patients should be developed on the basis of most commonly detected causative organism. Continuous periodic studies and among different surgical departments are required to deal with SSI which is the most common postoperative complication and related to increased morbidity and expense to the patient. Such study could provide a better estimate of incidence of SSI and most common organism and also provide us a better idea on prophylactic antibiotic and other measures to reduce the incidence of SSI in hospital.

2. MATERIALS & METHODS

Ethical clearance was obtained from the institutional review board before the start of the study. It was a prospective observational study conducted in the Department of General Surgery, Maharajgunj Medical Campus, TUTH. The study was conducted on patients undergoing Laparotomy in emergency setting. Patients more than 16 years and able to provide informed consent with the management with emergency laparotomy were enrolled. Patients who were less than 16 years of age, not willing to participate in the study, immunocompromised patients, pregnancy, laparotomy done outside and referred to our center were excluded. The data were collected in all patients enrolled in the study to determine the risk factors for SSI after Emegency laparotomy including age, sex and BMI of the patient, history of presentation, co-morbid conditions like diabetes and Hypertension. Investigations like Haemoglobin level, Albumin level were noted. Preoperative management including Blood transfusion was also noted. Intra-operatively, Preoperative prophylactic antibiotics, Duration of surgery, Blood loss, Intraop findings and procedure done was noted. Type of surgical wound, clean/clean contaminated/contaminated/dirty was determined. Post-operatively any signs of Surgical site infection like fever, discharge/pus from wound, day of infection, erythema, type of SSI, Clavien Dindo grading was observed in enrolled patients. Antibiotic changed after the reports and length of hospital stay were also noted. All operations were performed by consultants and MS residents in emergency settings. All operations were performed with the patient under general anesthesia with endotracheal intubation or under spinal anaesthesia block. All the cases were prepared using Betadine solution. The operation was performed either by the standard midline incisions or Gridiron incisions. All patients received third-generation cephalosporin intravenously or Piperacillin/Tazobactum at the time of induction according to surgeon's choice. Wash was done using normal saline and drain was placed according to surgeon's choice on the suspicion of postoperative collection.

Type of surgical wound was classified as per CDC definition as follows [2]:

- Class 1 wounds (clean): They are uninfected, no inflammation is present, and are primarily closed. If the draining of these wounds is necessary, a closed draining method is necessary. Additionally, these wounds do not enter respiratory, alimentary, genital, or urinary tracts.
- Class 2 wounds (clean-contaminated): These wounds lack unusual contamination. Class 2 wounds enter the respiratory, alimentary, genital, or urinary tracts. However, these wounds have entered these tracts under controlled conditions.
- Class 3 wounds (contaminated): These are fresh, open wounds that can result from insult to sterile techniques or leakage from the gastrointestinal tract into the wound. Additionally, incisions made that result in acute or lack of purulent inflammation are considered class 3 wounds.
- Class 4 wounds are considered to be dirty-infected. These wounds typically result from improperly cared for traumatic wounds. Class 4 wounds demonstrate devitalized tissue, and they most commonly result from microorganisms present in perforated viscera or the operative field [2].

Clinical outcomes, such as surgical site infection, swab/pus c/s,preop risk factors like abnormal BMI(BMI<18.5 or BMI>30),Low Haemoglobin(Hb <11),comorbid conditions like Diabetes ,Duration of surgery (> 2 hr as long duration) was studied. Wound infection was diagnosed based on clinical symptoms and signs of SSI. Patients were assessed for SSI during the hospital stay and then followed up on 7 days, 14 days, and 30 days after discharge. Type and consequences of SSI were noted during the follow-up. Similarly, morbidity as per Modified Clavein Dindo classification was taken into consideration.

Table 01: Modified Clavien-Dindo classification

Degree	Definition
I	Any deviation from the normal postoperative course without need of intervention beyond the administration of antiemetics, antipyretics, analgesics, diuretics, electrolytes and psychical therapy
II	Complication requiring pharmacological treatment with other medicines beyond the ones used for complications of degree I
III	Complications requiring surgical, endoscopic, or radiological intervention
IIIa	Intervention without general anaesthesia
IIIb	Intervention under general anaesthesia
IV	Life threatening complication requiring admission to intensive care unit
Iva	Uniorgan dysfunction (including dialysis)
IVb	Multiorgan dysfunction
V	Death

Quantitative data were presented as mean or median and interquartile range, as appropriate. For categorical variables, numbers & percentages were calculated. Chi-square test was applied for categorical data. For normally distributed data, the means of two groups were analyzed using a t-test. Multiple logistic regression analysis was used to calculate odds ratio to find out the correlation in between different variables. All calculations were two-sided & were performed using SPSS version 26 (Statistical Packages for the Social Sciences, Chicago, IL). A p-value of <0.05 was considered to indicate statistical significance.

3. RESULTS & DISCUSSIONS

Over the period of 1 year there were total 1037 surgeries in Department of General Surgery. Out of which there were total of 714 (69%) elective abdominal surgeries and 323 (31%) emergency surgeries in patient above 16 years, among them there were total 217 (21%) emergency laparotomies out of which total of 179 (17%) patients were enrolled in this study.

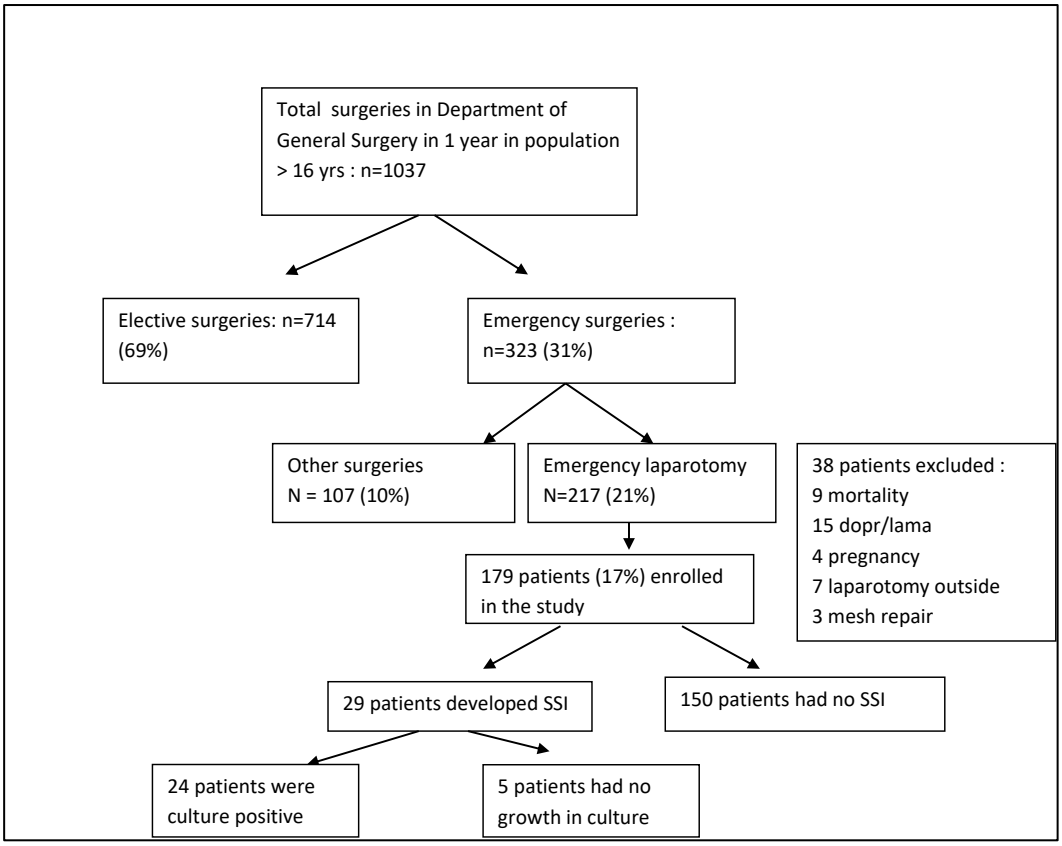

Figure 01: Flowchart

Table 02: Demographics of the patient

		SSI (N=)	TOTAL (N=)	INCIDENCE	P VALUE
SEX	FEMALE	8	58	13.8%	0.383 (> 0.05)
	MALE	21	121	17.3%	
AGE (YRS)	16-25	3	51	5.8%	0.348 (>0.05)
	25-35	4	36	11.1%	
	35-45	3	24	12.5%	
	45-55	1	17	5.8%	
	55-65	9	27	33.3%	
	65-75	6	15	40%	
	75-85	2	5	40%	
	85-95	1	4	25%	
BMI (KG/M^2)	<18.5	14	37	37.8%	0.011 (<0.05)
	>18.5<23	11	107	10.3%	
	>23<25	1	21	4.7%	
	>25 <30	3	14	21.4%	
TOTAL		29	179	16.2%	

In this study, mean age of patients was 42.08 ± 18.98 years (mean ± SD), ranging from 18 to 93 years. There were 121 male patients and 58 female patients in the study, the male to female ratio was 1: 0.49. Incidence of SSI in female is 13.8% and male is 17.3% which is statistically non-significant (p value 0.383). Incidence of SSI increases with increasing age with highest incidence 39.2% in age group greater than 60 years (p value 0.04 ie < 0.05). Similarly, Incidence of SSI was 37.8 % in underweight patient (p value

< 0.05). Rate of SSI in clean contaminated wound was found out to be 6.5% (n=5) ,rate of SSI in contaminated wound was 25% (n=2) with only 8 cases of contaminated wound and the rate of SSI in dirty wound was 23.2 % (n=22) which is statistically significant (ie < 0.05)

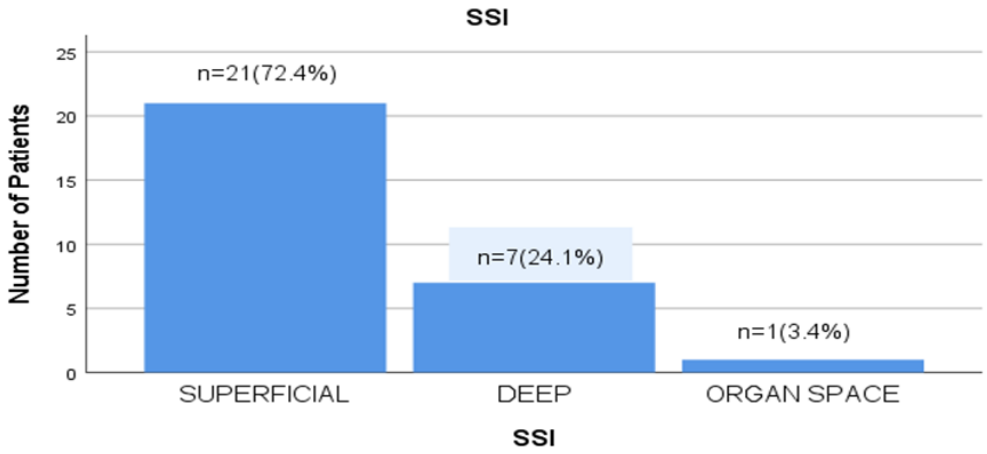

Figure 02: Rate of different types of SSI

Out of 179 cases,29 cases had SSI, 21 patients had superficial SSI which accounts for 72.4% of total SSI,7 had deep SSI accounting for 24.1% of SSI and 1 patient had organ space SSI accounting for 3.4% of total SSI.

Table 03: Rate of SSI in different types of surgical wound

TYPES OF SURGICAL WOUND	SSI (N=29)				
		SUPERFICIAL	DEEP	ORGAN SPACE	INCIDENCE (%)
	CLEAN CONTAMINATED (N=76)	5	0	0	6.5%
	CONTAMINATED (N=8)	1	1	0	25%
	DIRTY (N=95)	15	6	1	23.2%
TOTAL		21 (72.4%)	7(24.1%)	1(3.4%)	

In this study rate of SSI in clean contaminated surgical wound was found out to be 6.5%,rate of SSI in contaminated wound was 25% with only 8 cases of contaminated wound and the rate of SSI in dirty wound was found out to be 23.2 %..21 cases had superficial SSI, 7 had deep SSI and 1 case had organ space SSI.

Table 04: Frequency of SSI and different surgeries

	FREQUENCY (%)	SSI	PERCENT
ACUTE UNCOMPLICATED APPENDICITIS	56 (31.2%)	1	1.7%

HOLLOW VISCUS PERFORATION PERITONITIS	44 (24.5%)	8	18.2%
ACUTE COMPLICATED APPENDICITIS	23(12.8%)	9	39%
NON-ADHESIVE SMALL BOWEL OBSTRUCTION	20 (11.1%)	5	25%
ADHESIVE SMALL BOWEL OBSTRUCTION	11 (6.1%)	1	9%
BLUNT ABDOMINAL TRAUMA	8 (4.4%)	1	12.5%
STRANGULATED HERNIA	5 (2.7%)	2	40%
ACUTE MESENTERIC ISCHEMIA WITH GANGRENOUS BOWEL	3 (1.6%)	1	33.3%
STAB INJURY TO ABDOMEN	2 (1.1%)		
GOO SECONDARY TO ACID INGESTION	2 (1.1%)		
OTHERS	5 (2.8%)	1	20%
TOTAL	179	29	16.2%

In this study, among 179 cases most common surgery performed was for acute appendicitis in 56 cases (31.2%). Incidence of SSI was found to be highest in patients with acute complicated appendicitis i.e 39%

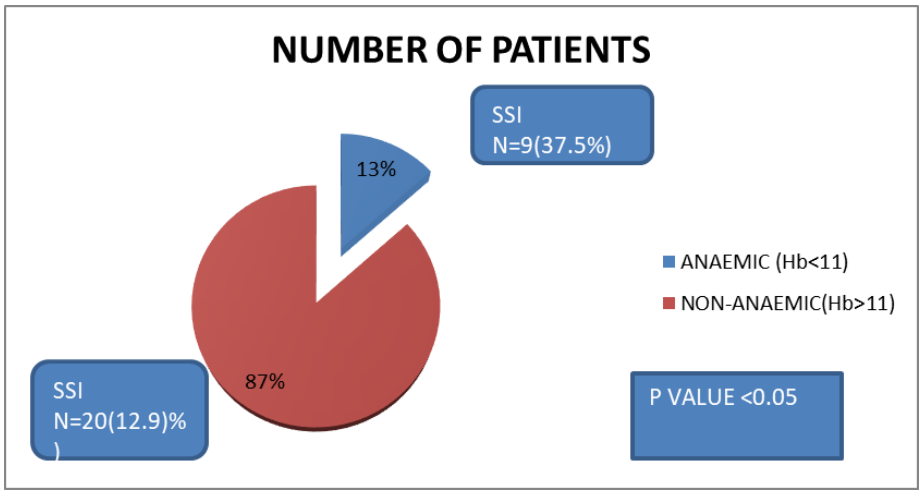

Figure 03: Relation of SSI with Preop Hb

In this study, out of 179 cases,24 case had anemia preoperatively of which 9 cases had SSI accounting for 37.5% of total SSI showing aneamia as one of the risk factor for development of SSI which is statistically significant (p value 0.024)

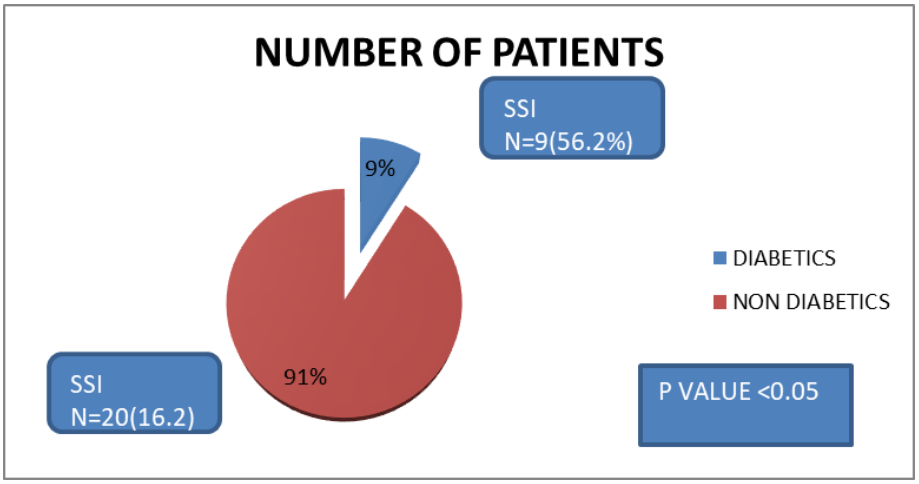

Figure 04: Relation of SSI with Diabetes

In this study, out of 179 cases,16 case had Diabetes of which 9 cases had SSI accounting for 56.2% of total SSI showing Diabetes as one of the risk factor for development of SSI with p value <0.05

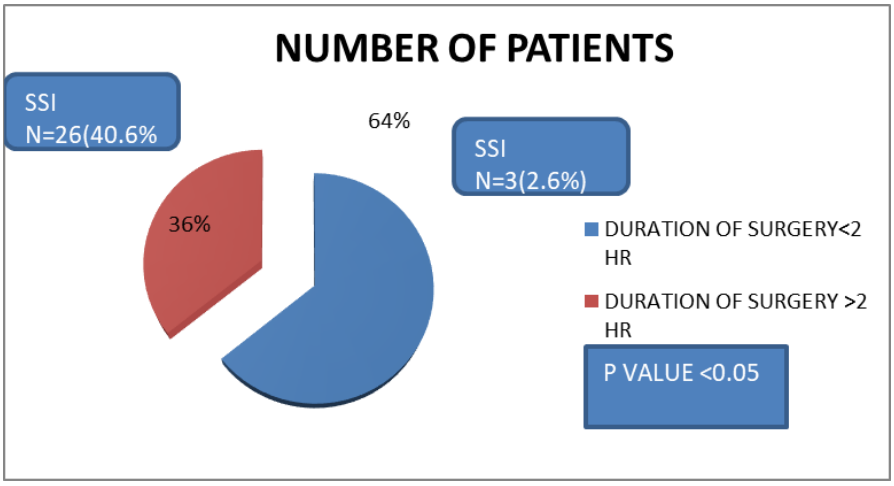

Figure 05: Relation of SSI with duration of surgery

In this study, out of 179 cases,64 cases were exposed duration of surgery > 2 hr of which 26 cases had SSI accounting for 40.6% of total SSI with p value <0.05 showing longer duration of surgery as one of the risk factor for development of SSI

Table 05: Relationship of SSI and comparison with different significant factors

	SSI (N=)		TOTAL (N=)	INCIDENCE	P VALUE	ODDS RATIO
DIABETES	YES	9	16	56.2%	0.004 (<0.05)	10.7
	NO	20	163	12.2%		
HAEMOGLOBIN (GM%)	Hb <11	9	24	37.5%	0.024 (<0.05)	5.6
	Hb >11	20	155	12.9%		
	< 2HR	3	115	2.6%	0.000	27.9

DURATION OF SURGERY	>2HR	26	64	40.6%	(<0.05)	
BMI (KG/M^2)	<18.5	14	37	37.8%	0.011 (<0.05)	6.8
	>18.5<23	11	107	10.3%		
	>23<25	1	21	4.7%		
	>25 <30	3	14	21.4%		
TOTAL		29	179	16.2%		

In this study, using logistic regression multivariate analysis among statistically significant factors for occurrence of SSI, increased duration of surgery seem to be most important factor for SSI with odds ratio of 27.9.

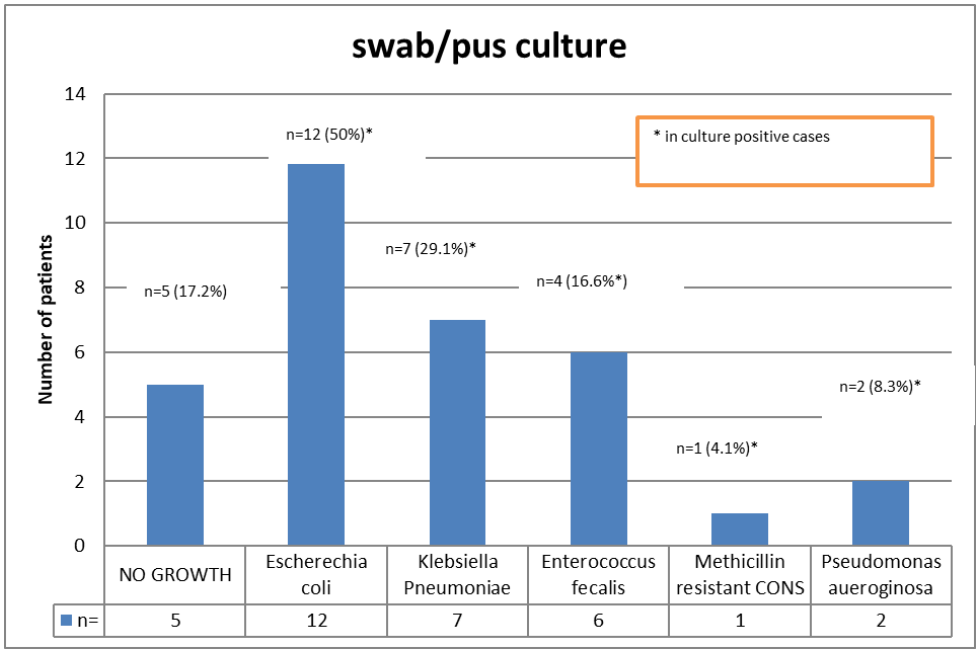

Figure 06: Patterns of microorganism in SSI

Out of 29 cases of SSI, 24 cases were culture positive with Escherichia coli being the most common organism (41.4%) and second commonest being the Klebsiella pneumonia(29.1%)

Table 06: Drug sensitivity pattern of different microorganisms

Microrganism		**Escherechia coli (n=12)**	**Klebsiella pneumonia (n=7)**	**Enterococcus faecalis (n=6)**	**Methicillin resistant CONS (n=1)**	**Pseudomonas (n=2)**
Drugs	**Amoxicillin**			1 (25%)		
	Ciprofloxacin	5 (41.6%)	1 (16.6%)	2 (50%)		
	Levofloxacin	8 (66.6%)	2 (33.3%)	2 (50%)		1 (100%)
	Gentamicin	6 (50%)				
	Amikacin	7 (58.3%)				1 (100%)
	Cotrim	3 (25%)				1 (100%)

	Chloramphenicol		1 (16.6%)	1 (25%)		
	Piperacillin /Tazobactum	6 (50%)	2 (33.3%)	1 (25%)		
	Teicoplanin		3 (50%)	2 (50%)	1 (100%)	
	Tegecycline	5 (41.6%)	3 (50%)	1 (25%)	1 (100%)	
	Polymixin	6 (50%)	4 (66.6%)	1 (25%)		
	Doxycycline		2 (33.3%)			

Table 07: Drug resistance patterns of different microorganism

Microrganism		Escherechia coli (n=12)	Klebsiella pneumonia (n=7)	Enterococcus faecalis (n=6)	Methicillin resistant CONS (n=1)	Pseudomonas (n=2)
Drugs	Amoxicillin	7 (58.3%)	2 (33%)	1 (25%)		1 (100%)
	Ciprofloxacin	4 (33.3%)	2 (33%)	1 (25%)	1 (100%)	
	Levofloxacin	3 (25%)	1 (16%)	1 (25%)	1 (100%)	
	Gentamicin	1 (8.3%)		1 (25%)		1 (100%)
	Amikacin				1 (100%)	
	Cotrim				1 (100%)	
	Chloramphenicol					
	Piperacillin /Tazobactum	4 (33.3%)	2 (33%)	1 (25%)		1 (100%)
	Teicoplanin					
	Tegecycline					
	Polymixin					
	Doxycycline				1 (100%)	

E.coli was sensitive to Levofloxacin on 66.6% occasions and resistant in 25% cases . Klebsiella pneumonia is sensitive to Levofloxacin on 33.3 % occasion. Beside this they were found most sensitive to Tegecycline; 41.6% with E coli and 50% with K pneumonia.

4. DISCUSSION

Laparotomy in an emergency settings is one of the common and routinely performed procedure in the Tertiary care center. In the study period there were total of 311 emergency surgery in patients above 16 years of which 217(69.7%) underwent emergency laparotomy. Out of these patients 179 patients were enrolled in the study. SSI is one of the most common postoperative complication encountered. In this study 29 cases out of 179 patients developed SSI with the incidence rate of 16.2%. A study performed, in a tertiary care unit at a tertiary care unit in Lahore conclude that out of 200 cases enrolled in the study 27 (13.5%) developed SSI [12]. A study performed a prospective study in which 150 patients were enrolled in the study, 23 patients developed SSI with an incidence rate of 15.33%. Incidence of SSI

in emergency laparotomy is more compared to elective laparotomy mostly because of inadequately optimized patients subjected to surgical stress. Different preoperative factors, intraoperative factors and postoperative factors plays a role in occurrence of SSI. A study performed, observed that Incidence of surgical site infections in their study was 13%. In elective surgeries it was 7.1% while in emergency surgeries it was 26.7% [14]. In this study, mean age of patients was 42.08 ± 18.98 years (mean ± SD), ranging from 18 to 93 years. There were 121 male patients and 58 female patients in the study, the male to female ratio was 1:0.49. Incidence of SSI in female is 13.8% and male is 17.3% which is statistically non-significant (p value 0.383). Incidence of SSI increases with increasing age with highest incidence 40% in age group 65 years to 85 years. However the result in this study was not significant for increasing age with incidence of SSI (p value 0.348). In 2023 a profiling in a tertiary center observed 74.5% SSI in (105) males compared to 25.5% (in 36) females [15]. An article on gender specific differences of SSI on analysis of 438050 patients in 2014 concluded that of the 438,050 operated patients, 241,437 were female (55%) and 196,613 male (45%). The overall rate of SSI for women was 1.74/100 procedures, whereas in male patients SSI occurred in 2.26/100 surgeries. This difference is highly significant with $p < 0.001$ [16]. A multicenter prospective study done in 2019 which included 953 patients the median age for SSI group was 56 and that of non SSI group was 47 (p value <0.01)[17]. In this study too, incidence of SSI on increasing age of the patient, however incidence of SSI is not related to gender of the patient. In this study total 37 case had low BMI (<18.5) out of which 14 case had SSI with the incidence rate of 37.8% (p value <0.01) whereas in normal BMI group incidence rate of SSI was 10.5% (15 out of 127). No cases included in this study were obese (BMI >30), a study performed in 2020 observed that 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, a study done in 2014 concluded that the overall rate of SSIs was 12.8%. The superficial incisional SSI rate was highest in the underweight group (44.4% in the underweight group, 11.0% in the normal group, and 0% in the overweight and obese group, p=0.006) [18]. Thus underweight patients are at risk of SSI post-operatively compared to Patient with normal BMI. Dirty wounds have higher incidence of Surgical site infections than clean or contaminated wounds. In this study, there were 76 cases of clean contaminated wounds,8 cases of contaminated wounds and 95 cases of dirty wounds. Among 95 dirty wounds 22 cases had SSI with incidence rate of 23.2%,2 cases out of 8 contaminated wounds had SSI with incidence rate of 25% and 5 cases out of 76 clean contaminated cases had SSI with incidence rate of 6.5%(p value 0.049). Similar reports were seen in a study done in 2020 where SSI was found to be predominant in Class IV wounds (46.9%), Class III wounds had SSI incidence of 25% and class II had incidence of 20%. In our study there were only few contaminated cases [8], so the incidence calculated is higher than dirty wounds giving false impression. A total of 29 cases out of 179 patients who underwent emergency laparotomy developed SSI among which 21 cases (72.4%) had superficial incisional SSI,7 cases (24.1%) had deep incisional SSI while 1(3.4%) case developed organ space SSI. In a study done in 2018 at a tertiary care unit in Lahore, SSI was seen in 27 patients out of 200 cases among which 15 (55.56%) were superficial,8 (29.62%) were deep and 4 (14.81%) were organ space infection. The most common cause for emergency laparotomy was acute uncomplicated appendicitis. There were 56 cases of acute uncomplicated appendicitis among which 1 case developed SSI followed by acute complicated appendicitis (n=23,SSI in 9 cases), Duodenal ulcer perforation peritonitis (n=31,SSI in 2cases), Adhesive small bowel obstruction (n=11,SSI in 1 case),Bowel obstruction due to other causes (n=20), SSI in 5 cases, Acute mesenteric ischemia with gangrenous bowel (n=3,SSI in 1 case),Blunt abdominal trauma (n=8,SSI in 1 case),Stab injury to abdomen (n=2,no SSI),Biliary peritonitis S/P lap cholecystectomy (n=2,no SSI),Gastric ulcer perforation peritonitis (n=5,SSI in 1 case),jejuna ulcer perforation peritonitis (n=2,SSI in 1 case),Enteric ulcer perforation peritonitis (n=3,SSI in 2 cases),Rectosigmoid perforation (n=3,SSI in 2 cases), Strangulated hernia(n=5,SSI in 2 cases) and Others(n=3,SSI in 1 case). In a similar study done appendecitis was the most common cause for emergency laparotomy (n=60,SSI in 15 cases) followed by adhesiolysis or resection and anastomosis in small intestinal obstruction (n=60,SSI in 6 cases), Repair of ileal perforation / ileostomy and thorough Peritoneal toileting (n= 31, SSI in 13 cases), Repair of Peptic ulcer Perforation (n= 23,SSI in 13

cases),Resection of Volvulus of sigmoid colon and primary anastomosis / Hartman's procedure (n= 20,SSI in 6 cases) and Herniotomy and Herniorhaphy in case of Obstructed inguinal hernia (n=6 ,no SSI) [13]. Diabetes is one of the comorbid condition that could be attributable to SSI. A study performed in 2012 observed that out of 22 patients with Diabetes Mellitus, 8 patients had SSI. The rate of SSI was 36.4% (8/22) in patients with Diabetes Mellitus compared to rate of SSI in patients without diabetes mellitus, which was 13.5% (24/178)(9). In our study there were total of 16 cases of Diabetes out of which 9 developed SSI with the incidence rate of 56.2% (p value <0.01). Only 20 out of 163 non-diabeteic cases developed SSI with incidence rate of 12.2%. Thus, Diabetes is one of the risk factors for development of SSI. The mechanisms involve immune dysfunction, poor circulation and atherosclerosis Patients. Similarly,preoperative anaemic condition or history of blood transfusion is another condition which could attribute to the development of SSI postoperatively. In this study total of 24 cases out of 179 cases had preop Haemoglobin level less than 11 gm/dl out of which 9 developed SSI giving a incidence rate of 37.5%.Out of 155 non-anaemic patient 20 developed SSI with incidence rate of 112.9%. This result was statistically significant (p value=0.009) showing anaemia as one of the risk factors for development of SSI. In a study performed in 2020 Out of 64 cases of SSI among 270 cases 10 cases were anaemic identifying it as a comorbid condition atrributable to the development of SSI. In our study,64 patients were exposed to duration of surgery more than 2 hours, out of them 26 cases developed SSI with the incidence rate of 40.6%. (p value <0.01).Only 3 cases out of 115 patients who were exposed to duration of surgery less than 2 hours developed SSI. It identified the patient who are exposed to longer duration of surgery are more vulnerable for SSI in post operative period. A clinicoprofiling on surgical site infections following emergency laparotomy done in 2023 the operative duration was 2 hours in 76 (30.4%), 3 hours in 126 (50.4%), 4 hours in 46 (18.4%) and 5 hours in 2 (0.8%) and they found that out of 76 operative procedures with a duration of 2 hours, 30 had SSI [17]. A study from Assam concluded that maximum incidence of SSI (54.6%) was seen in the cases with operative time greater than 2 hours [3]. A systemic review find relationship between operative duration and SSI concluded that the likelihood of SSI increased with increasing time increments; for example, a 13%, 17%, and 37% increased likelihood for every 15min, 30min, and 60min of surgery, respectively. On average, across various procedures, the mean operative time was approximately 30min longer in patients with SSIs compared with those patients without [19]. Out of 29 cases of SSI among 179 cases that underwent emergency laparotomy, swab/pus C/S was sent in all cases, only 24 cases had growth in the sample sent. Most common organism identified was Escherichia coli in 12 cases accounting for 50% of culture positive cases and second commonest organism identified was Klebsiella pneumonia in 6 cases with incidence of 25% followed by Enterococcus faecalis in 4 cases(16.6%),Methicillin resistant CONS in 1 case (4.1%) and Pseudomonas auregenosa in 1 case (4.1%). Similar prospective study conducted at Chengalpattu medical college, Chennai that Escherichia coli was the most common cause for SSI with the incidence of around 27% in laparotomy wounds [20].In a study performed on SSI following abdominal surgery, the bacteria most commonly isolated were extended spectrum B-lactamase producing Escherichia coli, followed by Enterococcus species[21,22].

5. CONCLUSIONS

Emergency laparotomy is commonly performed procedure in emergency settings. SSI is a common complication after emergency laparotomy. Patients with low BMI, low Hameoglobin level, diabetics and those exposed to increased duration of surgery are at risk of SSI. Antibiotic sensitivity and resistance pattern needs to be studied at any center at times to keep an update on microorganisms and drug that should be used prophylactically to tackle with those organisms causing SSI postoperatively. Escherichia coli is the most common organism isolated at our center and mostly sensitive to Levofloxacin.

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