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SURGICAL SITE INFECTIONS, AN EXPERIENCE AT TERTIARY CARE HOSPITAL

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ABSTRACT:

BACKGROUND & OBJECTIVE:

Surgical site infections (SSI) are important cause of morbidity and mortality in admitted patients worldwide. The objective is to determine the incidence of surgical site infection in General Surgical ward of a tertiary care hospital.

METHODOLOGY: Analytical cross-sectional study conducted at Department of General Surgery, Bolan Medical College/ Post-Graduate Medical Institute Quetta (PGMI) for a period of one year from 1st August 2019 to 31st July 2020. Descriptive statistics were used to present socio-economics, factors related to surgery and surgical antimicrobial prophylaxis received. Chi square test was used for checking association between infections and different factors keeping $p \leq 0.05$ as significant.

RESULTS: A total of 1500 patients underwent surgery, of which 500(33.33%) patients were operated as elective cases and 1000(66.66%) cases as emergency. Out of total 1500 patients, 600(40%) developed Surgical Site Infection (SSI). Risk associated with higher incidence of SSI were found to be age (30-45 years) and Diabetes mellitus (uncontrolled diabetes in perioperative period). Post-operatively obesity was noted to be having significant effect with $p=0.0002$, American Society of Anesthesiologists (ASA) score having p-value 0.045, hospital stay with $p<0.001$ and surgical type and previous surgical history with $p<0.001$, were as duration of surgery was having $p<0.001$.

CONCLUSION: Prevention of SSI requires a multipronged approach with emphasis on optimizing preoperative issues, adhering to strict protocols during the intraoperative period and addressing and optimizing metabolic and nutritional status in post-operative period.

KEYWORDS: Surgical site infection, Elective cases, Emergency cases, Wound infection.

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INTRODUCTION:

Healthcare-Associated Infections (HAIs) is a subject in which the great concerns of healthcare services are involved. Surgical site infections (SSI) are seen in the surgical procedures and is the most important among the topographies of HAIs[1].Against the bacterial infections of internal organ, skin plays a key role as a barrier. Whenever a surgical wound happens, it disrupts the barrier[2]. The main cause of SSI is the bacteria present on the skin all the time and the complexities of surgical procedures[3]. According to the range from low to high clinical significance, SSI involves different inflammatory responses[4], with surgery of abdomen being a typical example related to the increase mortality and morbidity[5]. With the worst scenario, SSI spreads into abdomen and surrounding tissues and important structures that can disrupt the entire hemostasis and this often require drainage[6]. In general surgery SSI occurs 2% to 5% in hospitals where as in ICU sitting it is very much less discussed as severe SSI leads to severe peritonitis, and as a critical public health care problem it requires particular attention [7].

In United States, approximately 160,000 to 300,000 SSI occurs every year[8]. With the increase in SSI, patient debilitates and there is dramatical increase in health care cost. In Pakistan, the occurrence of SSI in electiveand emergency surgeries is 4.6% and 12.7% respectively[9]. Three classes of SSI are Superficial, Deep incisional SSI, and Organ/ Space SSI. The treatment of SSI is very costly especially when a lot of surgical procedures and their complexities are considered in the referral hospitals[10, 11].

Morbidity and mortality rates of secondary and tertiary conditions are high as 17-63%[12]. Mortality rate of tertiary peritonitis is about 30-63% and it usually occurs in the ICU setting while dealing with secondary peritonitis for 48-72h [13]. Where as the chances and risks of SSI related with abdominal surgeries are 2-8% depending upon the surgery [14].

Classification of SSI is 2% Clean, 3% Clean-contaminated, 6% Contaminated and 7% Dirty[2,15]. Before surgery, the stratification for surveillance can identify at-risk patients. There are several risk factors that lead to SSI and makeup a surgical infection risk index. Example like American Society of Anesthesiologists (ASA) scoring, the Class of Wound,and the duration of Surgery in order to minimize the chances of SSI[4,16]. Despite of all this, operating settings such as elective and emergency have a significant role in determining the SSI [6,12].

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METHODOLOGY:

An Analytical cross-sectional study was conducted at the Department of surgery & ICU Bolan medical complex/ Post-Graduate Medical Institute Quetta (PGMI) from 1st August 2019 to 31st July 2020. After taking approval from ethical committee. Data was collected by non-probability convenient sampling.

Inclusion criteria: A total of 1500 patients admitted as either elective or emergency cases were included in the study. All patients with age >5 years were included in the study. We included all consecutive patients from any type of abdominal surgery who required ICU admission beyond 72 h for secondary or tertiary peritonitis after taking informed consent.

Exclusion criteria: Cases of wound infection operated elsewhere, diabetic foot and abscesses were excluded. Patients not willing to participate in study, receiving antimicrobial at time of admission or stopped receiving within 48 hours before operation and patients with initial diagnosis suggestive of infection were excluded.

All patients received standard preoperative hygiene care and antibiotic prophylaxis at an anesthetic drug induction consistent with our institutional protocols for elective and emergency surgeries. Clean wound is an infection less wound in which no inflammation is present at wound and none of the genital, alimentary or urinary tracks are opened during or before surgery. Clean wounds are basically closed primarily or drained by closed drainage. If the criteria meet then the incision occurred at operation with blunt trauma must be included in this category.

Cleaning of contaminated wound is basically an operative wound cleaning in which alimentary, respiratory or urinary tracts are involved under the normal and unusual contamination examples are surgeries of appendix, vaginal track, biliary track etc. Records have been accumulated by way of trained nurses (BSc) no longer operating or working at surgical wards. The data was obtained on a pretested record collection tool prepared by study group. The study group supervised the facts series method every day. Socio-demographic and other patient related factors have been obtained without delay from sufferer or affected person's scientific chart. Statistics on time of antimicrobial prophylaxis management and intra-operative doses were gathered with the aid of direct commentary and from sufferer's operation word.

The variables protected have been age in years, gender, admission date, co-morbidity, body mass index, systemic steroid use, malnutrition, immunity, date of surgery, type of surgical treatment, wound magnificence (easy or smooth-infected), time of skin incision, duration of operation and quantity of blood lost at some stage in operation.

ANTIMICROBIAL PROPHYLAXIS DESCRIPTION:

Ceftriaxone 1g was given to patients. In Govt hospitals more sophisticated drugs are only used when complex infections are encountered. Concerning surgical antimicrobial prophylaxis used, route through which antimicrobials were administered, name of antimicrobials, doses, first dose administration time, time of intra-operative dose administration, time of postoperative dose given and duration of administration had been recorded. We followed the sufferers and reviewed the charts daily, throughout and after operation till the sufferers had been discharged from the healthcare facility and after discharge until 30 days.

STATISTICAL ANALYSIS:

SPSS-22 version was used for data analysis. Descriptive statistics were used to present socio- economics, factors related to surgery and surgical antimicrobial prophylaxis received. We used frequency, percentage and cross tabulation to describe patient's characteristics, operational and surgical factors. Chi square test was used for checking association between infections and different factors. Significance level was check at $p \leq 0.05$.

RESULTS:

Out of 1500 patients, 856(75.06%) were male and 644(42.93%) were female. Out of total 1500, 799(53.29%) were belonging to urban and 701(46.73%) belong to rural area. Mean age of patients was 31.98±10.55 years. 325 patients were lying in age group of 5-15 years, 549 patients were lying in age group of 16-30 years, 398 patients were lying in age group of 31-45 years and 228 patients were lying in age group of >45 year. The mean Body Mass Index (BMI) was 23.72±5 kg/m2, 550(36.66%) were obese with BMI >30 Kg/m2 and 950(63.33%) were obese with BMI ≤30 kg/m2. Regarding ASA scoring, 900(60%) patients fell in ASA-II class. The Mean of total preoperative hospital stay of patients was 9.45 ± 0.345 as shown in Table-I.

Out of 1500 patients, 300(20%) were of hernia procedure, 115(7.66%) were of urological surgeries, 175(11.66%) were of breast surgery, 360(24%) patients had hand and neck surgeries, 250(16.66%) had vascular procedures, 300(20%) had Gastrointestinal surgical procedures (table-II). After that, surgical related factor are noted. Out of 1500 patients, 1000(66.66%) patients were operated in emergency and 500(33.33%) were in elective surgeries. 850(56.66%) were in clean wound cases and 950(63.33%) had previous surgical history (Table-III). At the end we checked association of surgical infection with different factors. Significant association were found of postoperative side effects with obesity having <0.001, ASA score having p-value <0.001, hospital stay having<0.001 and surgical type and previous surgical history with <0.001, and duration of surgery with <0.001(Table-IV).

Table-I: Demographic features of patients.

Characteristic	n (%)
Obesity	
BMI<30KG/M2	950(63.33)
BMI ≥30KG/M2	550(36.66)
ASA SCORE	
I	450(30)
II	900(60)
III	150(10)
Preoperative Hospital stays	
≤8 DAYS	900(60)
>8 DAYS	600(40)
Total	**1500(100%)**

Table-II: Surgical procedures.

Surgical Procedures	n (%)
Hernia Repair	300 (20)
Urological surgery	115 (7.66)
Breast surgery	175 (11.66)
Hand and neck surgery	360 (24)
Vascular procedure	250 (16.66)
Gastrointestinal surgery	300 (20)
Total	**1500(100%)**

Table-III: Surgical related factors

Factors	n (%)
Wound Class	
Clean	850(56.66)
Clean contaminated	650(43.33)
Surgery Type	
Elective surgery	500(33.33)
Emergency	1000(66.66)
Previous Surgery	
Yes	950(63.33)
No	550(36.66)
Total	**1500(100%)**

Table-IV: Association between Postoperative Infection and other Factors

Variable	Infections		Total	p-value
	Yes	No		
Gender	600(40%)	900(60%)	1500(100%)	<0.001
Male	430(28.66%)	426(28.40%)	856 (57.06%)	
Female	170(11.33%)	474(31.60%)	644(42.93%)	
Residence				
Urban	609(40.6%)	390(.26%)	799 (53.26)	<0.001
Rural	191(12.7%)	510(.34%)	701(46.73)	
Obesity				
BMI<30KG/M2	350(23.33%)	600(40%)	950(63.33%)	0.001
BMI≥30KG/M2	250(16.66%)	300(20%)	550(36.66%)	
AGE in Years				
5-15	200(13.33%)	125(8.33%)	325(21.66%)	<0.001
16-30	179(11.93%)	370(24.66%)	549(36.60%)	
31-45	173(11.53%)	225(15%)	398(26.53%)	
>45	48(3.2%)	180(12%)	228(15.2%)	
AS a SCORE				
I	520(34.66%)	380(25.33%)	900(60%)	<0.001
II	180(12%)	270(18%)	450(30%)	
III	50(3.33%)	100(6.66%)	150(10%)	
Postoperative Hospital Stay				
≤15 DAYS	300(20%)	600(40%)	900(60%)	<0.001
>15 DAYS	300(20%)	300(20%)	600(40%)	
Wound class				
Clean	450(30%)	400(26.66%)	850(56.66%)	<0.001
Clean contaminated	150(10%)	500(33.33%)	650(43.33%)	
Surgery type				
Elective surgery	100(6.66%)	400(26.66%)	500(33.33%)	<0.001
Emergency	500(33.33%)	500(33.33%)	1000(66.66)	
Previous surgery				
Yes	515(34.33%)	435(29%)	950(63.33%)	<0.001
No	85(5.66%)	465(31%)	550(36.66%)	
Diabetic				
Yes	350(23.33%)	700(46.66%)	1050(70%)	<0.001
No	250(16.66%)	200(13.33%)	450(30%)	
Duration of surgery				
>1 hour	300(20%)	550(36.66%)	850(56.66%)	<0.001
≤1 hour	300(20%)	350(23.33%)	650(43.33%)	

DISCUSSION:

A study conducted in 2018 in which they concluded the risk factors of surgical site infection from underweight to obesity. According to them several epidemiological studies show that body weight is related to the risk of infection as well as disease outcome. Whereas underweight in children and adolescents increases the risk of multiple infections, especially in developed countries. Both obesity and underweight have been shown to increase risk of infection in adults in a U-shaped fashion showing that normal BMI is correlated with the lower infection risk in several subjects. The current study also shows the significant result of obesity in increasing the risk of surgical site infections[11].

A systematic review conducted on estimating prolonged stay due to health care associated infections. They concluded that long stays in hospital increased the risk of health care related infections. Our study also shows significant p value i.e <0.001 providing evidence of higher risk of infections due to prolonged hospital stay[12].

This current study shows the significant results that type of surgery and higher BMI are associated with SSI. Sun Y et. al conducted a study in which risk factors of SSI after open reduction and internal fixation of ankle fracture were concluded. The major risk factors for SSI incidence, according to multivariate research, were open injuries, advanced age, higher BMI, chronic heart disease, and history of allergy[13]. Our study also showed more chances of infection with increase in BMI but contrary to this study more infections were seen in young patients in our study. This might be due to fact that in their study they worked on the patients of orthopedic department and in old age the healing of bones is not only slow but sometimes even there is no recovery.

A study conducted in 2019 concluded that independent risk factors for SSI during abdominal surgery are potentially modifiable, such as open surgical approach, infected wound class, and emergency surgery, should be treated routinely. This current study also considers the type of surgery as a potential risk factor for SSI [14].

Examination and identification of high risk patients is necessary to low the chances of SSI and in the same way taking appropriate measures during surgical procedure will reduce the risk of SSI. There are different ways which can reduce the chances of SSIs like administration of first dose within one hour of surgery, Shortening the preoperative hospital stay and shortening the duration of operations. Identification of risk factors of SSI are period of preoperative stay at hospitals, time duration of surgery and ASA index [15-17]. These risk factors are identified when doing surgeries to a lot of patients and surgeries done in general [18,19]. Factors such as ASA index and the wound class with duration of surgeries are well identified in specific surgeries like orthopedic surgeries associated with SSIs. However, in neck and head or cardiac surgeries, these factors are not well known for the SSIs. It is important to mention the duration of surgery not only because of its effects on SSIs but also many other risks factors such as ASA index, through which it is suggesting that those patients which has large ASA index should have long duration of surgery [20,21]. In addition to all these, the long duration of surgery not only increase the chance of SSI but also many other complications such as wound dehiscence, development of urinary tract infection and even septic shock. The short duration of surgery can reduce the risk of SSIs. The chances of occurring SSIs in secondary and tertiary peritonitis are very high requiring ICU admission. Physicians should notice the microorganism isolated with patients having SSIs when prescribing antibiotic therapy, are more likely multi drug resistant pathogens such as Gram-positive cocci, Fungi and Pseudomonas [22,23]. Due to inherent limitation of sampling of microorganism with swabs done in our labs, we need more study to confirm our results. We do not find any effect in the hospital mortality in our population despite the presence of SSI associated with prolonged surgery [24, 25]. In this study about 600 cases are reported of infection in which 33.3% were emergency while 6.66% were elective. The chances of occurrence of SSIs are: 4.4% in Taiwan, 7.5% in United States[8], 5.2% in Japan[9] ,6.23% in Peshawar[10]. Several factors are responsible for SSIs which varies from patient to patients, hospital environment, food, hospital staff, infected surgical instruments, dressing and even medicine and injections [26]. One of the important hosts related risk factor is advance age. Gender is not an important issue regarding SSI.

Duration of surgery and wound class play a key role in influencing SSIs. Those procedures that have time duration of more than 2 hours are at greater risk of having SSIs. Longer hospitals stay especially in the case of post-operative period is related to increase risk of wound infectious rate.

CONCLUSION:

Surgical site infection (SSI) may occur after surgical procedure. Most common cause is not adopting proper sterilization to surgical instruments or contact from surgical team to patient skin. This may occur superficial in the skin, deep in muscle, in organ or cavity. Pus culture and sensitivity test is helpful to identify organism and sensitivity of antibiotics. Most of the patients respond well after conservative treatment but few may require alternate surgical procedure.

LIMITATIONS: The study was conducted in a single center. If same study is conducted in multiple centers than more elaborated and better results can be achieved.

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Author's Contribution:

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Shahzada Amir Ahmed Baber: Help in data collection and statistical analysis.

Shabir Ahmed Lehri: Overall supervision.

Ibrahim Baloch: Collected data.

Muhammad Iqbal Khan: Statistical Analysis.

Rifat Arbab: Manuscript writing and revising it critically for important intellectual content.

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