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Frequency of Surgical Site Infection after Emergency Abdominal Surgeries; an Audit of 200 Cases at a Tertiary Care Unit

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ABSTRACT

Introduction: Frequency and pattern of Surgical Site Infection (SSI) after emergency abdominal surgeries is seen variably among different settings. Since, the surveillance systems are not very efficient in developing countries like Pakistan, it is essential to document the frequency of SSI in our setup. **Aims and Objectives:** Primary objective of the study was to determine the frequency of surgical site infections in emergency abdominal surgeries and secondary objectives were to detect the most common causative organisms and their pattern of sensitivity to antibiotics and their association with risk factors. **Place and Duration of Study:** The study was conducted in accident and emergency department of Sharif Medical City Hospital, Lahore over a period of two and half years. **Material and Methods:** Two hundred patients undergoing emergency abdominal surgeries of age (15-75 years), both genders were enrolled in the study. All patients after emergency abdominal surgeries were evaluated for surgical site infection clinically and radiologically. Types of SSI were documented. Culture and sensitivity was done in infected cases. **Results:** There were 94 (47%) female and 106 (53%) male patients with a mean age of 30.48±11.55 years. In the symptoms, 90% patients had pain, 63% fever and 77% patients were having abdominal distention. Surgical site infection was seen in 27 (13.5%) of the 200 cases. Of these 27 patients, 15 (55.56%) were superficial, 8 (29.62%) were deep and 4 (14.81%) were organ/space infection. Staphylococcus Aureus was detected in the specimens of 13 (48.14%) patients, Proteus in one (3.70%), Klebsiella in one (3.70%), E. Coli in 8 (29.62%) and Pseudomonas Aerugenosa in 4 (14.81%) patients. **Conclusion:** SSI rate was found to be quite high in comparison to developed countries. Better surveillance systems should be developed. Moreover, hospital guidelines on antibiotic use among surgical patients should be developed on the basis of most commonly detected causative organism. Studies for a longer period and among different surgical departments are required. These could provide a better estimate of incidence of SSI and most common organism.

Key words: Surgical site infection, emergency abdominal surgeries, organ/space infection

INTRODUCTION

Encounter with surgical site infection (SSI) has always been an all-time universal distress for medical practitioners and still is the most common post-operative bothersome situation.[1,2] The idea of infection is more than five millennia old. Egyptians were the paramount civilization to have been proficient heath care providers. They were mastersin inhibiting putrefaction by mummification.[3] Hippocrates, acknowledged as the father of medicine, used vinegar to hose open wounds and draped dressings around wounds to avoid supplementary harm.[4,5] The theory of wound healing stayed a mystery for a long time for prehistoric civilizations but they recognized that pus needs to be drained. Although, the perception of wound infection was modernized by the effort of Fleming, who invented Penicillin but, even in this modern era, SSI is still a crucial impediment of trauma and surgery.[6]

The quantity of SSI differs noticeably in different areas of the world. Frequency of surgical

site infection in a study from Japan has been reported up to 32.1%.[7] In an Indian study, the frequency of SSI in emergency abdominal surgery was from 16 – 23%.[8,9] A report from an African country Uganda shows this rate to be 16.4%.[10] In United States, the burden of SSI after emergency abdominal surgeries was 15.5.% - 25% in different hospitals. [11] Our local data demonstrates a great variation of frequency of SSI in different settings. The infection rate documented by Malik ZI, et al[12] was 12.7%, while that by Bib S[13] was 13.1%. Akhtar S, et al[14] documented an infection rate of 22.7% in emergency laparotomies. Surgical site infection in emergency laparotomy is categorized in three i.e. superficial incisional SSI, Deep Incisional SSI and organ/ space SSI. Nearly, two third of all SSI are restricted to the incision while the rest are linked to organ or space tangled in surgical route. It is accompanied with catastrophic penalties e.g. late wound healing, usage of antibiotics with consequent high cost, prolonged hospital stay, re-operation and mortality.[13]

A Few variables that mark possibility of SSI are extremes of age, smoking, malnutrition, diabetes, immune deficiency, span of surgery and malignancy. Preoperative regulation of co-morbid conditions, rheostat of operative atmosphere, appropriate skin scrubbing and usage of aseptic surgical system are amongst the means endorsed to avoid SSI.[14] Correct antibiotic prophylaxis can lessen the postoperative wound infection. Around 30-50% of antibiotics practice in hospitals is for prophylaxis and between 30-90% of this prophylaxis is incorrect because of wrong timings and duration.[15] Giving due consideration and certification to numerous autonomous causes connected with SSI will benefit us to restrict the nosocomial infections in general surgical patients by several defensive policies.

Performing emergency abdominal surgeries in a developing country is challenging. It requires a lot of skills and management of logistics especially in tertiary care hospitals of a private teaching hospital where patients have to carry all the burden of the treatment. Sterilization conditions, routine precautions and antibiotic prophylaxis is not uniformly practiced. In most of the developing countries including Pakistan, statistics about the prevalence of surgical site infection in emergency abdominal surgeries and the obedience to standard recommendations for hindrance of SSI are deficient. Usually, the surveillance system is not very strictly followed. Even in available local data, there is diversity in results ranging from 12.7% to 22.7%. Therefore, it is essential that every setup should document their infection reports and suggest prophylactic antibiotics according to sensitivity reports. This prospective study was conducted in a general surgical ward of a tertiary care teaching hospital to file the rate of SSIs and most common causative organism and describe sensitivity pattern.

MATERIAL AND METHODS

This descriptive study included 200 patients undergoing emergency abdominal surgeries of age ranging from 15-75 years of age, both gender, registered from accident and emergency department of Sharif City Hospital, Lahore and was carried out over a period of one year i.e. 1st July 2014 to 31st January 2017. Immunocompromised patients, patients unfit for general anesthesia and patients with uncontrolled diabetes mellitus and jaundice were excluded from study.

All patients underwent a detailed history regarding pain abdomen, fever, vomiting abdominal distension, absolute constipation, decreased urine output, and physical examination regarding tachycardia, dry coated tongue, cool clammy skin, tense tender abdomen with guarding and rigidity. Informed consent was taken for operation and to gather information for the study. Investigations like Complete Blood Count (CBC), Complete Urine Examination (CUE), Liver Function Test (LFT), Renal Function Test (RFT), Serum Electrolyte (S/E) and Blood Sugar Level (BSL) were sent. X-ray abdomen erect and supine, ultrasound abdomen/pelvis was done where indicated. Initial resuscitation was done to correct dehydration, electrolyte imbalance and acidosis. Prophylactic antibiotics were given to every patient preoperatively.

All patients underwent emergency abdominal surgeries. Drains of appropriate size were placed, when required. Surgical site infections was defined as per CDC, USA definition, which states that "infection will be taken as surgical site infection if it happens within 30 days of operation at the site of procedure along with at least one of the following: pus discharge from wound, pain, tenderness, swelling, redness, malodor, or fever. Infection involving the skin and subcutaneous tissue was

considered as superficial incisional surgical site infection while the surgical site infections that involves incision deep to the subcutaneous tissue, including the muscles of the anterior abdominal wall and rectus sheath was considered as deep incisional surgical site infection. Similarly, the surgical site infections that involve the organ or space inside the abdominal cavity other than the superficial or deep incision was considered as organ or space surgical site infection. Patients were closely observed for any sign and symptoms of fever, wound pain, tenderness, redness, increased temperature and any purulent discharge from incision or drain. Patient having features of deep/organ or space surgical site infection underwent ultrasound examination for any collection. Stitches of the infected wound were immediately opened as soon as appearance of any sign and symptoms of wound infection. Pus from the infected wound was sent for culture and sensitivity to determine the most common causative organism. If there was no other indication for hospital stay, patients were discharged after 6 to 7 days depending on the postoperative recovery. Proper instructions were given to the patients regarding daily dressing and general hygiene of the body. Stitches of the healthy wound were removed on the 7th post-operative day. Three follow up were done on 14, 21, 28 days and each patient was assessed for wound pain, fever, wound discharge, wound healing and wound dehiscence.

Statistical Analysis:

All the collected data was entered into SPSS version 20 and analyzed. The qualitative data like demographics, sign and symptoms showing wound condition, wound healing, dehiscence or any re-operation were presented as frequency distribution. Quantitative data in the study like CBC, CUE, LFTS, RFTS, S/E, BSR, culture and sensitivity, age of the patient and duration of hospital stay were presented as means and standard deviations. The main outcome variable was frequency of surgical site infections and detection of most common causative organism which was presented as frequency distribution tables.

RESULTS

Out of 200 patients, 94 (47%) were female and 106 (53%) were male with a mean age of 30.48 ± 11.55 years [range 15-56]. In the symptoms, 90% patients had pain, 63% patients presented with fever and 77% patients were having abdominal distention. The mean temperature of the patients was 99.2 ± 1.21 ^{0}F [range 98-102 ^{0}F]. The mean hemoglobin of the patients was 10.46 ± 1.50 g/dl. The mean white blood cell of the patients was 10179.00 ± 3128.41. The mean blood sugar level of the patients was 108.36 ± 19.44. There were 16 (8%) cases were labeled as clean cases in which no viscous was not opened, 132 (66%) patients were labeled as clean contaminated while 32 (10%) patients were labeled as contaminated wound and 20(16%) patients were labeled as dirty wounds.

Surgical site infection was seen in 27 (13.5%) of the 200 cases. Of these 27 patients, 15 (55.56%) were superficial, 8 (29.62%) were deep and 4 (14.81%) were organ/space infection. Ultarsonographs of all the 12 patients suspected with deep and organ/ space SSI was done. Out of 12 patients, 8 (66.67%) reports showed anterior wall abscesses that confirmed deep SSI in those cases. Of these, 2 (16.7 %) had pelvic collection and 2 (16.7%) had subphrenic collection and no interloop collection was noted. Distribution of patients according to emergency abdominal surgeries and SSI was shown in table 1. Results of Culture and sensitivity were shown in table 2 and 3. Association of age, gender, blood hemoglobin level and TLC to SSI was shown in table 4.

Emergency abdominal surgeries	No. of Patients (%)	SSI			Total
		Superficial	Deep	Organ/ space	
Acute appendicitis	117 (58.5)	4	1	1	6 (5.12%)
Duodenal ulcer perforation	19 (9.5)	4	1	2	7 (36.84%)
Small bowel perforation	13 (6.5)	6	3	1	10 (76.93%)
Strangulated ventral hernias	20 (10)	1	2	0	3 (15%)
Intestinal obstruction	31 (15.5)	0	1	0	1 (3.22%)

Table-1: Distribution of patients by emergency abdominal surgeries and SSI (n=200)

Organism	No. of patients	Percentage
Staphylococcus aureus	13	48.14%
Proteus	1	3.70%
Klebsiella	1	3.70%
E. Coli	8	29.62%
Pseudomonas Aerugenosa	4	14.81%

Table-2: Distribution of patients by Organism on Culture (n=27)

Antibiotics	Organisms											
	E. Coli (n=8)		Klebsiella (n=1)		Staphylococcus aureus (n=13)		Pseudomonas (n=4)		Enterobacter (n=0)		Proteus (n=1)	
	S	R	S	R	S	R	S	R	S	R	S	R
Carbapenem (Imipepnem, Meropenem)	8 (100%)	0 (0%)	0 (0%)	1 (100%)	8 (61.5%)	7 (53.8%)	0 (0%)	4 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Cephalosporins (Ceftriaxone, Co-Amoxiclav, Pipracillin / Tazobactum, Ticarcillin/ Clavulanate)	6 (7.5%)	2 (25%)	0 (0%)	1 (100%)	6 (46.1%)	2 (15.4%)	0 (0%)	4 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Quinolones (Ciprofloxacin)	6 (7.5%)	2 (25%)	0 (0%)	1 (100%)	5 (35.5%)	8 (61.5%)	4 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Aminoglycoside (Gentamycin)	6 (7.5%)	2 (25%)	1 (100%)	0 (0%)	0 (0%)	13 (100%)	4 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Macrolides (Clarithromycin)	0 (0%)	8 (100%)	0 (0%)	1 (100%)	0 (0%)	13 (100%)	0 (0%)	4 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Fosfomycin	0 (0%)	8 (100%)	1 (100%)	0 (0%)	0 (0%)	13 (100%)	0 (0%)	4 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Table-3: Antibiotic sensitivity (n=27)

Variables		Surgical site infection				p value
		Yes		No		
Age (years)		**No.**	**%**	**No.**	**%**	
	<50	21	11.67	159	88.34	>0.05
	>50	6	30	14	70	
Sex	Female	10	10.63	84	89.36	>0.05
	Male	17	16.03	89	83.96	
Hemoglobin (g/dl)	<10	12	7.59	146	92.40	>0.05
	>10	15	35.71	27	64.28	
TLC (/mm3)	<10,000	6	6.18	91	93.81	>0.05
	>10,000	21	20.38	82	79.61	

Table-4: Association of selected variables and SSI (n=27)

DISCUSSION

In this series, we studied 200 patients undergoing Emergency abdominal surgeries. This is one of few series described from Pakistan and Asia describing the frequency of SSI in emergency abdominal surgeries. Before this Akhtar S et al,[14] described a series of eight hundred patients but they also included patients undergoing through elective procedures.

The different frequency of SSI has been reported from different parts of the world. In a study by Razavi SM, et al.[16] frequency of SSI after abdominal surgery reported is 17.4% in a teaching hospital of Iran. All the patients in this study underwent exploratory laparotomy but only one third of the patients were operated upon in emergency. But, in this study, they included rate of surgical site infection after abdominal exploration (emergency plus elective). In a study conducted in 27 hospitals of Japan, SSI in laparotomy has been reported to be 32.1 % percent. [7] In USA, the frequency of SSI after laparotomy has been documented 9.2% in a series by Hedrick TL. In another series of 178 patient reported by Salim A, et al., the incidence of SSI after emergency laparotomies performed at an academic Level I center of USA was 20%. Ussiri EV, et al[5] has reported 15.6% incidence of SSI after clean and clean-contaminated laparotomies in South Africa. In Honkong, Poon JT, et al. reported a frequency of 5.7% for patients undergoing laparotomies. The overall incidence of incisional SSI in open laparotomies was 5.7% in a study of patients undergoing laparotomies. The above discussion suggests that the actual range of rate of SSI lies between 5% and 20% depending mainly on the type of surgical procedure and the wound. Although the rate of 13.5%, which we found in our study, is higher as compared with results from developed countries, it is similar to other less developed countries and better compared with African countries. By comparison, our results are not discouraging; keeping in mind the substandard operation theatre conditions in hospitals in Pakistan. In a study, Yousuf M. et al,[17] reported the incidence of surgical site infection in Pakistan as 24 %, which is roughly double to our study result.

Age has been associated with increased risk of wound infection. Our study was inconsistent with these studies showing that age significantly increases the risk of SSIs in patients older than 50 years. Some studies have correlated male sex with increased risk of SSI. In our study there was slight increase in rate of SSI in male patients (21.2% versus 28.3%), however it was not significant (p value < 0.05). Although, there was a slight higher frequency (28.4% versus 11.3) of patients who developed SSI with high white cell count (>10,000) as compared to those with lower white cell count (>10,000) but that was not significant (p value > 0.05).

Low hemoglobin level has been found to be a risk factor in some studies.[16,17] This study did not show any difference in SSI rate (25.5% versus 24.5%)in patients with hemoglobin level below 10gm/dl compared to those with hemoglobin above 10mg/dl.

A large proportion (68%) of the total SSIs were diagnosed during hospital stay. This reaffirms the conclusion that hospital surveillance is important in achieving more accurate SSI rates.[11] The proportion of superficial infection among those diagnosed during hospital stay was 12% while it was 4% for those diagnosed after discharge. The proportion of deep infection among those diagnosed during hospital stay was 25% while it was 12% for those diagnosed after discharge. This could be because patients with superficial SSI are less likely to come for follow up. The incidence of the deep infection may be higher because in most of the circumstances we cannot look into actual proportion of patients coming for follow up, as patients follow up could be a problem in Pakistan. Patients do not usually come back unless they develop serious problems with debilitation. Deficiency of health services may be one important cause. The other causes may include poverty and ignorance.

Culture and sensitivity testing was done in all of the twenty-five (100%) infected cases. No growth was obtained in a large number (32%) of culture and sensitivity reports. This makes it difficult to draw firm conclusions. The most common organism isolated was Staph Aureus (40%) which is also consistent with another study by Kaye KS, et al.[18]. E. Coli was the second most common organism found (20%) which was expected in the abdominal surgeries. Eight percent of the detected organisms were Pseudomonas Aerugenosa. But again, firm conclusion cannot be established due to use of prophylactic and empirical indoor antibiotic therapy in all cases. To make conclusion, we need to do a study with bigger population size as well.

It was observed in our study that most common presentation of SSI during hospital or follow up was pusy discharge form wound (84%) followed by pain (72%). Wound discharge was present in almost every case of superficial and deep SSI. Only organ / space SSI was lack of this finding which was diagnosed on USG of abdomen and pelvis. Dehiscence was seen only in 2 (8%).[19,20]

This study has some limitations. This was not a double blind study. NNIS risk category and American Society of Anesthesiologists classification were not included, of these criteria, 21 were used in most of the international studies. Antibiotic prophylaxis and treatment were considered together during analysis which may have altered results of culture and sensitivity reports.

CONCLUSION

SSI rate was found to be quite high in comparison to developed countries. Superficial SSI prevails over the other types. Both gram positive and negative organism were involved, which could be prevented with antibiotic prophylaxis. Most common antibiotic detected on culture and sensitivity were carbepenum or ciprofloxacin. It is therefore recommended that better surveillance systems should be developed. Moreover, hospital guidelines on antibiotic use among surgical patients should be revised on the basis of most commonly detected causative organism.

REFERENCES

1. Gottrup F, Melling A, Hollander DA. An overview of surgical site infection: etiology, incidence and risk factors. EWMA Journal. 2005; 5:11-5.
2. Leaper DJ, S van Goor H, Reilly J, Petrosillo N, Geiss HK, Torres AJ, Berger A: Surgical site infection-a European perspective of incidence and economic burden. Int Wound J 2004, 1(4):247-273.
3. Leaper DJ. Wound infection. In Russel R, William NS, Bulstrode CJ: editors. Short practice of surgery. 24th ed. London: Arnold. 2004; 118-9

4. Hutchinson N. Asepsis, antisepsis and skin preparation. Int J Surg. 2002; 58:190-2
5. Ussiri EV, Mkony CA, Aziz mR. Surgical wound infection in clean-contaminated and contaminated laparotomy wounds at Muhimbili National Hospital. ECAJS. 2005; 10:19-20.
6. Emori TG, Gaynes RP. An overview of nosocomial infections, including the role of the microbiology laboratory. Clin Microbiol Rev. Oct 1993; 6(4):428-42.
7. Masanori W, Hideyuki S, Satoshi N, Kentaro M, Naoto C, Osamu K, et al. Risk Factors for Surgical Site Infection in Emergency Colorectal Surgery: A Retrospective Analysis. Surgical Infections. June 2014; 15(3):256-261.
8. Khadilkar R, Khsirsagar V, Khadilkar S, Bendre M, Chavan S. A Comprehensive Study of 100 Patients of SSI (Surgical Site Infections) in Patients Undergoing Abdominal Surgery, Elective/Emergency, in Our Hospital. JMSCR 2017; 05(04):20947-20950.
9. Maheshwari MK, Sanjay P, Krishna BA, Abhinav A. A prospective study of surgical site infection in elective and emergency abdominal surgery in CSSH, Meerut. JARMS. 2013; 5(4): 413-418
10. Abubaker Lubega, Bazira Joel, and Najjuka Justina Lucy, "Incidence and Etiology of Surgical Site Infections among Emergency Postoperative Patients in Mbarara Regional Referral Hospital, South Western Uganda," Surgery Research and Practice, vol. 2017, Article ID 6365172, 6 pages, 2017. doi:10.1155/2017/6365172
11. Merkow RP, Ju MH, Chung JW, et al. Underlying reasons associated with hospital readmission following surgery in the United States. JAMA. 2015; 313(5):483–495.
12. Malik ZI, Nawaz T, Abdullah MT, Waqar SH. Zahid MA. Surgical Site Infections in General Surgical Wards at a Tertiary Care Hospital. Pak J Med Res 2013; 52(4):116-119.
13. Bibi S, Channa GA, Siddiqui TR, Ahmed W. Frequency and risk factors of surgical site infections in general surgery ward of a tertiary care hospital of Karachi, Pakistan. Int J Infect Control 2011; 7:i3:1-5.
14. Akhtar S, Gondal KM, Ahmed M, Mohammad Y, Goraya AR, Karim F. Surgical Wound Site Infection - Our experience. Ann King Edward Med Coll Jul - Sep 2001; 7(3):211-2.
15. Berríos-Torres, SI. et al., Centers for Disease Control and Prevention Guideline for the Prevention of Surgical Site Infection. JAMA Surg, 152(8): (2017):784-791.
16. Razavi SM, Ibrahimpoor M, Sabouri Kashani A, Jafarian A. Abdominal surgical site infections: incidence and risk factors at an Iranian teaching hospital. BMC Surg. 2005 Feb 27;5:2.
17. Yousuf M, Hussain M. Need and duration of antibiotic therapy in clean and clean contaminated operation. J Pak Med Assoc. 2002; 52:284-7.
18. Kaye KS, Anderson DJ, Sloane R, Chen LF, Choi Y, Link K, et al. The Effect of Surgical Site Infection on Older Operative Patients. J Am Geriatr Soc. 2009; 57(1):46-54
19. Chen YY, Chou YC, Chou P. Impact of nosocomial infection on cost of illness and length of stay in intensive care units. Infect Control Hosp Epidemiol 2005; 26: 281-287.
20. Moor Z, Cowman S, Effective wound management: identifying criteria for infection. Nurs Stand. 2007; 21:68-72.
21. Dettenkofer M, Forster DH, Ebner W, Gastmeier P, Ruden H, Daschner FD. The practice of perioperative antibiotic prophylaxis in eight German hospitals. Infection 2002; 30:164-7.

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