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ORIGINAL ARTICLE

Factors leading to surgical site infection (SSI); a 6 years analysis of general surgical cases in a newly developed teaching hospital.

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ABSTRACT… Objective: To determine the major factors leading to surgical site infection in elective surgeries. **Study Design:** Retrospective Cross Sectional study. **Setting:** Department of Surgery, Government Teaching Hospital Shahdara, Lahore. **Period:** January 2016 to December 2021. **Methods:** The cases of surgical site infections were collected from well-organized data according to health care commission's format of recording data in surgical site infection Register. Emergency patients were excluded. Each infected case was thoroughly investigated according to Performa and presented in meeting of infection control committee. Demographics were recorded and the factors were determined in individual case. Frequency and percentages of infected cases and main factors in all cases were analyzed by SPSS version 24. **Results:** We had 61 cases of SSI out of 2962 cases operated during the study period with calculated rate of 2.06%. Seventy two percent cases had age more than 40 years. 39(63.93%) were female and 22(36/07) were male. Mean age was 43.02 years with standard deviation of ± 8.98. 72% of infected cases. BMI in infected cases was 29.56 mean and Standard deviation ± 2.74 and 27.29 in non-infected cases (significant). Diabetes and Rank of surgeon had significant difference with increased infection in resident level. Smoking and gender of patients had no statistically significant impact. **Conclusion:** High Body mass index, diabetes, longer duration of procedure, rank of surgeon and use of mesh are the leading factors causing surgical site infection. Smoking, age and gender had no significant effect on SSI.

Key words: Body Mass Index, Cholecystectomy, Hernioplasty, Nosocomial, Surgical Site Infection.

INTRODUCTION

The United States Centers for Disease Control and Prevention (CDC) defines the Surgical site infection (SSI) as "the infection that occurs at the site of incision superficially or in organ or space within 30 days after the surgery or within 90 days if an implant was placed".[1] It is reckoned as the 3rd most reported nosocomial infection.[2] SSI's not only cause pain to the patient but also cause delay in wound healing, morbidity, mortality, bed occupation in ward, increase in the duration of stay in hospital or ICU, increased treatment cost and expenditure of already limited resources; in turn causing socioeconomic loss to the patient and the country. Hence, for the success of surgery it is substantially essential to limit these pathogens and decrease the incidence of SSI. For this purpose, initiatives should be taken for microbial management and surveillance of SSI. Despite all these efforts and studies the cases of surgical site infection keep rising in the developing countries; all payable to the limited resources, unhygienic environmental conditions, overcrowding, disproportionate number of staff and patients, staff deficient in knowledge, inadequate sterilization practices and nonconformity to the infection control guidelines.[2,3] Inferred from the above mentioned facts, it is necessary to find the root cause of the surgical site infections. We conducted a study to find the factors leading to surgical site infection (SSI) in the general surgical cases performed in the Government Teaching Hospital Shahdara, Lahore in the last 6 years. Through this study we aim to eliminate or at least alleviate the incidence of these infections in order to assuage the implications of these infections on the socioeconomic status of the patients and country.

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METHODS

This retrospective cross sectional study was conducted in department of general surgery Government Teaching Hospital Shahdara, Lahore after approval from ethical committee (16-12-20). Our study included all major surgical cases operated in department of surgery from January 2016 to December 2021. Total 2962 elective cases were included and entered in computer program by using SPSS version 25. All demographic data was recorded and grouped into types of surgery, duration of procedure whether less than one hour, surgeon's expertise (more than 2 years after post-graduation or residents and junior consultant), BMI, Diabetes status and smoking. Prophylactic antibiotic was given in all patients according to type of surgery. All infected cases were included which showed any symptom or sign of infection or surgical site occurrence. All SSI cases were evaluated in meetings of infection control committee and the factors were determined in each case. SSI rate was calculated month wise. Culture and sensitivity were obtained in some but not in all cases. This was due to non-availability of this test in this hospital. Only affording patients could get this test routinely. However empirical therapy was started according to condition of the wound. Culture reports of some patients, who were able to get, were also recorded and the treatment in these cases was modified according to the sensitivity reports. The data was analyzed and factors for causing SSI were determined. P value less than 0.05 was considered significant.

RESULTS

Total 2962 cases were operated during this study period. Infected cases were 2.06% (n=61). Among the infected cases, 39(63.93%) were female and 22(36.07%) were male. There was no statistically significant difference of infection between both genders and different age groups. Mean age was 43.02 years with standard deviation of ± 8.98. 72% of infected cases. BMI in infected cases was 29.56 mean and Standard deviation ± 2.74. In non-infected cases mean BMI was 27.29 showing statistically significant difference between both groups. About 95.1% of infected cases had BMI more than 25.

Forty one (67.2%) cases took longer than one hour for operation. Mean time of surgery in infected cases was about 81 minutes whereas 42 minutes in non-infected cases, also significant difference. A total 33 of infected cases were of Ventral hernias (54%) for which mesh hernioplasty was done followed by cholecystectomies and common bile duct exploration (27.9%). Diabetes and rank of surgeon also had significant p value(less than 0.05). Mesh hernioplasty for ventral hernias was most common infected procedure (54% of total infected cases). Cholecystectomies constituted 27.9% of total SSI cases as the second common infected procedure.

Smoking and gender of the patient had no significant difference.

Table-II shows the frequency of different common procedures performed during the study period which included Hernias, cholecystectomies, hemorrhoidectomy, and thyroidectomy, Parotidectomy, Breast and other.

DISCUSSION

Surgical Site Infection (SSI) is common challenge in both developed and underdeveloped countries. However this is underreported in our setups because surgeons don't wish to get defamed by reporting such cases. According to a study by the National Healthcare Safety Network (NHSN) including 850,000 general surgeries from United States the incidence of SSI was only 1.9% as compared to the 9.29% incidence of SSI determined in a study carried out in Peshawar, Pakistan.[3] Even the basic lifesaving surgeries like appendectomies and cesarean sections result in high surgical site infection and mortality in developing countries.[4] Probability of developing SSI is increased more so in the abdominal surgeries.[5] Present studies suggest that the incidence of SSI ranges from 1.2% to 5.2% after abdominal surgery.[6]

	Frequency	Percent	Valid Percent	Cumulative Percent
CBD Exploration	3	4.9	4.9	4.9
Keels' with Mesh Hernioplasty	1	1.6	1.6	6.6
Laparoscopic Cholecystectomy	7	11.5	11.5	18.0
Laparoscopic converted to Open Cholecystectomy	1	1.6	1.6	19.7
Mayo's Repair	3	4.9	4.9	24.6
Mesh Hernioplasty	8	13.1	13.1	37.7
Modified Radical Mastectomy	1	1.6	1.6	39.3
Onlay Mesh Hernioplasty	12	19.7	19.7	59.0
Open Cholecystectomy	6	9.8	9.8	68.9
Primary Repair	4	6.6	6.6	75.4
Stoppa	1	1.6	1.6	77.0
Subcutaneous Mastectomy	1	1.6	1.6	78.7
Sublay Mesh Hernioplasty	12	19.7	19.7	98.4
Subtotal Thyroidectomy	1	1.6	1.6	100.0
Total	61	100.0	100.0	

Table-I. Types of surgeries (infected cases)

Name of the Procedure	Frequency (n=2962)	Percentage %
Inguinal Hernia	1045	35.28
Para umbilical Hernia Primary Repair Mayo's Repair Sublay mesh hernioplasty Onlay mesh hernioplasty	364 56 75 140 93	12.29 1.89 2.53 4.72 3.14
Inguinal Hernia	48	1.62
Laparoscopic Cholecystectomy	896	30.25
Open Cholecystectomy	198	6.68
Hemorrhoidectomy	125	4.22
Fibro adenoma	108	3.66
Others (Thyroid, Parotid, Varicose veins, Pilonidal sinus, MRM, CBD Exploration)	178	6.01

Table-II. Different procedures and their frequency

Factors Affecting SSI	Presence of SSI		P-Value
	Yes	no	
Mean age	43	42	0.85
Mean BMI	29.56	27.29	0.00
Sex Male Female	 16 45	 763 2138	0.99
Time taken for surgery	81.48	42.57	0.00
Diabetes Yes No	 19 42	 280 2621	0.00
Smoking Yes No	 08 53	 395 2506	0.91
Surgeons rank Consultant Resident	 27 34	 1475 1426	0.00

Table-III. Factors affecting surgical site infection

Studies show that both gram positive and gram negative bacteria cause SSI and the most common among them is Staphylococcus aureus (31.58%), Klebsiella pneumoniae (26.31%), Pseudomonas aeruginosa (15.79%), Escherichia coli (10.53%), Acinetobacter (10.53%) and Proteus mirabilis (5.26%). These bacteria pose a great threat to the increased rate of SSI's as most of them are multi-drug resistant.[7]

Efforts to limit surgical site infections are made for which several studies are done to find the determinants of the infection. Pakistan's 1st National Infections Guidelines was instituted in 2006.[8] Studies have shown that the factors influencing the incidence of surgical site infection are patient based, surgeon based and hospital based. Patients' increasing age, his/her educational status and personal hygiene are important factors.[1-4] Likewise patient's weight (BMI) and history of drug abuse (e.g. smoking) greatly affect the chances of developing surgical site infection.[7,8] in our study also BMI had significant impact. Presence of other comorbidity

like hypertension, diabetes, anemia and past history of surgical intervention increases the surgical site infection rate.[6,7] Patient admitted through emergency tend to have SSI's more than the patients admitted on elective basis. SSI's are more common in the patients who have longer duration of stay in the hospital both preoperative and postoperative.[8,9] Studies have shown that the use of prophylactic antibiotic before the start of surgery greatly decreases the rate of SSI's.[6,9] Use of steroids and blood transfusion also causes increased rate of SSI's.[9,10] Surgeries done by highly skilled surgeons result in decreased rate of SSI's than the ones performed by less skilled surgeons.[11,12] similar results are presented in our study showing increased significant infection rate in resident level surgery as compared to consultant level surgery. As different surgeons use different techniques during the surgery like different methods of traction, effective hemostasis, irrigation of tissues, duration of closed suction drainage and judicious or excessive use of electro surgery; the technique of surgeon also plays part in the incidence of SSI's.[1] Moreover, SSI's depend immensely on the type of surgery performed regarding the organ involved.[2,4] The surgeries of the abdomen especially colorectal surgeries contribute more to the overall rate of surgical site infections.[6]

Our study had the limitation that we did not include emergency cases and could not get culture and sensitivity in every case except selected non respondent cases due to financial and logistic issues.

CONCLUSION

We concluded from our study that high BMI, diabetes, level of surgeon and increased procedure time are leading factors in causing SSI in our setup in elective surgeries, whereas smoking and gender had no significant effect in our study. We recommend weight reduction and procedure time should be kept to minimum in order to decrease surgical site infection rate.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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AUTHORSHIP AND CONTRIBUTION DECLARATION

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2	Mudassar Murtaza	Study design, Conduct, manuscirpt writing, acquisiton of whole study.	
3	Mumtaz Ali	Data collection.	