Surgical Site Infection Following Elective and Emergency Surgical Procedures

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ABSTRACT

Objective — *To determine the frequency of surgical site infection following elective and emergency surgical procedures.*

Study design — *Cross sectional observational study..*

Place & Duration of study — *Department of General Surgery Ward II, Jinnah Postgraduate Medical Centre (JPMC) Karachi, from January 2022 to January 2023.*

Methods — *Patients who underwent any surgical procedures, both as elective cases or in emergency, were included. Postoperatively patients were followed in wards and after discharge in outpatient department on 5th, 7th and 30th day. The wounds were assessed for the development of surgical site infection. In infected wounds the purulent discharge was sent for culture and sensitivity. Data were collected and analysed using SPSS version 23. Descriptive statistics were used for presenting quantitative and qualitative variables. A 95% confidence interval was calculated for each proportion and tested by one sample t test.*

Results — *Total of 903 patients were operated. This included 663 elective and 240 emergency cases. On elective operation list 392 (59.12%) female and 271(40.88%) male patients were operated while in emergency settings 184 (76.67%) male and 56 (23.33%) female underwent surgery. The surgical site infection in emergency operations noted in 156 (65%) and in elective operations in 32 (4.82%) patients. The wound infection was most commonly noted in patients who had peritonitis (n=126). This was found statistically significant [(n=122 - 96.82%) p=0.001]. In emergency cases the rate of mild infection was 42.30%, moderate 24.35% and severe 47.4%. In elective cases mild wound infection rate was 60%, moderate 29% and severe 10.5%.*

Conclusion — *The infection rate was very high in emergency cases especially in patients who presented with peritonitis. It was low in intestinal obstruction and trauma cases. Overall infection rate in elective cases was less than 5%.*

Key words — *Surgical site infection, Emergency surgery, Elective surgery, Wound infection, Peritonitis.*

INTRODUCTION:

A surgical wound is the residual skin defect after a surgical incision. The Centre for Disease Control (CDC) classified wounds into four categories namely; Class I (clean), Class II (clean contaminated), Class III (contaminated) and Class IV (dirty) wounds. In Class I wounds the hollow viscera are not entered while in Class II wounds, the respiratory, alimentary, genitourinary tract are entered but under controlled conditions. The Class III contaminated wounds are labelled when an open wound gets contaminated either from a breach in sterile technique or unexpected leakage of contents from the gastrointestinal tract and other hollow viscera.

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The Class IV wounds are dirty and infected due to severe contamination with the presence of devitalized tissues and microorganisms. Surgical site infection according to CDC can occur up to 30 days of operative procedure or a year if an implant is left in place. CDC classifies SSI into three categories superficial SSI, deep incisional, and organ/space, based upon the depth of tissues, involved.[1]

Surgical classification of wounds helps to predict the future rate of surgical site infection, complications and reoperations. Wound infection increases disease related morbidity and mortality as a result of sepsis and impairs quality of life.[2] Risk factors for surgical site infection includes prior presence of infectious disease, low serum albumin, extreme of ages, high BMI, smoking, known co morbid and others. Surgical risk factors include prolong duration of operation, inadequate surgical scrubbing, inadequate skin scrubbing, and handling of tissues.[3]

Signs and symptoms of SSI include painful, red, hot and tender swelling, purulent discharge from the wound, presence of microorganism on culture and delayed healing.[4,5] Surgical site infection is difficult to treat and adds to the cost of the surgical procedure. Counselling of the patients is therefore needed. SSI rate of 4.34% in elective procedures and 12.41% in emergency cases and an average of 7.32% is reported. *E. coli* was the commonest organism found in elective cases and *Proteus mirabilis* in emergency cases.[6]

This study was conducted to find out the frequency of surgical site infection, in our tertiary care setup which is a high volume healthcare facility, among patients who were operated on elective surgical list and those who are brought in emergency. This adds to the evidence based data on the subject that has important bearing on healthcare resources. This helps in making necessary changes in standard operating protocols.

METHODS:

Study design, place & duration: This cross sectional study was conducted in the Department of General Surgery Ward II, Jinnah Postgraduate Medical Centre Karachi, from January 2022 to January 2023.

Ethical considerations: The study was approved by the Ethical Review Committee JPMC letter No.F2-81/2022-GEN/210/JPMC dated 06-01-2022. Written informed consent was taken from the patients.

Sample size estimation: All patients were included in the above mentioned study period through non-probability purposive sampling.

Inclusion / Exclusion criteria: All general surgery patients of either gender, who were operated on elective list or in emergency settings, were included in this study. Patients under 12 years of age were excluded as they are referred to pediatric surgical department. Immunocompromised patients and those on steroids, with dirty wounds and operated in other hospitals with burst abdomen, were excluded.

Study protocol: All patients after surgery were followed postoperatively in the ward and then in the outpatient department on 5th, 7th and 30th day. At each visit fever and pain in the wound was inquired. Wound was examined for any discharge. Wounds were classified according to the type of the surgical procedure performed as clean, clean contaminated, and contaminated wounds. The SSI was recorded as mild (redness and tenderness, with mild serous discharge), moderate (when discharge become purulent and extend into subcutaneous plain with increased redness and pain), and severe (when infection has progressed into deep tissues like muscles along with systemic signs of infection).

Statistical analysis: A database was developed on SPSS version 23. The outcome of complications was presented by their frequencies along with proportions of total cases. A 95% confidence interval was calculated for each proportion and tested by one sample t test for binomial proportion against null hypothesis of p=0.5. The results were considered significant with p=0.05 according to the normal theory method.

RESULTS:

A total of 663 patients had an elective surgery while 240 patients presented as emergency cases and operated. The age of patients was from 13 years to 65 years. In elective group there were 392 (59.12%) females and 271(40.88%) males while in emergency settings 184 (76.67%) male and 56 (23.33%) female patients were operated. The details of infection rate are given in table I. The surgical site infection occurred in 156 (65%) patients who were operated in emergency. In elective cases, 32 (4.82%) patients developed wound infection. The infection rate in breast and neck surgery was very low and for the inguinal and abdominal regions was slightly high. The infection rate in patients with peritonitis was very high as compared to laparotomy for intestinal obstruction and trauma cases.

In emergency cases the rate of mild infection was 42.30%, moderate 24.35%, severe 47.4%. In peritonitis cases mild infection rate was 12%, moderate 26.9%, and severe 55.5%. In other patients

Table I: Frequency of Surgical Site Infection in Emergency and Elective Surgical Procedures

Emergency procedures	Number of patients (n)	Number of infected patients (n %) 95% CI	p-value (z-value)	Elective procedures	Number of patients (n)	Number of infected patients (n %) 95% CI	p-value (z-value)
Laparotomy for peritonitis	126	122 (96.82%) (92.52 -98.98)	0.001* (10.51)	Thyroidectomy	52	1 (1.92%) (0.09 -9.12)	0.001* (6.93)
Laparotomy for intestinal obstruction	20	8 (40%) (20.61 -62.11)	0.37 (0.89)	Mastectomy	54	1 (1.85%) (0.09 -8.79)	0.001* (6.93)
Appendectomy	58	12 (20.68%) (11.72 -32.52)	0.001* (4.46)	Incisional hernia	50	4 (8.00%) (2.59 -18.18)	0.001* (7.07)
Obstructed inguinal hernia	20	8 (40%) (20.61 -62.11)	0.37 (0.89)	Paraumbilical hernia	45	3 (6.67%) (1.72 -17.08)	0.001* (5.04)
Trauma	16	6 (37.50%) (16.83 -62.36)	0.31 (1.0)	Inguinal hernia	148	4 (2.70%) (0.86 -6.39) 95% CI	0.001* (5.81)
				Colorectal cancer surgeries	55	8(14.54%) (6.99 - 25.76)	0.001* (11.51)
				Open cholecystectomy	36	2 (5.55%) (0.94 – 17.16)	0.001* (5.25)
				Laparoscopic cholecystectomy	220	9 (4.09%) (2.01 – 7.37)	0.001* (13.62)
Total	240	156 (65%) (58.80 -70.84)			663	32 (4.82%)* (3.38 – 6.66)	

*Significant

in whom laparotomy was performed mild infection rate was 35%, moderate 15%, and severe 5%. In elective cases rate of mild infection was 60%, moderate 29% and severe 10.5%. Culture and sensitivity of purulent discharge revealed growth of *Escherichia coli, Proteus mirabilis* and *Enterobacter* in most of the cases. Infection rate in clean cases was 3.7%, in clean contaminated 12.70% and contaminated cases 96.82%.

DISCUSSION:

In this study infection rate in elective patients was 4.82% and in emergency cases 65% with average mean age 18-40, while in other study SSI was higher in emergency abdominal surgeries (20.7%) than in elective cases (4.9%).[7] Surgical site infection is usually a nosocomial infection and it depends on patients' hygiene. Most of the patients in our study were from a low socioeconomic status thus personal hygiene remained an important issue both during the admission and when they were discharged. Sterilization and antiseptic practices in operation theatre may be responsible for the wound infections in clean cases. However, the infection rate in elective cases was low which reflects better sterilization of equipment practices and surgical techniques in our set up.

In this study the frequency of typhoid intestinal perforation and tuberculous ileal perforation was high. The infection rate due to peritonitis in these patients was more as compared to other countries like France where it is 2.5%.[8] Use of contaminated instruments can cause the infection, therefore thorough cleansing of instruments is required to prevent surgical site infection.[9] In this study in emergency cases severe infection rate was 47.4% and the infection rate in peritonitis cases was 96.8%. These cases fall in the category of contaminated wounds. In another study conducted in China the infection rate in peritonitis cases was high up to 7.5% as compared to other procedures but it was far less than what is reported in our study.[10]

Wound classification also predicts the surgical site infection. In contaminated wounds the frequency of infection is more as compared to clean contaminated.[11] The infection rate in peritonitis is therefore high as reported in this study. In another study wound infection rate in emergency laparotomy was 11.4%.[12] The infection rate in trauma cases in our study was 6% which is similar to other study of 7%.[13] Early detection of infection and immediate treatment can prevent severe surgical site infection. This helps in early recovery of patients as well. The risk factor like diabetes mellitus, hypertension, and coronary artery disease should be treated properly as they can contribute to infection due to less oxygen

supply to the wound. In addition, sepsis can impair the control of diabetes mellitus and other cardiovascular diseases. Other risk factors like smoking and malnutrition can also contribute to infection.

In this study frequency of infection in elective cases was low. The reason may be the better health parameters of patients scheduled for the surgery with better control of co morbid conditions. Usually the elective settings are clean cases and sometimes clean contaminated such as due to rupture of gallbladder and spillage of bile during laparoscopic cholecystectomy. A slightly high rate of infection is expected in these cases. In a study the overall incidence of surgical site infection in elective cases was 14.29%.[14] This is higher than our study.

Limitations of the Study: The study is from a tertiary care public sector hospital that are overburdened with emergency cases. Patients are mostly from lower socioeconomic status with number of health related issues and poor hygiene status. Breach in sterilization and antiseptic protocols might be a reason as well. The results of the study may be considered under these limiting factors.

CONCLUSION:

A high wound infection rate was observed in patients operated in emergency. Majority had established peritonitis at the time of presentation. This was less in patients operated for intestinal obstruction and in trauma cases as contamination was limited. In elective cases the rate of infection was in acceptable range.

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