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Original Article

Surgical Site Infections in General Surgical Wards at a Tertiary Care Hospital

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Abstract

Background: Surgical site infections are important cause of morbidity and mortality in admitted patients world over.
Objectives: To determine the pattern of surgical site infections in General Surgical ward of a tertiary care hospital.
Study type, settings and duration: Analytical cross-sectional study conducted at Department of General Surgery, Pakistan Institute of Medical Sciences, Islamabad for two years from January 2010 to December 2011.
Subjects and Methods: All cases were admitted in surgical ward with various surgical problems either as elective or emergency cases who developed wound infection later were included in the study. Cases of wound infection operated elsewhere, diabetic foot, and abscesses were excluded. Data collected included age, gender, primary diagnosis, mode of admission, comorbid factors, type and duration of surgery, expertise of the surgeon, use of antibiotics and hospital stay. After operation, wound was examined for evidence of infection from third post-op day onward. Any discharge was submitted for bacteriological examination. The wounds were followed till healed.
Results: A total of 1913 patients underwent surgery, including 983 cases (51.5 %) operated as elective and 932(48.5 %) as emergency. Postoperative wound infections occurred in 165 cases giving an overall incidence of infection in 8.6% cases. Infection rate in elective cases was lower (4.6%) than that in the emergency (12.7%) cases. Sixty one patients (37%) developed minor infection or stitch abscess, 104(63%) has frank suppuration requiring opening and drainage of wound; while 5(3%) cases developed deep seated infection of intra-abdominal spaces. *E. coli* was the commonest bacteria for wound infection (39%).
Conclusion: Post operative wound infection rate was 8.6%. The infection was significantly higher in cases who underwent emergency surgery and *E. coli* was the commonest pathogen to cause infection.
Key words: Surgical site infections, surgical wound infections, bacterial infections, antibiotic prophylaxis.

Introduction

Infections which develop more than 48 hours after admission are hospital acquired or nosocomial infections[1]. They are the sixth leading cause of death in USA, accounting for 150,000 deaths per year, and their incidence varies from 5-10%[2]. Nosocomial infections are an important cause of preventable morbidity and mortality that prolong hospital stay by an average of eight days[3] while the treatment cost and work load on health care facilities is increased many folds. Among surgical patients, surgical site infections (SSIs) are one of the most commonly reported nosocomial infection; accounting for 16%[4] to 38% of all such infections[5]. SSIs can debilitate patients and dramatically increase health care costs[6]. They are a leading cause of readmission, may lead to complications like delayed wound healing and revision surgery[7] and with longer hospital stay can render patients susceptible to infections from the hospital environments[8].

The CDC-definitions for surveillance of surgical site infections take into account 3 classes of wound infections: superficial, deep incisional SSI, and organ/space SSI[9]. Since ancient times wound infections have markedly increased the sufferings of postoperative cases: and despite being largely preventable, they remain a major source of morbidity[10]. In order to minimize postoperative surgical wound infection, it is important to create a safe environment by controlling four main sources of infection i.e. personnel, equipment, the environment, and patient`s risk factors[11]. Knowledge of specific risk factors for SSI is essential to create a specific SSI risk stratification index[12], and to develop strategies to confine infection rate. The best approach is the prevention as it is simpler, cheaper and more rewarding for the patients; and at least one third of them are preventable by simple measures[13]. Thus, every hospital needs to organize its infection control program. Failure to implement infection control policies and lack of awareness are the factors contributing to hospital infections and disease outbreaks. On the other hand, studies provide evidence of a

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significant decreasing trend in the SSI rates following the infection control interventions[14].

In our hospitals, there are high rates of nosocomial infections with little efforts to control them. The present study was conducted on patients operated for various surgical problems in a tertiary care major public sector of Islamabad, to evaluate the frequency of surgical site infections.

Subjects and Methods

This analytical cross-sectional study was conducted in the department of general surgery, Pakistan Institute of Medical Sciences, Islamabad over two years from January 2010 to December 2011.

All adult cases admitted in surgical ward either as elective cases or as emergency were included in the study. Cases having wound infection, operated elsewhere, those with diabetic foot disease and those operated for incision and drainage of abscess were excluded. All the cases operated during the study period were observed for development of wound infection. Patients undergoing multiple admissions or operations for complications were counted once.

Consent was taken from all the patients who developed infection, for inclusion in the study. All the information collected was recorded on a specially designed proforma that included history, physical examination, any co-morbid factors and all investigations performed during their stay at the hospital. The operative details were noted including type of procedure, duration of surgery, whether operated by residents or consultants, and use of prophylactic antibiotics. The wounds were examined for infection from third postoperative day onward. Surgical site infection was identified with redness, inflammation, local heat, pain, temperature of 38^{o} C or above, and septic discharge from incision site during 30 days after operation (according to WHO guidelines)[15]. The discharge was sent for culture and sensitivity. The infections were managed by standard protocol involving repeated dressings according to the case, drainage of pus if required, and change of antibiotic in the light of culture/sensitivity reports. Pre and postoperative hospital stay was noted. Infected wounds were inspected regularly during follow up until they were healed.

The information was entered in computer and data was analyzed using SPSS version 12.0. Various frequencies and percentages were calculated; the results are displayed in tabulated or graphic forms.

Results

During the study period, a total of 2108 cases were registered in surgical ward and 1915 were operated. Surgery in 983 cases (51.3%) was elective or planned while 932 patients (48.7 %) were operated in emergency. Majority were males 1167(61%). The median age was 42.7 years (range 16-82 years) and majority 1417(74%) were below 50 years of age. Almost 58% men developed infection. Postoperative infection occurred in 165 cases giving an overall incidence of 8.6% infection.

Of 165 cases that developed wound infection, 69 (42%) patients were aged above 50 years. Infections were least common 20(2.1%) in clean procedures and were highest among dirty cases (Table-1). Out of 983 cases who were operated on elective list, infection occurred in 46 patients (4.6%). Out of 932 cases operated in emergency, infection occurred in 119 patients (12.7%).

Table 1: Infection rate in different procedures.

Type of procedure	*Total cases (n=1915)*		*Infected cases (165)*	
	n	*%*	*n*	*%*
Clean	976	51	20	2.1
Clean-contaminated	421	22	19	4.5
Contaminated	173	9	28	16.2
Dirty	343	18	98	28.5
Operative settings				
Setting	Number of infected cases		%	
Elective surgery (n=983)	46		4.6	
Emergency surgery (n=932)	119		12.7	

Average duration of surgery was 109 minutes (range 35 minutes to 7 hours 20 minutes). Antibiotic prophylaxis was given in clean cases (first generation cephalosporins) and clean-contaminated cases (third generation cephalosporins). In contaminated or dirty cases, regular use of antibiotics was employed according to the case, rather than giving prophylaxis.

Average duration of hospital stay after surgery was 7.4 days (range 1-110 days), while average duration of hospital stay before surgery was 1.8 days (range 10 hours to 13 days). Although infected cases took longer in hospital, however, this aspect was not studied in detail.

Surgeries in 948 cases (49%) were performed by senior registrar or a surgeon of higher status; in this group 76 cases developed wound infection (8.0%). In 967 cases (51%) operations were performed by residents, under supervision by senior surgeons; in this group 89 cases developed wound infection (9.2%). Therefore, there was no significant difference in infection rate among the two groups.

Of the co-morbids, anemia (haemoglobin less than 10 gm/dl) was the most common. In elective cases it was corrected before surgery but in emergency cases per operative blood transfusion was given. Other co-morbid factors in 165 patients are shown in Table-2.

Surgical wound infection developed in 165 cases. Majority 99(60%) showed frank suppuration that required opening and drainage of wound (Figure-1). Wound infection was observed within 3-5 days in 110 cases (67%), within 6-8 days in 41 cases (25%), and within 9-14

days in 13 cases (8%). One case presented with infection 10 months after mesh repair for incisional hernia.

Table 2: Distribution of co-morbid factors. (n=165)

Factor observed	*n*	*%*
Anemia (Haemoglobin less than 10 gm/dl)	63	38
Malnutrition (Loss of more than 6 Kg body weight)	41	25
Smoking (more than 10 cigarettes/day)	26	16
Diabetes mellitus	19	11.5
Hypertension and / or ischemic heart disease.	19	11.5
Obesity (more than 10% of ideal body weight)	08	5.0
Compensated chronic liver disease	03	2.0

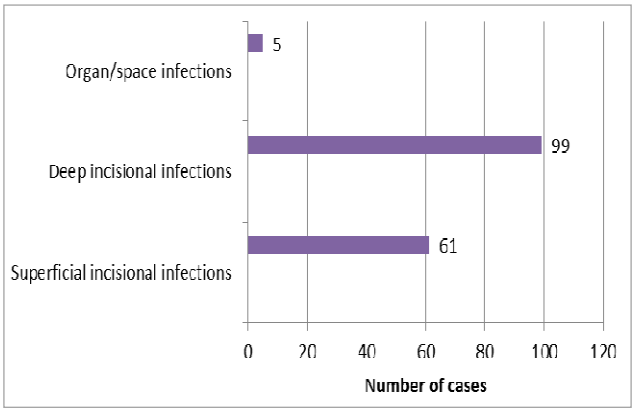

Figure 1: Types of infections

Discharge from the wound was submitted for bacterial culture in all cases. Twenty three cases (14%) showed mixed growth; 121(73%) showed growth of single organism; and 21(13%) had no growth. The commonest bacteria grown was *E. coli* in 64(39%) cases, *Klebsiella spp*. in 37(22%) cases, *Pseudomonas aeruginosa* in 25(15%) cases, and *Styphylococcus aureus* in 18(11%) cases including methicillin resistant *S. aureus (MRSA)* (Figure-2).

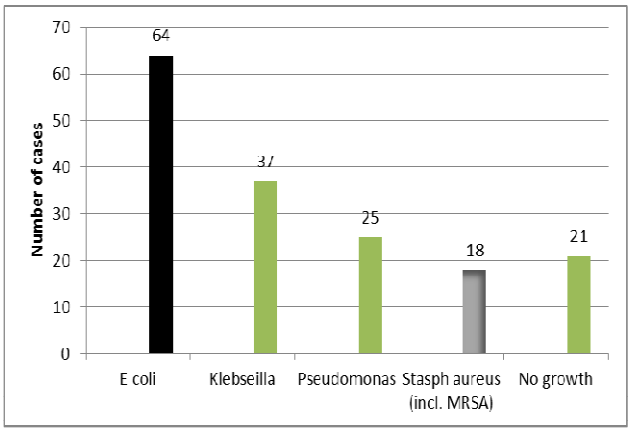

Figure 2: Organisms grown on culture.

Discussion

In the present study surgical site infection were seen in 8.6% cases with majority of the cases undergoing emergency surgery. The incidence of SSI varies and is 4.4% in Taiwan[16], 5% in United States[17], and 5.2% in Japan[18], while a Brazilian study reported a much lower incidence of 1.8%[19]. Reports from Pakistan show a higher incidence of 6.5% from Peshawar[20], and 11.4% from Karachi[21].

Several factors are responsible for causing infections which vary from patients themselves (especially contamination by alimentary tract bacteria) to other patients, hospital environment, food, hospital staff, infected surgical instruments, dressings, and even medicines and injections[22]. Advanced age is an important host-related risk factor[9,22]. Due to higher incidence of coexisting diseases, impaired immunological status, personal neglect, etc. However, gender is not a significant issue and same has been reported by others[22,23].

Type of surgery is directly related to the risk of developing wound infection. It is based on potential bacterial contamination of the tissues at the time of surgery and the level of bacterial burden. Our study also showed the association of type of surgery with infection rate and same reported by other worker[22]. Duration of surgery also influences wound infection and procedures that take more than two hours are associated with higher infection rates[24], due to longer exposure of tissues to theater environment, hypothermia[25], and requirement of blood transfusion all of them are potential risk factors for SSI[26]. In a study from Lahore, wound infection rate almost double in cases that took longer than 2 hours showing direct relation to duration of surgical procedure[24]. This was also observed in our study where most of the cases that got infected took longer than 100 minutes.

Operative settings (elective or emergency) also play a significant role in determining infection rates. Cases operated in emergency are more likely to get infected due to inadequate preparation, breech in sterilization protocol, pre-existing infection and reduced immunological status of patient. In the present study, infection rate in emergency cases was almost three times higher than in elective cases (12.7% versus 4.6%). This has also been observed by other workers. Studies from Lahore show about two and a half[27] to four times[24] higher infection rate in emergency cases.

Longer hospital stay, especially in post-operative period, is associated with substantial increase in wound infection rates[22]; and the risk increases with the duration of stay. On the other hand, prolonged preoperative hospital stay also contributes to increased infection rate[9]. This may be related to bacterial colonization of patient's skin and nares with resistant hospital flora.

Expertise of surgeon is a potential factor in determining wound infection rate as reported by some authors[24]. We did not observe any significant difference of infection rate between cases operated by seniors and juniors. Improvement in the surgical skills and techniques of resident staff and also their direct supervision not only decreases the duration of operation but also incidence of postoperative wound infection[24].

In our study most common bacterial growth was of *E. coli*, followed by *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, and *Styphylococcus aureus* including *MRSA*. Similar pattern has also been reported from Hyderabad[25], but this is in contrast to the literature that reported *Styphylococcus aureus* as the most common organism[20,26-28], that is resistant to the commonly used antibiotics.

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