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RESEARCH ARTICLE

STUDY OF INCIDENCE AND RISK FACTORS OF SURGICAL SITE INFECTIONS IN POST OPERATIVE CASES

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ABSTRACT

Background: Surgical site infection is one of the most common post operative complications and causes significant post operative morbidity and mortality. SSI rates are reported to range from 2.5% to 41.9% globally resulting in high morbidity and mortality.
Aim: This study was aimed to determine the prevalence of SSI and some determinants that can affect surgical site infection rate.
Methods: This is a 2 year prospective study carried on 350 patients operated in surgery department. The various parameters studied were age of the patient, presence of comorbidities, length of preoperative hospital stay, type of surgery, duration of surgery, the wound classes and antimicrobial prophylaxis.
Results: Surgical site infection rate was found to be 12.85% with higher infection rate in males and patients above 50 years of age. SSI rate is more with emergency surgeries, longer preoperative stay and longer duration of surgery. Escherichia coly is the most commonly identified organism in the culture.
Conclusion: In view of the high rate of SSI this study suggests that by reducing the average operation time to less than 2 hours, the average preoperative stay to less than 10 days and with proper prophylactic antibiotic use the SSI may be reduced to a more acceptable level.

INTRODUCTION

Surgical site infection is one of the most common post operative complications and causes significant post operative morbidity, mortality, prolongs hospital stay and increase hospital costs also (Anand saxena *et al*., 2013). Surgical site infection (SSI) is categorized under a broad term Nosocomial Infection (NI). These infections affect about 2 million people annually resulting in 5% to 15% of them requiring hospitalization. (Anusha *et al.,*2010; Brown *et al.,*2007). SSI rates are reported to range from 2.5% to 41.9% globally resulting in high morbidity and mortality (Mawalla *et al.,*2011; Nandi *et al.,*1999). A wide range of factors have been proven to influence wound infections. Some of these factors include preexisting illness, wound class, wound contamination, extremes of ages, malignancy, metabolic diseases, malnutrition, immune suppression, cigarette smoking, remote site infection, length of surgical operation, emergency procedures and long duration of pre and post operative hospitalization amongst others. Any purulent discharge within 30 days of an operation from a closed surgical incision, together with signs of inflammation of the surrounding tissue should be considered as wound infection irrespective of whether micro organisms can be cultured (Mary Olson *et al.,*1984). In spite of modern standards of preoperative preparation, antibiotic prophylaxis and refinements in an anesthetic and operative technique post operative wound infections remain a serious problem, (Brandt *et al*., 2006). We therefore conducted this study to determine the prevalence and some determinants of surgical site infections.

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MATERIALS AND METHODS

This was the prospective study carried out in the department of surgery of Bowring and Lady Curzon hospital during 2 year period on 350 admitted patients who underwent various surgical procedures.

Inclusion criteria
Age more than 12 years who have undergone surgery. Patients not having previous infections at surgical sites.

Exclusion criteria
Patients with known preoperative infections having dirty wounds.

Patients undergoing re-operations

The criteria developed by the Centers for Disease Control and Prevention (CDC) and national nosocomial infections surveillance system was used for the diagnosis of SSI. The swabs were obtained from wounds and were processed with delay using standard microbiological methods. The data collected includes age of the patients, diabetic status, preoperative hospital stay, details of timing of antimicrobial prophylaxis, surgical wound infections, type of surgery (emergency and elective surgery), duration of surgery, the wound classes, hemoglobin percentage apart from demographic profile of the patient.

RESULTS

A study of 350 operated cases was carried out of which 45 were diagnosed to be having surgical site infection as per the CDC criteria. Thus the incidence of SSI in this study is 12.85%.

Age and Sex

Out of total 255 male patients, 37 had SSIs (14.5%), while 8 (8.42%), out of 95 female patients had SSIs. Thus it could be inferred that males were more prone to operative wound infections. Age of more than 50 years was found to be a risk factor for the post operative wound infections.

Emergency Vs elective surgery

Out of 255 elective surgeries 10 patients had SSIs (3.9%). Out of 95 emergency surgeries 35 patients had SSIs (36.84%).

Co-morbidities

Risk factors	No of cases	Infected	Percentage
Diabetes	25	3	12%
Anemia	50	6	12%
Obesity	20	4	20%
Smoking	30	4	13.3%
Malignancy	10	2	20%

Preoperative hospital stay

No of days	No of cases	Infected	Percentage
1-5 days	210	20	9.5%
6-10 days	90	13	14.4%
11-15 days	50	12	24%

Wound class

Type	No of case	Incidence	Percentage
Clean	175	6	3.4%
Clean contaminated	125	18	14.4%
Contaminated	50	21	42%

Causative organism

The pathogens isolated were Escherichia coli (14 cases), Staphylococcus aureus (6 cases), Klebsiella (5 cases), Pseudomonas aeruginosa (6 cases), Citrobacter (2 cases), MRSA (3 cases) and others 3(3 cases). No growth seen in 6 cases.

Duration of surgery

Duration in hours	No of cases	Incidence	Percentage
< 1 hour	201	8	3.9%
1-2 hours	96	15	15.6%
> 2 hours	53	22	41.5%

Post operative care and use of antibiotics

All patients received routine postoperative care including antibiotic prophylaxis. The most frequent antibiotic prescribed was Ceftriaxone, followed by cefixime. Anaerobic coverage, consisting predominantly of Metronidazole was added.

DISCUSSION

Post operative SSI remains one of the most important causes of morbidity in patients treated surgically. These infections incur higher cost because of longer hospitalizations, more nursing care, additional wound care, potential readmission to the hospital and further surgical procedures. Intensive infection surveillance and control programs can reduce the rates of infection by as much as 35% to 50%. (Haley *et al.,*1985; Di Leo *et al.,*2009)

The overall infection rate in this study was 12.85%. This was higher than the infection rates reported in developed countries such as Italy (5.9%), the United States (4.3%) and Denmark (6%) (Neumayer *et al.,* 2007; Sorensen *et al.,*2005; Lilani *et al.,*2005). However many studies from India at different places have shown the SSI rate to vary from 6.09% to 38.7%. (Lilani *et al.,*2010; Anvikar *et al.,*1999; Ganguly *et al.,*2000; Satyanarayana *et al.,*2011). In our study we found that SSIs are more common in patients above 50 years of age. Cruse and Foord observed in their study that older patients are more likely to develop inflections. It can be due to multiple factors like a low healing rate, malnutrition, mal-absorption, increased catabolic processes and a low immunity. A higher incidence of infection was found in males as compared with females in our study. Similarly a study conducted in a Peruvian hospital in 2005 by Hernadez *et al*. reported 65.6% males and 34.4% females among the SSI patients.
The infection rate in our study was more with emergency surgery compared to elective surgery due to inadequate pre operative preparations, some underlying conditions which predispose patients to an emergency surgery and the likelihood of more frequent contaminated or dirty wounds in emergency surgeries. Emergency surgeries were usually performed by junior doctors, more often with complication and had dirtier cases (Watanabe *et al*., 2008). Smoking delays wound healing by causing local and systemic vasoconstriction. This results in tissue hypoxia, hypovolemia, an environment conducive to SSI. (Cheadle *et al.,* 2006) Obese patients presents technical challenges that often increase procedure time and complications. Because adipose tissue is vascularized poorly, it creates an environment suitable for the proliferation of microorganisms. Previous studies have documented that comorbidities are associated with an increased risk of SSI, (Arabshahi *et al.,* 2006; Beldi *et al.,* 2009). This is in agreement with our finding.

Preoperative hospitalization of more than 10 days had an incidence of 24%. The rates of SSIs has increased with the increasing duration of preoperative hospitalization. The higher incidence of infections due to a longer stay in the hospital could be attributed to the increased colonization of patients with nosocomial strains in the hospital with staphylococcus aureus (60%) and MRSA (50%) and also, a longer pre-operative stay in the hospital reflected the severity of the illness and the co- morbid conditions which required patient work- up and or therapy before the operation. Similar results were obtained in other studies like in the study by Syed Mansour Razavi *et al* which showed 1- 15 days of pre op admission had SSI of 18.6% where as more than 15 days had infection rate of 25.9%. Nongyao Kasatqibal *et al* 2006 also had increased risk of SSI with increasing duration pre operative hospital stay. By wound classification, a clean wound infection rate of 3.4%, clean contaminated rate of 14.4% and contaminated rate of 42% were determined. Mahesh CB *et al* in 2010 had SSI rate of 11.5% in clean surgeries, 23.3% in clean contaminated cases and 38.!% in contaminated cases. The most common organism isolated in our study was E.coli which was in agreement with findings reported previously.

Previous studies have also assessed the influence of prolonged operative time as a risk factor for SSI, (Haridas *et al.,* 2008). A prolonged operative time leads to fatigue, resulting in a decline in the use of aseptic measures during surgery, and may also be associated with advanced disease, re-operation, or intra-operative difficulties. Additionally, a prolonged operative time is often related to increased blood loss, which contributes to tissue hypoxia.
The preoperative antibiotic prophylaxis could decrease post operative morbidity, lessen the hospital stay and it could possibly reduce the overall expenditure which are attributable to the infection. Ideally the antibiotic should be administered within 30 minutes and certainly within two hours of the time of incision.

Conclusion

A pre-existing medical illness, prolonged operating time, the wound class, emergency surgeries and wound contamination strongly predispose to surgical site infection. Antimicrobial prophylaxis is effective in reducing the incidence of post- operative wound infections for a number of different operative procedures but, timing of administration is critical. Reduction of length of procedures through adequate training of the staff on proper surgical techniques, proper intra-operative infection control measures and feedback of appropriate data to surgeons regarding SSIs would be desirable to reduce the surgical site infection rate. A surveillance programme for SSI need to be applied by the hospital followed by auditing the infection rate on a regular basis.

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