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Original Article

Clinical Study of Causative Factors Precautionary Measures and Treatment of Surgical Site Infections

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Abstract

Introduction: Surgical site infections (SSIs) still remain a significant problem following an operation and third most frequently reported nosocomial infections. SSI contributes significantly to increase health-care costs in terms of prolonged hospital stay and lost working days.

Aim: This study aims to study the prevalence, risk factors, prevention, and treatment of surgical site infection.

Materials and Methods: In this study, 1570 elective and emergency general surgical cases involving clean and clean-contaminated surgeries were included in the study. An elaborate study of these cases with regard to the date of admission, history, clinical features date of surgery, type of surgery, emergency or elective, pre-operative preparation, and post-operative management is done till the patient is discharged from the hospital and then followed up the patient on OPD basis for any signs of wound infection.

Results: In the present study, the overall post-operative SSI rate in elective clean and clean-contaminated cases is 5.11% and emergency cases is 12.41%. From the above observation, it shows that the superficial SSIs are the most common type and accounted for about 72.09% in elective and 61.11% in an emergency of all the SSIs and deep surgical site infection accounted for about 23% in elective and 30.55% in emergency cases. *Escherichia coli* and *Proteus mirabilis* were the most common organisms isolated in my study in elective and emergency cases, respectively.

Conclusion: The study emphasizes the need for the evidence-based infection control and to identify the patients susceptible to wound infection which helps in reducing the hospital stay and reduces hospital cost.

Key words: Bacteria, Incidence, Surgical site infections

INTRODUCTION

Surgical site infections (SSIs) are infections of the tissues, organ, or spaces exposed by surgeons during the performance of an invasive procedure occurring within 30 days without prosthesis or within 1 year with a prosthesis. Despite the advances in surgical sciences, post-operative wound infection remains one of the common complications which surgeons encounter. This problem if not evaluated and treated in a timely manner can have a significant sequel.[1] They are characterized by a breach of mechanical/anatomic defense mechanisms (barriers) and are associated with greater morbidity, significant mortality, and increased cost of care. Hundreds of millions of people around the world undergo surgery each year. Infection of the surgical site (formerly referred to as "wound infection," terminology that is no longer used due to confusion between infections of surgical incisions and those of traumatic wounds) is a consequence of surgery, but it is not inevitable.[2,3] SSI is most challenging to every surgeon and each and everybody is trying their methods to reduce the problem. During the years, there has been considerable progress in both the prevention and treatment of infection.[4] Since Pasteur, Cohn, Lister, Koch, and Klebs, man has constantly strove to combat infection. The discovery and confirmation of the link between microbes and diseases led ultimately to the use of arsenic, mercury, and sulfonamides and following the discovery

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of penicillin to the steady development of antibiotics.[5] Remarkable lifesaving discoveries have been made, but infection-causing organisms have also been successful in combating antibiotics and the search continues. The cost of an infected operation to the patient and the community cannot be simply measured in rupees and dollars. The surgeon should understand the real cost by analyzing it in terms of morbidity and monetary. Everything that is done to reduce the infection rate costs money so that it is important that the effectiveness of any new procedures introduced must be evaluated.

AIM

This study aims to study the prevalence, risk factors, prevention, and treatment of SSI.

MATERIALS AND METHODS

This prospective study was conducted in the department of surgery at a tertiary care hospital for 3 years. A total number of 1570 patients admitted in general surgical wards for elective and emergency surgery in the study period, of which 990 were elective cases and 580 were emergency cases, fulfilling our study criteria. A total of 115 cases had SSIs which had been taken up for this study.

Inclusion Criteria

- Elective and emergency general surgical cases involving clean and clean-contaminated surgeries were taken up for study.
- Both sexes were included.
- Younger and older age groups were included.
- Patients who were willing to be part of this study were taken.

Exclusion Criteria

The following criteria were excluded from the study:

- Surgeries on severely immunocompromised patients.
- Incomplete primary closure.
- Relook surgeries.

An elaborate study of these cases with regard to the date of admission, history, clinical features date of surgery, type of surgery, emergency or elective, pre-operative preparation, and post-operative management is done till the patient is discharged from the hospital and then followed up the patient on OPD basis for any signs of wound infection. The wounds were examined for suggestive signs/symptoms of infection in the post-operative period, during wound dressing or when the dressings were soaked. In history, presenting complaints, duration, associated diseases, coexistent infections at a remote body site, and personal history including diet, smoking, and alcoholism were noted. The specimens are collected from patients with SSI inward/OT with a sterile stick with an absorbent cotton swab and sent to the microbiology laboratory for bacterial culture and sensitivity to drugs. In our series, all cases were prepared by shaving 1–2 h preoperatively and washed with routine soaps. Patients have admitted 1 or 2 days before surgery on an appointment basis since all the cases were electively posted for surgery except for few cases which required bowel preparations. Prophylactic antibiotics were given in all the cases 1–2 h preoperatively after test dose, most commonly cephalosporins (cefotaxime/cefazolin). Providing iodine and surgical spirits were the only antiseptic solutions used for painting the operative field and cleaning the wound before and during surgery in all cases. Conventional suturing by various combinations of absorbable and non-absorbable suture materials for various layers was used appropriately. Skin staplers or bowel staplers were not used in any of the cases. Dressings were done using povidone-iodine solution or ointment with sterile gauze and pads; post-operative wound review was done around 48–72 h following surgery. SSIs were diagnosed postoperatively on an average from the 3rd to 5th days, and the discharge from the wound was sent laboratory for culture and antibiotic sensitivity in most of the cases. Antibiotics were changed and administered according to the sensitivity profile based on the report. Symptomatic treatment was given depending on the combination and severity of various symptoms due to SSI.

RESULTS

In the present study, the overall post-operative SSI rate in elective clean and clean-contaminated cases is 5.11% and emergency cases is 12.41%. The superficial SSIs are the most common type and accounted for about 72.09% in elective and 61.11% in an emergency of all the SSIs and deep surgical site infection accounted for about 23% in elective and 30.55% in emergency cases. In our study, most of the cases were in the middle age group; almost 69.7% and 77.7% of the cases were in the age group between 20 and 60 years in elective and emergency cases, respectively. 11% and 10% of the cases were in the elderly age group in elective and emergency cases, respectively. Infections are more in drained wounds and the procedure involving implanting prosthesis-like mesh. This increased incidence may be due to the effect of the drain itself by acting as a microbial pathway. Implants carry a higher risk of infections acting as a foreign body if in case there is a breach in the strict aseptic protocols.

Patients detected with SSIs were found to have comorbidities such as diabetes and obesity accounting for about 34.9% and

26.4% of elective and emergency cases. The most common comorbidity among the sample cases was diabetes mellitus type 2 and followed by obesity being the second most common comorbidity. Poor glycemic control and reduced immunity in diabetic patients might be responsible for the development of SSI. Fat necrosis, fat stripping, tissue insult, and long hours of surgery in case of obese patients might be the cause for SSI. The homeostasis in such cases may also have been an imperfect activating infection.

In our study, emergency cases had a higher incidence of SSIs when compared to elective cases. SSIs in clean-contaminated cases were high when compared to clean elective cases.

When compared with the above-mentioned studies, the incidence of SSI in elective cases was slightly higher and the incidence of SSI in emergency cases was low. *Escherichia coli* and *Proteus mirabilis* were the most common organisms isolated in my study in elective and emergency cases, respectively, whereas *Staphylococcus aureus* was the most common in other studies.

Secondary suturing was done in 34.8% of cases and the remaining 65.2% of cases healed by secondary intention. The method used for wound healing was preferred based on the site, size, and intensity of the infection. Smaller wounds with less and superficial infections were allowed to heal by secondary intention. Whereas antibiotic administration according to sensitivity report, regular wound debridement and dressings with secondary closure have found to reduce the duration of hospital stay, faster wound healing, and less scar compared to secondary intention.

DISCUSSION

In the present study, the overall post-operative SSI rate in elective clean and clean-contaminated cases is 4.57%. Reports of SSI from different workers gave different infection rates. A number of studies carried out in India indicate an overall infection rate of 4.04–30% for clean surgical cases.

Different studies from India at different places have shown the SSI rate to vary from 6.09% to 38.7%.[6] The infection rate in Indian hospitals is much higher than that in other countries; for instance, in the USA, it is 2.8% and it is 2–5% in European countries.[7] The higher infection rate in Indian hospitals may be due to the poor set up of our hospitals and also due to the lack of attention toward the basic infection control measures.

The high incidence in patients aged 41–60 years in our study is perhaps due to increased chances of comorbid factors such as diabetes mellitus, hypertension, chronic ailments like asthma, conditions requiring steroid therapy, and personal habits such as smoking and alcoholism.[8]

The literature shows that SSI increases with obesity, one reason being a decrease in blood circulation in fat tissues. Initially, it was thought that obese patients have a higher complication rate in both open and laparoscopic approach. However, a few well-designed studies have demonstrated that laparoscopic colorectal surgery in obese patients is feasible and safe.[9]

Recent preliminary findings from a study of patients who underwent coronary artery bypass graft showed a significant relationship between increasing levels of HbA1c and SSI rates.[10] Furthermore, increased glucose levels (>200 mg/dL) in the immediate postoperative period (<48 h) were associated with increased SSI risk.

All the patients in our study were administered prophylactic antibiotics, mostly cephalosporins; cefotaxime was used in almost all the cases since our study deals with elective and emergency cases. Antibiotics were administered on an average of 1–2 h before surgery. Seyd Mansour Razavi, in 2005, showed that the administration of prophylactic antibiotic ½ h before the operation would bring about the best results and the lowest SSI.[11] However, there is still a debate about the duration of the antibiotic treatment and the kind of antibiotic which should be used. In summary, most studies favor one to three intravenous doses of the second-generation cephalosporin with or without metronidazole with the first dose being administered before skin incision.[11]

In 2001, Tang *et al.* in contrast to other reports, there was 3 times more predominant in surgical procedures preceded by antibiotic prophylaxis in colonic surgeries.[12] This might be explained by the fact that these were contaminated wounds with an increased risk of infection.

Hanifah *et al.* reported that the predominant organisms isolated were *S. aureus* followed by *Pseudomonas aeruginosa* and *Klebsiella* spp.[13] Twum-Dansok *et al.* reported *S. aureus* followed by *E. coli*, *Staphylococcus epidermidis*, *P. aeruginosa,* and *Enterobacter* spp.[14] Kamat had *Pseudomonas* species 21.4% sensitive for cefoperazone-sulbactam combination. The proportion of bacteria resistant to all antibiotics for which tested was as high as 63.93% (39/61).[15]

CONCLUSION

Antibiotic administration according to sensitivity report, regular wound debridement and dressings with secondary suturing once the local infection is reduced has found

to reduce the duration of hospital stay, faster wound healing and less scar compared to secondary intension. Antimicrobial prophylaxis is effective in reducing the incidence of post-operative wound infections for a number of different operative procedures, but the timing of administration is critical.

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