

Study of Organisms Causing Surgical Site Infections and their Antimicrobial Susceptibility Pattern in Rural Teaching Hospital


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ABSTRACT

Background: Surgical site infections (SSIs) are the most common nosocomial infection accounting for 14% healthcare-associated infections and are estimated to double the length of post-operative stay and significantly increase the cost of care. SSI rate varies between 2.5% and 41.9%. *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Enterobacteriaceae*, and *Acinetobacter* spp. are the predominant organism in SSI. **Objectives:** (1) To find the incidence of post-operative surgical wound infection in clean and clean-contaminated surgeries in orthopedic, surgery, and obstetrics and gynecology ward. (2) To determine the bacteriological profile and antimicrobial susceptibility pattern of an isolate. **Materials and Methods:** The prospective study was carried out for a period from June 2016 to February 2017. Approval from IEC was obtained. Patients were followed from the time of admission till discharge and also for 30 days postoperatively. The wound was examined at the time of dressing and considered infective if serous, purulent, or non-purulent discharge from the wound with sign of inflammation was seen. Sample was processed by Gram staining, culture on blood agar and MacConkey agar, biochemical tests for identification of organism. Antimicrobial susceptibility was done using disc diffusion tests. **Result:** Total 100 patients were followed during the study. 15 cases were positive for SSI. Total SSI rate was 15%. Among 31 clean surgeries, 3 cases showed infection. SSI rate in clean surgery was 9.6%. Out of 69 clean-contaminated surgeries, 12 cases were positive for SSI, and infection rate in clean-contaminated surgery was 17.39%. *S. aureus* was the predominant organism isolated in 9 cases followed by *P. aeruginosa* (2), *Pseudomonas* species (1), *Escherichia coli* (1), *Citrobacter* species (1), and *Acinetobacter* (1). *Staphylococcus* isolated was 100% resistant to penicillin, 22.22% susceptible to cefoxitin, 55.55% susceptible to tetracycline, 44.44% sensitive to gentamicin, and 66.66% sensitive to clindamycin. **Conclusion:** SSI is more common in clean-contaminated surgery as compared to clean surgery as rate increases with increase in the degree of contamination. *S. aureus* is the predominant organism involved in SSI. Considering the risk of methicillin-resistant *S. aureus*, its isolation from the surgical wound is major threat due to cross infection and multidrug-resistant strains. Reducing pre-operative stay, use of pre-operative antibiotics, reducing the duration of surgery can control SSI.

Key words: Clean surgery, clean-contaminated surgery, nosocomial infection, surgical site infection

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INTRODUCTION

Surgical site infections (SSIs) are the most common cause of nosocomial infections accounting for 14% healthcare-associated infections. They are estimated to double the length of post-operative stay in the hospital and significantly increase the cost of care.^[1] Surgery has made great advances in a recent century,

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and post-operative wound infection is most common complication faced by many surgeons since the advent of surgery.^[2] Emergence of multidrug-resistant bacterial pathogens in hospital is becoming a challenge for surgeons to treat hospital-acquired infections.^[3]

SSIs are defined as infections affecting either the incision or deep tissue at the operation site. These infections occur within 1 year of a surgical procedure with an implant and within 30 days without any implant. They are further categorized in terms of anatomical location; superficial infection affects only skin and subcutaneous tissue around the incision, deep infection affects deeper soft tissues such as fascia and muscle, organ space infections involve any part of the body that is manipulated during the surgery.^[1,4]

The local factors such as hematomas, seromas, suture material, poor surgical techniques, and degree of contamination and also, the patient-related factors such as age, nutrition, hygiene, and other associated diseases play an important role in etiology of post-operative wound infections.^[2]

The rate of SSI is between 15% and 20% depending on the type of surgical procedure and wound classification. *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Enterobacteriaceae*, and *Acinetobacter* spp. are the predominant organisms in SSI.^[4]

Aims and Objectives

1. To find the incidence of surgical wound infections in clean and clean-contaminated surgeries in orthopedic, surgery, and obstetrics-gynecology wards.
2. To determine the bacteriological profile and antimicrobial susceptibility pattern of an isolate.

MATERIALS AND METHODS

This was cross-sectional prospective study conducted in the Department of Microbiology at MIMER Medical College and Rural Hospital, Talegaon Dabhade, Pune. The study period was June 2016-February 2017. Institutional Ethical Committee approval was obtained before starting the study.

Sample Size

Total 100 patients operated for clean and clean-contaminated surgeries from the department of orthopedics, surgery, and obstetrics-gynecology

were included in the study. The details of the patient were recorded as per the pro forma. Each patient was followed from the time of admission till discharge from the hospital.

Inclusion Criteria

Clean surgeries and clean-contaminated surgeries.

Exclusion Criteria

1. Contaminated surgeries and dirty surgeries
2. Stitch abscess
3. Episiotomy and circumcision wounds.

Sample Collection

A wound was considered to be infected if any of the following criteria were fulfilled:

1. Serous or non-purulent discharge from the wound
2. Pus discharge from the wound
3. Serous or non-purulent discharge from the wound with signs of inflammation.

Sample Collection and Transport

Swabs were obtained from deep inside the wound avoiding contact with skin and taking all aseptic precautions. The surgical wound was inspected at the time of first dressing and weekly thereafter till discharge.^[5,6]

Smear Examination

A smear was prepared and stained by Gram staining method for early presumptive diagnosis. Culture was done by inoculation on blood agar and MacConkey agar. Identification of isolate was done by colony characteristics and biochemical tests as per standard bacteriological criteria.^[5] Antimicrobial susceptibility was done using disk diffusion test according to CLSI guidelines.^[7]

RESULTS

Total 100 patients were followed for SSI. Of which 15 cases developed infection.

Overall SSI rate was 15%.

Total numbers of clean surgeries done were 31, out of which 3 cases showed SSI. Thus, SSI rate in clean

surgeries is 9.6%. Total clean-contaminated surgeries done were 69, out of which 12 cases showed infection. SSI rate in clean-contaminated surgeries is 17.39%. This suggests that SSI rate increases with the degree of contamination.

Numbers of surgeries done under emergency condition were 52. Of which 12 cases showed infection indicating SSI rate in emergency surgery 23.07%. Number of elective surgeries was done 48, out of which 3 cases showed infection indicating SSI rate in elective surgeries 6.25%.

Table 1 shows the number of infected cases from the surgeries done during the study period. Maximum surgeries done were LSCS followed by hernia and appendectomy.

Following Table 2 shows organism isolated from post-operative cases.

S. aureus was the most common pathogen isolated from SSI followed by *E. coli*, *Citrobacter* species, *P. aeruginosa*, and *Acinetobacter* species.

S. aureus was 100% resistant to penicillin, 22.22% sensitive to cefoxitin, 55.55% sensitive to tetracycline, 44.44% sensitive to gentamicin, and 66.66% sensitive to clindamycin.

P. aeruginosa isolate was susceptible to aztreonam, piperacillin + tazobactam, piperacillin, and ceftazidime.

Table 1: Number of surgeries done and number of infected cases

Surgical procedure	Number of surgeries performed	No. of cases infected
LSCS	54	11
Appendectomy	10	0
Hernia	14	2
Orthopedic surgeries	6	1
Hydrocele	4	0
Endoscopic surgeries	4	1
Hemorrhoidectomy	3	0
Fistulectomy	2	0
Exploratory laparotomy	1	0
Splenectomy	1	0
Urethroplasty	1	0

LSCS: Lower segment cesarean section

Table 2: Organisms isolated from infected cases

Organism isolated	Number of infected cases
<i>S. aureus</i>	9
<i>E. coli</i>	1
<i>Citrobacter</i> species	1
<i>Acinetobacter</i> species	1
<i>P. aeruginosa</i>	2
<i>Pseudomonas</i> species	1

S. aureus: *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Escherichia coli*

Citrobacter species isolated was susceptible to meropenem, gentamicin, ciprofloxacin, and cefepime.

E. coli and *Acinetobacter* were resistant to all tested antibiotics.

DISCUSSION

The problem of post-operative wound infection is seen in both developed and developing countries, despite the introduction of meticulous antiseptic regime in clinical practice. It can occur either from an endogenous or an exogenous source.

Since all patients received pre-operative antibiotic prophylaxis in our study, comparison of rate of SSI with and without antibiotic prophylaxis could not be found. However, many other studies reported lower incidence of SSI with pre-operative antibiotic prophylaxis.

Bacterial contamination increases with the duration of surgery, also the cells are increasingly damaged by exposure to air or trauma due to surgical instruments, or because longer procedures are more likely to be associated with blood loss thereby reducing the patient's general resistance. All these factors contribute to increased rate of infection with increase in duration of surgery.

SSI is more in clean-contaminated surgeries as compared to clean surgeries. This is because SSI rate increases with increase in the degree of contamination. Our results are consistent with other studies.^[2,4,8]

S. aureus is the predominant organism involved in SSI which is consistent with other study result.^[2,4,8-11]

Resistance to multiple antibiotics among *Staphylococcus* isolate has been recognized as major challenge in hospital infection control. Early detection of methicillin-resistant *S. aureus* and formulation of effective antibiotic policy are of paramount importance.^[12]

Reducing pre-operative stay, use of pre-operative antibiotics, and proper control of comorbidities can reduce the incidence of SSI.

CONCLUSION

S. aureus is the most common organism predominantly isolated from SSI. Surveillance of SSI with appropriate feedback to surgeons can reduce SSI. CDC guidelines emphasize on the importance of good patient preparation, aseptic practice, attention to surgical techniques, and antimicrobial prophylaxis for prevention of SSI.^[13]

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