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Post-Operative Wound Infections: A Clinical Study

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Abstract: Surgical site infection (SSI) is the most common source of preventable morbidity and mortality. Adverse outcomes include tissue destruction, prolonged hospital stay, financial burden and death. Minimizing SSI is a top priority for surgeons and hospitals to ensure safest environment for patients undergoing surgery. To study the determinants of postoperative SSI- microbial pathogenecity, host defenses, environment and surgical technique. This is a prospective study of 50 cases of postoperative wound infection after randomly studying 316 patients admitted at Bapuji Hospital and Chigateri District Hospital, Davangere. The incidence of postoperative SSI in this study was 15.58% and the commonest organism isolated was Escherichia Coli and Pseudomonas. The most sensitive antibiotic was cefotaxime, amikacin, streptomycin and doxycycline. Prophylactic single dose parenteral antibiotic administered within 2 hours before incision was found to be sufficient in clean cases. Incidence of postoperative wound infection was found to be increased in patients with added risk factors like malnutrition, anaemia and diabetes. Length of hospital stay prior to surgery, duration of surgery and postoperative soakage of dressing showed an increase in incidence of wound infection. The clean, clean-contaminated, contaminated and dirty wound classifications provided by CDC was found to be a good predictor of the susceptibility of wound to infection. Open drains were more prone to wound infection than closed drains.
Keywords: Surgical site infection, surgery, postoperative, wound infection.

INTRODUCTION

Surgical site infections (SSIs) present a significant source of preventable morbidity and mortality. Studies suggest that 40-60% of these infections are preventable. The Centre for Disease Control (CDC) published definitions for Surgical wound infection in Box 1 are currently in widest use.

A wide variety of aerobic and anaerobic organisms maybe present singly or in combination in these wounds. The most frequently isolated organisms from these wounds include Staphylococcus aureus, Escherichia coli, Enterobacter species and Pseudomonas spp[1].

Factors that increase the susceptibility of the wound to infection at the whole patient level include extremes of age, pre existing illnesses, diabetes mellitus, obesity, malignancy, malnutrition, cigarette smoking, etc. Factors that are influenced by the surgeon include duration of the operation, glove puncture, type of operation (emergency or elective), time of the day, month of the year and airborne contamination. Wound class, based on degree of intraoperative wound contamination, is also an important factor that affects the susceptibility of a wound to infection (clean 1.5%, clean contaminated 7.7%, contaminated 15.2%, dirty 40%)[9].

The ever changing pattern of infection in hospitals and increasing incidence of drug resistant strains has made management of SSIs challenging. Preoperative prophylaxis with appropriately selected procedure-specific antibiotics administered 1 hour before skin incision is a mainstay of SSI prevention[6]. Excess use of prophylactic antibiotics either through poor selection or continuation postoperatively without evidence of SSI or significant contamination intraoperatively increases incidence of drug resistant microorganisms and adverse effects like diarrhoea[7].

SSIs have 2 clinical presentations. They may present as spreading cellulitis with no loculation of pus, wherein, systemic antibiotics is the mainstay of treatment, or may present with loculation pus wherein systemic and topical antibiotics and drainage of pus when necessary to achieve bacterial balance is the goal.

Box 1[5]
CDC definitions for surgical wound infection
Superficial incisional SSI
Infection occurs within 30 days after operation and infection involves skin and subcutaneous tissue of the incision and at least one of the following:
1. Purulent drainage, with or without laboratory confirmation, from the superficial incision.
2. Organisms isolated from an aseptically obtained culture of fluid or tissue from the superficial incision.
3. At least one of the following signs or symptoms of infection: pain or tenderness, localized swelling, redness, or heat and superficial incision is deliberately opened by surgeon, unless incision is culture negetive.
4. Diagnosis of superficial incisional SSI by the surgeon or attending physician.

Deep incisional SSI
Infection occurs within 30 days after the operation if no implant is left in place or within 1 year if implant is in place and the infection seems to be related to the operation and infection and infection involves deep soft tissues (eg, fascial and muscle layers) of the incision and at least one of the following:
1. Purulent drainage from the deep incision but not from the organ/space component of the surgical site.
2. A deep incision spontaneously dehisces or is deliberately opened by a surgeon when the patient has at least one of the following signs and symptoms: fever (>38°C), localised pain, or tenderness, unless site is culture-negative.
3. An abscess or other evidence of infection involving the deep incision is found on direct examination, during reoperation, or by histopathologic or radiologic examination.
4. Diagnosis of a deep incisional SSI by a surgeon or attending physician.

Organ/space SSI
Infection occurs within 30 days after operation if no implant is left in place or within 1 year if implant is in place and the infection seems to be related to the operation and infection involves any part of the anatomy (eg, organs or spaces), which was opened and manupilated during an operation and at least one of the following:
1. Purulent drainage from a drain which was placed through a stab wound into the organ/space.
2. Organisms obtained from an aseptically obtained culture of fluid or tissue in the organ/space.
3. An abscess or other evidence of infection involving the tissue organ/space that is found on direct examination, during reoperation, or by histopathological or radiologic examination.
4. Diagnosis of a deep incisional SSI by a surgeon or attending physician

A set of definitions which help to predict the probability of wound infection was put forth by CDC which included clean, clean-contaminated, contaminated and dirty or infected [11].

Objectives
To study the determinants of infection:
Microbial pathogenecity:
- Commonest organism associated with postoperative infection
- Most sensitive antibiotic to the pathogen.
- Most resistant antibiotic to the pathogen
- Single dose versus multiple doses of pre/postoperatively

Host defenses
- Age incidence in postoperative wound infection
- Malnutrition as an etiological factor in postoperative wound infection
- Diabetes as an etiological factor in postoperative wound infection
- Anaemia as an etiological factor in postoperative wound infection
- Urine- Albumin, sugar, an indicator for possible postoperative wound infection

Environment
- Soakage of dressing- its relation to postoperative wound infection
- Emergency/Elective operation- its relation to postoperative wound infection.
- Number of OT personals- its relation to postoperative wound infection.

Surgical Technique
- Type of operation- its relation to postoperative wound infection
- Duration of operation- its relation to postoperative wound infection
- Glove puncture- its relation to postoperative wound infection
- Drain open or close- its relation to postoperative wound infection

MATERIALS AND METHODS

This is a prospective study of 50 cases of postoperative wound infection after randomly studying 321 patients admitted at Bapuji Hospital and C.G. Hospital under General surgery over a period extending from March, 2016 to January, 2018

Only those cases which were operated were included in this study. Rectal and vaginal operations,

burns and circumcision were excluded. Minor wound area infections, stitch abscesses, surrounding skin inflammation and necrosis without microorganisms were excluded. Each patient was selected according to the CDC definitions of surgical site infections, mentioned earlier.

RESULTS

Out of the 321 patients studied 50 cases (15.58%) developed postoperative surgical site infection. The total no. of organisms isolated was 60 because 12 cases had 2 organisms isolated in each culture and in 1 case culture was contaminated and in 1 report was missing. The commonest organism isolated was Escherichia Coli (12) and Pseudomonas (12) followed by Proteus(8) and Klebsiella(8). Table 1 shows the various organisms isolated in this study and their frequency.

Table-1: Table showing various organisms isolated and the corresponding number of cases

Organism isolated	No. of cases
E.coli	12
Pseudomonas	12
Proteus	8
Klebsiella	8
Coagulase negative staphylococci	6
Coagulase positive staphylococci	6
Acinetobacter	3
Enterococci	3
Coliforms	2

The most sensitive antibiotic in this study was Cefotaxime, Amikacin, Polymixin B and Chloramphenicol. The most resistant antibiotics were found to be Co-trimoxazole, Erythromycin, Gentamicin, Amoxycillin, Streptomycin and Doxycycline.

A case controlled study was conducted wherein 20 patients were given single dose of antibiotic preoperatively and followed until they were discharged and 20 similar patients were given multiple drugs preoperatively which were continued postoperatively. The study showed no infection in both groups.

Age of incidence appeared to be highest between 30-39 years (30%). Table 2 shows the age of the patients in years and corresponding number of infected cases.

Table-2: Table showing age of patients (years) and corresponding number of infected cases

Age(years)	No. of cases
0-9	0
10-19	5
20-29	9
30-39	15
40-49	9
50-59	8
60-69	3
70-79	0
80-89	1

Total no. of malnourished patients in the 50 cases were 11 (22%) and in the non-infected 271 was only 12 (4.4%).

Total no. of diabetic patients in the infected 50 cases was 22 (44%) and that in the non-infected 271 was 28 (10.3%).

Total no. of anaemic cases in the infected 50 cases was 10 (20%) and in the non-infected 271 was 17 (6.27%)

Total no. of patients who were positive for urine sugar in the infected 50 cases was 21 (42%) and in the non-infected 271 was 28 (10.3%). Total no. of patients who were positive for urine albumin in the infected 50 cases was 13 (26%) and in the non-infected 271 was 15 (5.53%).

Total no. of patients who had soakage of dressing postoperatively in the infected 50 cases was 29 (58%) and in the non-infected 271 was 60 (22.1%).

Out of the 50 infected cases, 13 (26%) were emergency operations and 37 (64%) were elective operations. Out of the 271 non-infected cases, 26 (9.59%) were emergency operations and 245 (90.4%) were elective operations.

The average number of OT personals in the infected 50 cases was 11-12 (11.7) and that in the non-infected 271 was 8.

Table 3 shows the incidence of postoperative wound infection with respect to the class of wound.

Table-3: Table showing incidence of postoperative wound infection with respect to class of wound

Wound class	No. of cases studied	No. of infected cases	Percentage infected
Clean (Hernia repair)	15	1	6.66%
Clean-contaminated (Cholecystectomy)	24	3	12.5%
Contaminated (intestinal obstruction with anastomosis)	10	2	20%
Dirty (intestinal perforation)	29	7	24.13%

The average duration of surgery of laparotomy for intestinal perforation in non-infected cases was 1 hour and 30 mins and that in infected cases was 1 hour and 54 minutes. The average duration of Appendectomy in non-infected group was 33mins and that of the infected group was 53mins.

There was no difference in the incidence of postoperative wound infection with glove puncture between the infected and non-infected group.

Table 4 shows the frequency of postoperative wound infection in the patients with open and closed drains.

Table-4: Table showing frequency of postoperative wound infection in patients with open and closed drains

	Infected cases (50)		Non-infected cases (271)	
	No.	Percentage	No.	Percentage
Open drain	26	52%	35	9.43%
Closed drain	10	20%	16	5.9%

DISCUSSION

Incidence of postoperative wound infection in this study is 15.58%. Though this incidence is more when compared with developed countries, it is less when compared to most of the Indian studies probably because the number of patients studies is less.

Commonest organism encountered in this study is E.Coli and Pseudomonas. Studies conducted by Kowli *et al*. [5] revealed Staph. aureus (45%) as the predominant microorganism isolated. Studies conducted by Shaw *et al*. [6] reported that 73.3% of postoperative wound infections were due to Staph. aureus alone. Agarwal *et al*. [10] and majority of the studies on microbial pattern of postoperative wound infections show predominance of E.Coli. Most sensitive antibiotic is this study is Cefotaxime, Amikacin, Streptomycin and Doxycycline. Studies by Kowli *et al*. [8] showed Gentamicin, Cloxacillin, Cotrimoxazole, and Chloramphenicol to be the most sensitive in Gram positive aerobes and Cephaloridine, Gentamicin and Kanamycin in Gram negative aerobes. The study of preoperative single dose of ciprofloxacin with the control of similar type of patients with multiple dose of antibiotics pre and postoperatively showed no infection in both control and study group. However, all cases in this study were clean, elective without any associated risk factors.

Incidence of postoperative wound infection is found to be higher in patients with added risk factors like malnutrition, diabetes and anaemia. Urine albumin and sugar are useful in prediction of susceptibility of the wound to infection.

This study has shown an association of wound infection with soakage of dressing. Length of hospital stay prior to operation has been shown to have an association with the incidence of postoperative wound infection. The increased incidence of SSI with longer hospital stay prior to surgery is probably due to replacement of normal sensitive flora by resistant one[7]. This study shows a higher incidence of postoperative wound infection in emergency operations as compared to elective ones. However, the number of elective cases in this study was more than that of emergency cases. Wound class has been shown to be an independent predictor of wound infection-dirty(24.13%), contaminated(20%), clean-contaminated(12.5%) and clean (6.66%). In this study, the duration of surgery was found to be longer in the infected group as compared to the non-infected group for the same type of surgery. This study has shown no relation of glove puncture with wound infection. Studies conducted by Cruse and Frood [9] and Whyte *et al*. [10] revealed similar findings. However, Garibaldi *et al*. [8] studied 1812 wounds and showed a increased incidence of wound infection with glove puncture. Open drains are associated with an higher infection rate than closed ones.

CONCLUSION

The incidence of postoperative wound infection in the present study is 15.58%. E. Coli and

Pseudomonas were the most frequently incriminated pathogen followed by Proteus and Klebsiella. Most of the pathogens isolated from these cases were sensitive to cefotaxime, amikacin, polymyxin b and chloramphenicol and were most were resistant to co-trimoxazole, erythromycin, gentamicin, amoxycillin, streptomycin and doxycycline.

In clean, elective cases without any risk factors preoperative single dose parenteral antibiotic is sufficient.

Incidence of postoperative wound infection was found to be more in malnourished, diabetic and anaemic patients. Urine albumin and sugar is a predictor of postoperative wound infection. Soakage of dressing should be considered as a predisposing factor for wound infection. There is a significant increase in incidence of wound infection when number of OT personals increase. Wound class (clean, clean contaminated, contaminated and dirty) is a predictor of wound infection. The longer the duration of the surgery, the more is the risk of infection. The frequency of infection is more in cases with drains, especially open drains.

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