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Surgical site infections in tertiary care hospital of Odisha: A prospective study

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Abstract
Background: Surgical site infections (SSI) are one of the most common postoperative complications and the most frequently reported nosocomial infections, causing significant morbidity and mortality thereby having increased burden on patient as well as hospital. With this background, we conducted this prospective study on 100 clinically diagnosed patients of surgical site infections admitted in Department of General Surgery in a tertiary care hospital in Odisha from August 2018 to August 2020.
Methods: One hundred cases of postoperative wound infections were analysed. Swabs were collected from infected surgical wounds with all aseptic precautions and processed by the conventional microbiological methods.
Results: The most common microorganism isolated on culture was E.coli (36 cases) followed by Pseudomonas (15 cases) and the most sensitive antimicrobial was Amikacin and most resistant antimicrobials are Cephalexin and Ciprofloxacin. Post-surgical wound infection was commonly encountered in emergency cases with dirty type of wound class (55%).
Conclusion: Majority of the wounds were managed with local wound management and use of appropriate antibiotics based on culture & sensitivity. To treat various types of micro-organisms like E.coli and S. aureus which are responsible for surgical site infection, it is necessary to use antibiotics- (empirical & based on sensitivity profile). The most integral part is rational use of antibiotics which is necessary to combat the emerging multi drug resistant organisms.

Keywords: surgical site infections, nosocomial infection, micro-organisms, antibiotics.

Introduction

Healthcare-associated infections are one of the most common problem encountered by the patients and impose significant morbidity and mortality. This clinical event extends the hospital stay and increase the treatment cost which causes huge economic burden among the patients [1]. Surgical site infection (SSI) is generally referred as a wound infection which arises after an invasive surgical procedure [2]. Around 20% of all healthcare associated infections in surgical patients is due to SSI [3]. The global prevalence of SSI in surgical patients is reported to be 2–5% [4]. The surgery related mortality, predominantly occurs as result of SSI and it is high during superficial incisions [5]. Globally, one third of post-operative mortality is highly attributed due to the occurrence of SSI. The economic burden as a result of long hospital stay during SSI is very high. The additional economic burden caused by extended hospital stays due to SSI is large. A study conducted in England, shows that hospital faces huge economic cost with range 814 to 6,626 euros per patient based on the surgery type and infection severity [6]. The SSI risk is more in developing countries as compared to the developed countries. In Setty *et al*. study, conducted in Karnataka, India the SSI is reported to be 21.66% [7]. In another study conducted in rural teaching hospital of central India, the cumulative incidence rate of superficial SSI is 39% [8]. The major factor which governs the occurrence of SSI is wound type and site of surgery. Previous studies show that the high rate of SSI is observed in cardiovascular surgery and gastrointestinal surgery [9, 10]. A previous large cross sectional survey study, conducted among the Chinese cohorts on healthcare associated infections reveals that, E. coli is the major pathogen associated with the SSI followed by S. aureus and *P. aeruginosa* [11]. Further, 50% of these pathogens are resistant to antibiotics and among these 70% are found to be S. aureus drug resistant strains. In addition, factors such as age, surgical procedure, wound contamination, and anaesthetic method substantially increases the risk of SSI. In this backdrop, the present study was conducted to evaluate the bacteriological profile and their sensitivity and resistance to antibiotics in surgical site infection. Further, distribution of SSI based on type of surgical wound such as clean, clean- contaminated, contaminated and dirty were also evaluated.

Materials and Methods

The present prospective study was conducted in the Department of General Surgery in a tertiary care hospital, Odisha for 2 years from 2018 August to 2020 August. The study population included one hundred patients clinically diagnosed surgical site infection in their post-operative period.

Inclusion criteria

Patients of both sex, age >12 years, who had discharge from surgical wound with serous/sero purulent/purulent type of discharge and with signs of sepsis present concurrently (erythema, induration, pain, tenderness, raised local temperature) were included.

Exclusion criteria

Patients those who were treated on OPD basis, refused admission and terminally ill cases were excluded.

Methods of collection of data

A detailed history regarding demographic data, type of surgical wound, elective or emergency surgery, antibiotic prophylaxis, duration of surgery and any underlying or predisposing conditions were noted.

Swabs were obtained from the post-operative infected wounds and processed by the conventional microbiological methods. Antimicrobial susceptibility testing was done by Kirby-Bauer disc diffusion method [12] and interpretation was done according to CLSI (Clinical Laboratory Standards Institute) guidelines [13].

CDC criteria were used to define the type of surgical wound i.e. Class I- Clean, Class II- Clean contaminated, Class III- Contaminated, Class IV- Dirty [14].

Results

In this study**,** a total of 100 patients with SSI were studied. Male preponderance was observed in this study (Fig 1). The mean age of the patients was 38.4 years (range 12 to 75 years) and the peak incidence of SSI was observed in age group > 40 years. Out of the total 100 samples processed, Monomicrobial growth was seen in 92 samples while 8 samples showed polymicrobial growth.

In this study, the majority of patients underwent exploratory laparotomy for duodenal ulcer perforation 26 cases (26%) and the most prevalent presentation was discharge from surgical wound and it was present in 80 cases (80%). The purulent type of discharge was higher and was observed in 29 cases (29%) in post-operative period (Fig 2).

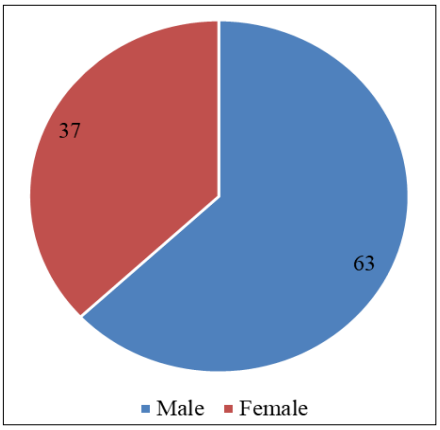

Fig 1: Gender wise distribution in the present study

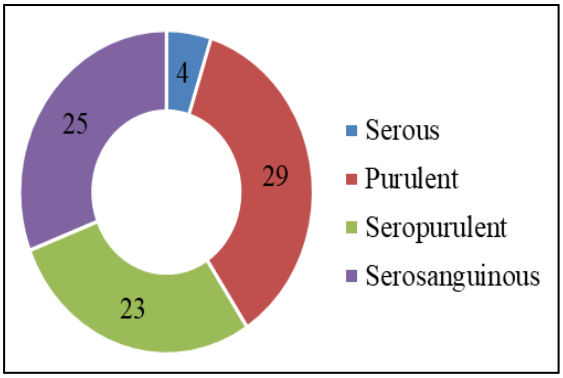

Fig 2: Type of discharge from wound

The most prevalent organism in the present study was E.coli which was identified in 36 cases. (36%), followed by pseudomonas in 15 cases (15%).The least common organism identified was Streptococci in 9 cases (9%). E.coli was also present as a mixed culture with Klebsiella, Proteus, Pseudomonas, and Staphylococcus. The results were shown in Fig 3.

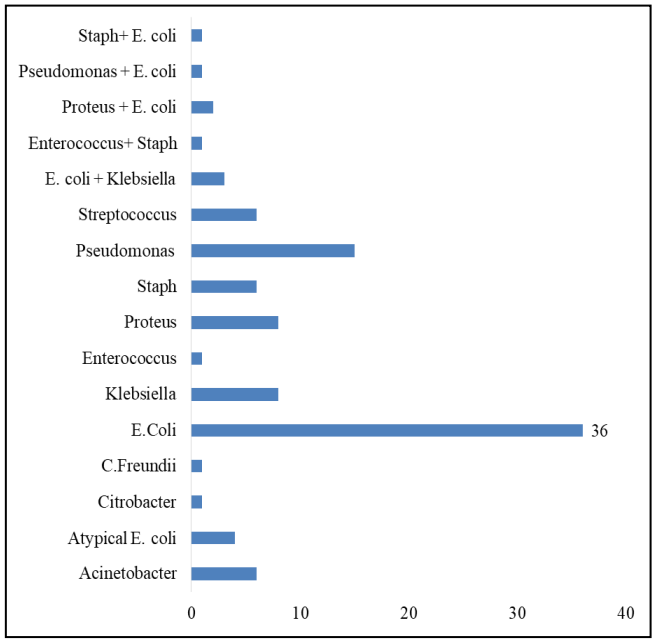

Fig 3: Type of microorganism in the present study

The most sensitive antibiotic in the present study was Amikacin. The next various sensitive agents were Chloramphenicol , Ceftriaxone, Carbenicillin, Cefotaxime, Polymyxin-B, Piperacillin. Highly resistant antibiotics were Cephalexin, Ciprofloxacin and Erythromycin. Further, the other agents such as Amoxicillin, Ceftazidime, Doxycycline also found to be resistant. 7 cases in this study resistant Antimicrobials except sensitive for Colistin an to all d Tigecycline. The results were shown in table 1.

Table 1: Antimicrobials sensitivity and resistance in the present study

Antibiotics	Sensitive	Resistant	Effectiveness
Ampicillin	44	49	-5
Amoxycillin	39	49	-10
Amikacin	70	22	+48
Chloramphenicol	42	32	+10
Ceftazidime	48	43	+5
Carbenicillin	53	43	+10
Cefotaxime	48	37	+11
Ciprofloxacin	21	73	-52
Cephalexin	11	86	-75
Ceftriaxone	45	47	-2
Doxycycline	28	68	-39
Erythromycin	21	69	-48
Gentamycin	26	67	-41
Polymyxin –B	50	41	+9
Piperacillin	64	30	+34
Colistin	7	0	+7
Tigecycline	7	0	+7

In this study, 55 patients (55%) undergone surgery for dirty type of wound according to CDC criteria which were operated on emergency basis with majority of cases

constituting diagnosis of preoperative perforation and with colonized body cavities. Further, 10 patients were subjected to surgery with clean type of wound according to CDC criteria, which were stated as elective, primarily closed, with no evidence of inflammation, no colonization in body cavities and with proper sterile methods. The results were shown in Fig 4.

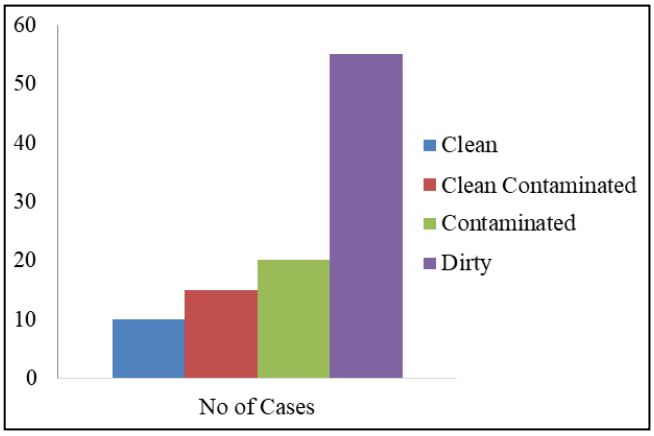

Fig 4: Type of surgical wound as per CDC criteria

All the patients were managed with antibiotics based on culture and sensitivity systemically followed by appropriate wound management which comprised of Hydrogel type of dressing, drainage of pus, debridement of wound. In our present study hydrogel type of dressing has been done in majority of patients accounting for about 56% followed by wound debridement 35% and drainage of pus in 9% of patients.

After appropriate treatment with antibiotics and wound management, about 91% of patients underwent secondary suturing for wound closure and 9 % of wounds were left to heal by secondary intention.

Discussion

SSI is a global clinical problem both in developed and developing albeit, there is a strict infection control practise and advanced antibiotics during surgery [15]. Management of patients with SSI is based on the type of bacteria both gram positive or negative and treatment with accurate antibiotic is very essential to reduce the post-operative infections and its associated morbidity and mortality [16].

In this study among the SSI patients male preponderance was observed. Previous studies showed that men were generally at a higher risk of SSI [17]. Mazmudar *et al.* reported that male sex is a marked risk factor for various adverse outcomes particularly SSI in patients undergoing elective pancreatectomy [18]. In our study, the incidence of SSI was high in patients with age more than 40 years. Similar to our report Negi *et al* [19]. showed that the patients with age more than 50 years displayed higher incidence of SSI as compared to patients with less than 30 years of age (51.8% vs 12.4%) respectively. Increasing age is one of the important risk factor in the progression of SSI due to decreased healing rate, low immunity and presence various comorbidities such as diabetes, hypertension, etc.

In this the most prevalent organism responsible for SSI is E.coli and it was observed in 36% of the cases. Similar to our report, in Chada *et al* [20]. Study E.coli was the major pathogen isolated from SSI patients and it constitute aroid 38%. As per the CDC reports, S. aureus, and E. coli were the most prevalent organisms responsible for the SSI. Thus the variations in the pattern of pathogens might be due to the diversity in the study population, antibiotic use which lead to emergence of pathogens with increased resistant. The next major reason Another reason for increased prevalence of Gram negative organisms in the present study is due to majority of the patients had undergone abdominal surgery and Gram negatives organism are the major organism responsible for infection during intra-abdominal surgeries [21].

In this study, the most sensitive antibiotic was Amikacin and highly resistant antibiotic were Cephalexin. Similar to our report, in a study done by Mundhada *et al* [22]. The amikacin was the most sensitive antibiotic against the isolated pathogens during SSI. Further, in a study done by Bansal *et al* [23]. The most resistant antibiotics for SSI organism were cephalosporin group (>70%) and quinolones (70%) which is in line with the present study.

In this study, majority of the patients, 55% undergone surgery for dirty wounds. Classification of surgical wound as per CDC is the best way to predict SSI. Earlier studies shows that the incidence of higher risk of SSI was observed in patients with dirty or contaminated wound [24] which is line with the present study. The reason for high SSI in dirty wound is more amount of bacterial load as compared to clean wounds. Previous studies have shown that emergency surgery was very high in dirty wounds with increased prevalence of SSI and it is line with the present study [25].

In this study, hydrogel type of dressing was done for the majority of the wound (56%). The hydrogel is more biocompatible and has reduced time of resorption and so it has minimal side effects. Previous studies shows that hydrogels has ten-fold reduction in the occurrence of early SSIs in patients undergoing Joint Arthroplasty [26].

Conclusion

The present study clearly delineates the factors associated with the etiology of SSI. The E.coli was the most common pathogen isolated and majority of the resistant strain were S. aureus. The most sensitive antibiotic was Amikacin and the more resistant antibiotic was Cephalexin. For the dirty type of wounds, the SSI rate was high and it is chief cause for secondary surgeries in post-operative period. Hydrogel surgical dressing was used for the majority of patients.

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