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Research Article

PREVENTION OF SURGICAL SITE INFECTION IN ELECTIVE SURGERY BY PROPHYLACTIC USE OF SINGLE DOSE ANTIBIOTIC

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A B S T R A C T

Background:- Surgical site infections [SSIs] are the most common nosocomial infection amongst surgical patients and are associated with prolonged hospital stays and increased costs. Infection develops when endogenous flora is translocated to a normally sterile site or distant site [especially in patients with prosthesis or another implant].The development of surgical site infections are influence by certain factors like bacterial inoculums and virulence, host defences, preoperative care and intraoperative management. The use of peri-operative antimicrobial prophylaxis is to overcome this problem. Our study was planned to evaluate the effect of prophylactic antibiotic in clean and clean contaminated cases and to assess the outcome.

Methods:- A prospective study was conducted which include 175 patients undergoing elective surgery admitted to the Department of Surgery at I.Q. City Medical College, Durgapur from August 2017 to July 2018. Patients who underwent clean or clean contaminated surgery were included in the study. Cefuroxime was used preoperatively 30 minute prior to incision and its impact on post operative wound infection was studied.

Results:- We had 175 cases in our study predominantly males with maximum age group 18 – 30 years. Out of the total 175 patients only 4% develop SSI despite antimicrobial prophylaxis.

Conclusions:- A single dose of antibiotics Cefuroxime preoperatively is effective to prevent surgical site infection in elective case assuming an uncomplicated procedure.

INTRODUCTION

The introduction of antisepsis in orthopaedic surgeries by Joseph Lister brought down the rate of infection significantly and provided the surgeons with a tool to combat infections. The discovery of antibiotics further revolutionized the field of surgery and created a hope amongst the surgeons that surgery without infections could be achieved. Use of antibiotics provided surgeons with an assurance and emboldened them to practise highly technical and invasive surgeries. But despite the knowledge of infection prevention and the advances in surgical practice, infection after surgery remains a problem which is encountered by every surgeon. Surgical site infections (SSIs) are the most common nosocomial infection amongst surgical patients and are responsible for approximately 38% of infections in such patients. [1] A patient developing SSIs has a more than 60% risk of being admitted to intensive care and is 15 times more likely to be readmitted within 30 days of discharge from the hospital.

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Apart from bearing an extra cost of $ 3000 per infection, such patients have increased length of hospital stay. [2] Thus apart from causing physical trauma SSIs increases the economic burden on these patients.

Use of antimicrobial prophylaxis (AMP) has long been advocated as a means to prevent infections post surgery. The concept of prophylactic use of antibiotics to prevent SSIs was not without challenges and it required the monumental work of Miles [3] and colleagues and Burke [4] to convince the medical fraternity of the importance of AMP. In their study on guinea pig they demonstrated that the severity of wound infection was less in those guinea pigs that were administered antibiotics before subcutaneous inoculation of bacteria as compared to those who did not receive any antibiotics. It was also observed that delay in administration of antibiotics by 3 to 4 hours resulted in same size of induration thus highlighting the importance of appropriate timing for AMP. The rationale behind the use of peri- operative antimicrobial prophylaxis is that antibiotics if present in sufficient concentration in the tissue boost the immune system and help in elimination of any bacteria that might be present in these surgical sites.

An understanding about the pharmacokinetics of the drugs used in AMP is essential so that adequate minimum inhibitory concentration of the drug may be present during the entire duration of the surgery. Serum concentrations of some antimicrobials tend to fall rapidly during certain surgical procedures while other remains unaffected. Use of cardiopulmonary bypass during cardiothoracic surgery reduces the serum concentration of vancomycin rapidly and as result increasing the risk of developing SSIs in these patients. [5] Various guidelines encompassing a wide array of surgical procedures have been formulated for correct use of AMP. [6-9] Most of these guidelines recommend the use of cephalosporins specially those with anaerobic activity as the drug of choice but selection of antibiotic can vary depending on the bacterial flora at the site of incision, penetration of antibiotic at the site and the patient's allergic profile.

The correct timing of antimicrobial administration prior to surgical incision is extremely essential as suboptimal levels of antibiotics in tissue significantly increase the risk of SSI. The exact timing of antibiotic administration varies between 30 minutes to 2 hours prior to incision. According to surgical care improvement project (SCIP) the ideal time for antibiotic administration should be 1 hour prior to incision for most antimicrobials except for flouroquinolones and vancomycin for which 2 hours is considered to be the ideal time. [10] Similar observation were made in the Trial to Reduce Antimicrobial Prophylaxis Errors (TRAPE) as regards to timing in prophylaxis among cardiac, orthopaedic, and hysterectomy patients. [11] This study proposed that cephalosporins should be administered 30 minutes prior to incision and flouroquinolones and vancomycin should be given 1 hour prior to incision.

METHODS

The present study was conducted in IQ City Medical College, Durgapur from August 2017 to July 2018 after obtaining approval from the institute's Ethical Committee. 175 consecutive surgical patients who underwent clean or clean contaminated surgeries were included in the study. Informed written consent was obtained from all participating patients and those who were not willing to give consent were not included in the study. Patients below 18 years, patients with uncontrolled co morbidity and patients having allergy to cephalosporin were also not included in the study. Patients were examined clinically to rule out any sign and symptom of infection. Proper treatment history was taken from patients to ensure that none had received any antibiotics 14 days prior to the surgical procedure. Routine laboratory tests were done before surgical procedure.

Antimicrobial prophylaxis with 1.5 gm intravenous cefuroxime was given 30 minutes prior to incision. No antimicrobial doses were given after surgery. Surgery was performed maintaining proper asepsis and surgical wound dressing was done with an appropriate sterile dressing at the end of surgery. Surgical wound dressing was done on post operative day 2 following strict aseptic technique. Thereafter the surgical site was left open for inspection. All patients were followed up till 30 days after operation to detect any sign or symptoms of surgical site infection. The patient was said to have SSI if he fulfilled the definitions for SSI as described by the Centre for Disease Control and Prevention.[12] If clinical sign and symptoms of infection was present, sample was collected after properly cleaning the wound using two sterile swab sticks. Samples were sent to the microbiology laboratory for identification and antimicrobial susceptibility report. All patients developing SSI had to visit the hospital for regular dressing of wound and oral antibiotics were prescribed to the patients. The SSI rate was calculated by dividing the total number of SSIs by the total number of surgeries.

RESULT

During the period between August 2017 to July 2018, 175 consecutive clean and clean contaminated surgeries were included in the study. Out of the total 175 patients 7 (4%) developed SSI despite antimicrobial prophylaxis. There was male preponderance in the study with 102 out of total 175 included patients being males. The mean age of the patients was 37 years. Most of the patients undergoing surgery were in the age group 18 - 30 years. Highest incidence of infections was recorded in age above 60 years.

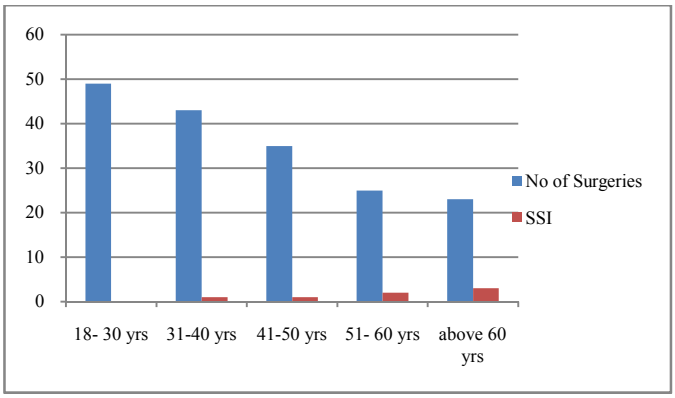

Fig 1 Relation of Ssi With Age

Type of surgery performed

A total of 109 clean and 66 clean contaminated surgeries were performed during the study period. The most common surgery performed in clean surgeries was hernioplasty (29). Among the clean contaminated surgery cholecystectomy was the most common surgery performed.

Table 1 Total number of surgeries performed

Name of Surgery	Surgery performed	
	Total number	Percentage
Appendicectomy (Open)	15	8.57
Appendicectomy (Lap)	12	6.86
Cystolithotomy	7	4
Cholecystectomy (Open)	6	3.42
Cholecystectomy (Lap)	26	14.85
Lipoma excision	19	10.85
Hernioplasty Lichtenstein	29	16.57
TAPP (Lap Hernia)	2	1.14
Ventral Hernia Mesh Repair	7	4
Umbilical Hernia Mesh Repair	3	1.71
Sebaceous Cyst Excisions	14	8
Hydrocele	16	9.14
Fibroadenoma excision	19	10.85

Surgical cases developing SSI – Two cases each of cholecystectomy and hernioplasty developed SSI. SSI was also seen in one case each of appendicectomy, ventral hernia mesh repair and Hydrocele.

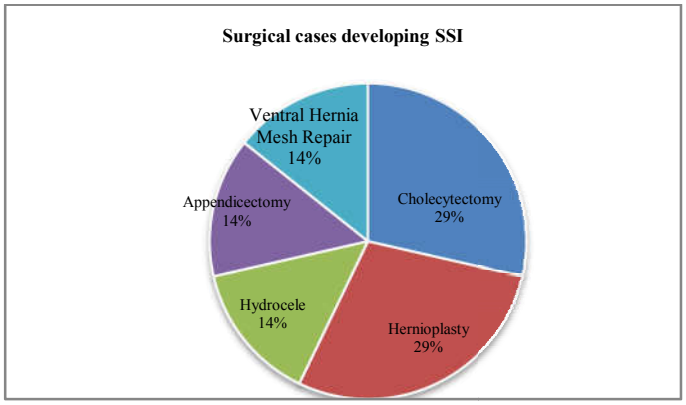

Fig 2 Surgical cases developing SSI

Bacteriology of SSI

Name of operation	Organism isolated
Cholecystectomy	*Escherichia coli*
Cholecystectomy	*Pseudomonas aeruginosa*
Hernioplasty	*Staphylococcus aureus*
Hernioplasty	*Acinetobacter baumanii*
Appendicectomy	*Staphylococcus aureus*
Hydrocele	*Pseudomonas aeruginosa*
Ventral Hernia Mesh Repair	*Staphylococcus aureus*

The most common bacteria isolated from the samples was *Staphylococcus aureus* which was followed by *Pseudomonas aeruginosa. S. aureus* was isolated from case of hernioplasty, appendicectomy and ventral hernia mesh repair.

DISCUSSION

Surgical site infections are an important type of healthcare associated infection and its surveillance is part of infection control measures in most hospitals. SSI rates are frequently used to assess the quality of infection control measure in hospitals. SSI increases morbidity and mortality as well as cost amongst surgical patients and increases the burden on healthcare facilities which can be a major problem in resource limited countries. [13]

The infection rates have been reported to range from 2.5% to 26%. [14-18] The infection rate in the present study was 4%. This wide variation in infection rates could be contributed to the difference in type of wound contamination and how effectively post discharge surveillance (PDS) is implemented. Cruse and Foord in their study of 62,939 operations found that the overall incidence rate among surgical wound was 4.7% and the incidence rate was 1.5%, 7.7%, 15.2% and 40% in clean, clean contaminated, contaminated and dirty operations.[19] This study clearly establishes the fact that the incidence of SSI was highest in dirty operative procedures. Thus in those centres where more cases of dirty operative procedures were performed, the incidence of SSI would be higher as compared to those centres where more number of clean operations were performed.

Post discharge surveillance is an important parameter in determining the SSI rate. Scottish Surveillance of Healthcare Associated Infection Programme (SSHAIP) conducted a study between April 1, 2002, and June 30, 2004 to demonstrate the importance of PDS. [20] The SSI rate among the 8,825 operations with no PDS was 2.61%, which was significantly lower than the SSI rate found among the 12,885 operations for which PDS was performed (6.34%).

Several guidelines have suggested use of single dose of antimicrobial prophylaxis with a narrow spectrum antibiotic to prevent occurrence of SSI. [6-8] The reason behind this suggestion is that misuse of antibiotics is associated with adverse affects and bacterial resistance apart from increasing the economic burden on the patients. [21,22] In a study on 357 patients who had *Clostridium difficile* associated diarrhoea, 6% had received antimicrobial prophylaxis and 58% among these were administered the antibiotic inappropriately thus exhibiting the adverse outcome of misuse of antibiotics. [23] Silva Nunes and colleagues examined the effect on hospital costs after reduction of AMP from 24 hours to single dose. [24] They demonstrated that reducing the dosage of antimicrobial prophylaxis lead to a monthly saving of 2000$ to the hospital costs. These figures are very important in resource limited countries like ours as following single dose AMP can reduce the cause without increasing the risk of SSI.

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