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Original Article

Role of Single Dose Preoperative Ceftriaxone in the Control of Surgical Site Infection in a Tertiary Level Hospital

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Abstract:

Post-surgical wound infection is a crucial factor in surgical practice. Prolong use of postoperative antibiotic is common practice in our surgical world. This causes financial burden to our patients and antibiotic resistance. But international journals and literatures suggest using antibiotics as prophylaxis only at the time of operation and no further postoperative antibiotic is needed in clean contaminated surgery. This comparative cross-sectional study was done at the department of surgery, Sylhet MAG Osmani Medical College Hospital from 1st July 2007 to 30th June 2008. A total number of 100 patients of clean-contaminated elective laparotomy were selected. Patients were randomly divided into two groups, in Group-I (got single dose preoperative Inj. Ceftriaxone) and in group-II (got single dose preoperative Inj. Ceftriaxone followed by Inj. Ceftriaxone for 2 days and then Cap. Cefxime for next 5 days). There is no statistically significant difference in outcome between two groups. So, single dose preoperative Inj. Ceftriaxone (1gm) is sufficient as a prophylaxis of surgical site infection in clean-contaminated elective surgery.

Key words: Surgical site infection, Elective laparotomy, Prophylactic antibiotic.

Introduction:

Post-operative wound infections are the second most common nosocomial infection and are a major cause of post operative morbidity and resource utilization[1]. Infection rate in clean surgery is 1-2%, in clean contaminated surgery is <10%, contaminated surgery is 15-20% and dirty surgery is <40%[2].

A surgical infection occurs when micro-organisms from the skin or the environment enter the incision that the surgeon makes through the skin in order to carry out the operation. These infections can develop at any time from two to three days after surgery until the wound has healed[3]. Every wound has its own critical inoculums level, it is about 10^5 organisms[4]. Infection in surgical wounds results from imbalance between the number and extent of bacterial contamination and the defense mechanism of the patient. It is related to advanced age, anaemia, jaundice, malnutrition, diabetes, uraemia, malignant neoplasm, use of steroid, type of operation, type of incision, and presence of foreign material[5].

Antibiotics are an important component of prophylaxis against surgical wound infection. They should be used together with preoperative patient preparation, good surgical technique and appropriate postoperative wound care. Antibiotics are not a substitute for the other three components. Control of postoperative infection is a multifaceted problem with many variables. High tissue concentration of antibiotic at the time of operation by regional prophylaxis appeared to be effective in preventing acute postoperative wound infection. Effective prophylaxis depends on effective concentrations throughout the period of potential tissue contamination[4]. Antibiotic must be in the tissue before the bacteria are introduced i.e. antibiotic must be given intravenously shortly before surgery to ensure high blood/tissue levels. There is no data to support more than a single dose, further dose generally constitutes a treatment. The period of risk for surgical site infection (SSI) begins with the incision. Administration of prophylaxis should be started preoperatively in most

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circumstances, ideally within 30 minutes of the induction of anaesthesia. In all operations the administration of additional doses after the end of surgery does not provide any additional prophylactic benefits[6]. Late infection is blood borne and that cannot be controlled by prophylactic use of antibiotic. Prolonged use of antimicrobial prophylaxis is common in our country. Majority of the literature from developed countries suggesting short duration of antimicrobial prophylaxis. In a developing country like India, with extremely limited health care resources along with poor economic status of the patient, healthcare professionals including surgeons do not want to take any chances for infection. However, it may not be a rational reason for prolonged antibiotic use. The majority of the surgeons are still reluctant to leave the conventional practice. There is a need for change from this conventional practice of prolonged prophylactic antibiotic usage by surgeons[7].

Ceftriaxone is a third generation cephalosporin antibiotic. Like other third generation cephalosporin, it has broad spectrum activity against Gram positive and Gram negative bacteria[8]. It is an antibiotic which is cheap, easily available, non-toxic, having extended bacterial coverage, time dependent bacterial action and wider tissue distribution. So the purpose of this study is to see whether a single dose of Inj. Ceftriaxone (1gm) I/V is better than that of multiple doses in reducing surgical site infection.

Materials and Methods:

It was a cross sectional comparative study carried out in the department of Surgery in Sylhet M A G Osmani Medical College Hospital from 1st July 2007 to 30th June 2008 and elective clean-contaminated laparotomy fulfilled the inclusion and exclusion criteria have been taken as study population. All clean-contaminated abdominal surgery of the patients of the age between 18-60 years of both sexes included and clean surgery, contaminated & dirty operations, emergency operations, patients with DM, uraemia, immunosupression, having corticosteroid therapy, BMI <18 or >25 were excluded from the study. A sample of 50 in each study group (a total of 100 patients) was calculated considering 5% significance level, 9% precision level & considering the incidence of 10% wound infection in clean-contaminated operation[9]. Convenient, consecutive and exhaustive sampling process was applied.

After the enrollment of patients into study population were divided randomly into group-I and group-II. Patients of elective laparotomies those fulfill inclusion and exclusion criteria were given arbitrary number, every odd number of patient was included as group-I and even number of patient was included as group-II. Group-I patients got single dose preoperative Inj. Ceftraxone and Group-II patients got single dose preoperative Inj. Ceftriaxone followed by Inj. Ceftriaxone for 2 days followed by Cap. Cefxime for next 5 days.

All the patients were assessed before operation by history taking, physical examination and necessary investigations. Hb%, RBS, serum urea and creatinine was estimated of each patient to exclude anaemia, diabetes mellitus and uraemia respectively. Patient's BMI were measured by measuring height and weight of the patient and calculating the BMI. Patients were searched for any focal source of sepsis. They have been informed about the purpose of data collection and written consent has been taken. They were asked to take a preoperative showering before the day of operation. Shaving of the patient was done on operation table. Skin was prepared by 10% povidone iodine in all cases. Other aseptic procedures during operations were performed in both groups by standard method.

Patients of group-I: Inj. Ceftriaxone (1gm) was given intravenously 30 minutes before induction of anaesthesia. After operation group-I patients have got no more antibiotic. Patients of group-II: Inj. Ceftriaxone (1gm) was given intravenously 30 minutes before induction of anaesthesia. After operation each patient of group-II got antibiotic for next 7 days (Inj. Ceftriaxone for 2 days followed by Cap. Cefxime for next 5 days).

In all cases diathermy was used for haemostasis and drainage tube inserted (if necessary) through a separate stab wound. If any discharge from the wound was present, it was collected and was sent for bacteriological examination and antibiotics were changed according to culture and sensitivity report. Adequate postoperative analgesia was ensured and patients were encouraged for early mobilization. Patients have been followed up on 3rd to 7th postoperative day and regularly examined for surgical site infection on the basis of ASEPSIS score[9].

Result:

The mean age of study and control group is 35. 56 (SD 10.88) and 40.44 (SD 10.66) years respectively. There is no significant difference of age in both groups of patients (Table-I).

Table - I: Age Distribution of Both Groups of patients

Age (in yrs)	Group – I (Case) n=50		Group – II (Control) n=50		P
	Frequency	Mean (SD)	Frequency	Mean (SD)	
17-30	18	21.3(10.1)	8	22.1(9.42)	
31-40	16	36.4(6.22)	17	37.21(7.11)	>.001
41-50	14	43.6(8.41)	16	45.71(3.47)	df = 3, X^2
51-60	2	52.1(3.21)	11	54.21(4.25)	= .0842

In the study group there were 27 (54%) male patients and 23 (46%) female patients. In the control group there were 25 (50%) male patients and 25 (50%) female (Fig-1). patients.

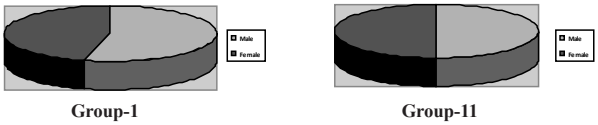

Fig - 1: Graphical Presentation of Sex Distribution

Mean BMI of study group of patients was 19.72 (±1.73) and control group was 19.67 (±1.06). The difference of mean BMI of study and control group of patients was not statistically significant (table-II). The mean haemoglobin level of study group of patients was 11.9 (±1.8) and control group was 12.1 (±1.5). The difference of mean haemoglobin level of study and control group was not statistically significant (Table-II).

Table - II: Distribution of patients according to BMI and haemoglobin level

Parameters	Group – I (Case) n=50	Group – II (Control) n=50	P
BMI	19.72 (1.73)	19.67 (1.06)	> 0.05 [t = 0.2043, df = 49]
Hb%	11.9 (1.8)	12.1 (1.5)	> 0.05 [t = 0.0785, df = 49]

Categorization of wound infection out of 100 patients, 81 patients had found satisfactory healing and 19 patients had found from disturbance of wound healing to severe wound infection (9 in group-I and 10 in group-II) (Table-III).

Table - III: Different categories of wound infection

Condition of wound	Group -I	Group – II	Total
Satisfactory healing	41 (82%)	40 (80%)	81 (81%)
Disturbance of healing	4 (8%)	5 (10%)	
Minor wound infection	3 (6%)	2 (4%)	19 (19%)
Moderate wound infection	2 (4%)	3 (6%)	
Severe wound infection	0 (0%)	0 (0%)	

Both groups of patients were distributed according to the operation. In the study group; 23 patients had cholocystectomy, 16 had gastrojejunostomy, 4 had choledecholithotomy, 2 had resection and anastomosis of small gut and 5 had interval appendicectomy. In the control group; 21 patients had cholecystectomy, 18 had gastrojejunostomy, 4 had cholodecholithotomy, 3 had resection and anastomosis of small gut and 4 had interval appendicectomy. There is no statistically significant difference in between 2 groups of patients (Table-IV).

Table - IV: Distribution of patients according to the operation

Operation	Group - I	Group – II	P
Cholecystectomy	23	21	
Gastrojejunostomy	16	18	>.05
Choledocholithotomy	4	4	df = 4,
Resection & anastomosis	2	3	X^2 =
Interval appendicectomy	5	4	1.0079

Operations were distributed according to the length of incision. Among the study group; 15 patients had 7-8 cm incision, 14 had 9-10 cm, 12 had 11-12 cm, 6 had 13-14 cm and 3 had 15-16 cm. Among the control group; 16 patients had 7-8cm incision, 16 had 9-10 cm, 12 had 11-12 cm, 4 had 13-14 cm and 2 had 15-16 cm. No significant difference is found between the lengths of incision of both groups of patients (Table-V).

Table-V: Distribution of operations according to length of incision

Length of incision (cm)	Group - I	Group - II	P
7-8	15	16	
9-10	14	16	
11-12	12	12	> .05
13-14	6	4	df = 4, X^2 =
15-16	3	2	0.9773

Operations were distributed according to the duration. Among the study group; 21 patients had duration of operation 41-50 minutes, 6 had 51-60 minutes, 14 had 61-70 minutes, 3 had 71-80 minutes and 6 had 81-90 minutes. Among the control group; 18 patients had duration of operation 41-50 minutes, 9 had 51-60 minutes, 14 had 61-70 minutes, 4 had 71-80 minutes and 5 had 81-90 minutes. No statistical difference is found between the duration of operation of both groups of patients (Table-VI).

Table - VI: Distribution of operations according to the duration

Duration of operations (in minutes)	Group - I	Group – II	P
41-50	21	18	
51-60	6	9	
61-70	14	14	> .05
71-80	3	4	df = 4, X^2
81-90	6	5	= 1.7118

Patients of both groups were distributed according to preoperative hospital stay. Among the study group; 4 patients had preoperative hospital stay 6-10 days, 16 had 11-15 days, 12 had 16-20 days, 12 had 21-25 days, 4 had 26-30 days and 2 had 31-35 days. Among the control group; 4 patients had preoperative hospital stay 6-10 days, 12 had 11-15 days, 14 had 21-25 days, 4 had 26-30 days and 2 had 31-35 days. There is no statistically significant difference between the hospital stay of both groups of patients (Table-VII).

Table - VII: Distribution of patients according to preoperative hospital stay

Preoperative hospital stay (days)	Group - I	Group – II	P
6-10	4(8%)	4(8%)	
11-15	16(32%)	12(24%)	
16-20	12(24%)	14(28%)	> .05
21-25	12(24%)	14(28%)	df = 5, X^2
26-30	4(8%)	4(8%)	= 1.4917
31-35	2(4%)	2(8%)	

Wound infections of both groups of patients were compared. In the study group, 41 patients had satisfactory wound healing, 4 had disturbance of healing, 3 had minor wound infection and 2 had moderate wound infection. In the control group, 40 patients had satisfactory wound healing, 5 had disturbance of healing, 2 had minor wound healing and 3 had moderate wound infection. There is no significant difference of wound infection between the two groups of patients.

Table - VIII: Comparison of wound infection between 2 groups of patients

Sample	Group - I	Group - II	P
Satisfactory healing	41	40	
Disturbance of healing	4	5	> .05
Minor wound infection	3	2	df = 3, X^2 =
Moderate wound infection	2	3	1.1467

Discussion:

The potential for infection depends on a number of patient variables such as the state of hydration, nutrition and existing medical conditions as well as extrinsic factors, for example related to pre, intra, and postoperative care if the patient has undergone surgery. This often makes it difficult to predict which wounds will become infected. Consequently the prevention of wound infection should be a primary management objective for all healthcare practitioner[10]. This cross sectional comparative study is conducted to assess whether preoperative antibiotic is sufficient to prevent postoperative wound infection. In this study Inj. Ceftriaxone was used as prophylactic antibiotic. The study group of patient had not got any antibiotic postoperatively. For control group Inj. Ceftriaxone followed by Cap. Cefxime were used in postoperative period.

In this study, both study and control group of patients are distributed in different categories. Different age categories are matched and there is no significant difference of age variation in study and control group of patients. But in the 51-60 years of age category, there is frequency difference which is 2 in study group and 11 in control group.

In this study BMI and Hb% of the patients are matched. Mean BMI of study groups of patients is 19.78 (1.73) and mean Hb% is 11.9 (1.73). In the control group, mean BMI and Hb% are 19.67 (1.06) and 12.1 (1.5) respectively. No statistical difference is found in the BMI and Hb% of both groups of patients.

In this study total infection rate is 19%. It is higher than the international standard. This may be due to overcrowding of the hospital and limited facilities of the hospital. In a prospective study comparing single with multiple antibiotic prophylaxis dose in elective cholecystectomy, Rajesh Chaudhury et al[11] showed over all infection rate 12. 76%, which was less than out result.

In a study, in the Department of Pediatric Cardiac Surgery, Sakakibara Heart institute, Tokyo, Japan showed, the mini skin incision, if associated with prolonged operation time, may increase the overall insult in pediatric cardiac surgery[12]. So, some of the confounding variables like length of incision, duration of operation, preoperative hospital stay were matched between two groups of patients and no significant difference is observed.

In a publication cited in British journal of Surgery showed that "The suture length to wound length ratio is an important parameter for healing of midline incisions closed with a continuous suture technique"[13]. In my study, there is no statistical difference of between the length of incision between study & control group of patients.

In a study, Gastmeier P concluded that duration of operation is at least partially determined by hospital factors and, consequently, should be used as a quality indicator to compare SSI infections between hospitals, rather than being used as a patient factor to adjust comparisons between hospitals[14]. In my study, there is no statistical difference of between the duration of operation between study & control group of patients.

Finally wound infections of both groups of patients are matched to find out any difference and no significant is noted which is matched with result of Single Versus Multiple Dose Antibiotic Prophylaxis in Lumbar Disc Surgery cited by Mattew[15].

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