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Original Research Article

A comparative study of single dose preoperative antibiotic prophylaxis versus five-day conventional postoperative antibiotic therapy in patient undergoing elective surgical procedure

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ABSTRACT

Background: Surgical site infections (SSIs) increase overall mortality and morbidity and increase the length of hospital stay and overall costs. With the fear of developing wound infection after surgery, author used to administer antibiotics for a period of 7-10days even in clean and clean-contaminated cases. This study aimed to fill that lacunae and there by aid the gradual shift away from over reliance on antibiotics in prevention of SSI, so author can prevent rapid development of resistance against antibiotics, prolonged hospital stays, and drug induced complication.
Methods: This facility based prospective study was carried out over a period of 1year involving 102 patients between the age group of 20-70years. All the patients in study group were given a single dose of 1gm (150mg/kg) of injection cefotaxime, 30minute before skin incision. All the cases in the control group received injection cefotaxime 1gm (150mg/kg) I.V. BD for five days.
Results: Data in the form of age, sex, type of surgery, post-operative fever, severity of pain and swelling at site of incision, duration of post-operative hospital stay, cost of treatment were noted in prescribed format and statistical analysis was done.
Conclusions: Single dose antibiotic prophylaxis is sufficient for clean and clean contaminated surgeries because there was no difference found in SSI either using single dose pre-operative antibiotic prophylaxis or using five days conventional post-operative antibiotic therapy with the added advantage of significant reduction in hospital stay and savings in resources.

Keywords: Clean contaminated surgeries, Prophylaxis, Surgical site infection

INTRODUCTION

Antimicrobial prophylaxis has been administered in many randomized clinical trials to reduce the incidence of wound infections.[1-3] Surgical site infections (SSIs) increase overall mortality and morbidity and increase the length of hospital stay and overall costs.[4] With the fear of developing wound infection after surgery author used to administer antibiotics for a period of 7-10days even in clean and clean-contaminated cases. This is not only expensive but also lead to hospital acquired infection and resistance to not only that particular antibiotic but also other antibiotics of the same group.[5] There is no evidence that administration of postoperative doses of an antimicrobial agent provides additional benefit, and this practice should be discouraged as it is costly and is associated with increased rates of microbial drug resistance. It is important to emphasize that surgical antibiotic prophylaxis is an adjunct to, not a substitute for, good surgical technique. Numerous clinical studies have clearly shown that appropriately timed “single shot” prophylaxis is as effective multiple-dose prophylaxis. Keeping in view the value of prophylactic antibiotics in world literature, this study was undertaken to evaluate as its place in the hospital to minimize great economic loss both in cost and staff-working hours, to the person as individual and the nation as a whole.[6]

This study aimed to fill that lacunae and there by aid the gradual shift away from over reliance on antibiotics in prevention of SSI especially clean and clean contaminated wound, so author can prevent rapidly development of resistance against antibiotics, prolonged hospital stays and drug induced complication. The aim of study was to assess the efficacy and advantages of single dose preoperative antibiotic administration versus five days conventional postoperative antibiotic therapy in preventing wound infection, to study the bacteriology of wound infection and to study cost efficacy of both regimens.

METHODS

This study was carried out in P.G. Department of Surgery, M.L.N. Medical College, Allahabad from 1 September 2017 to 31 August 2018. 102 patients were selected. The patients with the age group 20-70years both male and female with no co-morbid conditions undergoing elective surgeries were included. The patients who did not gave consent, who underwent emergency surgery with outpatient surgical procedures or those with a length of stay (LOS) 24hours or with minor surgical procedures including endoscopic procedures, who absconded or left the study or died during the period of study, who already had contaminated cavities like pyocele, empyema, drainage of pus and the patients with co-morbid condition like diabetes mellitus and malignancy were excluded.

It was a facility based prospective study carried out in P.G. department of Surgery, M.L.N. Medical College, Allahabad, India from 1 September 2017 to 31 August 2018. Total of 100 patients who were planned for elective surgeries from 1 September to December 2017 were taken as sample size. They were followed up till the end of study (6-month duration). Patients were randomly selected for study and cohort group. A total of 102 patients between the age group of 20-70years who give a written consent and fulfill the criteria of inclusion were included in this study, 50 were in study group while 52 were in control group, 2 patients from group left the study in mid so there were 50 left in control group also.

Procedure

Patients planned for elective surgeries and fulfill the criteria of inclusion and gave written consent (102 patients), author chose the patients with last digit of IPD no. was odd number were chosen as participants of study group. Similarly, author chose randomly the patients having the last digit of IPD number even number until author get 52 participants in control group.

All the patients in study group were given a single dose of 1gm of injection cefotaxime at the time of induction or 30minute before skin incision. They received no further antibiotic I.V. or oral. All the cases in the second group received injection cefotaxime 1gm I.V. BD for five days. In case of underweight or obese patients, the dose was adjusted according to their body weight. In the cases of laparoscopic cholecystectomy in control group, the patients who were discharged in 2 to 3days were given Tab. cefixime 200mg BD for 2 to 3days. The criteria used for defining surgical site infections were:

- A Surgical wound was considered infected if it met the following criteria
- Grossly purulent material drained from the wound
- The wound spontaneously opened and drained purulent fluid
- The wound drained fluid that was culture positive or gram stain positive for bacteria
- The surgeon noted erythema or drainage of pus and opened the wound after deeming it to be infected.

Post-operative patients were followed up daily. A temperature chart was maintained and the patients were observed for systemic infections. Dressing of wound were opened on the third postoperative day and checked for signs of wound infection like local erythema, induration and local rise of temperature or discharge. Inspection of the wound were repeated on the fifth and seventh postoperative day.

Data was charted on Micro soft Excel sheet and Chi-Square test was applied for the evaluation of statistical significance. The relevant statistics are discussed in the observation and discussion. Level of significance "p" mentioned in the results signifies as below:

- $P > 0.05$ not significant (ns),
- $p < 0.05$ just significant (*),
- $p < 0.01$ moderate significant (**),
- $p < 0.001$ highly significant (***).

RESULTS

The 50 patients in study group and 50 patients in control group were subjected serially to complete surgical procedure after fulfilling the recommended protocol for particular surgeries done by an experienced surgeon followed by post-operative care and follow up for 6month by investigator. In study group, antibiotics were given prior to surgery, while control group were covered with conventional 4-5days antibiotics post operatively. Results were compared and conclusion were drawn. Total number of patients at the end of study in each group were

50, were taken as 100%, all observations were expressed in % also to compare the results with available literatures.

After random selection of 102 patients in study group and control group, (everyone gets equal selection in either single dose antibiotic group or either in multiple dose groups). Pre-operative distribution of patients according to the age, sex, type of surgery in both groups matched by frequencies and chi-square test and to check for no significant discrepancy in distribution of cases based on basis of age, sex and type of surgeries between the groups.

Table 1: Distribution of participants according to age in study and control group.

Age (years)	Study group A	Control group B	Test of significance (Chi-square value) (χ^2)	p-value
<30	8 (16%)	7 (14%)	χ^2 - 0.873 df-4	0.928
31-40	15 (30%)	16 (32%)		
41-50	14 (28%)	12 (24%)		
51-60	7 (14%)	10 (20%)		
>60	6 (12%)	5 (10%)		
Total	50 (100%)	50 (100%)		

Table 1 shows that there were 100 participants in both groups 50 were in each group, in this study the age distribution of the patients varied from less than 30years to more than 60years. The most common age group was 41-50years. There was no significant difference between the control and study group based on age as borne out by the tables and p value of 0.928 which was not significant. Table 2 depicts that the male and female distribution in both group, majority of participants in both groups were males in study group 31 (62%) were male while in control group 32 (64%) were male and rest of participants were females but there were no significant association in both groups with sex of patients (P-0.836).

Table 2: Distribution of participants according to sex in study and control group.

Sex	Study group	Control group	Chi-square value (χ^2)	p-value
Male	31 (62%)	32 (64%)	χ^2 -0.043 df-1	0.836
Female	19 (38%)	18 (36%)		
Total	50 (100%)	50 (100%)		

Table 3: Distribution of participants according to type of surgery in study and control group.

Surgery	Study group	Control group	Chi-square value (χ^2)	p-value
Appendicectomy	6 (12%)	5 (10%)	χ^2 -0.526 Yates' chi-square df-2	0.913
Lap cholecystectomy	19 (38%)	19 (38%)		
Hernioplasty	24 (48%)	25 (50%)		
Other surgeries	1 (2%)	1 (2%)		
Total	50 (100%)	50 (100%)		

Table 4: Distribution of participants according post op of fever in study and control group.

Post- op fever	Study group	Control group	Test of significance (Chi-square value χ^2)	p-value
No	45 (90%)	44 (88%)	χ^2 - 0.102 df-1	p-0.479
Yes	5 (10%)	6 (12%)		
Total	50 (100%)	50 (100%)		

Table 3 depicted that the distribution of participants among the study and comparator group in relation to type of surgeries, from this table it was concluded that majority of the patients were admitted for hernioplasty i.e. (48%) and 50% in this study and control group followed by laparoscopic cholecystectomy i.e. 38% in both the group then appendicectomy and other surgeries but there were no significant association in both groups with type surgery of patients (p-0.913). *So, there was no significant discrepancy in distribution of cases based on type of surgeries between the groups.

Table 4 showed that the distribution of participants among the study and control group was most of patients did not having high fever post operatively in both groups i.e. 90% and 88% while 10% among study group and 12% in control group were complaining of fever. Although the number of patients with fever were more among the control group but this association was not proved statistically significant (p-0.4790).

Table 5: Distribution of participants according to complaint of severe pain at site of incision in study and control group.

Severe pain	Study group	Control group	Chi square value (χ^2)	p-value
No	46 (92%)	44 (88%)	χ^2 -0.444 df-1	0.505
Yes	4 (8.0%)	6 (12%)		
Total	50 (100%)	50 (100%)		

Table 5 depicted that the distribution of participants among the study and control group with respects to complaints of severe pain, most of patients in both groups were not complaining of severe pain i.e. 92% and 88% respectively in first and second groups, while 8% in study group and 12 % in control group were complaining of severe pain, as this table showed the number of participants with complaints of pain were more in second group but this association were not found significant (p-0.505).

*Severe pain- because these patients were cover with routine pain killers and anti-inflammatory drugs.

Table 6: Distribution of participants according to swelling at site of surgery in study and control group.

Swelling	Study group	Control group	Chi square value (χ^2)	p-value
No	47 (94%)	46 (92%)	χ^2 - 0.154 df-1	0.695
Yes	3 (6.0%)	4 (8.0%)		
Total	50 (100%)	50 (100%)		

Table 6 showed that the distribution of participants among the study and control in respects to visible swelling, most of patients in both group were without visible swelling 47 (94%) in study group and 46 (92%) among the control groups, 3 patients in study group and 4 in control group were having visible swelling during post-operative period 3-6days, these patients extra medicine.

Table 7: Distribution of participants according to wound discharge at surgical site in study and control group.

Wound discharge	Study group	Control group	Chi square value (χ^2)	p-value
No	47 (94%)	46 (92%)	χ^2 - 0.154 df-1	0.695
Yes	3 (6.0%)	4 (8.0%)		
Total	50 (100%)	50 (100%)		

As shows in this Table, no. of patients with swelling at site of incision were more among the control group but this difference was not shown any statistically relation (p-0.693).

Table 7 showed that the distribution of participants among the study and control in respects to wound discharge most of patients in both group were without wound discharge i.e. 94% and 92%, while 3 patients were having wound discharge in study group and 4 patients were in control group, more number of patients were with wound discharge in control group but this difference was not show any significant association (p-0.693).

Table 8 showed that the lab confirmed main growth in surgical site were *Streptococcal*, *Staphylococal aureus* and *E. coli* in control group where participants or patients received postoperative 3-4days conventional antibiotic cover as 3 patients were showed organism from their pus or contaminated wound, although the lesser. Of patients were found positive with pathogens but this association was not found significant (p-0.861).

Table 9 showed that the confirmed surgical site infection was found in 3 patients among the group of patients those who were given pre-operative single dose antibiotic study group and number of SSI patients were 4 in control group.

Hence, the incidence rate of infection among the patients were received preoperative single dose antibiotic was found 6.00% (3/50). Incidence rate was high in patients i.e. 8.00% (4/50), it was seemed that the pre-operative antibiotic was more effective to prevent post-operative infection but it was not proved statistically significant (p-0.695).

Table 10 showed that in the both groups most of patients or participants did not needed any additional medical treatment i.e. 47 and 46 respectably, although the medical management required in less in study group 3 and 4 participants among the control group but it was not found significant at 95% confidence interval (p-0.6947).

Table 11 depicts that maximum patients (46) among the study group were stays 2-3days while among the control group most of patients (28) were stay in hospital for 4-5days, 3 patients in group of study group stay for 7days and in control group number of patients were 7. So, this Table shows that the duration of hospital stay was more among the patients on conventional post-operative antibiotics, it was statistically proved significant (p-0.0).

Table 12 showed that the 34 patients in study group, and 15 patients in control group stated that the cost of treatment was almost free, while 10 in study group and 21 patients in control group states that the cost of treatment within range, 3 patients in study group and 7 in control group tells that the cost was not much high or not low, while 3 in first group and 7 control group tells that the cost of treatment was very high, it was statistically proved (p-0.0023). Meaning of cost mostly included the indirect cost due to prolonged stay loss of wages, cost of patient's attendants and visitors stay, direct cost of treatment almost nil in all cases because this study was conducted in a Government setup.

Table 8: Distribution of participants according to type of organisms at surgical site in study and control group.

Organisms	Study group	Control group	Test of significance (chi square test)	p-value
No growth	47 (94%)	46 (92%)	χ^2 - 0.799 Yates' chi-square, df-3	0.861
Streptococcal	0 (0%)	1 (2%)		
Staphylococcal	2 (4%)	2 (4%)		
E coli	1 (2%)	1 (2%)		
Total	50 (100%)	50 (100%)		

Table 9: Distribution of participants according to confirmed surgical site infection among study and control group.

Surgical site infection (SSI)	Study Group	Control Group	Chi square value (χ^2)	p-value
No	47 (94%)	46 (92%)	χ^2 - 0.154, df-1	0.695
Yes	3 (6%)	4 (8.0%)		
Total	50 (100%)	50 (100%)		

Table 10: Distribution of participants according to medical management needed for infection in study and control group.

Management	Study group	Control group	Chi square value (χ^2)	p-value
No	47 (94%)	46 (92%)	χ^2 -0.154, df-1	0.6947
Yes	3 (6%)	4 (8%)		
Total	50 (100%)	50 (100%)		

Table 11: Distribution of participants according to post-operative stays in hospital in study and control group.

Hospital stay	Study group	Control group	Chi square value (χ^2)	p-value
2 -3days	46 (92%)	15 (30%)	χ^2 -42.131, df-2	0.0
4-5days	1 (2%)	28 (56%)		
7 or more days	3 (6%)	7 (14%)		
Total	50 (100%)	50 (100%)		

Table 12: Distribution of participants according to direct and indirect cost during hospital stays in study and control groups.

Cost of hospital stay	Study group	Control group	Chi square value (χ^2)	p-value
Almost free	34 (68%)	15 (30%)	χ^2 -14.471, df-3	0.0023
Within range	10 (20%)	21 (42%)		
Medium cost	3 (6%)	7 (14%)		
High cost	3 (6%)	7 (14%)		
Total	50 (100%)	50 (100%)		

DISCUSSION

In this study, most of participants or patients were belonged to age groups of 31-40 and 41-50years i.e. 15 (30%), 14 (28%) in study group who received the single dose pre-operative antibiotic and 16 (32%) and 12 (24%) in control group the group in which the patients were put on 5days conventional post-operative antibiotics.

In presents study majority of participants were male 64% in study group and 62% in control group were male rest 36% and 38% in study and control group were female it was comparable to study by Ranjan A et al, 84% were male in study group while in second group 80% group rest were female. SSI in this study was 6% among study group while 8% among the control group.[6] In this study, in study group given preoperative I.V. Cefotaxime 1gm (150mg/kg) in preoperative period 30minutes before skin incision and to control group received injection cefotaxime 1gm BD for five days, other medication like pain killer given similarly to both groups. It was comparable to Jayalal JA et al, where patients in study group undergoing surgeries were given 1gm cefotaxime after test dose 60min prior to surgery. In the control group, the patients were given 3days intravenous injection ciprofloxacin 200mg intravenous (IV) twice a day, injection metronidazole 500mg thrice a day. The infection rate was similar in both groups. Grade 2 infections in 2 cases out of 30 in each group and there were no significant differences.[7]

In this study, wound infection was developed among 3 patients in study group 2, 2 (4%) male and 1 (2%) among female while among the 50 participants of control group 2 (4%) male and 2 (4%) female were developed wound infection. In contrast to Ranjan A et al, post-operative wound infection was more common among female among both group 25% and 20% in study group and control group while 7.1% and 6.25% among male participants in study group and control group respectively.

In present study, author included four type of elective surgeries i.e. appendisectomy, laparoscopic cholecystectomy, hernioplasty, other surgeries, wound infection develop in study group were 16.67%, 9.09% and in control group were 20%, 13.64% among the patients undergone appendisectomy and hernioplasty respectively while 0% wound infection among post-operative patients of Lap cholecystectomy and other surgeries in both group, it was comparable to Thejeswi PC et al, found that the thyroidectomy and hernioplasty patients constituted the major group in their study, while they conducted study on different type of surgeries . The incidence of wound infection in study group patients was 2.66% and in control group it was 4.66%, which was not statistically significant.[8]

In present study, the total cost of hospital stay in group most of patients stated that the total cost was almost free (68%), while in group received postoperative convention 5days antibiotics out of them mostly 42% stated that the total cost of surgery within range while patients stated that the cost were high 65 in study group and 14% in control group, this difference was found statistically highly significant (p-0.0023), in study group all three patients who develop SSI were stated that cost were very high while in control group patients other than those who develop SSI also stated that the cost were high.

In present study, the hospital stay duration of 92% study group stayed for 2-3days, 2% for 4-5days while 6% for stayed more, while in control group only 30% were discharged within 2-3days, 56% were discharged on 4-5days and 14% were stayed in hospital for 7days or more, in study group only patients develop SSI stayed prolonged while in control group patients few other than who develop wound infection also stayed more, this difference of hospital stay duration were also found statistically significant (p-0), it was comparable to Patel SM et al, Anvikar AR et al, stated that because of hospital prolonged stay they were susceptibility to infection by lowering host resistance or by providing increased opportunity for ultimate bacterial colonization, also reported higher rate of SSI in patients with prolonged preoperative hospital stay.[9,10]

CONCLUSION

This study on "single dose preoperative antibiotic prophylaxis versus five-day conventional postoperative antibiotic therapy in patient undergoing elective surgical cases" has led me to various conclusions.

Firstly, that single dose antibiotic prophylaxis was sufficient for clean and clean contaminated surgeries because there was no difference found in SSI either using single dose preoperative antibiotic prophylaxis or using five days conventional postoperative antibiotic therapy. Secondly, hospital stay of the patients was reduced by using single dose antibiotic prophylaxis. Thirdly, by using the single dose antibiotic prophylaxis the cost of the treatment can also be reduced.

However, overuse of antibiotics has no benefit but may lead to increased cost burden on patients and increase the emergence of resistant microorganisms and also increase side effects seen with antibiotic overuse without any extra benefit. In a resource deficit nation like ours, implementation of single dose antibiotic prophylaxis regimes can result in enormous savings.

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