Original Research

To compare the effectiveness of a single dose of preventive antibiotic with the use of empirical post-operative antibiotics in preventing Surgical Site Infection (SSI)

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Abstract

Aim: To compare the effectiveness of a single dose of preventive antibiotic with the use of empirical post-operative antibiotics in preventing Surgical Site Infection (SSI).

Material and methods: The study group consisted of 100 patients, while the control group consisted of another 100 patients. The patients were evenly split into two groups: Group A, designated as the study group, and Group B, designated as the control group. The study group participants were given a single 1gm dose of cefotaxime injection either during the induction or 30 minutes before to making an incision in the skin. No more intravenous or oral antibiotics were administered to them. The second group of patients were administered cefotaxime 1gm I.V. BD injections for a duration of five days. If the patient was underweighting or obese, the dosage was modified based on their body weight. In the control group, patients who had laparoscopic cholecystectomy and were released within 2 to 3 days were prescribed Tab. cefixime 200mg BD for the same duration.

Results: The majority of patients in both groups, namely 91% and 89%, did not have high fever after the operation. However, 9% of patients in the study group and 11% in the control group reported having a fever. The laboratory confirmed the predominant growth of Streptococcal, Staphylococal aureus, and E. coli in the surgical site of the control group. The participants or patients in this group received conventional antibiotic treatment for 3-4 days after the surgery. Out of the 7 patients, some showed the presence of these organisms in their pus or contaminated wound, albeit in smaller quantities. Out of the patients, several tested positives for infections, although this link was not statistically significant ($p = 0.11$).There were 5 patients in the pre-operative single dose antibiotic study group who had proven surgical site infections. In contrast, the control group had 7 patients with surgical site infections.Consequently, the rate of infection among the patients who got a single dosage of antibiotic before surgery was determined to be 7%. The incidence rate in patients was 9%, suggesting that the pre-operative antibiotic seemed to be more successful in preventing post-operative infection. However, this impact was not statistically significant ($p = 0.22$).

Conclusion: We concluded that the single dose of antibiotic prophylaxis is enough for procedures that are classified as clean or clean contaminated

Keywords: Clean contaminated surgeries, Prophylaxis, Surgical site infection

Introduction

Surgical site infection is a frequently occurring complication that occurs more than 30 days following the surgical procedure. The surgical site infection specifically affects the epidermis, subcutaneous tissue, and deep soft tissue of the incision, as well as any other anatomical region [1,2]. The clinical characteristics of a surgical site infection are determined by factors such as the condition of the skin surface, the kind of infecting organism, and the resistance of the host. The indications of infections include elevated temperature, inflammation, enlargement, discomfort, and impaired functionality at the location where the invasive surgery was performed [3,4]. During the local phase of infection, macrophages may be unable to fully phagocytose all dead cells, which may lead to the potential proliferation of bacteria in the surrounding region. In

the systemic phase of infection, the microorganisms finally penetrate the bloodstream and spread to distant organs. The poisons generated by the bacterium infiltrate the host and inflict harm on the host's tissue [5]. The wound healing process occurs via a series of pathways, including the inflammatory phase, fibroblastic phase, and remodeling phase [6].Surgeons often prescribe antimicrobial medications for a duration of 7-10 days, even for clean patients, to prevent the emergence of surgical site infections after surgery. This might potentially result in increased financial burden for patients, as well as an elevated risk of contracting hospital-acquired infections [7]. Typically, antibiotics are not needed to prevent surgical site infections after clean surgeries. However, certain studies suggest that antibiotics have been used inappropriately to treat surgical site infections. Administering prophylactic antibiotics before surgery can reduce the risk of both wound infections and complications arising from infection. This practice helps minimize the risk of infection. It should be administered to all instances that are both clean and infected. Therapeutic antibiotics are required for treating infected and unclean wounds [9]. Antibiotic selection for surgical site infection prevention is determined on the specific pathogen identified. The treatment should be both economically efficient and ensure the safety of the patient. First and second generation antibiotics are often employed[10].The objective of the study was to evaluate the efficacy of a single dose preventive antibiotic with that of empirical post-operative antibiotics in preventing surgical site infections (SSI). This prospective observational study aimed to assess the effectiveness of a single dosage prophylactic antibiotic compared to the use of both pre-operative and post-operative antibiotics in decreasing surgical site infections (SSI). Additionally, the study aimed to evaluate the duration of hospital stay between the two groups of patients.

Material and methods

A cohort of 200 patients was monitored until the conclusion of the trial. The research and cohort group consisted of patients who were recruited randomly. This research comprised a total of 200 patients, aged between 20 and 70 years, who provided written permission and met the inclusion criteria. The study group consisted of 100 patients, while the control group consisted of another 100 patients. The following patients were excluded from the study: those who did not provide consent, those who underwent emergency surgery with outpatient procedures, those with a length of stay (LOS) of less than 24 hours or with minor surgical procedures such as endoscopic procedures, those who absconded or left the study, those who died during the study period, those who already had contaminated cavities such as pyocele or empyema with drainage of pus, and those with co-morbid conditions such as diabetes mellitus and malignancy.

Methodology

The patients were evenly split into two groups: Group A, designated as the study group, and Group B, designated as the control group. The study group participants were given a single 1gm dose of cefotaxime injection either during the induction or 30 minutes before to making an incision in the skin. No more intravenous or oral antibiotics were administered to them. The second group of patients were administered cefotaxime 1gm I.V. BD injections for a duration of five days. If the patient was underweight or obese, the dosage was modified based on their body weight. In the control group, patients who had laparoscopic cholecystectomy and were released within 2 to 3 days were prescribed Tab. cefixime 200mg BD for the same duration. Patients who had undergone surgery were monitored on a daily basis. A fever chart was kept and the patients were monitored for systemic illnesses. The wound dressing was removed on the third day after the surgery and examined for indications of wound infection, such as redness, swelling, increased local temperature, or discharge. Wound inspections were conducted again on the fifth and seventh day after the surgery.The data was recorded in a Microsoft Excel spreadsheet and a Chi-Square test was conducted to assess the statistical significance. The pertinent data are addressed in the observation and discussion. The P value is less than 0.001, indicating a high level of statistical significance.

Results

A total of 100 patients were assigned to the research group and another 100 patients were assigned to the control group. They had a full surgical operation according to the prescribed protocol for their specific procedures, performed by an experienced surgeon. The patients received post-operative care and were followed up by the investigator for a period of 6 months. In the trial group, antibiotics were administered preoperatively, while the control group received standard antibiotics for 4-5 days after the operation.

Table 1 illustrates the distribution of males and females in both groups. The majority of participants in both groups were males. In the study group, 61 participants (61%) were male, while in the control group, 63 participants (63%) were male. The remaining participants were females. However, there was no significant association between the sex of the patients and the groups (P-0.11). The age group with the highest frequency was 40-50 years. There was no notable disparity in age between the control and study group, as seen by the tables and the non-significant p value of 0.76.

Table 2 shows the distribution of participants in the study and comparator groups based on the type of surgeries. The majority of patients were admitted for hernioplasty, accounting for 50% in both groups. This was followed by laparoscopic cholecystectomy,

which accounted for 37% in both groups. Appendicectomy and other surgeries were less common. However, there was no significant association between the type of surgery and the patients in both groups (p-0.14). There was no notable difference in the distribution of cases depending on the kind of procedures across the groups.The majority of patients in both groups, namely 91% and 89%, did not have high fever after the operation. However, 9% of patients in the study group and 11% in the control group reported having a fever. Although the control group had a higher number of patients with fever, this connection did not demonstrate statistical significance (p = 0.17).

Table 3 shows the distribution of participants in the study and control groups based on complaints of severe pain. The majority of patients in both groups did not report severe pain, with 91% in the first group and 87% in the second group. However, 9% of participants in the study group and 13% in the control group did report severe pain. Although the number of participants with pain complaints was higher in the second group, this association was not statistically significant (p = 0.11).

Table 4 indicated that the allocation of participants between the study and control groups with regards to apparent edema revealed that the majority of patients in both groups did not exhibit any visible swelling. In the trial group, 93% of patients had noticeable edema during the post-operative period of 3-6 days, whereas in the control group, this percentage was 91%. Among these patients, 7 in the study group and 9 in the control group required further medication. According to the data shown in this Table, the number of patients experiencing edema at the incision site was higher in the control group. However, this difference did not demonstrate any statistically significant relationship (p- 0.24).

Table 5 indicated the distribution of participants between the study and control groups in relation to wound discharge. The majority of patients in both groups did not have any wound discharge, with 93% in the study group and 91% in the control group. However, there were 7 patients with wound discharge in the study group and 9 patients in the control group. Although there were more patients with wound discharge in the control group, this difference did not demonstrate any significant association (p=0.28).

Table 6 indicated that the laboratory confirmed the predominant growth of Streptococcal, Staphylococal aureus, and E. coli in the surgical site of the control group. The participants or patients in this group received conventional antibiotic treatment for 3-4 days after the surgery. Out of the 7 patients, some showed the presence of these organisms in their pus or contaminated wound, albeit in smaller quantities. Out of the patients, several tested positive for infections, although this link was not statistically significant (p = 0.11).

Table 7 indicated that there were 5 patients in the pre-operative single dose antibiotic study group who had proven surgical site infections. In contrast, the control group had 7 patients with surgical site infections.

Consequently, the rate of infection among the patients who got a single dosage of antibiotic before surgery was determined to be 7%. The incidence rate in patients was 9%, suggesting that the pre-operative antibiotic seemed to be more successful in preventing post-operative infection. However, this impact was not statistically significant (p = 0.22).The majority of patients or participants, namely 93 and 91 respectively, did not need any further medical intervention. However, in the research group, only 7 and 9 individuals within the control group required less medical care, but this difference was not statistically significant at a 95% confidence interval (p=0.18).

Table 8 illustrates that the majority of patients in the study group (90%) stayed in the hospital for 2-3 days, but in the control group, the highest percentage of patients (28%) stayed for 4-5 days. Only 3% of patients in the research group stayed for 7 days, while in the control group, the percentage was 7%. The Table demonstrates that patients who received traditional post-operative antibiotics had a longer length of hospital stay, and this difference was statistically significant (p < 0.01).

Table1: Gender and age of the participants

	Group A		**Group B**		**P value**
Gender	**Number**	**Percentage**	**Number**	**Percentage**	**0.11**
Male	61	**61**	63	**63**	
Female	39	**39**	37	**37**	
Age (years)					
<30	15	15	15	15	
30-40	31	31	33	33	
40-50	29	29	25	25	0.76
50-60	15	15	18	18	
>60	10	10	9	9	

Table 2: Type of surgery

Surgery	Study group		Control group		p-value
	Number	Percentage	Number	Percentage	
Appendicectomy	9	9	11	11	
Lapcholecystectomy	37	37	37	37	0.14
Hernioplasty	50	50	51	51	
Othersurgeries	4	4	1	1	

Table 3: Severe pain at site of incision

Severe pain	Study group		Control group		p-value
	Number	Percentage	Number	Percentage	
No	91	91	87	87	
Yes	9	9	13	13	0.11

Table 4: Swelling at site of surgery

Swelling	Study group		Control group		p- value
	Number	Percentage	Number	Percentage	
No	93	93	91	91	0.24
Yes	7	7	9	9	

Table 5: Wound discharge at surgical site

Wound discharge	Study group		Control group		p- value
	Number	Percentage	Number	Percentage	
No	93	93	91	91	0.28
Yes	7	7	9	9	

Table 6: Type of organisms

Organisms	Study group		Control group		p-value
	Number	Percentage	Number	Percentage	
No growth	93	93	90	90	0.11
Streptococcal	0	0	3	3	
Staphylococcal	5	5	5	5	
Ecoli	2	2	2	2	

Table 7: Surgical site infection

Surgical site infection(SSI)	Study Group		Control Group		p-value
	Number	Percentage	Number	Percentage	
No	95	95	93	93	
Yes	5	5	7	7	0.695

Table8: Post-operative stays in hospital

Hospital stay	Study group		Control group		p-value
	Number	Percentage	Number	Percentage	
2-3days	90	90	28	28	
4-5days	3	3	57	57	0.02
7ormoredays	7	7	15	15	

Discussion

The research revealed a predominant male representation in both groups, with the majority of participants in the study group being men. In the experimental group, 61 individuals (61%) were male, while in the control group, 63 individuals (63%) were male. The remaining participants in both groups were female. However, there was no statistically significant connection between the sex of the patients and the groups (P-0.11). The age group with the highest frequency was 40-50 years. There was no notable disparity in age between the control and study group, as seen by the tables and the non-significant p-value of 0.76. The research conducted by Ranjan A et al found that 84% of the participants in the study group were male, whereas in the second group, 80% of the participants were male and the remaining participants were female. The research found that the SSI rate was 5% in the study group and 7% in the control group[11]. In this research, the study group was administered a preoperative intravenous dose of Cefotaxime 1gm (150mg/kg) 30 minutes before the

skin incision. The control group, on the other hand, got a twice-daily injection of Cefotaxime 1gm for five days. Both groups were given comparable pain medication. The research conducted by Jayalal JA et al included administering 1gm of cefotaxime to individuals in the study group who were having operations, following a test dosage, 60 minutes before the procedure. The patients in the control group received a 3-day treatment consisting of intravenous administration of ciprofloxacin 200mg twice daily and metronidazole 500mg three times daily. The infection rate was comparable in both groups. There were Grade 2 infections in 2 instances out of 30 in each group, and no significant differences were seen [12].

This study examined the distribution of participants between the study and control groups in relation to wound discharge. The majority of patients in both groups did not have wound discharge, specifically 93% in the study group and 91% in the control group. However, there were 7 patients in the study group and 9 patients in the control group who did have wound discharge. Although there were more patients with wound discharge in the control group, this difference did not show any significant association (p-0.28). Unlike the findings of Ranjan A et al, the occurrence of post-operative wound infection was higher among females in both the study group (25%) and the control group (20%), compared to males in the study group (7.1%) and the control group (6.25%).

The majority of patients in this study were admitted for hernioplasty (50%) and laparoscopic cholecystectomy (37%) in both the study and control groups. Appendicectomy and other surgeries were also performed, but there was no significant association between the type of surgery and the patients in both groups (p-0.14). The research done by Thejeswi PC et al discovered that the majority of patients in their study had thyroidectomy and hernioplasty, however they also examined other types of operations. The study group patients had a wound infection incidence of 2.66%, whereas the control group had an incidence of 4.66%. However, this difference was not statistically significant [13].

In the current research, the majority of patients in the study group (90%) stayed in the hospital for 2-3 days. In contrast, the majority of patients in the control group (28%) were in the hospital for 4-5 days. A small percentage of patients (3%) in the study group stayed for 7 days, while in the control group, the number of patients was 7%. The table demonstrates that patients who received conventional post-operative antibiotics had a longer duration of hospital stay. This finding was statistically significant (p-0.01). Similar observations were made by Patel SM et al and Anvikar AR et al, who noted that prolonged hospital stays increased the risk of infection by reducing the body's ability to resist pathogens or by creating more opportunities for bacterial colonization. These studies also reported a higher incidence of surgical site infections in patients with extended preoperative hospital stays [14,15].

Conclusion

We concluded that the single dose of antibiotic prophylaxis is enough for procedures that are classified as clean or clean contaminated. This conclusion is based on the absence of any significant difference in surgical site infections (SSI) between the administration of a single dose of preoperative antibiotic prophylaxis and a five-day course of traditional postoperative antibiotic treatment. Furthermore, the duration of hospitalization for patients was decreased with the use of a single administration of antibiotic prophylaxis. Furthermore, the use of single dose antibiotic prophylaxis might effectively decrease the overall expenses associated with the therapy.

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