E-ISSN: 2616-3470
P-ISSN: 2616-3462

www.surgeryscience.com
2023; 7(4): 104-107
Received: 07-10-2023
Accepted: 11-11-2023

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A comparative study of single dose prophylactic antibiotic versus empirical post-operative antibiotics in prevention of SSI

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DOI: https://doi.org/10.33545/surgery.2023.v7.i4b.1036

Abstract
Introduction: Surgical site infection (SSI) is one of the most common cause of post-operative morbidity. The introduction of antibiotics in 20th century leads to great improvement in surgical outcomes. But with rampant antibiotic use sets its own problems like rise in incidence of antibiotic resistant strains like (MRSA) and rise in incidence of allergies and other complications of antibiotic use.
Aims and Objectives: To compare the efficacy of single dose prophylactic antibiotic versus Empirical post-operative antibiotic prophylaxis in prevention of SSI.
Materials and Methods: The present study was a comparative study of patients receiving single dose prophylactic antibiotic versus empirical post-operative antibiotic prophylaxis in prevention of SSI during 2 years study period, Patents who met the inclusion criteria were included in the study.
Results: This study includes 100 clean and clean contaminated cases randomised in to two groups of 50 each. The study group will receive a single dose antibiotic pre-operatively while the control group will receive 3 to 5 days empirical antibiotic therapy. The common age group was 30-50 years; there is no significant difference between the control group and study group based on age. In this study there is no significant difference in post-operative fever in both study and control groups and there is significant difference in postoperative swelling due to SSI between this two groups with p-value of 0.6.
Conclusion: Based on my study I would like to conclude that it is recommendable to use single dose antibiotic prophylaxis using appropriate antibiotics for all class 1 and class 2 cases, as per the study results there is no significant difference in incidence of SSI when compared to the traditional regimens with the added advantage of significant reduction in both hospital stay with resultant savings in resources.

Keywords: SSI, antibiotics, antibiotic prophylaxis, traditional regimens

Introduction
A surgical site infection (SSI) is one of the most common causes of post-operative morbidity. The introduction of antibiotics in 20th century led to great improvement in surgical outcomes. But the rampant use of antibiotics came its own set of problems like the rise in incidence of antibiotic resistant strains like (MRSA) and rise in incidence of allergies and other complications of antibiotic use. The recent incidence of mass causality due to tainted antibiotic in mass sterilisation camp being one of them. This is perhaps due to lack of significant clinical trials especially in the government setup showing the efficacy of antibiotic prophylaxis alone in preventing incidence of SSI.
To be classified as superficial incisional wound infection it must meet the following criteria. Infection must occur at the incision site within 30 days after surgery and must involves skin or subcutaneous tissue above fascial layer and any of the following [1]. Surgical wounds are classified based on the assumed magnitude of bacterial load at the time of operation as clean, clean contaminated, contaminated and dirty [2]. Inflammation is normal and needed pre-requisite to healing. Changes in the vascular flow cause the clinical symptoms that are used to detect an inflammatory response. The vast majority of specialized cells involved in this phase of healing process come from blood [3].
The fibrin plugs that clots in the wound also form in the lymphatic vessels. Blocking the lymphatic flow seals the wound and also helps to stop the spread of infection. The lymphatics remain closed until later in the healing process [4].

Some fibroblasts responding to the chemical signals issued by macrophages provide a structural framework for many tissues, playing a critical role in wound healing. They responding to the stimulation secrete the precursors of all the components of the extracellular matrix, predominantly the ground substance and variety of fibres [5]. Adequate supplies of oxygen, ascorbic acid, and other co factors such as zinc, iron. Copper are needed to help create the proper background for fibroplasia, which is the production of fibrous tissue, usually implying an abnormal increase of non-euplastic fibrous tissue [6]. There are several factors affecting wound healing [7]. They are divided in to local factors and systemic factors. Local factors which affect wound healing are surgical technique, blood supply, mechanical stress, suture materials, infection and radiation. Systemic factors which affect wound healing are age. Malnutrition, vitamin deficiency and zinc deficiency, anaemia, uraemia, jaundice, malignant disease. Firstly there is exaggerated lysis of wound collagen by collagenolytic enzymes some of these are lysosomal enzymes present in polymorphonuclear lymphocytes in infected wounds others are enzymes which normally present in tissue.
The aim of the study is to evaluate the effectiveness of antibiotic prophylaxis in preventing Surgical Site Infections (SSI), exploring the classification of SSIs, understanding wound healing processes, and identifying factors that affect wound healing, amidst concerns of antibiotic resistance and complications.

Materials and Methods

The prospective comparative study was carried out in the department of general surgery, Mamata General Hospital, Khammam, Telangana from November 2021 to November 2023 with a total of 100 patients admitted to surgical ward. Study was approved by institutional ethics committee and written informed consent was obtained from al patients participating in the study

Study population: This study includes 100 clean and clean contaminated cases randomized in to two groups of 50 each

Inclusion Criteria

Clean and clean contaminated cases in department of general surgery

Exclusion Criteria

1. Contaminated cases are excluded
2. Those patients who not given consent were excluded
3. Patients below 18 years are excluded
4. Pregnant patients were excluded

Method of collection of data

This study includes 100 clean and clean contaminated cases randomized to groups of 50 each. The study group will receive a single dose of antibiotic preoperatively while the control group will receive 3 to 5 days of empirical antibiotic therapy.
All the clean class 1 cases in the study group were given a single dose of 1gm of inj. Ceftriaxone at the time of induction or 30 minutes before skin incision in case the procedure is prolonged for more than 3 hrs a second dose was given.
They received no further antibiotics i.v or oral. All the cases in the control group received 5 days of inj. Cefotaxime 1Gm iv BD for 5 days. The incidence of SSI was noted and analysed.
All the class 2 cases in study group received inj. Ceftriaxone 1gm and inj. Metronidazole 500 mg iv 30 minutes before the skin incision. In case the procedure was extended beyond 3 hrs a second dose was given. They received no further antibiotics i.v or oral. All the cases in the control group received inj. Cefotaxime 1gm IV BD along with inj. Metronidazole 500 mg IV TDS for 5 days. In case of underweight or obese patients the dose was adjusted accordingto their body weight.
All the cases were followed up at 8th POD, 15th POD, and 30th POD and later at 3 months and 6 months. Any wound related complications noted and dataobtained. The incidence of SSI in both the groups was calculated and results analysed.

Statistical Analysis: Statistical analysis was done using chi square test with p value of 0.3 which is not significant

Results

Table 1: Distribution of cases based on side of hernia

Side of hernia	Control	Study	Total	Chisq	P
Left	10	9	19		
Right	11	15	26	2.46	0.2
Bilateral	04	1	5		
Total	25	25	50		

In the study there was an even distribution of case based on the side of hernia. There was slightly preponderance to the right overall. But again as borne out by p value of 0.2 which is not significant

Table 2: Distribution of cases based on SSI for inguinal hernia

SSI	Control	Study	Total	Chisq	P
No	23	22	45		
Yes	2	3	5	0.22	0.6
Total	25	25	50		

In the present study 2 patients in the control group and 3 patients in the study group developed SSI. All of them developed superficial SSI and none had deep SSI. The incidence of SSI in the present study was 0.5% in the control group and 0.75% in the study group. The difference is not significant as shown by the p value of 0.6

Table 3: Distribution of cases based on management for inguinal hernia

Management	Control	Study	Total	Chisq	P
NA	23	22	45		
Antibiotics	2	3	5	0.28	0.6
Total	25	25	50		

In the present study 2 patients in the control group and 3 patients in the study group developed SSI. All of them were managed with additional antibiotics. They were initially managed with broad spectrum antibiotics and later based on culture sensitivity report antibiotics were changed

Table 4: Distribution of cases based on age for appendicectomy

Age	Control	Study	Total	Chisq	P
<30	11	7	18		
31-40	12	12	24		
41-50	2	2	4	4.89	0.18
51-60	0	4	4		
Total	25	25	50		

Most of the patients were in the 31-40 years of age group there was no significant difference in the age wise distribution of cases between two groups as borne out by the P value of 0.18 which is not significant

Table 5: Distribution of cases based on SSI for appendicectomy

SSI	Control	Study	Total	Chisq	P
No	17	18	35		
Yes	8	7	15	0.09	0.7
Total	25	25	50		

In the present study 8 out of 25 patients in the control group and 7 out of 25 patients in the study group developed SSI. The incidence was 2% in the control group and 1.75% in the study group. There was no significant difference in SSI between groups made out by p value of 0.7 which is not significant

Table 6: Distribution of cases based on management for appendicectomy

Management	Control	Study	Total	Chisq	P
NA	17	18	35		
Observation	1	4	1		
Additional antibiotics	1	1	6	1.02	0.79
Drainage of collection	6	2	8		
Total	25	25	50		

Out of 8 patients who developed SSI in control group 6 patients were managed by drainage of infection and in one patient infection resolved with additional antibiotics and one patient resolved spontaneously. In study group out of 7 patients who developed SSI 4patients resolved spontaneously. There was no significant difference between groups as shown by the p value of 0.7 which is not significant

Discussion

For ease of comparison clean cases were restricted to hernioplasty and clean contaminated cases are restricted to appendicectomy. All the clean case in the study group received single dose of inj. Ceftriaxone 1gram 30 minutes before skin incision. They received no further antibiotics IV or oral with the exception of a single repeat dose if the surgery duration exceeds 3 hours. All the cases in the control group received inj. Ceftriaxone 1gram IV BD for 5 days. All the cases in the study group of clean contaminated cases receive single dose of inj. Ceftriaxone 1gram and inj. Metronidazole 500mg iv 30 minutes before skin incision. They received no further antibiotics iv or oral with the exception of single repeat dose if the surgery duration exceeds 3 hours. All the cases in the control group received 5 days of inj. ceftriaxone 1gram iv bd and inj. Metronidazole 500mg iv TID. The incidence of SSI was noted and results analysed

In the study comparing the incidence of Surgical Site Infections (SSI) in clean surgeries, the findings showed an incidence of 0.5% in the control group and a slightly higher 0.75% in the study group, with a p-value of 0.6 indicating no significant statistical difference. This incidence aligns closely with other studies, such as Shahane *et al*. at 0.59% [8] and compared to a much higher 7% reported by Pathak *et al*. [9]. In clean contaminated cases, the study observed SSIs in 8 out of 25 patients (32%) in the control group and 7 out of 25 (28%) in the study group, corresponding to incidences of 2% and 1.75% respectively, with a p-value of 0.7 again showing no significant difference. These findings suggest that the observed differences in SSI rates in both clean and clean contaminated surgeries are likely not due to the specific variables being studied, emphasizing the importance of consistent surgical practices and infection control in minimizing SSI risks.

In the section discussing clean contaminated cases from your study, the incidence of Surgical Site Infections (SSI) was observed in both the control and study groups. Specifically, 8 out of 25 patients (32%) in the control group and 7 out of 25 patients (28%) in the study group developed SSI, translating to incidences of 2% and 1.75% respectively. The p-value of 0.7 indicated no significant statistical difference between the two groups in terms of SSI incidence. This outcome is compared with other studies: Cruse *et al*. reported a significantly higher incidence of 18%, Shahane *et al*. observed a slightly higher incidence at 2.6%, and Pathak *et al*. reported an incidence of 11.4%. In contrast, the incidence observed in your study was 2.0%, which is lower than most of these other studies but similar to Setty *et al*. [10].

These findings suggest that the rate of SSI in clean contaminated surgeries in your study was relatively low and comparable to some other studies, but significantly lower than others. The lack of a statistically significant difference in SSI rates between the control and study groups in your research further suggests that the incidence of SSI in clean contaminated cases may not be strongly influenced by the specific factors being investigated in these groups.

Conclusion

This study concludes that it is recommendable to use single dose antibiotic prophylaxis using appropriate antibiotics for class 1 and class 2 cases. As per study results there is no significant difference in incidence of SSI when compared to the traditional regimes with the added advantage of significant reduction in hospital stay, with its resultant savings in resources. In addition as the use of antibiotics is reduced it further results in cost effectiveness and reduces the incidence of complications due to antibiotic overuse.

Conflict of Interest

Not available

Financial Support

Not available

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How to Cite This Article
Vardhan IV, Inamdar P, Gurram L. A comparative study of single dose prophylactic antibiotic versus empirical post-operative antibiotics in prevention of SSI. International Journal of Surgery Science. 2023;7(4):104-107.