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Role of Prophylactic Antibiotics to Prevent the Surgical Site Infections - A Study in A Tertiary Care Hospitals

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Abstract

Introduction: *Surgical site infections are the third most common nosocomial infection, which constitute 38% of surgical infections. So, the selection of an appropriate antimicrobial agent depends on the identification of the most likely pathogens that are associated with a specific surgical procedure. The administration of antibiotic prophylaxis is considered to be optimal if it is given between 30 and 60 min before skin incision.*

This study was performed to evaluate the use of perioperative prophylactic antibiotics in clean surgeries

Materials and Methods: *The objective of the study was to compare the frequencies of patients developing postoperative wound infection in two groups of patients (study group and control group) undergoing clean elective general surgery operations. Patients in study group were given perioperative prophylactic antibiotics while patients in control group were not given perioperative prophylactic antibiotics.*

It was an experimental prospective study. The study was conducted in general surgical ward in our unit in our hospital from June 2011 to June 2012. Only those patients undergoing clean elective general surgery operations were included.

Observation and Results: *Out of 50 patients in study group, 26 patients underwent hernia surgery, 12 patients underwent neck surgeries, 7 patients underwent breast surgeries and remaining 5 patients underwent scrotal surgeries. Out of 50 patients in control group, 25 patients underwent hernia surgery, 11 patients underwent neck surgeries, 8 patients underwent breast surgeries and remaining 6 patients underwent scrotal surgeries.*

Regarding age distribution, in study group, 18 patients were of age <40 years, 8 patients were >60 years and the remaining were between the age group of 40-60 years. In control group, 20 patients were of age <40 years, 3 patients were >60 years and the remaining 27 patients were between the age group of 40-60 years.

Regarding sex distribution of patients, 37 numbers of patients in study group were male and the remaining 13 were female in study group. In control group, 34 were male and 16 were female patients.

None of the patients either in study or control group developed organ or space infection. Patients developed only incisional surgical site infection which was either superficial or deep seated (redness, erythema, hematoma, purulent discharge). And the isolates from purulent discharge were mostly staphylococcus aureus (2 in study group and 3 in control group). One patient in each group developed Escherichia coli.

Conclusion: *we come to a conclusion that for a clean an uncontaminated surgery, the use of antibiotics prophylactically does cause a significant reduction in the rate of surgical site infection Also literature, it is not established that prophylactic antibiotic for surgeries in general surgery reduce the infection rate as in contaminated and contaminated surgeries where its role is extension studied and its reduction in rate of surgical site infection is established.*

Thus to conclude, according to this study performed prophylactic antibiotics, unless warranted, has no significant role clean elective surgeries.

Key Words: *Infection, Prophylaxsis, Antibodies.*

INTRODUCTION

Surgical site infections are the third most common nosocomial infection, which constitute 38% of surgical infections. It is the most common nosocomial infection in the surgical ward.[1,2,3] They account for 14% to 16% of all nosocomial infections. It creates great burden to the patients by increasing hospital stay by 7-10 days. Also, it increases hospital expenditures creating an economic burden to the patient and country.

The basis of antimicrobial prophylaxis in surgery is to achieve adequate levels of drug in serum and tissues that exceed the Minimum Inhibitory Concentrations (MIC) for the organisms that are likely to be encountered during the operation, for the whole duration of the procedure.

So, the selection of an appropriate antimicrobial agent depends on the identification of the most likely pathogens that are associated with a specific surgical procedure. The administration of antibiotic prophylaxis is considered to be optimal if it is given between 30 and 60 min before skin incision.[4,5,6] A single dose of an antimicrobial agent is sufficient for most surgical operations. The prolonged use of prophylactic antimicrobials is associated with the emergence of resistant bacterial strains.[7,8] Although the principles of antimicrobial prophylaxis in surgery are clearly established and several guidelines have been published, the implementation of these guidelines is problematic among surgeons.

The risk of postoperative wound infection is lowest after clean surgical procedures. Surgical-site infection (SSI) rate in patients undergoing clean extra-abdominal operations and patients undergoing intra-abdominal operations are 2% to 5% and up to 20% respectively.

Generally, in our surgical wards, for most patients undergoing clean surgical operations, prophylactic systemic antibiotics are not indicated. But prevalent usage of prophylactic antibiotics in these clean procedures is due to the undue fear of infection in the minds of majority of our surgeons. Appropriate usage of antibiotics gains paramount importance, when misuse of potent antimicrobial agents leads to toxicity of drugs, super added infection, increase in healthcare cost and colonization of highly resistant strains of bacteria in surgical wards. [9,10]

This study was performed to evaluate the use of perioperative prophylactic antibiotics in clean surgeries – does it work at all? And if it does work should it be used for all cases?

MATERIALS AND METHODS

Main objective of the study

The objective of the study was to compare the frequencies of patients developing postoperative wound infection in two groups of patients (study group and control group) undergoing clean elective general surgery operations. Patients in study group were given perioperative prophylactic antibiotics while patients in control group were not given perioperative prophylactic antibiotics.

Prophylactic antibiotic vs. no antibiotics

This study was performed to compare the usage of perioperative prophylactic antibiotics in clean elective general surgery operations with no use of antibiotics in these operations in reducing surgical site infections.

Methodology of study

It was an experimental prospective study. The study was conducted in general surgical ward in our unit in our hospital from June 2011 to June 2012. Only those patients undergoing clean elective general surgery operations were included.

General surgical procedures included

The surgeries included in the study were hernia repair (open and laparoscopic approaches), breast surgeries (modified radical mastectomy for carcinoma breast and excision biopsies for fibroadenoma breast), neck surgeries (total thyroidectomy for multinodular goitre and hemithyroidectomy for solitary nodular goitre, excision biopsy of lipoma nape of neck) and scrotal surgeries (eversion of sac for hydrocele and excision for epididymal cyst).

Patients

Hundred patients were included in this study. Convenience sampling technique was used for the selection of patients. Patients undergoing clean elective general surgery operations were blindly

divided into two equal groups (study Group and control Group) alternating at the time of operation. Those in the study Group were given injection cefotaxim 1g IV 30 minutes before operation. Patients of control group did not receive any antibiotics. Surgical techniques employed were similar. Patients from both groups were observed for the presence of surgical site infection.

OBSERVATION AND RESULTS

Surgeries included in this study were hernia repair, neck surgeries which includes thyroid surgeries and lipoma excision, breast surgeries and scrotal surgeries like hydrocele and epididymal cyst excision, shown in table 1 .

TABLE-1: Surgeries Included In Study

CONTROL	STUDY	PROCEDURE	S.NO.
25 21 4	26 23 3	Hernia repair open Hernioplasty laparoscopic hernioplasty	1
11 7 4	12 6 6	Neck Thyroid surgeries Lipoma nape of neck	2
8 5 3	7 4 3	Breast Modified radical mastectomy Excision biopsy	3
6 5 1	5 4 1	Scrotal surgeries Hydrocele Epididymal cyst excision	4
50	50	TOTAL	6

Total number of cases were 100 in this study, which were distributed in to two groups . These patients were selected randomly. Distribution of operated cases was shown in table 2, chart 1.

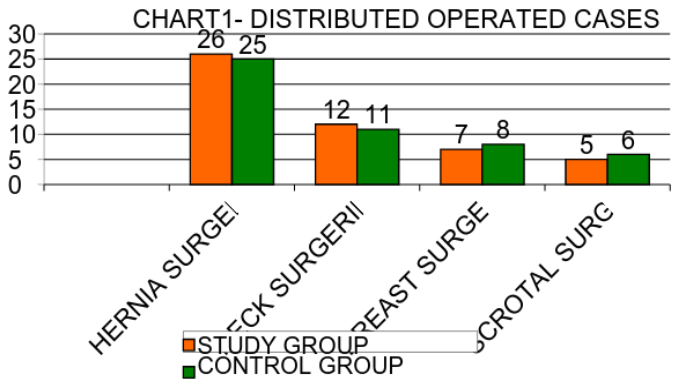
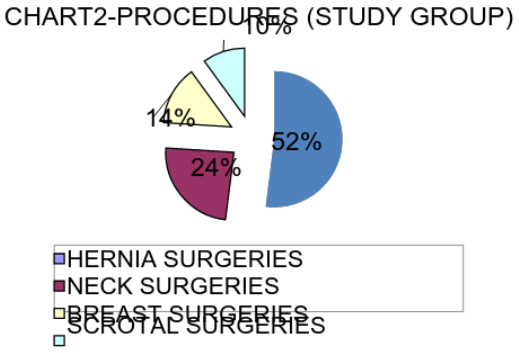
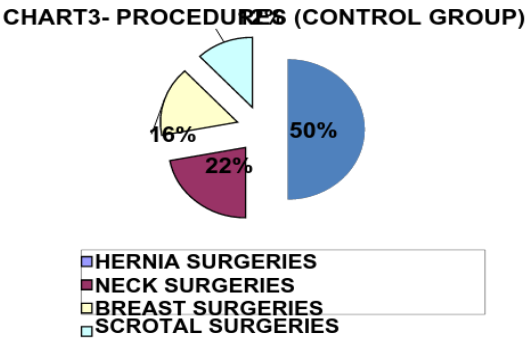


TABLE 2: Distribution of Operated Cases

TOTAL N=100	CONTROL GROUP N=50	STUDY GROUP N=50	PROCEDURES	S.NO
51	25	26	HERNIA SURGERIES	1.
23	11	12	NECK SURGERIES	2.
15	8	7	BREAST SURGERIES	3.
11	6	5	SCROTAL SURGERIES	4.
100	50	50		

Out of 50 patients in study group, as shown in chart 2, 26 patients underwent hernia surgery, 12 patients underwent neck surgeries, 7 patients underwent breast surgeries and remaining 5 patients underwent scrotal surgeries. Out of 50 patients in control group, 25 patients underwent hernia surgery, 11 patients underwent neck surgeries, 8 patients underwent breast surgeries and remaining 6 patients underwent scrotal surgeries, which is shown in chart 3.

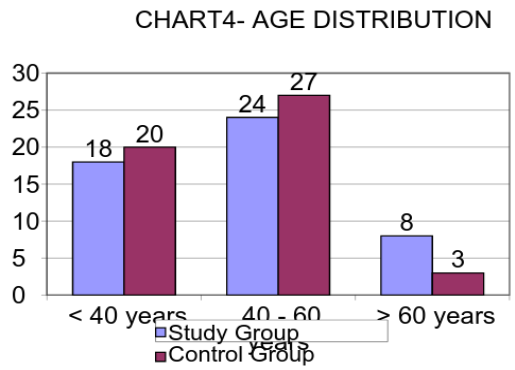




Regarding age distribution, in study group, 18 patients were of age <40 years, 8 patients were >60 years and the remaining were between the age group of 40-60 years. In control group, 20 patients were of age <40 years, 3 patients were >60 years and the remaining 27 patients were between the age group of 40-60 years as shown in table 3,chart 4.

TABLE – 3 Age Distribution of Patients

Control Group	Study Group	Age Distribution
20	18	< 40 years
27	24	40 - 60 years
3	8	> 60 years



According to table 4, regarding sex distribution of patients, 37 number of patients in study group were male and the remaining 13 were female in study group. In control group, 34 were male and 16 were female patients

Table 4- sex distribution of patient

Control Group	Study Group	Sex Distribution
34	37	Male
16	13	Female

As in table 5, chart 5, shows the rate of wound infection and none of the patients either in study or control group developed organ or space infection. Patients developed only incisional surgical site infection which was either superficial or deep seated shown in table 6 and chart 6, (redness, erythema, hematoma, purulent discharge). And the isolates from purulent discharge were mostly staphylococcus aureus (2 in study group and 3 in control group). One patient in each group developed Escherichia coli as in table 7, chart 7.

Table 5 Wound Infection Rate of Patients

Control Group	Study Group	Wound Infection
6	3	SSI +
44	47	SSI -

P value - 0.542 Not significant

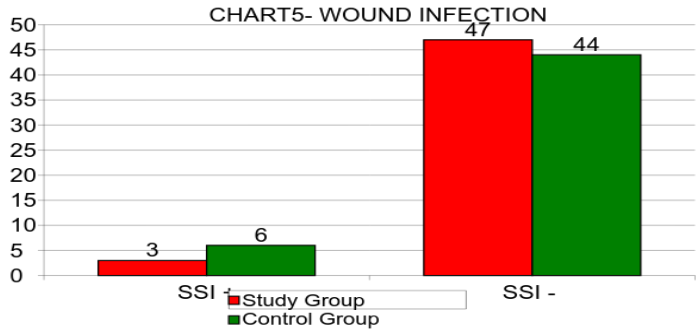


Table – 6: Type of SSI

Control Group	Study Group	Type of SSI
4	2	Superficial Incisional
2	1	Deep Incisional
0	0	Organ / Space

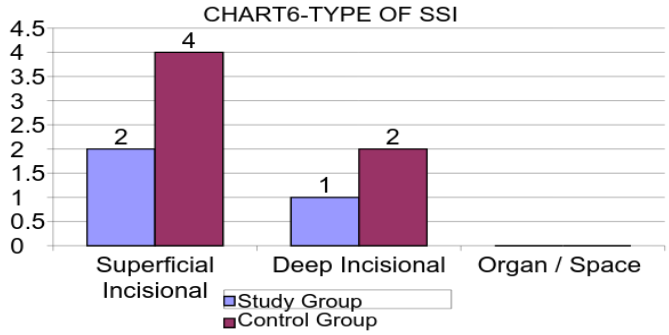
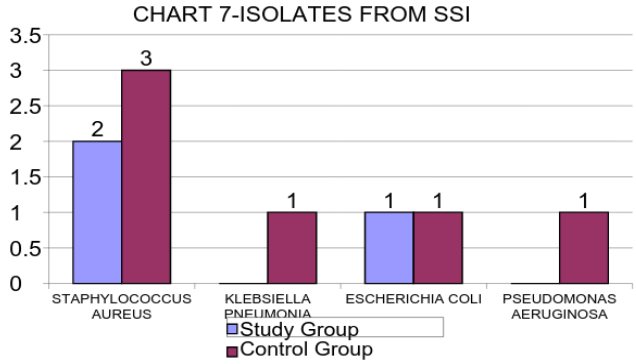


Table 7 Isolates from SSI

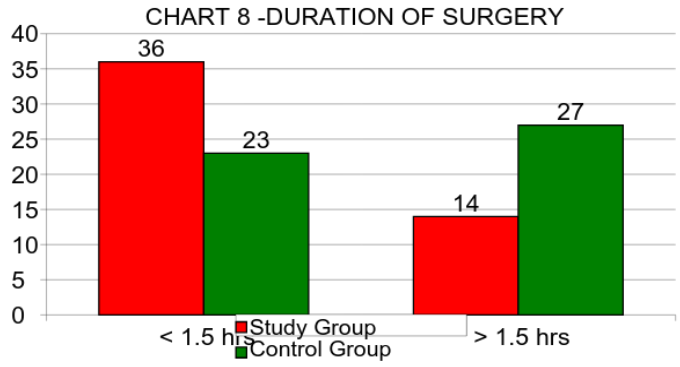
Control Group	Study Group	Isolates from SSI
3	2	STAPHYLOCOCCUS AUREUS
1	0	KLEBSIELLA PNEUMONIA
1	1	ESCHERICHIA COLI
1	0	PSEUDOMONAS AERUGINOSA



The duration of surgery was, <1.5 hrs in 36 cases in study group and 23cases in control group and > 1.5 hrs was 14 cases in study group and 27 cases in control group. Duration of surgery was more in cases in control group.

Table 8 Duration Of Surgery

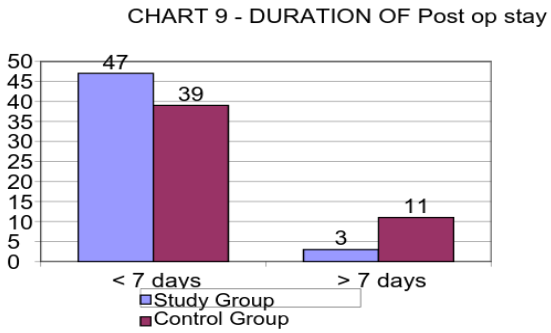
Control Group	Study Group	Duration of Surgery
23	36	< 1.5 hrs
27	14	> 1.5 hrs



47 cases of study group and 39 cases of control group have < 7 days post operative stay in the hospital as in table 9 and chart 9

TABLE 9: Post OP Stay of Patients

Control Group	Study Group	Duration of Post op Stay
39	47	< 7 days
11	3	> 7 days



DISCUSSION AND SUMMARY

The term clean surgeries describes the procedures where in a sterile technique is strictly adopted and any of the tracts like GIT, respiratory and genitor-urinary tracts are not entered.

Apart from the factors like the operating team and the risk factors of the patient which contributes to the risk of infection , the operating atmosphere and the sterility of the instruments and the effort, which is taken to maintain asepsis also interfere with the rate of surgical infections [11,12,13]

It is rather not fair for a surgeon to prescribe an antibiotic when there is any breach in the technique of aspesis as it is never a substitute to aspesis. [14,15,16,17] In a clean surgery, the infection is almost always entered the operative field from an exogenous source like skin of the patient or the nostrils of the operating team.

In this study the factors like hypertension, diabetes mellitus or any other co-morbities, immunocompromised state, malnutrition, previous surgeries, hupergentivity to any antimicrobial agents have been excluded. As per the literature, the rate of infection after a clean surgery is 1.5% and is hardly more than 4%. [18,19,20]

According to the study performed in our institution, the rate of infection in the study group i.e., the patient who received a prophylactic antibiotic was 6%. 3 out of 50 patients developed an infection among which 2 had superficial incisional SSI. In the group who never received an antibiotic prophylactically, 6 out of 50 patients (12%) developed on infection of which 4 developed a superficial incisional SSI and the remaining deep incisional SSI. None of the patients in both groups developed an organ or space SSI. 48% of the patients in the study group and 54% of the patients in the control group were in the age group of 40 to 60 years with no significant co morbid conditions.

Organisms obtained from the isolates of patients from both the study group and the control group were predominantly staphylococcus aureus. other organisms obtained were klebsiella pneumonia and escgerichia coli. The difference in the infection rate of both the groups was not significant statistically as the P value obtained from the chi square test was 0.452(P value becomes significant when it is less than 0.05). This was actually similar to some studies performed in Rawalpindi, Pakistan for a similar set of clean and uncontaminated surgeries in a military hospital. [21,22]

But according to Platt et al, who conducted a study to evaluate the use of perioperative prophylaxis in clean surgeries, there was an absolute decrease in the risk of surgical site infection to approximately 50%.[23,24,25] In this study, the sample size (n = 1000) was sufficiently larger than our study. More the number of

procedures performed, more the sample size, more the power of study which makes the results of study considerably reliable. Also from such randomised trials performed the regimens for specific surgical infections can be devised.

Regimens usually successful are those which are

a) Available at a cheaper cost to the patient.

b) Remains in the serum for a longer time (half life).

c) Considerable activity against organisms which are usually found in the nostrils and skin of the health care personnels.

Though the drug cefazolin serves the above purpose and been used nowadays for many clean and uncontaminated surgeries, the best agent for prophylaxis varies according to the type of surgery performed and likely source of infection.[26,27]

Apart from the efficacy of the antibiotics used to treat or prevent a surgical site infection, the important factor which helps a surgeon to choose an antibiotic is its cost.[28,29], Nowadays, antimicrobial agents have been misused in inpatient setup. This is also similar in an outpatient set up as 'over the counter' drugs. Antibiotic misuse gives an economic burden in a society due to increased costs in health care services. It also leads to newer infections like antibiotic associated diarrhoea caused by clostridium difficult. Emergence of multi drug resistant strains and organisms like "super bugs" which are resistant to all but few antimicrobial agents makes the already worsened situated more sober.[30,31]

A responsible surgeon must weigh the potential risks and advantages of giving an antibiotic after a particular procedure, especially a clean and uncontaminated surgery where the chance of infection rate is very minimal and act accordingly.

Improvements in the quality of medical care can only be accomplished by proper usage of an antibiotic which is effective in preventing and conrtolling an infection. Optimal regimens for treating a surgical site infection must be tailored based on whom and what procedure is been performed as it takes a heavy toll on the economy.

CONCLUSION

According to the results of this study whish evaluated the role of prophylatic antibiotics to prevent surgical site infections in clean surgeries which included hernia repair (both open and laparoscopic), neck surgeries (thyroid surgeries and lipoma), breast surgeries (modified radical mastectomy and fibroadenoma excision) and scrotal surgeries (hydrocele and epididymal cyst excision), the rate of surgical site infection in the group which received prophylactic antibiotic (study group) was 6% and the one which did not receive any antibiotic prior to surgery developed 12% of wound infection rate. This difference in the rate of infection is not significant statistically as the p value was 0.452 (>0.05) obtained by the test of significance (chi square test).

Thus we come to a conclusion that for a clean an uncontaminated surgery, the use of antibiotics prophylactically does cause a significant reduction in the rate of surgical site infection Also literature, it is not established that prophylactic antibiotic for surgeries in general surgery reduce the infection rate as in contaminated and contaminated surgeries where its role is extension studied and its reduction in rate of surgical site infection is established.

Thus to conclude, according to this study performed prophylactic antibiotics, unless warranted, has no significant role clean elective surgeries.

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