**Scholars Journal of Applied Medical Sciences**
Abbreviated Key Title: Sch J App Med Sci
ISSN 2347-954X (Print) | ISSN 2320-6691 (Online)
Journal homepage: www.saspublishers.com

OPEN ACCESS

Surgery

# Comparative Study of Surgical Site Infection among Recipients of Short-term Prophylactic and Traditional Long-term Antibiotic Therapy in Elective Surgery

Dr. Goutom Kumar Ghosh[1], Dr.Md. Sherajul Islam[2], Dr. Shyamal Kumar Bashak[3], Dr. Kh. Mehedi Ibnay Mostfa[4], Dr. A S M Kutub Uddin Awal[5], Dr. ASM Abdur Rahman[6]

[1]Senior Consultant (Surgery), 250 Bedded General Hospital, Pabna, Bngladesh
[2]Junior Consultant (Surgery), 250 Bedded General Hospital, Pabna, Bangladesh
[3]Ex- Senior Consultant (Anaesthesiology), 250 Bedded General Hospitals, Pabna, Bangladesh
[4]Lecturer (Community Medicine) Pabna Medical College, Pabna, Bangladesh
[5]Junior Cosultant (Surgery) 250 Bedded General Hospital, Pabna, Bangladesh
[6]Senior Consultant, Department Of Anaesthesiology, Sadar Hospital, Jhenaidh, Bangladesh

**DOI:** 10.36347/sjams.2019.v07i07.041 | **Received:** 16.07.2019 | **Accepted:** 24.05.2019 | **Published:** 30.07.2019

***Corresponding author:** Dr. Goutom Kumar Ghosh

**Abstract** **Original Research Article**

Antibiotic prophylaxis for surgery has appeared indicated whenever likelihood of infection is great or consequences of such are catastrophic. Surgical site infections are associated with prolonged hospital stay and increase costs of treatment. The majority of surgical site infections have been linked to the failure to administer prophylactic antibiotics or the inappropriate timing of antibiotic prophylaxis. We carried out a comparative study in the department of surgery Rajshahi Medical College Hospital, Rajshahi, Bangladesh during the period from July 1, 2007 to June 30, 2008. A total of 160 patients who were admitted for elective general surgical operations were selected by purposive sampling. Among them 65 patients were given 3 dose of prophylactic antibiotic and another 95 patients were given 7 days of traditional prophylactic antibiotic. Evidence of surgical site infection was observed in both groups up-to 30 days postoperatively in inpatient and outpatient. Our aim was to compare the result of short-term three prophylactic antibiotics versus traditional long-term seven days prophylactic antibiotic for prevention of surgical site infection. In short-term group (9.23%) and in long-term group (7.36%) got surgical site infection. The difference in infection rates between two groups was not statistically significant. (P-value =0.771). Short-term prophylactic antibiotic can be recommended in elective surgical as it is less costly and has the same prophylactic benefits as that of traditional long-term prophylactic antibiotic.

**Key words:** Antibiotic, Prophylaxis, Postoperatively, Catastrophic, Infection, Elective, Surgery.



## INTRODUCTION

Surgical site infection (SSI), previously called postoperative wound infection, results from bacterial contamination during or after a surgical procedure [1]. SSIs are classified into incisional SSIs which can be superficial or deep, and organ/space SSI, which affect the rest of the body other than the bloody wall layers that are manipulated during the procedure. Superficial incisional SSI is more common than deep incisional SSI and organ/space SSI and accounts for more than half of all SSIs for tall categories of surgery [2]. Surgical site infections, accounts 14-16% of the estimated 2 million nosocomial infections affecting hospitalized patients in united states [3]. A survey sponsored by the world health organization monstered a prevalence of nosocomial infections accounting for 5-34% of the total [4]. The 2002 survey reported by the Nosocomial Infection National surveillance service (NINSS), indicates the incidence of hospital acquired infection (HAI) related to surgical wounds in the United Kingdom is as high as 10% cost the nation health service in the United Kingdom approximately 1 billion pounds (1.8 billion dollars) annually[5]. The concept of prophylactic was established in the 1960s when experimental data established that antibiotics had to be in the circulatory system at a high enough dose at the time of incision to be effective[6]. Antibiotic prophylaxis is not an alternative to good surgical practice including strict aseptic technique, and is indicated when the risk of infection is high or the results of infection are serious [7]. If prophylactic antibiotics

are given empirically, they should be used when the local wound defenses are not yet activated [8]. Incidence of surgical site infections could be reduced significantly by preoperative administration of antibiotic in elective operations on the stomach (22% to 4%), on the biliary tract (11% to 2%) and large bowel (16% to 6%) compared to match surgical patients with antibiotics being instituted only after operation or not at all [9]. The principles governing safe and affective antibiotic prophylaxis in surgical practice are well established and include the following: Therapeutic tissue concentrate of the antibiotic must be present at the time of skin incision and should be maintained throughout the procedure (repeated dosing during prolonged operations for more than 3-4 hour or if there is excessive blood loss). The antibiotic should, whenever possible, be bactericidal in nature with high tissue penetration ability and low toxicity [7]. The choice of agent depends on the expected spectrum of organisms likely to be encountered in a given situation, the cost and local hospital policies, which are based on experience of local resistance trends [8]. A single dose administered intravenously at induction is sufficient. Short-term use involves further injections at 8 and 16 hours after 1st dose. A single dose or short-term use is as efficacious as long-term postoperative use. Antibiotic prophylaxis should not be used routinely in clean operations except where prosthetic materials, implants and vascular gifts are inserted [7]. Normally in a clean operating a single dose is sufficient. In contaminated operations three doses are often given [10]. But in most centers in our country we administer antibiotics for about 7-10 days in all types of surgery, which is contrary to the principles of antibiotic prophylaxis. Furthermore, long-term use of antibiotics may produce super infection. In this study the frequency as well as spectra and long-term antibiotic prophylactic groups. Short-term prophylactic antibiotic therapy is equally effective as that traditional long-term therapy for prevention of surgical site infection.

## OBJECTIVES

**a) General objective**

- To compare the rate of surgical site infection (SSI) after short-term use of prophylactic antibiotics and its long-term use in elective surgery (clean & clean-contaminated surgery, open & laparoscopic surgery).

**b) Specific Objectives**

- To find out the frequency of surgical site infections (SSIs) among recipients of short-term prophylactic antibiotic.
- To compare the outcome of two regimens of antibiotic therapy.

## METHODOLOGY AND MATERIALS

Total 160 patients were selected by purposive sampling method. Patients were categorized into 2 groups. In one group second generation cephalosporin cefuroxime (750 gm) in parenteral form (i.V) were given as an antibiotic prophylaxis. The 1st dose was given during induction of anesthesia followed by 2nd and 3rd dose postoperative on 8 and 16 hours after 1st dose respectively. And thereafter, no antibiotics were given and this group was termed as short-term group. The other group was named as long-term group in whom cefuroxime 750 mg I/V was given like short-term group and it was continued, and was changed for oral antibiotic when it became possible. Cefuroxime was continued for a total 7 days. Data were processed and analyzed using SPSS. The test statistical used to analyzed were descriptive statistical. The summarized data were presented in from of the table and graphs and were duty interpreted.

- **Inclusion Criteria**
  Patients admitted for elective general surgical operations in different surgical units of RMCH.

- **Exclusion Criteria**
  Patients suffering from severe malnutrition, malignancy, tuberculosis, obstructive jaundice and patients having medical problems like metabolic, cardiovascular, respiratory disease

## RESULTS

In this study a total of 160 patients were selected who underwent elective general surgery and received prophylactic antibiotics of different duration to prevent surgical site infections. The patients who received 3 dose antibiotics were considered as short-term and those who received 7 days surgical antibiotics were termed long-term antibiotic group. The surgical site infections (SSIs) following surgical were compared between these two antibiotic regimen groups. Table I shows the age distribution of the patients. Of the total 160 patients, 17(10.7%) were below 20 years of age. Nearly 20% of patients were between 20-30 years of age, followed by 18.2% between 30-40 years, 25.2% between 40-50 years and the rest 27% were 50 years above. The mean age was 38.66±15.11 years and the minimum and maximum ages were 13 and 80 years respectively. Figure I compare the sex distribution between 2 antibiotic regimens. About 50% of the short-term antibiotic group and 64.6% of the long-term antibiotic group were male and the male female ratio was roughly 3:2. Figure II shows disease wise distribution of patients brought under study. About one third of the total patients constituted the majority group (31.25%) suffering from chronic calculous cholecystitis. The next group of patients was suffering from inguinal hernia (26.87%). The least group constituted of only 7 patients (4.38%) who were admitted for resolved appendix mass. Figure III shows out of 160 operations clean surgery was 92 (57%) and clean-contaminated surgery was 68 (43%). Table IV shows that 92 (57.50%) surgery was clean surgery.

Among the clean surgery prophylactic long-term antibiotic was used in 61.96% of patients and in clean-contaminated surgery it was used in 55.88% of patients. Table V reveals that infections occurred in 13 (8.13%) patients inspire of prophylactic antibiotic used. In short-term group the proportion of infection was 9.23% and in ling-term groups it was 7.36%. Table VI shows that total 13 infections occurred in the operated patients. Superficial incisional SSI was 84.61% (11) out of total 160 operated patients. In short-term group superficial incisional SSI was double 66.66% (4) than that of deep incisional SSI in long-term group.

**Table-I: Age wise distribution of patients. (n=160)**

| Age (years) | Frequency | Percentage (%) |
|---|---|---|
| **<20** | 17 | 10.7 |
| **20-30** | 30 | 18.9 |
| **30-40** | 29 | 18.2 |
| **40-50** | 40 | 25.2 |
| **≥50** | 43 | 27.0 |

Mean age =38.66 ±15.11 years. Range =13-80 years

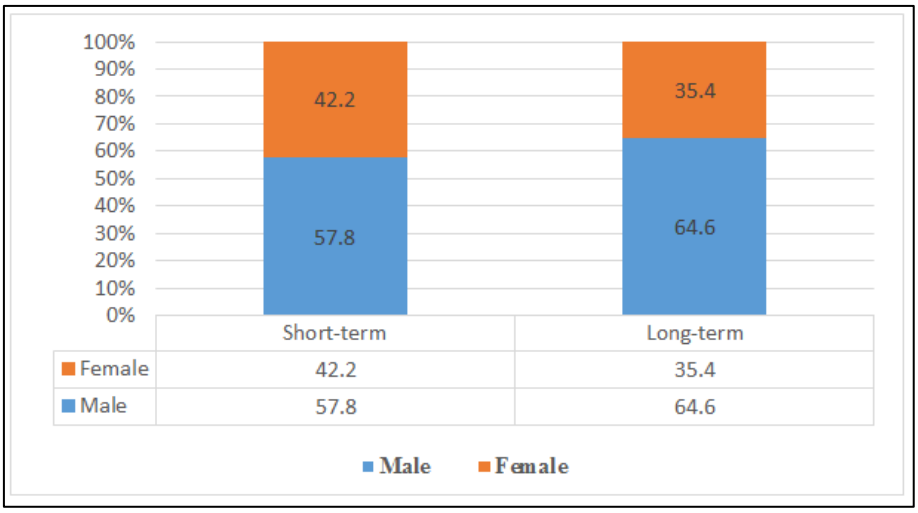


**Fig-I: Shows the sex wise distribution of the patients. (n=160)**

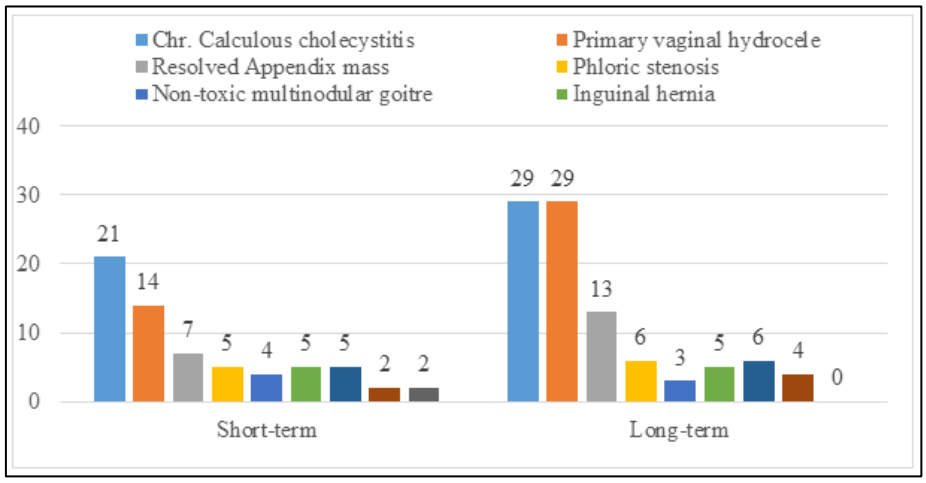


**Fig-II: Disease Wise distribution of the patients. (n=160)**

**Table-II: Antibiotics used in each group and routes of administration. (n=160)**

| Antibiotic prophylactic group | Antibiotic used | Dose of antibiotic | Routes of administration |
|---|---|---|---|
| Short-term | Cefuroxime | 3 doses | Intravenous |
| Long-term | Cefuroxime | 7 days | Intravenous and oral |

**Table-III: Types of surgery (Clean and clean-contaminated surgery). (n=160)**

| Types of surgery | Examples (Name of operation) |
|---|---|
| **Clean Surgery** | Herniotomy & herniorrhaphy |
| | Herniorrhaphy |
| | Herniotomy |
| | Excision & eversion of hydrocele sac |
| | Hemi-thyroidectomy |
| | Sub-total thyroidectomy |
| | Enucleation and biopsy of Fibroadenoma of Breast |
| | Bilateral Lumbar Sympathectomy |
| **clean-contaminated surgery** | Open Cholecystectomy |
| | Laparoscopic Cholecystectomy |
| | Pyloric stenosis |
| | Elective Appendicectomy |

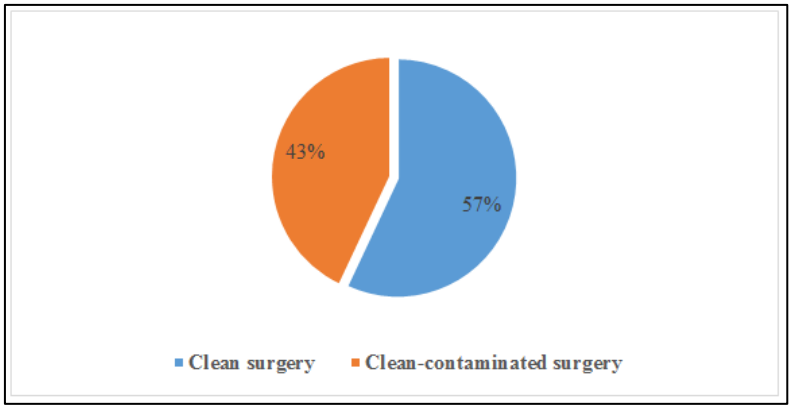


**Fig-III: Number and proportion of type of surgery (Clean and clean-contaminated surgery). (n=160)**

**Table-IV: Types of prophylactic antibiotic used in clean and clean-contaminated surgery (n=160)**

| Prophylactic antibiotic regimen | Clean surgery | | clean-contaminated surgery | | Total | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % |
| **Short-term** | 36 | (53.84) [38.04] | 30 | (46.16) [44.12] | 65 | (40.62) |
| **Long-term** | 57 | (60.00) [61.96] | | (40.00) [55.88] | 90 | (59.38) |
| **Total** | 92 | (57.50) [100.00] | 68 | (42.50) [100.00] | 160 | (100.00) |

Data were analyzed using Chi-square ($x^2$) test.

**Table-V: Surgical site infection in two prophylactic antibiotic used groups of patients. (n=160)**

| Antibiotic Prophylactic group | Superficial incisional SSI | | Deep incisional SSI | | Total | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % |
| **hort-term** | 4 | (66.66) | 2 | (33.34) | 6 | (46.15) |
| **Long-term** | 7 | (100.00) | 0 | (00.00) | 7 | (53.85) |
| **Total** | 11 | (84.61) | 2 | (15.39) | 13 | (100.00) |

Though the difference was not significant (P-values was 0.771).

## DISCUSSION

Antibiotic prophylaxis has profound role in minimizing surgical site infection along with other factors like patient's personal hygiene, nutritional status expertise, and duration of surgery, asepsis, antisepsis, proper sterilization, and disinfection methods. In this study, the rate of surgical site infection in different elective surgical operations, in different surgical wounds, duration of hospital stay with short-term and long-term prophylactic antibiotic were carried out along with categorization of surgical site infection and aerobic bacteriological study. My findings can be compared with the result of study made by [11-16]. In this series, of the total 160 patients, 17(10.7%) were below 20 years of age. Nearly 20% of patients were between 20-30 years of age, followed by 18.2% between 30-40 years, 25.2% between 40-50 years and the rest 27% were 50 years above. The mean age was 38.66±15.11 years and the minimum and maximum ages were 13 and 80 years respectively. Figure I compare the sex distribution between 2 antibiotic regimens. About 50% of the short-term antibiotic group and 64.6% of the long-term antibiotic group were male and the male female ratio was roughly 3:2. The rate of OD SSI occurred in 13(8.13%) patients in spite of conflictive antibiotic used. This indicates that there are still other factors for development of SSI. Again, in short term antibiotic used group the proportion of surgical site infection was 9.23% and in long-term group it was 7.36%. This may be due to unusual sample size of two groups of patients, inhomogeneous samples, different grades/ categories of surgeon performing operations which may reflect the differences. This difference may be due to unusual sample size, inhomogeneous samples different grades/ categories of surgeon performing operations with different durations of operation. Though the rate of surgical sites infection in short term antibiotic group was proportionately higher than that of long-term antibiotic group, but the difference was not statistically significant (P-value 0.771). So, short-term prophylactic antibiotic is adequate for elective surgery. Regarding the type of operation, the Hight rate of infection in bilateral truncal vagotomy and gastrojejunostomy operation (18.18%). The rate of infection in open cholecystectomy was higher than that of lipotropic cholecystectomy (12.12% Vs 5.88%). This finding can be compared with the study made by [11] published and coted in different journals. Regarding the types of surgery 92 (57.50%) surgery was clean surgery. Among the clean surgery prophylactic long-term antibiotic was used in 61.96% of patients and in clean-contaminated surgery it was used in 55.88% of patients. SSI in clean contaminated, found 7(10.30%) was more than that of clean wound 6(6.52%). The rate of SSI in clean surgery was less because in this type of surgery no inflammation was observed and no unusual contamination occurred as because the respiratory, gastrointestinal, biliary, genital and urinary tract is not entered. Moreover, of the clean surgery thyroidectomy and enucleation of fibroadenoma of breast oppressions were done by more experienced surgeon this finding can be compared with the study made by [14]. Most of the surgical site infections 10(76.92%) out of the total 1a3, was detected on 3rd, 4th and 5th postoperative day (POD). A few cases were detected on 7th POD and 8th POD. This findings consistence with findings observed by[1]. So, it could be stated from this study that SSI increases the cost of treatment, prolongs postoperative hospital stays and suffering which means increase the morbidity of patients and also increase the workload of hospital stuffs.

## LIMITATIONS OF THE STUDY

It was a comparative type study with small sample size, which doesn't reflect the scenario of the whole country.

## CONCLUSION AND RECOMMENDATIONS

This study shows short term three dose of prophylactic antibiotic is as effective as long-term use of antibiotics traditional practiced in many centers of our country in elective surgery. The short-term regimen is less costly for the patients, has the same prophylactic benefits. There is no advantage in prolonging a patient's hospital stay following elective surgery to administer postoperative antibiotics for long duration. This study concludes that short-term prophylactic antibiotic is as effective as traditional long-term prophylactic antibiotic for prevention of surgical site infection and it is cost effective. Short-term prophylactic antibiotic can be recommended in elective surgery as it is less costly and has the same prophylactic benefit as that of traditional long-term prophylactic antibiotic.

## REFERENCES

1. Cobb Parren J, Schmieg Robert, Hurt Thomas k, Mundy Linda M. (ed). Inflammation, infection and Antimicrobial Therapy. In: Current Surgical Diagnosis and Treatment, USA, McGraw Hill; 12th ed. 2006:106-107.
2. Centers for Disease Control and Prevention. National nosocomial infections surveillance (NNIS) report, data summary from October 1986-April 1996, issued May 1996. A report from the National Nosocomial Infections Surveillance (NNIS) system. Am J Infect Control. 1996;24:380-8.
3. Emori TG, Gaynes RP. An overview of nosocomial infections, including the role of the microbiology laboratory. Clinical microbiology reviews. 1993 Oct 1;6(4):428-42.
4. Mayon-White RT, Ducel G, Kereselidze T, Tikomirov E. An international survey of the prevalence of hospital-acquired infection. Journal of Hospital Infection. 1988 Feb 1;11:43-8.
5. National Nosocomial Infection Surveillance (NNIS) system, 2002. NNIS report, data sunnary

from January 1992 to June 2002, issued August 2002. Am J Infect control. 2002 Dec; 30(8):458-75.
6. Burke JF. The effective period of preventive antibiotic action in experimental incisions and dermal lesions. Surgery. 1961 Jul 1;50(1):161-8.
7. Ross AK, Davis PJ, Dear GD, Ginsberg B, McGowan FX, Stiller RD, Henson LG, Huffman C, Muir KT. Pharmacokinetics of remifentanil in anesthetized pediatric patients undergoing elective surgery or diagnostic procedures. Anesthesia & Analgesia. 2001 Dec 1;93(6):1393-401.
8. Leaper DJ. Wound infection: In: Russekk RCG; Williams N.S; Bulstrode CJK (ed). Bailey and Loves Short Practice of Surgery, London, Arnold. 2004; 24th ed: 120-126.
9. Stone HH, Hooper CA, Kolb LD, Geheber CE, Dawkins EJ. Antibiotic prophylaxis in gastric, biliary and colonic surgery. Annals of surgery. 1976 Oct;184(4):443.
10. Davies A, Kibbler C. Prevention of infection in surgical practice. In:Kirk RM., Mansfield AO., (ed), Clinical Survey in general Edinburgh, Churchill Living Stone.2004; 4th ed, PP: 212-213.
11. Culver DH, Horan TC, Gaynes RP, Martone WJ, Jarvis WR, Emori TG, Banerjee SN, Edwards JR, Tolson JS, Henderson TS, Hughes JM. Surgical wound infection rates by wound class, operative procedure, and patient risk index. The American journal of medicine. 1991 Sep 16;91(3):S152-7.
12. Zahid MA, Bakhsh R, Dar FS, Akhter N, Malik ZI. Comparison of single dose and three dose antibiotic prophylaxis with cefotaxime sodium in cholecystectomy. Journal of Ayub Medical College Abbottabad. 2003;15(1).
13. McDonald M, Grabsch E, Marshall C, Forbes A. Single-versus multiple–dose antimicrobial prophylaxis for major surgery: a systematic review. Australian and New Zealand Journal of Surgery. 1998 Jun;68(6):388-95.
14. Haley RW, Schaberg DR, Crossley KB, Von Allmen SD, McGowan Jr JE. Extra charges and prolongation of stay attributable to nosocomial infections: a prospective interhospital comparison. The American journal of medicine. 1981 Jan 1;70(1):51-8.
15. Kirkland KB, Briggs JP, Trivette SL, Wilkinson WE, Sexton DJ. The impact of surgical-site infections in the 1990s: attributable mortality, excess length of hospitalization, and extra costs. Infection Control & Hospital Epidemiology. 1999 Nov; 20(11):725-30.
16. Nelson CL, Green TG, Porter RA, Warren RD. One day versus seven days of preventive antibiotic therapy in orthopedic surgery. Clinical orthopaedics and related research. 1983 Jun (176):258-63.