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Correspondence

Dr. Kamal Koirala
Associate Professor, Department of
Surgery
KIST Medical College and Teaching
Hospital, Lalitpur, Nepal
Email: drkkoirala@gmail.com

Peer reviewed by

Dr. Sumana Bajracharya
Patan Academy of Health Sciences

Dr. Ashis Shrestha
Patan Academy of Health Sciences

A single-dose antibiotic prophylaxis to prevent surgical site infection in clean-contaminated surgery among diabetic patients

Kamal Koirala,¹ Rupesh Mukhia,¹ Suman Sharma,¹ Sujan Manandhar,² Niroj Banepali,² Rishikesh Narayan Shrestha,³ Mahesh Khakurel,³ Bijendra Raj Raghubanshi,⁴ Balman Singh Karki⁵

¹Associate Professor, ²Lecturer, ³Professor

Department of Surgery

⁴Lecturer, ⁵Professor

Department of Microbiology

KIST Medical College and Teaching Hospital, Lalitpur, Nepal

ABSTRACT

Introduction: Guidelines on antibiotics use in surgical patients recommends a single dose prophylaxis for clean-contaminated cases and therapeutic course for contaminated and dirty cases. Compliance to this guideline is poor among diabetic patients. The aim of this study was to test the efficacy of single dose antibiotic prophylaxis on the occurrence of postoperative surgical site infection (SSI) in clean-contaminated surgery in diabetic patients.

Methods: Retrospective cross-sectional study was carried out at KIST Medical College and Teaching Hospital from September 2008 to August 2012 involving 144 diabetic patients who underwent major clean-contaminated surgery. Forty eight patients received one gram of ceftriaxone intravenously as prophylactic antibiotic within 30 minutes prior to incision (group 1) and 96 patients received three doses of ceftriaxone (group 2). One dose was given within 30 minutes prior to incision and other two doses were given postoperatively. All patients were followed up for 30 postoperative days on outpatient basis. The SSI rates were compared in two groups. Pus from the infected wound was tested for culture and sensitivity.

Results: The SSI rates in group 1 and group 2 were of 5/48 (10.42%) and of 9/96 (9.37%) respectively. There was no significant difference in SSI rates between group 1 and group 2 ($p=0.322$).

Conclusions: Single dose of Ceftriaxone shows the similar effect as three doses in clean-contaminated surgery in diabetic patients.

Keywords: antibiotic prophylaxis, diabetic patients, surgical site infection

Plain Language Summary

The study showed that a single dose of Ceftriaxone has the similar effect as three doses in clean-contaminated surgery in diabetic patients. A single dose of Ceftriaxone within 30 minutes prior to incision had equal efficacy as three doses.

INTRODUCTIONS

Patients with surgical site infections (SSI) have prolonged hospital stay, re-hospitalization, increased morbidity and mortality, and high costs of treatment.¹ Surgical antibiotic prophylaxis (SAP) is given to reduce surgical SSI based on evidence of effectiveness, minimizing the alteration on the patient's normal bacterial flora, minimizing adverse effects and causing minimal change to the patient's host defences.² A single standard intravenous therapeutic dose of antibiotic is given ≤ 30 minutes pre-operatively^{3,4} and is recommended for all elective operations in the clean-contaminated or contaminated categories regardless of the presence of risk factors.² Though we are all aware of these guidelines, compliance is poor. The aim of this study was to test the efficacy of a single dose of Ceftriaxone prophylaxis in clean-contaminated surgery among diabetic patients.

METHODS

The retrospective cross-sectional study was carried out at KIST Medical College and Teaching Hospital, Lalitpur, Nepal from September 2008 to August 2012 involving 144 diabetic patients of all age groups and gender who underwent major clean-contaminated surgery. The procedures were gastrectomy, hemicolectomy, laparoscopic appendectomy, laparoscopic cholecystectomy, laparotomy, nephrectomy, nephrolithotomy, open appendectomy, open cholecystectomy, open cholecystectomy with common bile duct exploration, pyelolithotomy and retropubic prostatectomy. All the above procedures were completed within three hours.

The patients who missed follow up for 30 post operative days were excluded from the study. The inclusion criteria were categorized into two groups. Some surgeons preferred single dose and others three doses of antibiotics in the same department. Among them, 48 patients received one gram of ceftriaxone intravenously as prophylactic antibiotic within 30 minutes prior to incision (group 1) and 96 patients received three doses of ceftriaxone (group 2), out of which one dose was given within 30 minutes prior to incision and other two doses were given postoperatively at twelve hours interval. Ethical approval was taken from the institutional review board.

Patients were followed for 30 postoperative days.⁵ Those patients who had SSI were followed up frequently for the management of SSI. Those patients who did not have SSI at the time of suture removal on 7th to 9th post-operative day were told to follow up for wound discharge, redness or pain any time and after one month even if there was no sign of SSI. The patients

were followed up on outpatient basis. The SSI rates were calculated and compared in two groups. Pus or pus swabs of the patient with discharging surgical incision were obtained and transported to the laboratory within an hour of collection.

After identification of the organism, susceptibility testing to various antibiotics was performed using disc diffusion methods.⁶ Data were analyzed using Statistical Package for Social Sciences (SPSS) 20. Paired sample t-test was used in process of data analysis. A p-value less than 0.05 was considered as statistically significant.

RESULTS

There were total of 144 patients, 48 in group 1 (single dose ceftriaxone) and 96 in group 2 three doses. The mean age of the patients in group 1 was 53.27 ± 15.89 years (mean \pm SD) and in group 2 was 51.45 ± 13.14 years (mean \pm SD).

Table 1. Major surgical intervention in diabetic patients (n=144) and SSI

Variables	Single dose of ceftriaxone		Three doses of ceftriaxone	
	Frequency	%	Frequency	%
Type of operation				
Laparoscopic cholecystectomy	20	41.7	37	38.5
Retropubic Prostatectomy	2	4.2	3	3.1
Open cholecystectomy	9	18.8	17	17.7
Pyelolithotomy	5	10.4	9	9.4
Laparotomy	5	10.4	9	9.4
Gastrectomy	2	4.2	2	2.1
Open appendectomy	3	6.3	9	9.4
Open cholecystectomy with Common Bile Duct exploration	0	0	4	4.2
Nephrectomy	1	2.1	2	2.1
Nephrolithotomy	0	0	2	2.1
Laparoscopic appendectomy	0	0	2	2.1
Hemicolectomy	1	2.1	0	0
Total	48	100	96	100
SSI				
No SSI	43	89.6	87	90.6
SSI	5	10.4	9	9.4

ssi= surgical site infections

Among 14 patients with clinical SSI in group one and two, nine (64.29%) had positive aerobic culture. *Staphylococcus aureus* was the predominant organism isolated in 5/9 (55.56%) followed by *Escherichia coli* isolated in 2/9 (22.22%) cases and 60.31% of total isolates (including all organisms) were sensitive to ceftriaxone.

DISCUSSIONS

There was no significant difference in SSI rates between group 1 and when the SSI rates before the era of prophylactic antibiotics and after its use are compared, we can see the positive role of prophylactic antibiotics in reducing the SSI rates.^{7,8} Infection rates after prophylactic antibiotics in US National Nosocomial Infection Surveillance (NNIS) system hospitals were reported to be: clean 2.1%, clean-contaminated 3.3%, contaminated 6.4% and dirty 7.1%.⁷ In our study, we observed the higher SSI rates compared to the USNNIS lower than studies with 5.4%, 35.5% and 77.8% in clean, clean-contaminated and contaminated wounds respectively.^{9,10} We observed no significant difference in SSI rates being 10.42% and 9.37% among clean-contaminated cases in single dose SAP and prolonged course group respectively.

Laparoscopic cholecystectomy was the commonest clean-contaminated operation (24% of clean-contaminated operations).¹¹ The duration of the majority of surgical operations (88.4%) did not exceed three hours.¹¹ In our study also, the procedures were performed within three hours and the most commonly performed clean-contaminated operation was laparoscopic cholecystectomy.

In our study, *Staphylococcus aureus* was found to be the predominant organism followed by *Escherichia coli*. Similar results were seen in other studies.¹⁰ Out of total isolates (including all organisms), 60.31% were sensitive to ceftriaxone in our study. Other studies have also shown ceftriaxone to be superior than other cephalosporins and other antibiotics in the use for prophylaxis.^{12,13}

There are multiple risk factors for SSI such as extremes of age, poor nutritional state, obesity, diabetes mellitus, smoking, coexisting infections at other sites, bacterial colonization, immunosuppression etc. The guidelines recommend only a single dose of antibiotic in clean-contaminated cases regardless of the presence of risk factors.² In our study also, we have found the similar results.

CONCLUSIONS

Single dose of Ceftriaxone shows the similar effect as three doses in clean-contaminated surgery in diabetic patients.

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