EFFICACY OF SHORT COURSE ANTIBIOTIC PROPHYLAXIS IN SURGICAL TREATMENT OF CLOSED FRACTURE

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ARTICLE INFO

Article History

Received : 27 December, 2018

Accepted : 24 April, 2019

Published : 30 April, 2019

ORA 99

DOI: http://dx.doi.org/10.3126/bjhs.v4i1.23931

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Citation

Jha SC. Efficacy of Short Course Antibiotic Prophylaxis in Surgical Treatment of Closed Fracture. BJHS 2019;4(1)8: 607 - 610.

ABSTRACT

Introduction

Unnecessary and rampant use of antibiotic for perioperative prophylaxis are not only increasing cost of treatment but also are hazardous in terms of increasing antibiotic resistance, super infection with resistant pathogens and antibiotic toxicity.

Objective

Hence our primary objective is to assess the efficacy of short course antibiotic prophylaxis in preventing surgical site infection (SSI) in surgery of closed orthopedic fracture.

Methodology

Patients fulfilling all the inclusion criteria and willing and able to give informed consent were included in the study. All participants were treated by standard surgical technique following standard surgical protocol. Short course antibiotic prophylaxis was administered in peri-operative period to all patients in given format: 3 divided dose of intravenous 1.5 gram cefuroxime during peri-operative period followed by no intravenous or oral antibiotics; 1st dose half an hour before incision; 2nd and 3rd dose repeated at 12 hours interval.

Results

Of total 100 patient included, three developed surgical site infection till one year follow-up. All three patients with surgical site infection were treated successfully with intravenous antibiotic based on the culture sensitivity report. The average cost of antibiotic for short course antibiotic prophylaxis was 1500 NPR for each patient.

Conclusions

There was no significant increase in rate of surgical site infection with short course antibiotic prophylaxis, rather it was less expensive and may have less adverse effect, in terms of antibiotic resistance and antibiotic side effects on long run.

KEYWORDS

Cefuroxime; closed fracture; short course antibiotic; surgical site infection.

INTRODUCTION

Antibiotic prophylaxis for orthopedic surgeries are standard practice to avoid post-operative surgical site infection (SSI).[1] SSI accounts for 38% of infections among surgical patients: two third are incisional infections and one third are deep infections or involved organs.[2] SSI is among the most common post-operative complication with incidence been reported to be 2.2% in primary elective orthopedic procedure and 3.6% in revision elective orthopedic procedure.[3]

However, the choice of antibiotic and duration of administration varies among each surgeon and hospitals depending on personal choice. This practice of rampant and unnecessary use of antibiotic predisposes to development of antibiotic resistance, super infection with resistant pathogen, antibiotic toxicity and unnecessary increase in medical cost.[1,4]

The purpose of our study was to assess the efficacy of short course antibiotic for prevention of SSI. Hence, obtained finding can be implemented in our general practice or can be beneficial for formation of general policy.

METHODOLOGY

It was a prospective interventional study conducted at department of orthopedics and traumatology, Dhulikhel hospital, Kathmandu university hospital from November, 2016 to November, 2018. A total of 100 patients fulfilling the inclusion criteria were included in the study. The study was approved by the institutional review committee of the university.

Patients of either sex from age 18-70 years, who arrived at our hospital with closed fracture of limb, with normal nutritional status, requiring open reduction or closed reduction with internal fixation were included in the study. Normal nutritional status was defined according to nutritional risk screening (NRS) 2002,[5] in conjugation with certain pre-operative laboratory parameter like serum albumin level >30 gm/L and total lymphocyte count > 1500 × 10^9/L.[6, 7] Patients having poly-trauma, open fracture, known hypersensitivity to cephalosporin, antibiotic use or symptoms of infection in the week before surgery, pregnant lady, patient having medical co-morbidities known to increase infection e.g. diabetes mellitus, renal failure, coronary artery disease, hypertension, chronic obstructive pulmonary disease, human immunodeficiency virus, connective tissue disorder, cancer, pre-existing infection (pneumonia, cellulitis, etc.), urinary catheter in situ, steroid therapy, chemotherapy, any other chronic ailment, serum albumin level <30 gm/L, total lymphocyte count <1500 × 10^9/L were excluded.

Patients fulfilling all the inclusion criteria and willing and able to give informed consent were included in the study. All the participants were treated by standard surgical technique following standard surgical protocol by 7 different orthopedic surgeons. Standard hand scrub technique using 7.5% povidone iodine cleansing solution for operating team and surgical site preparation by 0.3% chlorhexidine gluconate solution followed by 10% w/v povidone iodine, and sterile drape was done inside the operating theater for all the cases. Short course antibiotic prophylaxis was administered to all the patients in given format: 3 divided doses of intravenous 1.5 gram cefuroxime during perioperative period followed by no intravenous or oral antibiotic; 1st dose was administered half an hour before incision, 2nd and 3rd dose repeated at 12 hours interval. The surgical wound was clinically observed on 2nd post-operative day (POD) when the dressing was done. Apart from this patients was asked daily for any excess local pain or discomfort and daily temperature charting was done by nursing staff. Most of the patients were discharged from hospital on 2nd POD. Wound dressing was done on every 3rd day or as advised by the visiting surgeon. Clinical follow-up was done on 14th POD for suture removal. Surgical site assessment for SSI was done on every routine follow-up at our outpatient clinic at 6 weeks, 12 weeks, 6 months, and 1 year post surgery. SSIs were initially diagnosed clinically and defined and classified according to criteria described by center for disease control and prevention as superficial incisional SSI, deep incisional SSI or organ/space SSI.[2]

Suspicion of SSI at any point of time during follow-up was thoroughly assessed and work-up was done. Clinical assessment of wound and general systemic examination was done and complete hemogram (hemoglobin, total leukocyte count, differential leukocyte count, platelet count, erythrocyte sedimentation rate, c-reactive protein) along with liver function test and renal function test was sent on the same day of suspicion. Similarly, microbiological samples like wound swab/pus/wound aspirate from surgical site were collected and transported to microbiology laboratory as per standard protocol for gram stain, acid fast bacilli stain, culture and identification and antibiotic susceptibility. If required peripheral blood and urine were also sent for routine examination and culture sensitivity to rule out any other cause for fever/infection.

Thereby suspected or diagnosed SSI was treated immediately with specific antibiotic based on culture and sensitivity report. Standard sterile surgical dressing was followed for daily management of surgical wound. Wound not responding to this medical management was thoroughly debrided and irrigated with or without removal of implant depending on whether the implant is infected or not, decided by the operating surgeon. Apart from assessing the efficacy of short course antibiotic prophylaxis we also calculated the average cost of antibiotic and hospital stay and expense during the stay.

STATA version 12 was used for data analysis. Descriptive analysis of the data was performed by chi-squared test and t-test and multivariate regression analysis was performed to assess the efficacy of the short course antibiotic prophylaxis.

RESULTS

A total of 100 patients were enrolled in the study. Of these

100 surgeries 46 (46 %) were done under spinal anesthesia, 26 (26 %) were done under general anesthesia and 28 (28 %) were done under regional block. The distribution of fractures is shown in table 1. Out of 100 surgeries open reduction and internal fixation was done in 64 (64 %) and close reduction and internal fixation is done in 36 (36 %). Screw fixation was done in 4 (4 %), plating in 55 (55 %), interlocking in 26 (26 %) and tension band wiring in 15 (15 %) cases.

Out of 100 patients enrolled in one patient the operating surgeon continued intravenous antibiotic (cefuroxime 1.5 gram BD) for 7 days as he suspected SSI on 1st POD, two patients developed a SSI within one year follow up. In first patient the culture result was sterile, in 2nd and 3rd patient culture sample grew Staphylococcus aureus sensitive to cefuroxime. On the basis of the report intravenous cefuroxime 1.5 gram BD was given for 10 days. There was good clinical response in all three patients, no one required debridement. The approximate cost of antibiotic was around 1500 NPR per patient.

Table 1: Table showing demographic distribution of the fracture in upper and lower limb

Operated Site	Numbers
Clavicle	6
Humerus	10
Forearm	30
Hand and Wrist	8
Femur	18
Patella and leg	20
Ankle and Foot	8
Total	**100**

DISCUSSION

SSI consumes time, medical resources and adversely affects post-operative morbidity, mortality and cost.[1, 8, 9] Hence, infection control in post-operative period is necessary by using antibiotic correctly and consciously rather than rampantly.[10] With the widespread presence of multidrug resistant pathogen and limited availability of therapeutic choices, it is important to limit the prolonged use of broad spectrum antibiotic as perioperative prophylaxis.[1] Studies demonstrates that more than one third of health budget of developing counter is spent on antibiotics.[11]

Even adequate single dose prophylaxis with a long acting broad spectrum antibiotic substantially reduces the incidence of wound infection and early nosocomial infection after surgery for limb fracture.[12] Studies have demonstrated short course of cefuroxime or cefazolin for upto 24 hours post operation as an optimum dosage for perioperative prophylaxis.[13, 14] Cefuroxime gives a high bio-availability in tissue and serum after single dose and is also efficacious for preventing perioperative infection.[15] In the present era of evidence based medicine, although many of the limb fractures are being treated by internal fixation, but the duration and choice of antibiotic for perioperative prophylaxis in such surgery are still based on personal preference i.e. not justifiable and nor according to the medical ethics. In our study the rate of SSI was three percentage, which is comparable to the results of other. Although the interpretation of the finding is limited in terms of small sample size, the results are promising. More studies with larger sample size are needed inn future which will help for formation of national guideline.

SSI prolongs the length of stay for 2 weeks on average and nearly doubles the cost of treatment for orthopedic trauma patients.[10, 16, 17] Ikeanyi et al.[9] identified 4 factors for increased post-operative infection rate; increased age of patient, prolonged length of pre-operative hospitalization stay, use of implant and wound drain. However patient sex, ward admission, operating room, use of tourniquet, homologous blood transfusion, theater population, surgeon and duration of surgery didn't have significant influence on infection rate in their observation. On other hand Mangram et al.[2] identified malnutrition, prolonged hospital length of stay, older age, previous surgery, long duration of surgery and obesity as the main risk factors for the development of post-operative infection. Increased infection rate observed with increasing age may be due to occurrence of other risk factors observed with aging like reduction in immunity.[18]

To minimize the bias, pre-operative nutritional status was assessed by NRS 2002 and only patient with age <70 years with body mass index >20.5, no weight loss in last 3 weeks, with no reduction in dietary intake in the last 3 weeks with no severe illness were included. Kaminski et al.[19] found a 2.5 fold increase in hospital mortality in the patient group with serum transferrin level <1.7 gm/L. Similarly, Blackbun et al.[20] found significant increase in risk of sepsis and death in the patient with transferrin level <1.7 gm/L. Seltzer et al.[21, 22] observed 4 fold increase in complication and 6 fold increase in mortality in patient with serum albumin level <35 gm/L and/or decreased total lymphocyte count <1500 × 10^9/L, in his review of 500 consecutive medicine and/or surgical admission and 130 intensive care patients. Similar finding was observed by Muller et al.[23] who suggested that albumin level of <30 gm/L and transferrin level of <2.20 gm/L were associated with an increased incidence of postoperative complication. In our study we considered these laboratory parameters and included only those patients who have matched the criteria so as to minimize the bias.

CONCLUSIONS

Short course antibiotic prophylaxis regimen is equally effective for preventing SSI in surgery of closed fracture of limbs with added benefit of less cost and toxicity to patient and decreased chance for developing drug resistance. However large and multicentric studies covering different region of country are required to substantiate the role of short course antibiotic prophylaxis.

RECOMMENDATIONS

Since our results are comparable to the literature, it signifies that the short course antibiotic prophylaxis is equally effective for clean orthopedic surgery in limb fracture. Prolonged course of antibiotic has grievous consequences

for health care facilities. In developing country such resource saving can be utilized for other productive things.

LIMITATION OF THE STUDY

Since we didn't have control group in our study we took reference of previous literature. Moreover there is lack of information about post-operative SSI rate in our prospective, hence we compared our results with study conducted in India and other developing countries. Prolonged follow up was not done so late SSI could not be assessed. Larger sample size will be required in future studies to ascertain better statistical significance. Another drawback of our study was that molecular studies could not be performed to assess the relatedness of stains isolated from the patients so that it would have provided evidence of the exact source of perioperative infection.

ACKNOWLEDGEMENTS

Our sincere gratitude to all the operating surgeons and operating room staff of Dhulikhel hospital, Kathmandu University hospital for their support and encouragement.

CONFLICT OF INTEREST

Authors declare no conflict of interest.

FINANCIAL DISCLOSURE

None

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