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COMPARATIVE EVALUATION OF SHORT TERM VERSUS LONG TERM ANTIMICROBIAL PROPHYLAXIS AFTER ORTHOPAEDIC PROCEDURES

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Abstract:

Objective : The aim of this study was to compare the efficacy of short-term (2 days) versus long-term (5 days) antibiotic therapy in preventing wound infections in orthopaedic surgeries.

Patients and methods: A total of 100 patients were recruited and were randomly allocated into two groups: Group 1 and Group 2. Group 1 will receive short term (2 days) antibiotic therapy and Group 2 will receive long term (5 days) antibiotic therapy. Wound evaluation was done on the basis of ASEPSIS Scoring System.

Results: Of the 100 patients enrolled, four developed a surgical site infection. The incidence of SSI (4%) in clean orthopaedic procedures was similar in both the groups, with two cases of SSI in each group. 3 patients had deep incisional type of SSI and one patient had superficial incisional type of SSI. In the short term antibiotic group two patients (4%) had minor infection according to Asepsis Scoring System whereas in the long term antibiotic group one patient (2%) had disturbance of healing while one patient (2%) had severe infection. The mean duration of hospital stay in short term antibiotic group was 6.50 days while in the long term antibiotic group it was 10.18 days.

Conclusion: There was no significant difference in rates of SSI among the two groups in our study. However the mean duration of hospital stay was significantly less in the group with short term antibiotic prophylaxis.

Key words: *short term, long term, antimicrobial prophylaxis, orthopaedic procedures*

Introduction

Surgical site infections (SSIs) are a major source of postoperative illness. Despite advances in infection control practices, SSIs remain a substantial cause of morbidity and mortality among hospitalized patients. It is one of the more common complications of orthopedic surgery that could lead to removal of implanted hardware and a prolonged course of antimicrobials.[1]

Bacteria contaminate every surgical wound. The most common source is the endogenous flora of the skin, which is usually composed primarily of aerobic gram-positive cocci. The skin may also harbor fecal organisms, including gram-negative rods and anaerobes. Staphylococcus aureus, coagulase-negative staphylococci, Enterococcus species, and Escherichia coli were the most frequently isolated pathogens.[2]

Surgical antimicrobial prophylaxis is not administered to sterilize the tissues but as an adjunct to modulate intraoperative contamination of the surgical wound to a level that will not overwhelm the defenses of the host. Optimal prophylaxis ensures that an adequate concentration of an antimicrobial agent is present in the serum and tissue during the entire time the surgical wound is open.

The antibiotic prophylaxis should have the smallest impact possible on the normal bacterial flora of the patient and should take into account the biogram (the common infecting organisms in a particular community) of the community. The use of prophylactic antibiotic therapy before the induction of anesthesia and continuing it after surgery is an accepted method of avoiding postoperative infection.[3]

Cephalosporins remain the first choice of many international guidelines for antimicrobial prophylaxis in orthopaedic surgery. This has been due to their safety profile, broad spectrum, tissue penetration, price and their early proven effectiveness in clinical trials.[4]

Although timing is one of the most important factors in achieving optimal antimicrobial efficacy, it is still suboptimized in current practice. It varies in different studies from 15 min to 120 min before the skin incision.[5]

There is no consensus with regard to the optimal duration of prophylaxis. The standard practice is to administer prophylactic intravenous antibiotics only on the day of surgery in Western countries. India being a tropical country, with a hot and humid climate is a conducive environment for both Gram-positive and Gram-negative bacterial colonization of skin, linen, and wards in general. Therefore we need studies tailored to our environment.[6]

Benefits of perioperative antimicrobial prophylaxis need to be balanced against risks. The benefits of decreased infection rate, length of hospital stay, and mortality have been shown in various populations. Risks include allergic reactions, toxic side effects of anti-microbials, adverse interactions with other drugs, and development of resistant organisms.[7]

The purpose of conducting this study is to know whether prophylactic administration of antibiotics for short term can decrease postoperative morbidity, shorten hospitalization, and prevent un-necessary use of antibiotics for longer periods.

Aims And Objectives

To compare the efficacy of short-term (2 days) versus long-term (5 days) antibiotic therapy in preventing wound infections in orthopaedic surgeries

Materials And Methods

This prospective study was carried out to determine and compare the efficacy of short-term (2 days) versus long-term (5 days), antibiotic therapy in preventing wound infections in orthopaedic surgeries, in the Department of Orthopaedics, Sri Guru Ram Das institute of Medical Science and Research, Amritsar.

A total of 100 patients were recruited who were admitted in the orthopaedic ward. Patients were randomly allocated into two groups: Group A and Group B.

Patients of the Group A were given perioperative prophylactic intravenous antibiotic (Generation 1 Cephalosporin, Cefazolin 2g, IV) 30 minutes prior to the induction of anaesthesia, which was continued in the post operative period for 2 days, after which it was discontinued.

In patients of the Group B the same protocol was followed as in the Group A, and after first 2 days of post-operative period, they were further given an oral antimicrobial agent (Generation 2 Cephalosporin, Cefuroxime 500mg BD, PO) as a part of post surgical prophylaxis for 3 more days.

Inclusion criteria

- Patient giving consent to be included in the surgery
- Patients of all ages and both sexes
- Patients who are otherwise healthy and coming to the hospital for orthopaedic soft tissue procedures and procedures involving implants

Exclusion criteria

- Patients with pre-existing diseases, such as diabetes mellitus, chronic kidney diseases,

cirrhosis liver etc.

- Open fractures.
- Surgeries with duration exceeding 3 hours.
- Revision surgeries.
- Patients already on antibiotic therapy at the time of initial presentation.
- Documented immuno- compromised status.
- Patients with osteomyelitis.

All participants were treated by the standard surgical techniques. They were evaluated for development of wound infections daily till the time of discharge. The wound was clinically observed at 48 and 96 h post-surgery, when the dressings were done.

A clinical follow up was done between 10- 14 days when the patient's sutures were removed. All surgical wounds infections were initially diagnosed clinically. The classification of surgical wound infections was done as per standard definitions and using Asepsis Scoring System.

Table 1: Asepsis Scoring System

Wound characteristic	Proportion of wound affected (%)					
	0	<20	20–39	40–59	60–79	>80
Serous exudate	0	1	2	3	4	5
Erythema	0	1	2	3	4	5
Purulent exudates	0	2	4	6	8	10
Separation of deep tissues	0	2	4	6	8	10
Criteria	**Points**					
Additional treatment						
Antibiotics	10					
Drainage of pus under local anesthesia	5					
Debridement of wound (general anesthesia)	10					
Serous discharge	Daily 0–5					
Erythema	Daily 0–5					
Purulent exudates	Daily 0–10					
Separation of deep tissues	Daily 0–10					
Isolation of bacteria	10					
Stay as inpatient prolonged over 14 days	5					
Category of infection						
Total score						
0–10	Satisfactory healing					
11–20	Disturbance of healing					
21–30	Minor wound infection					
31–40	Moderate wound infection					
>40	Severe wound infection					

Results

A total of 100 participants were enrolled in the study. The mean age of patients in short term antibiotic group was 38.72 years and in long term antibiotic group was 42.22 years, with age ranging from 8-80 years. There was male preponderance in the present study with 58% males in short term antibiotic group and 60% in long term antibiotic group.

Thirty five patients out of hundred underwent open reduction and internal fixation with plating. Thirty patients underwent closed reduction and internal fixation with nailing and screw fixation. Twelve patients underwent arthroscopic procedures, sixteen patients underwent arthroplasty procedures and six patients underwent K- wire fixation and Tension Band Wiring. Soft tissue procedure was done in one patient.

TABLE 2: Details of patients with SSI

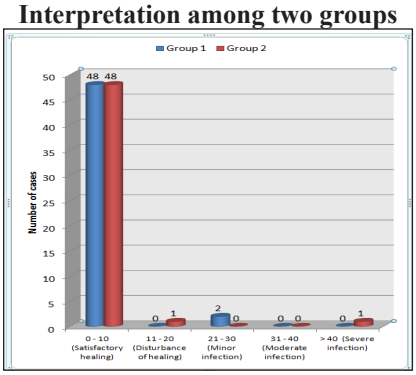
Patient no.	Group	Age(Y)	Surgical procedure	Time(H) after surgery when SSI developed	Organism isolated
1	1	62	Fracture shaft femur for CRIF with nailing	48	*Staph aureus*
2	1	47	Arthroscopic ACL reconstruction	120	*Staph aureus*
3	2	60	Intertrochanteric fracture for CRIF with PFN	48	*Acinetobacter baumanii*
4	2	50	Fracture proximal humerus for ORIF with plating	48	No growth

Of the 100 patients enrolled, four patients (4%) developed a surgical site infection. Of these, two patients were in short term antibiotic group and the remaining two in long term antibiotic group. Three patients had deep incisional type of SSI and one patient had superficial incisional type of SSI

We found that 3(75%) out of the 4 clinical SSIs were culture positive. Most common organism isolated was Staphylococcus aureus followed by Acinetobacter baumannii

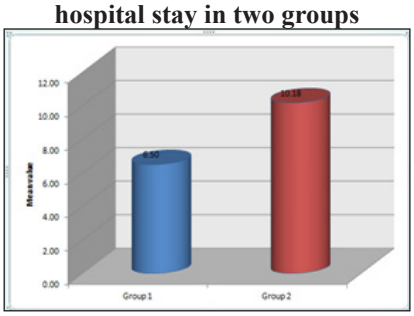
Wound evaluations were done on the basis of Asepsis Scoring System. 96 of 100 patients had satisfactory healing according to asepsis scoring system. Two patients in group 1 had minor infection and required surgical debridement. One patient in group 2 had severe infection requiring removal of the implant, whereas another patient in group 2 had disturbance of healing and responded to medical management alone. The mean asepsis score in the short term antibiotic group was 3.38 while in the long term antibiotic group it was 4.96. The difference in the mean asepsis score among the two groups was statistically not significant (p value 0.291).

Figure 1 : Asepsis Score Interpretation among two groups



The average duration of hospital stay in the short term antibiotic group was 6.50 days while in the long term antibiotic group it was 10.18 days. The difference in the duration of hospital stay among the three group was highly significant (p value < 0.001)

Figure 2 : Mean Duration of hospital stay in two groups



Discussion

Post-operative wound infection is an important and potentially devastating complication that should be prevented at any cost. Prophylactic

antibiotic has been used as part of the strategy to reduce the possibility of post-operative wound infection. However, its duration of administration remains a matter of personal choice. With the widespread presence of multi-drug resistant pathogens and limited availability of therapeutic choices, it is important to restrict the usage of broad spectrum antimicrobials, especially their prolonged courses as perioperative prophylaxis.

In our study, the total SSI rate was 4% based on the new definition of SSI.[8] Although the overall infection rate in this study was slightly higher seen in orthopaedic surgeries in developed countries ranging from 1-3%[9,10] but it is lower than the rates seen in some developing countries ranging from 4.8%-22.7%.[11,12]

In our study no significant difference in the surgical site infections between the groups was found. This correlates well with two recent meta-analyses by Slobogean et al[13] and Gillespie et al[14], which show no signifcant difference in infection rates between single and multiple-dose regimens of antibiotic prophylaxis.

ASEPSIS scoring is a quantitative scoring method that provides a numerical score related to the severity of wound infection using objective criteria based on wound appearance and the clinical consequences of the infection.[15]

Chiew YF et al studied infection rate of total hip replacement operations using different methods of assessment of surgical site infections. These were: (a) clinician diagnosis; (b) ASEPSIS score; (c) presence of pus cells; and (d) assessment by a clinical microbiologist. Two hundred and six patients were enlisted in the study and 189 primary replacements and 22 revision replacements were carried out. Infection rates which were calculated according to the risk indexes varied considerably among these four methods. The infection rates for risk index 0 were 4.35% (method a), 2.61% (method b), 0.87% (methods c and d); and for risk indexes 1 and 2 were 4.17% (method a), 2.08% (method b), 1.04% (methods c and d).[16]

The most frequent infections in our study were deep incisional surgical site infection accounting for 75% of total SSI whereas superficial incisional surgical site infections contributed for 25% of total SSI. This is in contrast to studies that describe superficial incisional infection is the most common surgical site infection.[9, 17]

Gram-positive bacteria are the most commonly implicated microorganisms in SSIs as depicted in various studies.[18, 19] Our results concurred with the same as 66.66% of isolated microorganisms were gram-positive bacteria and 33.33% were gram negative bacteria.

The mean duration of hospital stay in short term antibiotic group was significantly lower than in the long term antibiotic group. This in accordance with study conducted by Ohtori et al[20] and Jetto et al[21] but in contrast to study by Ali et al.[22]

Shorter courses of perioperative antimicrobials reduce cost, duration of hospital stay, toxicity and development of drug resistance in the long run.[23] Prolonged courses of prophylactic antimicrobials have tremendous economic consequences for health care facilities. In developing nations, such resource saving can be utilized for purchase of other life-saving drugs/ devices.

The study had limitations though as the interpretation of the findings is limited in view of the small sample size. The study is underpowered, and the confidence intervals are very wide. Though all measures were taken to reduce the bias, allocation bias and performance bias could have been present. Moreover, we conducted this study in a single hospital; therefore, the generalizability of our findings deserve further investigation in the future.

Conclusion

In conclusion, our findings indicate that a short course of perioperative antimicrobial prophylaxis can be efficacious as well as cost-effective for prevention of infections in developing countries. However, since the sample size was less, larger and multicentric studies covering different regions of the country are required to substantiate the role of short-course prophylaxis in our country.

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