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Original Research Article

A comparative study of one day versus three days peri-operative use of prophylactic antibiotics in orthopedic surgery

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ABSTRACT

Prophylactic systemic antibiotics is the standard practice to prevent surgical site infections in orthopedic surgery including arthroplasty. There is enough evidence showing its utility in preventing or reducing surgical site infection. Timing of administration, antibiotics to be used and duration of antibiotics are controversial points regarding this practice. The present study using Ceftriaxone 1 gram intravenously 3 doses during 24 hours peri-operative period (group 1 n =58) versus 3 days (group 2 n= 57) has been carried out on planned orthopedic surgeries with specific exclusion and followed up for 1 year. None of the cases of either group developed any infection. The study demonstrates the utility of antibiotics prophylaxis and is a step in deciding guidelines about antibiotics use in our country.

1. Introduction

Infection following orthopedic surgery is associated with prolonged morbidity, disability and increased mortality. Surgical site infection in planned surgery includes local incisional, superficial and deep infection. Infection rate depends on various factors and is an indication of peri operative care and surgical skill. Infection rate of 2% to 14 - 16% have been reported in various studies.[1,2] In clean orthopedic surgery such as joint replacement 1-5% of cases may develop superficial or deep infection. A 19 items surgical safety checklist including prophylactic antibiotics before any surgical procedure has been recommended by the World Health Organization.[3,4] This list includes steps to be undertaken before induction of anesthesia, before skin incision and before the patient leaves the operating room. Steps before anesthesia relate to confirmation of patient's identity, site of surgery, procedure planned, written consent and anesthesia safety check points. Steps before skin incision include introduction of team members, re confirmation of the patient and site and surgical procedure, anticipated critical events and antibiotic prophylaxis within the last 60 minutes. Steps before the patient leaves operation theater include name of the procedure recorded, count of instrument, sponge, needle, any equipment problem, specimen labelling and any other concern regarding management.

Systemic antibiotics prophylaxis in orthopedic surgery is the standard practice of care. There is sufficient evidence to suggest use of prophylactic antibiotic in orthopedics to reduce surgical site infection.[5,6] However, timing of administration, antibiotics to be used and duration of prophylactic antibiotics remain variable in different center. The present study has been done to find out the utility and differences in the outcome after use of single broad spectrum prophylactic antibiotic for one day or three days duration in clean orthopedic surgery.

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2. Materials and Methods

The study was carried out in orthopedic department of tertiary care hospital situated in rural central India after taking proper approval from institutional ethics committee. All the patients admitted and planned for elective orthopedic surgery including fracture fixation, implant removal or surgical procedure for non-traumatic condition were included. Exclusion criteria included all open fractures, crush injuries and major orthopedic procedures such as spinal fixation, joint replacement, tumor excision and reconstruction procedures. Informed consent was taken from participations after explaining them the nature of study.

The patients were randomly allotted to one day antibiotics (group 1) versus three days (group 2) antibiotics prophylaxis. Injection Ceftriaxone was chosen as the antibiotic to be used. One-gram intravenous Injection Ceftriaxone was given 30 minutes prior to surgery in all the patients. Among patients who required tourniquet application, antibiotics was infused prior to tourniquet inflation. All the operations were done in laminar flow operation theaters with routine aseptic atmosphere. In group 1 the antibiotics was repeated at 8 hours and 16 hours post-operatively and no further antibiotic was given. Group 2 antibiotics schedule was the same as group 1 on day 1. On day 2 and day 3 injection ceftriaxone one gram intravenous was given at 12 hours interval, total 4 doses in 2 days.

All the patient were observed for any symptoms and signs of local infection at the surgery site or systemic infection till they were in the hospital. The cases were examined for surgical site pain, fever > 38 degrees Celsius, localized swelling, redness, purulent discharge, or abscess at each examination. The wounds were routinely inspected 48 hours after surgery. The cases were discharged on 5^{th} day and called for stitch removal on 10-12 days. The patients were further followed up at 1 month, 3 months, 6 months and 1 year. At each follow up pain at surgical site, localized swelling, redness, any discharge or collection in the operative area was looked for. In case of any discharge the material was sent for gram staining and culture and sensitivity and treated as per the report. In many cases follow up at 6 months and 1 year was done by telephonic interaction and video examination due to Covid pandemic.

3. Observation and Results

The study was conducted from October 2019 to October 2021. Group 1, One day antibiotics was used in 58 cases and Group 2, three days antibiotics was used in 57 patients. The number of Male and female in group 1 was 42 and 16 and in group 2 47 and 10 respectively. The patients age ranged from 3 to 85 years. The average age of patients was 38 years and 40.84 years in group 1 and group 2 respectively.(Tables 1 and 2)

Table 1: Showing age distribution of patients

Age	Group 1 (n= 58)	Group 2 (n=57)
Up to 20 years	12	06
1. 20 to 40 years	26	24
2. 40 years	20	27
Age range	03 to 80 years	09 to 85 years
Average age	38 years	40.84 years

Table 2: Shows various diagnosis for which surgeries were done

Diagnosis	Group 1 (n=58)	Group 2 (n=57)
Upper limb fractures fixation	16	04
Lower limb fractures fixation	10	31
Old cases for implant removal	24	05
Ligament/ tendon reconstruction	06	07
Diagnostic arthroscopy	00	01
Cord decompression of femur head	00	02
Epidural steroid infiltration	00	02
Amputation	02	01
Osteotomy in CTEV – femur	00	02
Right femur tumor excision	00	01
Laminectomy	00	01
Total	58	57

In both the groups surgical site pain, localized swelling and redness around the operated area was observed during first 48 hours and subsided on its own gradually. In both groups at further follow up also no local sign of inflammation, infection or pus formation was noted. Till the last follow up at 12 months none of the patients of group 1 or group 2 developed wound infections. This shows that in both the groups the peri-operative antibiotics regimen was effective equally in preventing post-operative infection. This reaffirms the fact that prophylactic antibiotics are needed primarily in the first 24 perioperative hours. Further use of antibiotics for 3 or more days is not needed.

4. Discussion

Orthopedic surgery has advanced at rapid rate due to improvement in orthopedics implants and instruments, constant upgradation of surgical technique of fixation, newer technique of anesthesia and measures to prevent sepsis. Previously antibiotics were used for a period of 12 -14 days or more after surgery due to fear of infection. Some centers used injectable antibiotics continuously while other centers switched to oral antibiotics after initial 5

days of injectable broad-spectrum antibiotics. Post operative infections used to occur despite antibiotics use due to poor surgical technique, tissue trauma leading to ischemia, improper use of measures of sterilization and non-adherence to points of surgical safety list mentioned by WHO.[3,4]

The most prevalent organisms in orthopedic surgery are Staphylococcus aureus and Staphylococcus epidermidis. 2^{nd} generation cephalosporin (cefuroxime) or 3^{rd} generation cephalosporin (Cefoperazone and Ceftriaxone) have been found effective against these. Ceftriaxone is effective against both gram negative as well as gram positive bacteria. Antibiotics administration timing and dose are variable in different studies, varying from single preoperative dose to 3 doses to 5 days and 14 days.[1,7] Stefansdottir et al used only 2 doses, one at induction of anesthesia and second 6 hours after surgery.[8] Niimi et al did the case control study of 1-day intravenous antibiotics administration with that of long-term intravenous antibiotics.[9] Dhammi et al discussed controversial issues in the use of prophylactic antibiotics in orthopedic surgery.[10]

The hot and humid climate condition of our country provides a conducive atmosphere for colonization of gram-positive and gram-negative bacteria in skin, linen and hospital surroundings. Antibiotics use may help prevention of infection if it is used till epithelization of wound, around 3 to 5 days. Long term use of antibiotics may cause drug resistance in bacteria, drug induced kidney or liver damage along with increasing the cost of treatment. According to American Society of Health-System Pharmacists (ASHP) guidelines, the minimal duration of antibiotics coverage should include making of surgical incision to closure of incision, usually covered by single antibiotic dose.[2]

Controversy regarding timing of administration, which antibiotic to be used and duration of prophylactic antibiotics persist even today but the large number of centers are using antibiotics now for 1 to 3 days. The timing of administration has been noted in different studies from 15 minutes to 120 minutes before the skin incisions.[6–11] Administration 30-60 minutes prior to surgery or at time of induction of anesthesia or at least 10 minutes before inflation of tourniquet have been recommended.[8,11] Niimi et al[10] used IV antibiotic infusion 30 minutes prior to joint replacement surgery and noted no wound infection till 12 months post operative follow up. Thonse et al[6] recommended antibiotic regimen at the time of induction anesthesia and 2 doses later at 8 and 16 hours post operatively, same as in the present study. Babu s et al[12] have studied incidence of surgical site infection with different antibiotics regimen in elective total knee arthroplasty. Higher risk of surgical infection was noted when antibiotic was given more than 60 minutes before surgery and incision. The western literature shows the trend of using second generation cephalosporin(cefuroxime) prophylactic antibiotics 30 minutes to 1 hour before skin incision and further use for 24 hours to 3 days post operatively.[10]

Our country has varying perioperative conditions in different health care centers and the prevalent pathogens may be different. Hence, for decision regarding prophylactic antibiotics multicentric indigenous studies are needed to formulate guidelines. The present study is a small step in this direction and demonstrates the effect in preventing infection after 1 day versus 3 days prophylactic use of intravenous antibiotics in common orthopedic operations. This study has the limitation of not including cases of arthroplasty, spine surgery, open fractures and extensive tumor excision and reconstructive procedures due to fear of infection with short term use of antibiotics. But the total absence of surgical site infection with 1 day or 3 days use of peri operative ceftriaxone prophylaxis has made the authors more confident to extend it to all types of orthopedic procedure.

5. Conclusion

One-gram intravenous ceftriaxone, three doses perioperatively for 24 hours or for 3 days work equally well in preventing infections in cases of elective orthopedic surgery. Hence, the study recommended use of prophylactic antibiotics for 24 hours in the perioperative period.

6. Source of Funding

None.

7. Conflict of Interest

There is no conflict of interest of any author during the study or preparation of its manuscript.

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