

Role of Antibiotic Prophylaxis in Orthopaedic Surgery

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Infection is the most dreaded complication in orthopedic surgery. It causes increased morbidity and mortality and is a source of great harassment not only for the patient but the doctor as well. Incidence of surgical site infection in USA is more than 2% [1]. Whereas in India the infection ranges from 2.5 - 41% [2]. This causes an increase in the mortality rate by 2 - 3 times. The rate of postoperative infection in procedures like total hip replacement (THR) and total knee replacement (TKR) is 1 - 5% [3].

Preoperative systemic antibiotic prophylaxis for implant surgeries in orthopaedics is commonly used [4]. Studies show that regardless of the precautions being used, prophylactic antibiotics do reduce the incidence of infection [1,5-7]. Three controversies persist regarding the use of preoperative antibiotics (1) Timing (2) Duration (3) Which antibiotic to be used.

Timing

Timing of antibiotic administration is controversial. Studies have assessed giving the antibiotic 15 min to 120 min before skin incision [5,7,9,10]. While Yeap, *et al.* [5] found that not only the administration of antibiotics 30-60 min before surgery or 10 mins before inflating the tourniquet was effective but, they also found that there was no benefit of giving the antibiotic after skin incision [5]. Stefánsdóttir, *et al.* reported that antibiotics should be given 30 min before skin incision and if given before 60 mins then higher risk of surgical site infection was seen [11]. This was agreed upon by many studies [7,10]. This may be attributed to the fact that most commonly used antibiotics are cloxacillin and cephalosporin and the half-life of cloxacillin is 30 mins. Antibiotic concentration should be above the minimum inhibitory concentration until skin closure to prevent infections [7]. The antibiotic is not effective if given after tourniquet application and the extremity is unprotected.

Duration

This controversy varies from a single dose to 3 doses to 5 days or 14 days [5]. Musmar, *et al.* suggested that antibiotics should only be given for 24h after surgery to prevent antibiotic resistance [1]. Thonse, *et al.* [7] recommended antibiotics at induction of anesthesia and 8 and 16 hours after surgery. Stefánsdóttir, *et al.* recommended two doses, first at induction and the other 6 hours postoperative [11]. However, Niimi, *et al.* [9] in their study concluded that 1-day antibiotic infusion was as effective as long term antibiotic infusion in preventing infection. Also, long term antibiotic use was associated with drug resistance, side effects and high medical costs. Other studies have also corroborated on the above conclusion. ASHP guidelines [3] state that the minimum duration of the antibiotic coverage is the time from incision to closure of the surgical site and this can be covered by a single antibiotic dosage. However, we need studies suited to our environment and working conditions. India is a tropical country, with a hot and humid climate which promotes the growth of both Gram-positive and Gram-negative bacteria in skin, linen, and wards. Antibiotics should be given till epithelization of the wound occurs and it should not be stopped at wound closure.

Which antibiotics

The antibiotic should be inexpensive, nontoxic and of limited spectrum [1]. Most common orthopaedic infections are due to gram positive *Staphylococcus aureus* and *epidermidis*. They are skin commensals and may be implanted during the surgery [6]. The antibiotics used are β -lactams like cephalosporins, penicillin and their derivatives like cloxacillin, glycopeptides as teicoplanin and aminoglycosides like gentamicin [6]. According to American Society of Health System Pharmacists (ASHP) cefazolin was the most commonly used antibiotic, combination of cefazolin with gentamicin was the second most common regime, whereas 3rd generation cephalosporin was 3rd most commonly used [3]. In Malaysia, National clinical practice guidelines recommended cloxacillin with gentamicin as the first choice, 2nd generation cephalosporin as the second choice antibiotics in both arthroplasties and trauma surgeries. Yeap, *et al.* in their study concluded that the 2nd generation cephalosporin should be used as the first line drug in both arthroplasties and trauma surgeries and the 3rd generation should be used as the 2nd line drugs. This was because 2nd generation Cephalosporins had better effect against *Staph aureus* [12] whereas theoretically 3rd generation had better action against the gram-negative organisms. However, in arthroplasty 3rd generation cephalosporins should be used [12]. Many studies recommend the use of Second generation cephalosporins [1,4,6,7]. However, there is no conclusive data as to which generation cephalosporin is better and whether it is superior to cloxacillin. However, on comparison there was no significant difference in the effect cephalosporin versus teicoplanin; cephalosporin versus penicillin derivatives (cloxacillin) and comparisons between 2nd generation and 1st generation cephalosporins.

Conclusion

Preoperative antibiotics should be given 30 mins to 1 hour before incision and antibiotics infusion should be given for a minimum period of 24 hours for a clean case. The preferred antibiotic seems to be 2nd generation cephalosporins. However, for India we need studies to assess the conditions and to formulate guidelines which may clear the above mentioned 3 controversies regarding the use of antibiotics in orthopaedics.

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