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Mini Review

Antibiotic policy for prevention of SSIs & AMR in orthopaedics

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Prophylactic use of antimicrobials is a standard practice for about last three decades for prevention of surgical site infections (SSIs) in any elective surgical procedures. Ample evidences are available in favor of use of prophylactic use of antibiotics for prevention of SSIs.

World Health Organization has cautioned that Antimicrobial Resistance (AMR) is becoming a major global threat.¹

The anti-microbial resistance (AMR) poses a real threat and about 20 lakh illnesses and 23000 deaths per year as a consequence of AMR are reported in United States alone.²

Therefore, it becomes pertinent to disseminate awareness regarding the judicious use of antimicrobials to reap benefits from antimicrobials for prevention of surgical site infections (SSIs) and for thwarting the chances of AMR.

However, for judicious prophylactic use of antimicrobials three controversies need clarity viz-

1. What should be the appropriate timing of administration of prophylactic antibiotics?
2. Which prophylactic antibiotic should be used?
3. What should be the total duration of prophylactic antibiotic treatment?

1. What should be the appropriate timing of administration of prophylactic antibiotics?

The timing of administration of prophylactic antibiotic is crucial to ensure maintenance of antibiotic concentration above MIC (minimum inhibitory concentration) for the bacterial growth for the entire duration of surgery i.e. from incision to closure of the skin.³

As concentration of antibiotics appears in blood within 20 min and within 60 min in bone after the administration, it appears logical to administer antibiotic within an hour of the incision. Although, most studies advocate that antibiotics should ideally be given 30-60 min prior to incision or at the time of induction of anaesthesia,^{4,5} however, few authors do advocate that antibiotics can also be administered within two hours of incision,^{3,6} and it has been observed that failure to give antimicrobials within 2 hour period prior to incision results in 2-6 fold rise in SSIs,⁷ as maintenance of the concentration of antimicrobials is crucial following skin incision for prevention of SSIs.⁸

If use of tourniquet is contemplated, a minimum 10 min interval is recommended between antibiotic administration and tourniquet inflation.⁹

2. Which prophylactic antibiotic should be used?

Though regarding the timing of prophylactic antibiotic administration ample strong evidences are available in literature, but regarding the efficacy of one particular antibiotic over another, there is paucity of evidences.

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Majority of surgical site infections develop during surgery due to contamination either by airborne microbes or by pathogens of patient's skin flora and the commonest organisms implicated in SSIs are Staphylococcus aureus and epidermidis¹⁰ and therefore the first choice of prophylactic antibiotics lies with β -lactams (cephalosporins and penicillin derivatives like cloxacillin), glycopeptides (teicoplanin), and aminoglycoside (gentamicin).¹¹

As per recommendations of American Society of Health System Pharmacists (ASHP), ceftazidime was the most preferred prophylactic antimicrobial followed by ceftazidime + gentamicin combination and third most widely used antibiotics were 3rd generation cephalosporin.¹²

The prophylactic antibiotic chosen should be of sufficiently long half life so that the minimum inhibitory concentration may be sustained throughout the surgery and should also have maximum coverage against the commonest pathogens implicated in SSIs.

3. What should be the total duration of prophylactic antibiotic treatment?

Prolonged antibiotic therapy is implicated with development of antimicrobial resistance, complications like hepato or nephropathy, and high medical cost.

Though the appropriate duration of prophylactic therapy in an elective procedure has not yet been clearly defined, most of the studies reported that prolongation of antibiotic therapy beyond 24 hours postoperatively doesn't yield any additional benefits and single dose prophylactic antibiotic may suffice in most of the elective surgeries.¹²⁻¹⁵

As per American Society of Health System Pharmacists (ASHP) guidelines minimum duration of prophylactic antibiotic coverage is required from incision to closure of the operative site for which a single dose of prophylactic antibiotic appears pragmatic.

American Academy of Orthopaedic Surgeons (AAOS) recommends that prophylactic antibiotics should not be continued beyond 24 hours even if the drains and/or catheters are used.⁸

4. Conclusion

In light of the recommendations of World Health Organization (WHO), American Association of Orthopaedic Surgeons (AAOS), and American Society of Health System Pharmacists (ASHP) following conclusions may be drawn and incorporated in clinical practice for prevention of Surgical Site Infections (SSIs) & more importantly Anti-microbial Resistance (AMR):

1. Timing of administration of prophylactic antibiotic in elective surgeries should preferably be 30-60 min before incision;
2. Nature of prophylactic antibiotic should preferably be one that covers the commonly implicated Gram

+ve as well as Gram -ve pathogens in SSIs. As the commonest organisms implicated in SSIs are Staphylococcus aureus and epidermidis and as per most of the studies β -lactam group antibiotics especially 2nd & 3rd generation cephalosporins and aminoglycoside group antibiotics especially gentamicin should be preferred.

3. Total duration of prophylactic antibiotic administration as per most of the studies should not exceed 24 hrs postoperatively however the dosage regimen may be either of the following two:

- (a) Single dose regimen- 30-60 min before incision;
- (b) Three dose regimen within 24 h- one dose 30-60 min before incision and subsequent two doses at 6 h and 12 h postoperatively.

Despite all the recommendations & evidences available in literature regarding not to exceed prophylactic antibiotic use beyond 24 hours postoperatively, it has been observed that majority of orthopaedic surgeons don't follow the single or three dose regimen and antibiotics are continued for days together which is contributing to anti-microbial resistance (AMR) across the globe and it seems that the reasons behind this may be reluctance or hesitancy on the part of orthopaedic surgeons towards switching over to the recommended and evidence based antibiotic regimens or it may be sheer lack of updation of knowledge of current researches.

5. Conflict of Interest

None.

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