EDITORIAL

Surgical Antibiotic Prophylaxis

Surgical antibiotic prophylaxis is defined as the use of antibiotics to prevent infections at the surgical site. Prophylaxis has become the standard of care for contaminated and clean-contaminated surgery and for surgery involving insertion of artificial devices. The antibiotic selected should only cover the likely pathogens.[1]

It should be given at the correct time. Most parenteral antibiotics is usually given at induction of anaesthesia. A single dose of antibiotic is usually sufficient if the duration of surgery is four hours or less.[2] Inappropriate use of antibiotics for surgical prophylaxis increases both cost and the selective pressure favouring the emergence of resistant bacteria.

Wound infections are the commonest hospital-acquired infections in surgical patients. They result in increased antibiotic usage, increased costs and prolonged hospitalization.

Appropriate antibiotic prophylaxis can reduce the risk of postoperative wound infections, but additional antibiotic use also increases the selective pressure favouring the emergence of antimicrobial resistance. Judicious use of antibiotics in the hospital environment is therefore essential.

Surgical antibiotic prophylaxis is defined as the use of antibiotics to prevent infections at the surgical site. It must be clearly distinguished from pre-emptive use of antibiotics to treat early infection, for example perforated appendix, even though infection may not be clinically apparent

The original surgical antibiotic prophylaxis experiments were performed 40 years ago in pigs. The results concluded that 'the most effective period for prophylaxis begins the moment bacteria gain access to the tissues and is over in three hours.[3] Since then there have been many studies in animal models and in humans undergoing surgery. This has resulted in the principles of antibiotic prophylaxis becoming an accepted part of surgical practice.[4] Approximately 30-50% of antibiotic use in hospital practice is now for surgical prophylaxis. However, between 30% and 90% of this prophylaxis is inappropriate. Most commonly, the antibiotic is either given at the wrong time or continued for too long.[4-5] Controversy remains as to duration of prophylaxis and also as to which specific surgical procedures should receive prophylaxis.[4]

Before starting prophylactic antibiotics we need to decide whether prophylaxis is appropriate we have to determine the bacterial flora most likely to cause postoperative infection, not every species needs to be covered. We have to choose an antibiotic, based on the steps above, with the narrowest antibacterial spectrum required. It is important to choose the less expensive drug if two drugs are otherwise of equal anti-bacterial spectrum, efficacy, toxicity, and ease of administration. It is also important to administer dose at the right time and we have to administer antibiotics for a short period (one dose if surgery of four hours duration or less). It is also important to avoid antibiotics likely to be of use in the treatment of serious sepsis. Use of anti-biotics prophylaxis does not help to overcome poor surgical technique. Lastly we have to review antibiotic prophylaxis protocols regularly as both cost and hospital antibiotic resistance patterns may change.

Clean wound does not require antibiotic prophylaxis. Clean-contaminated wound and contaminated wound requires antibiotic prophylaxis. Antibiotic prophylaxis also required

operations involving the insertion of an artificial device or prosthetic material. Less well-accepted indications for prophylaxis include clean operations in patients with impaired host defences or patients in whom the consequences of infection may be catastrophic, for example neurosurgery, open heart surgery and ophthalmic surgery. Before starting antibiotic we should always ask the patient about a prior history of antibiotic allergy, as beta-lactams are the commonest type of antibiotics used in prophylaxis. A history of severe penicillin allergy (anaphylaxis, angioedema) means that cephalosporins are also contraindicated, as there is a small but significant risk of cross-reaction.

Most importantly, the antibiotic should be active against the bacteria most likely to cause an infection. Most post-operative infections are due to the patient's own bacterial flora. Prophylaxis does not need to cover all bacterial species found in the patient's flora, as some species are either not particularly pathogenic or are low in numbers or both

It is important to select an antibiotic with the narrowest antibacterial spectrum required, to reduce the emergence of multi-resistant pathogens and also because broad spectrum antibiotics may be required later if the patient develops serious sepsis. The use of 'third generation' cephalosporins such as ceftriaxone and cefotaxime should therefore be avoided in surgical prophylaxis.

Often several antibiotics are equal in terms of antibacterial spectrum, efficacy, toxicity, and ease of administration. If so, the least expensive drug should be chosen, as antibiotics for surgical prophylaxis comprise a large portion of hospital pharmacy budgets.

Commonly used surgical prophylactic antibiotics include intravenous 'first generation' cephalosporins - cephazolin or cephalothin, intravenous gentamicin, intravenous or rectal metronidazole (if anaerobic infection is likely), oral tinidazole (if anaerobic infection is likely), intravenous flucloxacillin (if methicillin-susceptible staphylococcal infection is likely), intravenous vancomycin (if methicillin-resistant staphylococcal infection is likely).[7]

Parenteral 'second generation' cephalosporins such as cefotetan have improved anaerobic and aerobic Gram-negative cover compared to first generation cephalosporins. They are sometimes used as a more convenient, but more expensive, alternative to the combination of metronidazole plus either first generation cephalosporin or gentamicin for abdominal surgical prophylaxis. The bacterial flora in some hospitalised patients may include multi-resistant bacteria such as methicillin-resistant staphylococci. An assessment then needs to be made for each surgical procedure about whether or not prophylaxis with parenteral vancomycin is indicated

The Un-necessary use of vancomycin results in emergence of vancomycin-resistant enterococci (VRE), vancomycin-intermediate Staphylococcus aureus (VISA), and vancomycin-resistant Staphylococcus aureus (VRSA)

It is critical to ask the patient about beta-lactam allergy prior to anaesthesia to minimize the risk of anaphylaxis under anaesthesia. A test dose of antibiotic is not necessary before surgery if the patient denies antibiotic allergy. Prophylactic antibiotics are usually given intravenously as a bolus on induction of anaesthesia to ensure adequate tissue concentrations at the time of surgical incision. This timing of dosing is particularly important for most beta-lactams which have relatively short half-lives. Vancomycin has to be infused over one hour so it must be started earlier so the infusion finishes just before induction. Intramuscular antibiotics are less commonly used than intravenous antibiotics. They are typically given at the time of pre-medication so that peak tissue levels are attained at the most critical time, the time of surgical incision. Oral or rectal antibiotics need to be given earlier to ensure adequate tissue concentrations during surgery. Metronidazole suppositories are commonly used in bowel surgery and must be given 2-4 hours before it begins. Topical antibiotics are not recommended, with the exceptions of

ophthalmic or burns surgery.

Persistence of tissue concentrations past the period of surgery and recovery of normal physiology following anaesthesia does not improve efficacy and increases toxicity and cost. If the operation lasts four hours or less, one antibiotic dose is usually sufficient. In prolonged surgery of greater than four hours, further antibiotic doses may be required to maintain the concentration, particularly if the antibiotic has a short half-life. Continuing antibiotic prophylaxis until surgical drains have been removed is illogical and also of unproven benefit.

In conclusion surgical antibiotic prophylaxis is an effective management strategy for reducing post-operative wound infections, provided that appropriate antibiotics are given at the correct time for appropriate durations and for appropriate surgical procedures.

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