Chapter 9: Antimicrobial prophylaxis for surgical procedures

Altemeier classification of surgical wounds[256]

Class 1: Clean SSI risk < 1%	Sterile area of body. Skin intact before surgical incision. Surgery does not involve opening of gastrointestinal, respiratory, genito-urinary or oropharyngeal tracts.
Class II: Clean contaminated SSI risk 2–5%	Opening of body cavities; gastrointestinal tract, respiratory tract, genito-urinary tract or oro-pharyngeal tracts in the absence of gross contamination.
Class III: Contaminated SSI risk 5–10%	Massive surgical soiling by gastrointestinal contents or opening of genito-urinary or biliary tracks in patients with tract infections. Recent open traumatic wounds.
Class IV: Dirty SSI risk > 10%	Body site that contains pus, foreign body or faeces. Traumatic open wounds > 4 hours.

SSI – Surgical site infection

There are four considerations to keep in mind when prescribing antibiotic prophylaxis:[257]

1. Who needs antibiotic prophylaxis?
2. What are the factors that influence antibiotic choice?
3. Timing.
4. Duration of antibiotic prophylaxis.

Procedures that need antibiotic prophylaxis

- Class I surgery involving the placement of prosthesis or implants.
- Class II surgery.
- Class III and IV should be on curative antibiotics.

In procedures where antibiotic prophylaxis would not normally be used, it should be considered in patients with an increased risk for surgical site infections (SSIs) or where infection will be catastrophic. Patients at increased risk for infection include geriatric and oncology patients, those with diabetes, HIV, obesity, transplant patients, etc.[258]

Do not give antibiotic prophylaxis for clean, non-prosthetic uncomplicated surgery.[257,259]

Choice of prophylactic antibiotics

Use an antibiotic that is safe, inexpensive and a bactericidal with an in vitro spectrum that covers the most probable intraoperative contaminants for the operation. Other factors that may influence the choice of antibiotics include renal function, other comorbidities, recent antimicrobial use, institutionalised patients, known colonisation with a drug-resistant organism as well as impaired immunocompetency.

Use your local antibiotic formulary, and always consider potential adverse effects when giving antibiotics for prophylaxis. For a detailed table of surgical procedure and the best choice of prophylactic antibiotics, see Appendix A.[257]

Timing of prophylactic antibiotics

Give a single dose of antibiotic prophylaxis intravenously 30 minutes before skin incision. Timing of administration should be no longer than one hour before incision. Antibiotics that need to be administered as infusions should ideally be completed 30 minutes prior to skin incision. Consider earlier administration of antibiotic prophylaxis for operations in which a tourniquet is used.

With regards to Caesarean delivery, antibiotic prophylaxis should not be delayed to the clamping of the cord.[258] A second dose of an antibiotic with a relatively short half-life, e.g. cephazolin, is often recommended for prolonged procedures or procedures with massive blood loss.

Duration of prophylactic antibiotic therapy

Antibiotic prophylaxis should be brief and limited to the surgical time. It is sometimes used up to 24 hours and under very exceptional circumstances for up to 48 hours. Prophylaxis should never continue for more than 48 hours.

Rationale

- Antibiotic prophylaxis reduces bacterial inoculum at the time of surgery. It significantly decreases the rate of bacterial contamination of the surgical site.
- Antibiotics have associated risks. Adverse effects include gastrointestinal symptoms (nausea, vomiting or diarrhoea), antibiotic-associated *Clostridium difficile* and minor allergic reactions, such as skin rashes, myalgias and arthralgias. Rare adverse effects may include pancytopenia, renal dysfunction, liver dysfunction and life-threatening anaphylaxis.
- Hospitals should develop local guidelines for surgical antibiotic prophylaxis, based on local infective microbes and their antibiotic resistance patterns. They can be formulated by local microbiologists, in consultation with surgical colleagues, and must then be adhered to in the perioperative setting.
- In most clean wounds, SSIs would be due to skin flora. The most common pathogens are skin flora microbes, especially the *Streptococcus* spp. and *Staphylococcus* spp. First-generation cephalosporin, e.g. cefazolin, adequately covers these organisms in a cost-effective manner.[260] Surgeries that involve the bowel necessitate Gram-negative and anaerobic coverage, for which cefoxitin is appropriate. Use of broader spectrum antimicrobial drugs such as co-amoxiclav may be considered based on cost, safety profile and ease of administration (when metronidazole is unavailable). Vancomycin may be the prophylaxis of choice when a "cluster of methicillin-resistant *S. aureus* mediastinitis, or incisional SSI owing to methicillin-resistant, coagulase-negative staphylococci, has been detected".[258,260]
- Studies have shown that the minimum inhibitory concentration of the antibiotic agent at tissue level must be exceeded for the period from incision to wound closure. Thus, the timing of the prophylactic antibiotics is crucial.
- Infection rates are lowest if antibiotics are administered within 30 minutes of incision, with the odds of infection increasing twofold if antibiotics are administered after incision, or 60 minutes before incision. If a fluoroquinolone is used, consider starting the dose 120 minutes before skin incision.[258]
- The WHO initiative, "Safe surgery saves lives" surgical safety checklist emphasises the inclusion of antibiotic prophylaxis given 60 minutes before skin incision.[261]
- Always consider the timing and pharmacokinetics, for example, the serum half-life, and necessary infusion time of the antibiotic (vancomycin). Repeat the dose of antibiotic when the operation is longer than the half-life of the given antibiotic or if there is excessive blood loss. Note that the dose should be adjusted for patients with delayed clearance of the drug.[258,262]

See Appendix A for a complete summary of antibiotics for specific surgical procedures.[257]