Module 12: Antimicrobial Stewardship in Surgery

Objectives

By the end of this module, you should be able to:

1. Define key AMS terms related to surgery, including SSI and Surgical Antibiotic Prophylaxis (SAP).
2. Explain the importance of rational antibiotic use in surgery for reducing SSIs and AMR.
3. Apply the principles of SAP, including appropriate antibiotic selection, timing, dose, and duration.
4. Describe the roles of surgeons, anesthesiologists, pharmacists, and nurses in surgical AMS.
5. Identify challenges and implement strategies, including effective communication and checklists, to optimize antibiotic use in surgery.

Definition of Terms

- Surgical Site Infection (SSI) is an infection occurring at the surgical site within 30 days after surgery or up to 90 days if an implant is involved.
- Surgical Antibiotic Prophylaxis (SAP) involves giving antibiotics before or during surgery to prevent SSIs.
- The goal of SAP is to prevent infections, not to treat existing ones.
- SAP helps reduce the risk of complications like delayed healing, longer hospital stays, and higher healthcare costs.

Introduction

- **Rational antibiotic use in surgery** is key to patient safety, infection prevention, and controlling antimicrobial resistance (AMR).
- Following **evidence-based guidelines** on antibiotic choice, timing, dose, and duration reduces SSIs and limits AMR.
- Success requires overcoming barriers through **antimicrobial stewardship (AMS) programs, education, and access to microbiology data**.
- With AMR as a growing threat, **optimizing antibiotic use in surgery is vital** for protecting patients and public health.

Burden of Surgical Site Infections

- SSIs account for approximately 20% of healthcare-associated infections (HAIs) and can lead to increase in mortality rates by 2 to 11 fold (WHO, 2016)
- SSIs result to:
    - Prolonged hospital stays
    - Increased morbidity and mortality
    - Substantial healthcare costs
- While prophylactic antibiotics can significantly reduce the risk of infection, their misuse contributes to AMR, which is a major threat to global health.

Principles of Rational Antibiotic Use in Surgery

Appropriate Antibiotic Selection

Selection should be based on:

- Type of surgery
- Patient's individual characteristics
- Surgeries that carry a risk of contamination by Gram-negative bacteria, such as procedures involving the bowel.
- Local microbial resistance profile e.g.
  - Cefazolin is recommended for clean surgeries due to its effectiveness against common skin flora, including Staphylococcus aureus, and its low toxicity profile
  - Broad-spectrum antibiotics are generally reserved for high-risk procedures or patients with a history of multidrug-resistant organisms.

Principles of Rational Antibiotic Use in Surgery...

Optimal Timing of Administration

- Timing of antibiotic administration is crucial to ensuring effective drug levels in tissues at the time of incision
- Current guidelines recommend administering prophylactic antibiotics within 60 minutes **before** the incision
- For drugs with longer half-lives, such as vancomycin, administration within 120 minutes may be appropriate

Principles of Rational Antibiotic Use in Surgery...

Correct Dosage and Duration

- Appropriate dosing is essential to achieving therapeutic levels without toxicity.
- Dosing adjustments may be necessary based on patient factors, such as body weight and renal function
- Prophylactic antibiotics should typically not exceed 24 hours postoperatively, as extended use does not reduce infection rates but increases the risk of AMR and adverse effects

Surgical Wound Classification and Subsequent Risk of Infection

Classification	Description	Infective Risk (%)
Clean (Class I)	• Uninfected operative wound • No acute inflammation • Closed primarily • Respiratory, gastrointestinal, biliary, and urinary tracts not entered • No break in aseptic technique • Closed drainage used if necessary	**≤ 2**
Clean-contaminated (Class II)	• Elective entry into respiratory, biliary, gastrointestinal, urinary tracts and with minimal spillage • No evidence of infection or major break in aseptic technique • Example: appendectomy	**≤ 10**
Contaminated (Class III)	• Non-purulent inflammation present • Gross spillage from gastrointestinal tract • Penetrating traumatic wounds < 4 hours • Major break in aseptic technique	**About 20**
Dirty-infected (Class IV)	• Purulent inflammation present • Preoperative perforation of viscera • Penetrating traumatic wounds ≥ 4 hours	**About 40**

Ref: Kenya National guidelines on empiric antibiotic use and Surgical antibiotic prophylaxis

Prophylaxis Vs Treatment

Wound Class	Definition	Prophylaxis Indication	Treatment Indication
Clean	Uninfected operative wound; no inflammation; no entry into respiratory, alimentary, genital, or urinary tracts	Prophylaxis usually indicated only for high-risk procedures (e.g., implantation of prosthetics)	Treatment not required unless infection develops
Clean-Contaminated	Operative wound with controlled entry into respiratory, alimentary, genital, or urinary tracts without unusual contamination	Prophylaxis indicated to reduce risk of SSIs	Treatment required only if infection is confirmed
Contaminated	Open, fresh accidental wounds; operations with major breaks in sterile technique; gross spillage from the GI tract	Prophylaxis strongly recommended	Treatment required if signs of infection appear
Dirty/Infected	Old traumatic wounds with devitalized tissue, existing clinical infection, or perforated viscera	Prophylaxis not appropriate; therapeutic antibiotics required	Treatment mandatory due to existing infection

Ref: Kenya National guidelines on empiric antibiotic use and Surgical antibiotic prophylaxis

Principles of Rational Antibiotic Use in Surgery

Timing and Selection of Antibiotics:

- Timing: Administer SAP within 60 minutes before incision; for drugs e.g. vancomycin or fluoroquinolones, give within 120 minutes due to longer infusion times.
- Consider the need for redosing if surgery lasts over 2–4 hours or there is significant blood loss (children 25 ml/kg and adults 1.5 litres) to maintain antibiotic levels dependent on the different drug half lives.
- Antibiotic Selection:
  - First-line: Cefazolin (a broad-spectrum beta-lactam) for most procedures.
  - Alternatives: Clindamycin or vancomycin for patients with beta-lactam allergies.
  - Local Resistance: Choice should be guided by local antibiogram data to address resistance patterns and National guidelines if not available.

Principles of Rational Antibiotic Use in Surgery...

Duration of Prophylaxis

- In most cases, a single preoperative dose of an antibiotic is sufficient.
- Prophylactic antibiotics should generally be discontinued within 24 hours post-surgery (or 48 hours for cardiac surgeries).
- Prolonged use beyond 24 hours does not typically reduce infection risk and may contribute to antimicrobial resistance.
- In cases of unexpected contamination or high-risk patients, postoperative dosing may be considered but should still be limited to the shortest effective duration.

Examples of Surgical Antibiotic Prophylaxis

Procedure	Organisms	Regimen
Cardiac Valve Replacement Surgery	• Staphylococcus aureus • Coagulase Negative staphylococci • Corynebacteria	**Cefazolin 2g** for patients >80kg and **1g** for <80kg, initiated 30 to 60 minutes before skin incision. Repeat dose of 1g in patients with normal renal function every 3-4 hours if surgical incision still open or with massive blood loss.
Pneumonectomy / Lobectomy	• Staphylococcus aureus • Coagulase negative staphylococci • Coliforms • Streptococcus species	**Cefazolin 2g** for patients >80kg and **1g** for <80kg, initiated 30 to 60 minutes before skin incision, **THEN Cefazolin 2g IV** (child: 30mg/kg up to 2g) 8-hourly for 2 more doses commencing 4 hours after the initial dose
Colorectal surgery (Colon/small bowel resection, revision of anastomosis/stoma, appendectomy etc.)	• Coliforms • Anaerobes • Enterococci	**Cefazolin 2g IV** initiated 30 to 60 minutes before skin incision (Child: 30mg/kg up to 2g) **PLUS Metronidazole 500mg IV** infusion (child: 12.5mg/kg up to 500mg) **PLUS Gentamicin 2mg/kg IV**
Elective Craniotomy procedures	• Coagulase negative staphylococci • Staphylococcus aureus • Corynebacteria	**Cefazolin 2g IV stat** (Child 30mg/kg) **Penicillin allergy: Vancomycin 1g IV** or **Clindamycin** (600mg IV if <70kg, 900mg if >70kg)

Ref: Kenya National guidelines on empiric antibiotic use and Surgical antibiotic prophylaxis

Examples of Surgical Antibiotic Prophylaxis…

Procedure	Organisms	Regimen
Total abdominal hysterectomy, radical hysterectomy and laparoscopic hysterectomy	• Staphylococcus aureus • Coliforms • Enterococci • Group B Streptococci	**Cefazolin 2g IV** (3g if patient is >120kg). Repeat dose after 3 hours if surgery prolonged
Emergency or elective Caesarean Section (no labor, no rupture of membranes)	• Staphylococcus aureus • Coliforms • Enterococci • Group B Streptococci	**Cefazolin 2g IV** **Penicillin allergy: Vancomycin 1g IV** infusion (1.5g for patients >80kg actual body weight)
Emergency Caesarean Section with Chorioamnionitis	• Staphylococcus aureus • Coliforms • Enterococci • Group B Streptococci	**Amoxicillin+clavulanic acid 1.2g 8 hourly PLUS Metronidazole 500mg 8 hourly** Treat for 5 days
Internal fixation of large bones	• Skin commensals e.g. Staphylococcus aureus • Coagulase negative staphylococci • Coliforms	**Cefazolin 2g IV** initiated 30 to 60 minutes before skin incision (child <12 years: 30mg/kg up to 2g) **THEN** Repeat 8-hourly for 2 further doses. (Max 3 doses irrespective of the presence of surgical drains)

Ref: Kenya National guidelines on empiric antibiotic use and Surgical antibiotic prophylaxis

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Responsibilities of Key Team Members

Surgeons

- Assess the need for prophylactic antibiotics based on the type of surgery and patient risk factors
- Select, in consultation with microbiology and pharmacy, appropriate antibiotics based on the type of surgery and anticipated organisms
- Responsible for ensuring that antibiotics are administered at the right time, typically within 60 minutes before incision.
- Decide on postoperative continuation or discontinuation of antibiotics, emphasizing a short duration

Responsibilities of Key Team Members…

Anesthesiologists

- Ensure that antibiotics are administered at the correct time, often during the preoperative preparation
- Coordinate intraoperative redosing to maintain effective antibiotic levels if required
- Documenting the timing and dosing of antibiotics, which is essential for compliance monitoring.

Responsibilities of Key Team Members…

Pharmacists

- Provide expertise on antibiotic selection, dosing, and adjustments based on patient factors like weight, kidney function, and allergies
- Monitor local resistance patterns and provide updated guidance on antibiotic choices to the surgical team
- Educate surgical staff on antibiotic stewardship principles, including the risks of inappropriate use and the importance of adherence to protocols.

Responsibilities of Key Team Members…

Nurses

- Prepare and administer antibiotics as directed by protocols
- Monitoring for Adverse Reactions
- Communicate with the surgical and anesthesia teams to confirm the timing of antibiotic administration and any necessary redosing.

Challenges in Implementing Rational Antibiotic Use in Surgery

- Inadequate stewardship programs
- Insufficient staff training
- Limited access to microbiological data due to inadequate lab capacity for cultures
- Irrational use of antimicrobials by healthcare workers driven by unfounded fears of patient acquiring SSI
- Absence of local antibiograms in many settings hinders the selection of appropriate antibiotics

Communication Strategies for Effective Surgical AMS Practices

- Implementing surgical checklists that include antibiotic prophylaxis timing, selection, and redosing reminders helps ensure that AMS principles are followed consistently.
- Preoperative briefings should cover the plan for antibiotic prophylaxis, including drug choice and timing, while postoperative debriefings allow for discussion of any deviations or improvements in AMS practices.
- Accurate documentation of antibiotic administration, including timing, dose, and any adjustments, allows the team to track compliance and identify areas for improvement.
- Regular feedback on compliance with AMS protocols, infection rates, and resistance patterns.

Strategies for Optimizing Rational Antibiotic Use in Surgery

- Education and Training of the surgical teams on surgical prophylaxis guidelines and the risks associated with antibiotic misuse
- Use of local antibiograms to guide antibiotic selection based on prevalent pathogens and resistance patterns
- Involving the infection prevention and control (IPC) teams, pharmacists, and microbiologists when developing surgical prophylactic protocols will ensure rational antibiotic use if patient is known to be colonised or previous infection with resistant pathogen in area of surgery.
- Regular audits and feedback on antibiotic prescribing practices helps to identify gaps and encourage compliance with AMS protocols.

Key Points

1. Proper antibiotic use reduces SSIs and helps fight AMR.
2. Antibiotic selection should be based on surgery type, patient factors, and local resistance patterns.
3. Administer SAP within 60 minutes before incision (or within 120 minutes for certain antibiotics like vancomycin).
4. Tailor antibiotic prophylaxis based on wound classification (clean, clean-contaminated, contaminated, dirty).
5. Effective AMS requires collaboration among surgeons, anesthesiologists, pharmacists, and nurses, supported by checklists, documentation, and regular feedback.

The End

You have come to the end of this module. Kindly attempt module 12 quiz before proceeding to module 13

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