SSI PREVENTION - CORRECT AND SAFE SURGICAL ANTIBIOTIC PROPHYLAXIS

Things you should know!

- There is wide consensus on specific procedures that warrant antibiotic prophylaxis as well as in which procedures it is not required.
- Correct use of surgical antibiotic prophylaxis is very important not only to prevent surgical site infection but also to avoid emergence of antimicrobial resistant pathogens that can cause more serious disease to the patient and are able to spread more easily. Thus, a standardized approach is warranted.
- Key elements of a correct and safe surgical antibiotic prophylaxis are:
    1. **Correct pre-operative administration timing,** *to achieve the right concentration of drug at the site of incision at the beginning of the operation when there is high risk for surgical site contamination.*
    2. **Correct antibiotic type according to the procedure and patient history,** *to kill the bacteria most frequently found at the operation site and to keep the patient safe.*
    3. **Correct dose and intraoperative redosing**, only if needed, *to maintain the right antibiotic concentration at the operation site throughout the entire operation.*
    4. **Appropriate discontinuation after surgery,** *to avoid unnecessary extra costs, potential side effects, and emergence of antimicrobial resistant pathogens which can hamper subsequent infection treatment and can spread in the environment and to other patients, visitors and healthcare workers.*

Things you should do right!

1. Surgical antibiotic prophylaxis should be administered only when indicated.
2. **Correct pre-operative administration timing:** The optimal time for administration of antibiotic preoperative doses is **60 minutes before surgical incision[1].**
3. **Correct antibiotic type according to the procedure and patient history** (of allergy or severe adverse events): See tables.
4. **Correct dose and intraoperative redosing: Standardized doses** (see table) should be used. Increased doses based on patient weight should be administered to obese patients. According to the antibiotic type, doses should be repeated during the operation at specific time intervals (see table) if the duration of the **procedure[2] is prolonged** or if there are **excessive blood loss** (e.g., >1500 mL) or **extensive burns.** The intraoperative redosing interval must be measured from the time of administration of the preoperative dose, not from the beginning of the procedure.
5. **Appropriate discontinuation after surgery:** Therapeutic antibiotic levels should be maintained a few hours after the incision is closed in the operating room. In general, the duration of antimicrobial prophylaxis should be **less than 24 hours**.

[1] 2 hours for fluoroquinolones (e.g. ciprofloxacin) and vancomycin because they require administration over one to two hours.
[2] More specifically, if the procedure time exceeds two half-lives of the antimicrobial agent. Some antibiotics (e.g. ertapenem, gentamicin[5mg/kg], metronidazole) do not require intraoperative redosing due to their pharmacokinetic properties.

RECOMMENDED ANTIBIOTIC PROPHYLAXIS

Procedure	Drug/dosing pre-operatively	Alternative drug for history of anaphylactic reactions	Recommended re-dosing interval, hours
Colorectal	Cefazolin 2 g (3g for pts weighing > 120kg) + metronidazole 500 mg OR Cefotetan 2 g OR Cefoxitin 1g	Ciprofloxacin 400 mg + metronidazole 500 mg	Cefazolin, 4 Metronidazole, not needed, unless operation >8 hr Cefotetan, 6 Cefoxitin, 2 Ciprofloxacin, not needed, unless operation >7 hr
High-risk gastro-duodenal and biliary	Cefazolin 2 g (3g for pts weighing > 120kg)	Ciprofloxacin 400 mg	Cefazolin, 4 Ciprofloxacin, not needed, unless operation >7 hr
Breast	Cefazolin 2 g (3g for pts weighing > 120kg)	Clindamycin 900 mg or Vancomycin 15 mg/kg	Cefazolin, 4 Clindamycin, 6 Vancomycin, not needed, unless operation >8 hr
Orthopedic – (total joint replacement, closed fractures / use of nails, bone plates, other internal fixation devices, functional repair without implant /devices, trauma)	Cefazolin 2 g (3g for pts weighing > 120kg)	Gentamicin 5 mg/kg + Clindamycin 900 mg	Cefazolin, 4 Gentamicin, not needed, unless operation >8 hr Clindamycin 6
Noncardiac thoracic – thoracic (lobectomy, pneumonectomy, wedge resection, other noncardiac mediastinal procedures), closed tube thoracostomy	Cefazolin 2 g (3g for pts weighing > 120kg)	Clindamycin 900mg	Cefazolin, 4 Clindamycin, 6

Appendectomy	Cefazolin 2 g (3g for pts weighing > 120kg) + metronidazole 500 mg OR Cefotetan 2g OR Cefoxitin 2g	Ciprofloxacin 400 mg + Metronidazole 500 mg	Cefazolin, 4 Metronidazole, not needed, unless operation >8 hr Cefotetan, 6 Cefoxitin, 2 Ciprofloxacin, not needed, unless operation >7 hr
Obstetric and gynecologic	Cefazolin 2 g (3g for pts weighing > 120kg)	Ciprofloxacin 400 mg + Metronidazole 500mg	Cefazolin, 4 Metronidazole, not needed, unless operation >8 hr Ciprofloxacin, not needed, unless operation >7 hr
Urologic (may not be beneficial if urine is sterile)	Cefazolin 2 g (3g for pts weighing > 120kg)	Ciprofloxacin 400 mg + Metronidazole 500mg	Cefazolin, 4 Metronidazole, not needed, unless operation >8 hr Ciprofloxacin, not needed, unless operation >7 hr

Sources:

J Solomkin. Antibiotic prophylaxis in surgery. In Infetious Diseases, 2nd ed. J Cohen and WG Powderly editors. Mosby, 2004.
Brazler DW et al. Clinical practice guidelines for antimicrobial prophylaxis in surgery. Am J Health-Syst Pharm. 2013; 70:195-283

RECOMMENDED INDICATIONS FOR SURGICAL ANTIBIOTIC PROPHYLAXIS TO PREVENT SSI

Procedure	Antibiotic Prophylaxis Recommendation	
HEAD AND NECK (INTRACRANIAL)		
Craniotomy	A	Antibiotic prophylaxis is **recommended**
Cerebrospinal Fluid (CSF) Shunt	A	Antibiotic prophylaxis is **recommended**
Spinal surgery	A	Antibiotic prophylaxis is **recommended**
HEAD AND NECK (OTHER)		
Head, facial or neck surgery *(clean, benign)*	D	Antibiotic prophylaxis is **not recommended**
Head and neck surgery *(clean, malignant; neck dissection)*	C	Antibiotic prophylaxis **should be considered**
Head and neck surgery *(contaminated/clean- contaminated)*	A	Antibiotic prophylaxis is **recommended**
	C	The duration of prophylactic antibiotics should not be more than 24 hours
	D	Ensured broad spectrum antimicrobial cover for aerobic and anaerobic organisms
THORAX		
Breast cancer surgery	A	Antibiotic prophylaxis **should be considered**
Open heart surgery	C	Antibiotic prophylaxis is **recommended** The duration of prophylactic antibiotics should not be more than 48 hours
Pulmonary Resection	A	Antibiotic prophylaxis is **recommended**
UPPER GASTROINTESTINAL		
Esophageal surgery	D	Antibiotic prophylaxis is **recommended**

Stomach and duodenal surgery	A	Antibiotic prophylaxis is **recommended**
Gastric bypass surgery	D	Antibiotic prophylaxis is **recommended**
Small intestine surgery	D	Antibiotic prophylaxis is **recommended**
HEPATOBILIARY		
Bile duct surgery	A	Antibiotic prophylaxis is **recommended**
Pancreatic surgery	B	Antibiotic prophylaxis is **recommended**
Liver surgery	B	Antibiotic prophylaxis is **recommended**
Gall bladder surgery *(open)*	A	Antibiotic prophylaxis is **recommended**
Gall bladder surgery *(laparoscopic)*	A	Antibiotic prophylaxis is **not recommended**
	✓	Antibiotic prophylaxis **should be considered** in high risk patients ***High risk:*** *intraoperative cholangiogram, bile spillage, conversion to laparotomy, acute cholecystitis/pancreatitis, jaundice, pregnancy, immunosuppression, insertion of prosthetic devices*
LOWER GASTROINTESTINAL		
Appendectomy	A	Antibiotic prophylaxis is **highly recommended**
Colorectal Surgery	A	Antibiotic prophylaxis is **highly recommended**
ABDOMEN		
Hernia repair-groin (inguinal/femoral with or without mesh)	A	Antibiotic prophylaxis is **not recommended**
Hernia repair-groin (laparoscopic with or without mesh)	B	Antibiotic prophylaxis is **not recommended**
Hernia repair (incisional with or without mesh)	C	Antibiotic prophylaxis is **not recommended**
Open/laparoscopic surgery with mesh *(eg gastric band or rectoplexy)*	B	Antibiotic prophylaxis is **not recommended**
	✓	Antibiotic prophylaxis **should be considered** in high risk patients

Splenectomy	✓	Antibiotic prophylaxis is **not recommended** Antibiotic prophylaxis **should be considered** in high risk patients ***High risk:*** *immunosuppression*
GYNECOLOGICAL		
Abdominal hysterectomy	A	Antibiotic prophylaxis is **recommended**
Vaginal hysterectomy	A	Antibiotic prophylaxis is **recommended**
Caesarean section	A	Antibiotic prophylaxis is **highly recommended**
Assisted delivery	A	Antibiotic prophylaxis is **not recommended**
Perineal tear	D	Antibiotic prophylaxis is **recommended** for third/fourth degree perineal tears involving the anal sphincter/rectal mucosa
Manual removal of the placenta	D	Antibiotic prophylaxis **should be considered** Antibiotic prophylaxis is **recommended** for patients with proven chlamydia or gonorrhoea infection
Induced abortion	A	Antibiotic prophylaxis is **highly recommended**
Evacuation of incomplete miscarriage	A	Antibiotic prophylaxis is **not recommended**
UROGENITAL		
Percutaneous nephrolithotomy	B	Antibiotic prophylaxis is **recommended** for patients with stone ≥20 mm or with pelvicalyceal dilation Oral quinolone for one week preoperatively is recommended
Transurethral resection of the prostate	A	Antibiotic prophylaxis is **highly recommended**
Transurethral resection of bladder tumours	D	Antibiotic prophylaxis is **not recommended**
Radical cystectomy	✓	Antibiotic prophylaxis is **recommended**
Nephrectomy	✓	Antibiotic prophylaxis is **not recommended** (Information provided only in children)

SURGERIES CONCERNING THE LIMB		
Arthroplasty	B	Antibiotic prophylaxis is **highly recommended** Antibiotic-loaded cement is recommended in addition to intravenous antibiotics Up to 24 hours of antibiotic prophylaxis should be considered
Open fracture	A	Antibiotic prophylaxis is **highly recommended**
Open surgery for closed fracture	A	Antibiotic prophylaxis is **highly recommended**
Hip fracture	A	Antibiotic prophylaxis is **highly recommended**
Orthopaedic surgery *(without implant)*	D	Antibiotic prophylaxis is **not recommended**
Lower limb amputation	A	Antibiotic prophylaxis is **recommended**
Vascular surgery *(abdominal and lower limb arterial reconstruction)*	A	Antibiotic prophylaxis is **recommended**
Soft tissue surgery of the hand	✓	Antibiotic prophylaxis **should be considered**
GENERAL		
Clean-contaminated procedures – *where no specific evidence is available*	D	Antibiotic prophylaxis is **recommended**
Insertion of a prosthetic device or implant –*where no specific evidence is available*	D	Antibiotic prophylaxis is **recommended**

GRADES OF RECOMMENDATION
Note: The grade of recommendation relates to the strength of the evidence on which the recommendation is based. It does not reflect the clinical importance of the recommendation.
A: At least one meta-analysis, systematic review, or RCT rated as 1++, and directly applicable to the target population; or A body of evidence consisting principally of studies rated as 1+, directly applicable to the target population, and demonstrating overall consistency of results
B: A body of evidence including studies rated as 2++, directly applicable to the target population, and demonstrating overall consistency of results; or Extrapolated evidence from studies rated as 1++ or 1+
C: A body of evidence including studies rated as 2+, directly applicable to the target population and demonstrating overall consistency of results; or Extrapolated evidence from studies rated as 2++
D: Evidence level 3 or 4; or Extrapolated evidence from studies rated as 2+
GOOD PRACTICE POINTS ✓: Recommended best practice based on the clinical experience of the guideline development group

Sources: Scottish Intercollegiate Guidelines Network (SIGN). Antibiotic prophylaxis in surgery. Edinburgh: SIGN; 2008. (SIGN publication no.104). [July 2008]. Available from URL: http://www.sign.ac.uk