SURGICAL ANTIBIOTIC PROPHYLAXIS GUIDELINES WITHIN GENERAL AND VASCULAR SURGERY FOR ADULT PATIENTS

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Ratified by	• Antibiotic Guidelines Committee • Drugs and Therapeutics Committee • General Surgery Directorate
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Consultation:	• Consultant General Surgeons (both campuses) • Consultant Vascular Surgeons • Antibiotic Guidelines Committee Members
Evidence Base	• National SIGN guidelines on Surgical Antibiotic Prophylaxis 2000 available from www.sign.ac.uk • References from the draft version of the forthcoming SIGN guideline update. • Recommended best practice based on clinical experience of guideline developers
Changes from previous Guideline	• This is the first ”crosstown” prophylaxis guideline and replaces previous campus-specific versions
Inclusion Criteria	• Adult patients undergoing general surgical procedures outlined within the guideline
Audit	• Annual Directorate Audit Plans as appropriate
Distribution	• Consultants and registrars within general surgery via e-mail • General surgery junior doctor’s induction pack • Ward managers of relevant areas (E14, E15, E16, D8 at QMC; Harvey One, Simpson Two, Surgical Admissions Unit, Edward Unit, Short Stay Surgical Unit, Day Surgery Unit at City Hospital Campus) • NUH Antibiotic websites
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This guideline has been registered with the Trust. However, clinical guidelines are ‘guidelines’ only. The interpretation and application of clinical guidelines will remain the responsibility of the individual clinician. If in doubt consult a senior colleague or expert. Caution is advised when using guidelines after the review date.

SURGICAL ANTIBIOTIC PROPHYLAXIS GUIDELINES WITHIN GENERAL SURGERY FOR ADULT PATIENTS

Contents

Evidence Scores

1++	High quality Meta-analyses, systematic reviews of RCTs or RCTs with a very low risk of bias
1+	Well conducted Meta-analyses, systematic reviews of RCTs or RCTs with a low risk of bias
1-	Meta-analyses, systematic reviews of RCTs or RCTs with a high risk of bias
2++	High quality systematic reviews of case control or cohort studies High quality case control or cohort studies with a very low risk of confounding or bias and a high probability that the relationship is causal
2+	Well conducted case control or cohort studies with a low risk of confounding or bias and a moderate probability that the relationship is causal
2-	Case control or cohort studies with a high risk of confounding or bias and a significant risk that the relationship is not causal
3	Non-analytic studies, e.g. case reports, case series
4	Expert Opinion

1.Introduction:

- Surgical site infection (SSI) is one of the most common healthcare associated infections resulting in an average additional hospital stay of 6.5 days per case.
- In operations with a higher risk of infection (e.g. clean-contaminated surgery), peri-operative antibiotic prophylaxis has been shown to lower the incidence of infection.
- High antibiotic levels at the site of incision for the duration of the operation, are essential for effective prophylaxis.
- Studies have shown that the administration of prophylactic antibiotics after wound closure do not reduce infection rates further and can result in harm (see below).
- Administration of antibiotics also increases the prevalence of antibiotic-resistant bacteria and predisposes the patient to infection with organisms such as *Clostridium difficile*, a cause of antibiotic-associated colitis. This risk increases with the duration that antibiotics are given for and is higher in the elderly, immunosuppressed, patients who have a prolonged hospital stay or who have received gastro-intestinal surgery.

2. Risk of infection:

The risk of SSI depends on a number of factors; these can be related to the patient or the operation and some of them are modifiable (see Table 1):

Patient	Operation
• Age • Nutritional status • Diabetes • Smoking • Obesity • Coexistent infections at a remote body site • Colonization with microorganisms (e.g. S*taph. aureus)* • Immunosuppression (inc. taking glucocorticoid steroids or immunosuppressant drugs) • Length of preoperative stay • Coexistent severe disease that either limits activity or is incapacitating. • Malignancy	• Duration of surgical scrub / Skin antisepsis • Preoperative shaving/ preoperative skin prep. • Length of operation • Appropriate antimicrobial prophylaxis • Operating room ventilation • Inadequate sterilization of instruments • Foreign material in the surgical site • Surgical drains • Surgical technique inc. haemostasis, poor closure, tissue trauma • Post-operative hypothermia

Table 1 Risk factors that increase the rate of SSI

The risk is also related to the amount of contamination with microorganisms the so-called "class" of the operation (see Table 2):

Class	Definition
Clean	Operations in which no inflammation is encountered and the respiratory, alimentary or genitourinary tracts are not entered. There is no break in aseptic operating theatre technique.
Clean-contaminated	Operations in which the respiratory, alimentary or genitourinary tracts are entered but without significant spillage.
Contaminated	Operations where acute inflammation (without pus) is encountered, or where there is visible contamination of the wound. Examples include gross spillage from a hollow viscus during the operation or compound/open injuries operated on within four hours
Dirty	Operations in the presence of pus, where there is a previously perforated hollow viscus, or compound/open injuries more than four hours old.

Table 2 Definitions of operation class.

Peri-operative antibiotics are generally recommended for clean-contaminated or contaminated operations. "Dirty" operations (e.g. perforated appendectomy) generally require treatment with antibiotics.

3 Antibiotic Prophylaxis

3.1 Timing for Administration

- Antibiotic prophylaxis administered too early or too late increases the risk of SSI. Studies suggest that antibiotics are most effective when given ≤30 minutes before skin is incised.
- **The pragmatic approach is to administer prophylaxis towards the end of induction and ensure that surgery starts within 30 minutes of this time wherever possible.**

3.2 Additional Intra-operative doses

- High antibiotic levels, at the site of incision, for the duration of the operation, are essential for effective prophylaxis.
- Patient's who experience major blood loss (greater than 1500ml) should have fluid resuscitation, followed by re-dosing with the recommend prophylaxis regimen for that operation (see section 4 and 5).
- For operations lasting more than 4 hours re-dosing may be necessary (see table 3)

Antibiotic	Recommended re-dosing interval/dose to give
Cefuroxime	4 hours, give 750mg IV
Co-amoxiclav	4 hours, give 1.2g IV
Gentamicin	re-dosing not recommended
Metronidazole	8 hours, give 500mg IV
Teicoplanin	re-dosing not recommended
Vancomycin	re-dosing not recommended

Table 3: Recommend re-dosing interval

3.3 Post-operative antibiotic prophylaxis

- Studies have shown that giving additional antibiotic prophylaxis after wound closure does not reduce infection rates further. Post-operative antibiotics should only be given to treat active/on-going infection (e.g. perforated appendectomy) unless specifically recommended against the surgical procedure (see section 4 and 5).

3.4 Risk of endocarditis

Patients with specific cardiac pathologies (see table 4) are at higher risk of developing endocarditis following specific procedures/operations (all other pathologies are defined as low risk).

The antibiotic regimens below have been separated into "Standard low endocarditis risk regimens" (section 4.1) recommended for those without any of the conditions in table 3 and "Regimens for patients at moderate/high risk of endocarditis" (see section 4.2) for patients who do.

- History of previous endocarditis
- Prosthetic cardiac valves
- Surgically constructed shunt/conduit
- Complex congenital heart disease (except secundum atrial - septal defects)
- Complex LV outflow abnormalities, including aortic stenosis and bicuspid aortic valves.
- Acquired valvulopathy*
- Mitral valve prolapse*

*With echocardiographic documentation of substantial leaflet pathology and regurgitation

Table 4: Cardiac conditions that predispose to endocarditis.

4 General Surgery Antibiotic Prophylaxis Regimens

4.1.1 Standard regimens low endocarditis risk (for definitions see section 3.4)

Laparoscopy/Laparotomy without mucosa breech (i.e. clean surgery as in section 2.1 above)

- Antibiotic prophylaxis not recommended, unless inflammation uncovered during operation.

Hernia repair, with or without mesh

- Standard regimen – Antibiotic prophylaxis not recommended (Evidence 1++)
- Immunocompromise or taking immunosuppressant drugs (inc. systemic corticosteroids):
  Give **Cefuroxime** 1.5g IV and **Metronidazole** 500mg IV – single dose of each on induction.

Laparoscopic cholecystectomy

- Standard regimen – Antibiotic prophylaxis not recommended (Evidence 1++) if significant bile spillage or conversion to laparotomy give a single dose of **Cefuroxime** IV 1.5g on occurrence.
- High Risk patients defined as: Intra-operative choloangiogram, acute cholocystitis/pancreatitis, jaundice, pregnancy, immunosupression, insertion of prosthetic device (e.g. stent):
  Give **Cefuroxime** 1.5g IV– single dose on induction. (Evidence 1++)

Other Biliary or Upper GI surgery

- Give **Cefuroxime** 1.5g IV– single dose on induction. (Evidence 1++)

Appendectomy

- Give **Cefuroxime** 1.5g IV and **Metronidazole** 500mg IV – single dose of each on induction. (Evidence 1++)
- If perforated appendix and/or peritonitis found continue treatment antibiotics post-op for 2-5 days.

Other Lower GI

- Give **Cefuroxime** 1.5g IV and **Metronidazole** 500mg IV – single dose of each on induction. (Evidence 1++)

Vascular Surgery

- Give **Co-amoxiclav** 1.2g IV – single dose on induction. (Evidence 1+)

Mild rash to penicillins (no angiodema/anaphylaxis/immediate onset urticaria)-

- Give **Cefuroxime** 1.5g IV and **Metronidazole** 500mg IV – single dose of each on induction.
- If patient is at high risk of MRSA infection i.e. Known colonisation with MRSA; Nursing home resident with long term leg ulcers, pressure sore or urinary catheter; or inpatient > 1 week; also give **Gentamicin** 2mg/kg IV as a single dose on induction in addition to **Co-amoxiclav or Cefuroxime/metronidazole** above.

4.1.2 Alternative regimens for patients with severe allergy to penicillins/allergy to cephalosporins - Low risk of endocarditis (for definitions see section 3.4)

Vascular Surgery

- Give **Vancomycin** 1g IV infused over 100 minutes, start infusion before leaving ward, aiming to complete the infusion around the time of incision, and **Gentamicin** 2mg/kg IV as a single dose on induction.

Lower GI or appendectomy (if indicated in 4.1.1)

- Give **Gentamicin** 2mg/kg IV and **Metronidazole** 500mg IV – single dose of each on induction.

Biliary or Upper GI surgery (if indicated in 4.1.1)

- Give **Gentamicin** 2mg/kg IV– as a single dose on induction.

4.2 Regimens for patients at moderate/high risk of endocarditis (for definitions see section 3.4)

4.2.1 Penicillin based standard regimens- for patient who are not allergic to penicillin and have not received a penicillin in last 14 days/ currently on a penicillin

Vascular, Hernia, Laparoscopy/Laparotomy without mucosa breech
Endocarditis prophylaxis not required, use low risk guidance above (**4.1.1**and **4.1.2**)

Operations involving intestinal mucosa

- **Co-amoxiclav** 1.2g IV plus **Gentamicin** 2mg/kg IV

Operations involving the hepato-biliary system

- **Amoxicillin** 1g IV plus **Gentamicin** 2mg/kg IV

4.2.2 Alternative regimens for patients at risk of endocarditis (for definitions see table 3) and are allergic to penicillin or received a penicillin in last 14 days or currently on a penicillin

Upper GI or hepato-biliary system

- **Teicoplanin** 400mg IV plus **Gentamicin** 2mg/kg IV single dose of each given on induction.

Lower GI

- **Teicoplanin** 400mg IV plus **Gentamicin** 2mg/kg IV plus **Metronidazole** 500mg IV single dose of each given on induction.

5.1 Summary Table for General Surgery Antibiotic Prophylaxis Regimens in patients at low risk of endocarditis.

	Low risk of endocarditis (for definitions see table 4)	
Surgery	**Standard Regimen (Inc. non-severe penicillin allergy eg rash only)**	**Severe allergy to penicillins/allergy to cephalosporins**
Laparoscopy/Laparotomy without mucosa breech	None Doses may be given if operation uncovers inflammation.	None Doses may be given if operation uncovers inflammation.
Hernia repair, with or without mesh Standard regimen	None	None
Hernia repair, with or without mesh *If immunosuppressed/ or taking immunosuppressant drugs (inc. systemic corticosteroids):*	Cefuroxime 1.5g IV PLUS Metronidazole 500 mg IV at induction	Gentamicin 2mg/kg IV PLUS Metronidazole 500mg IV at induction.
Laparoscopic cholecystectomy Standard regimen	None. If significant bile spillage or conversion to laparotomy give a single dose of Cefuroxime 1.5g IV on occurrence	None If significant bile spillage or conversion to laparotomy give a single dose of Gentamicin 2mg/kg immediately
Laparoscopic cholecystectomy High risk patients: *Intra-operative choloangiogram, acute cholocystitis/ pancreatitis, jaundice, pregnancy, immunosupression, insertion of prosthetic device (e.g. stent).*	Cefuroxime 1.5g IV at induction	Gentamicin 2mg/kg IV at induction
Other Biliary or Upper GI surgery	Cefuroxime 1.5g IV at induction	Gentamicin 2mg/kg IV at induction
Appendectomy or Lower GI If perforated appendix and/or peritonitis found give treatment antibiotics post-op for 2-5 days	Cefuroxime 1.5g IV PLUS Metronidazole 500 mg IV at induction.	Gentamicin 2mg/kg IV PLUS Metronidazole 500mg IV at induction.
Vascular Surgery low risk of MRSA[1]	Co-amoxiclav 1.2g IV at induction Mild penicillin allergy (no angioedema/ anaphylaxis/ immediate onset urticaria): Cefuroxime 1.5g IV PLUS Metronidazole 500 mg IV at induction.	Vancomycin 1g IV infused over 100 minutes, start infusion before leaving ward, aiming to complete the infusion around the time of incision, and Gentamicin 2mg/kg IV as a single dose on induction.
Vascular Surgery high risk of MRSA[1]	Add Gentamicin 2mg/kg IV at induction to low risk regimen above	Same as low MRSA risk regimen above
Further intraoperative doses: Re-dose with Cefuroxime 750mg IV or Co-amoxiclav 1.2g IV if operation lasts >4 hours or excessive blood loss >1500ml, redosing with gentamicin, teicoplanin or vancomycin not recommended.		
[1]**Pts at high risk MRSA:** Known colonisation with MRSA; Nursing home resident with long term leg ulcers, pressure sore or urinary catheter; or inpatient > 1 week.		

5.2 Summary Table for General Surgery Antibiotic Prophylaxis Regimens in patients at Moderate/High risk of endocarditis.

	Moderate/High risk of endocarditis (see table 4)	
Surgery	**Standard Regimen**	**Penicillin allergy/ received a penicillin in last 14 days or currently on a penicillin**
Laparoscopy/Laparotomy without mucosa breech	Same as low endocarditis risk regimen in section 5.1 above	Same as low endocarditis risk regimen in section 5.1 above
Hernia repair, with or without mesh Standard regimen	Same as low endocarditis risk regimen in section 5.1 above	Same as low endocarditis risk regimen in section 5.1 above
Hernia repair, with or without mesh *If immunosuppressed/ or taking immunosuppressant drugs (inc. systemic corticosteroids):*	Same as low endocarditis risk regimen in section 5.1 above	Same as low endocarditis risk regimen in section 5.1 above
Laparoscopic cholecystectomy Standard regimen	Amoxicillin 1g IV PLUS Gentamicin 2mg/kg IV at induction	Teicoplanin 400mg IV PLUS Gentamicin 2mg/kg IV
Laparoscopic cholecystectomy High risk patients: *Intra-operative choloangiogram, acute cholocystitis/ pancreatitis, jaundice, pregnancy, immunosupression, insertion of prosthetic device (e.g. stent).*	Amoxicillin 1g IV PLUS Gentamicin 2mg/kg IV at induction	Teicoplanin 400mg IV PLUS Gentamicin 2mg/kg IV
Other Biliary or Upper GI surgery	Amoxicillin 1g IV PLUS Gentamicin 2mg/kg IV at induction	Teicoplanin 400mg IV PLUS Gentamicin 2mg/kg IV at induction
Appendectomy If perforated appendix and/or peritonitis found give treatment antibiotics post-op for 2-5 days	Co-amoxiclav 1.2g IV PLUS Gentamicin 2mg/kg IV at induction	Teicoplanin 400mg IV PLUS Gentamicin 2mg/kg IV PLUS Metronidazole 500mg IV at induction
Other Lower GI	Co-amoxiclav 1.2g IV PLUS Gentamicin 2mg/kg IV at induction	Teicoplanin 400mg IV PLUS Gentamicin 2mg/kg IV PLUS Metronidazole 500mg IV at induction
Vascular Surgery low risk of MRSA[1]	Co-amoxiclav 1.2g IV PLUS Gentamicin 2mg/kg IV at induction	Teicoplanin 400mg IV PLUS Gentamicin 2mg/kg IV PLUS Metronidazole 500mg IV at induction
Vascular Surgery high risk of MRSA[1]	Same as low endocarditis risk regimen in section 5.1 above	Same as low endocarditis risk regimen in section 5.1 above
Further intraoperative doses: Re-dose with Cefuroxime 750mg IV or Co-amoxiclav 1.2g IV if operation lasts >4 hours or excessive blood loss >1500ml, re-dosing with gentamicin, teicoplanin or vancomycin not recommended.		
[1]**Pts at high risk MRSA:** Known colonisation with MRSA; Nursing home resident with long term leg ulcers, pressure sore or urinary catheter; or inpatient > 1 week.		