Barts Health NHS
NHS Trust

Newham University Hospital

POLICY/GUIDELINE TITLE:

Empiric Antibiotic Guideline for Adult Inpatients

Author/Lead	Microbiologists Antimicrobial Pharmacist
Consultation:	Antimicrobial Pharmacists Members of the Trust Infection Control Committee Members of the Trust Medicines Committee Certain clinical consultant specialists for specialist areas guidelines
Date of Last Review and Title of Document this replaces	November 2008
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Approval Date and Name of Committee/Group that has approved the document	12th April 2012 Medicines Committee
Distribution:	All adult wards within the Trust On Intranet Email link to all prescribing staff
Related Documents:	Trust Surgical Antibiotic Prophylaxis Guideline for Adults MRSA screening policy Neutropaenic sepsis policy Isolation Policy Medicines and food allergy policy

DOCUMENT REVISION RECORD

Version	Description of Change(s)	Reason for Change	Author & Group(s) approving change(s)	Date:
2	Change in name	More detail supplied rather than 'quick' guide	Consultant microbiologists Antimicrobial pharmacist	December 2011
2	Addition of a Table of Contents	Improve speed to access appropriate section of guideline	Consultant microbiologists Antimicrobial pharmacist	December 2011
2	Update contact details	Telephone numbers changed		December 2011
2	Addition of further option for treatment of Severe Community Acquired	Update of guidelines for Community Acquired pneumonia	Consultant microbiologists Antimicrobial pharmacist	December 2011

	pneumonia in patients being ventilated			
2	Change of treatment for pyelonephritis in penicillin allergic patients	Change in recommendations. Prevention of nephrotoxicity of long term aminoglycosides	Consultant microbiologists Antimicrobial pharmacist	December 2011
2	Change of treatment duration for acute prostatitis	According to revised guidelines	Consultant microbiologists Antimicrobial pharmacist	December 2011
2	Management of endocarditis	More detail for empiric treatment New draft BSAC Guidelines	Consultant microbiologists Antimicrobial pharmacist	December 2011
2	Management of cellulitis	More detail of empiric treatment Addition of a classification system for management	Consultant microbiologists Antimicrobial pharmacist	December 2011
2	Management of diabetic foot infection	Detail of empiric treatment Addition of a classification system for management	Consultant microbiologists Dr Sonibare Antimicrobial pharmacist	December 2011
2	Management of *Clostridium difficile* infection	Addition of a classification system for management	Consultant microbiologists Antimicrobial pharmacist	December 2011
2	Loading dose of vancomycin for severe MRSA infections	Under dosing of vancomycin has been shown to occur using standard dose regimens. Increase in MRSA strains with higher MICs to vancomycin	Consultant microbiologists Antimicrobial pharmacist	December 2011
2	Addition of (amoxicillin/clavulanic acid) detail to co-amoxiclav	To ensure all prescribers are aware that co-amoxiclav contains the penicillin amoxicillin	Consultant microbiologists Antimicrobial pharmacist	December 2011

Synopsis:

The following document provides a revised set of guidelines for prescribing antibiotics within Newham University Hospital NHS Trust. This updated version takes into account both local susceptibility patterns of infection as well as the need to reduce the number of patients developing antibiotic related *Clostridium difficile* infections. While any antibiotic can predispose to *Clostridium difficile* infection, the cephalosporins and quinolones are recognised as the major antibiotic risk groups.

General principles to be followed are:

short courses of antibiotics are preferable.

all intravenous antibiotics will continue to be reviewed at 48 hours for possible oral switch.

all prescriptions for antibiotics to be reviewed daily taking into account clinical picture and

relevant microbiological results.

Prescribers are expected to follow these guidelines and discuss with the antibiotic pharmacist

or microbiologist should deviations be clinically indicated.
This revised guidance will be closely monitored to ensure the use of antibiotics remains effective.

Aims & Objectives:
Effective and appropriate prescribing of antibiotics including indications and duration of therapy
Prevention of antibiotic associated diarrhoea
Prevention of incidents of antibiotic-related allergic reactions
Prevention of antimicrobial resistance

Who the policy/guideline applies to/is relevant to:
All clinical staff who prescribe and administer antibiotics to adults.

Training implications:
Antimicrobial training is provided by the Trust microbiologist and Antimicrobial pharmacist.

Equipment:
A hard copy of this policy will be available on each clinical area.
Policy available on the Trust intranet.
New medication chart with separate section for antimicrobial prescribing.

Outcome measures: Process for Audit / Monitoring Compliance

What is monitored	How is it monitored and frequency	Responsibility	Where are the results reported	Who monitors outcomes/ recommendations
All elements of the antibiotic prescribing guideline	***Quarterly audit of all wards***	***Antimicrobial Pharmacists***	***Hospital Infection Control Committee*** ***Business unit governance meetings*** ***Quality report*** ***Infection Control Dashboard***	***Antimicrobial pharmacists*** ***Microbiologists***

Appropriate use:

For all adult patients receiving antibiotics in the trust

Inappropriate use:

Paediatric patients Parts of the policy do not apply to patients being discharged from A&E who are not to be admitted. (see separate guideline).

What to do if policy is not followed by others:

- Education of clinical staff involved
- Completion of an incident form if required
- Feedback to relevant governance group
- Ongoing monitoring of adherence
- Regular review of policy

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CONTACT LIST WORKING HOURS (9.30am –5.30pm)	
MICROBIOLOGY	
Microbiology Specialist Registrar	07887 856174
Dr. Peter Wilson Consultant Microbiologist	mobile via switchboard or via secretary RLH ext 60333
Dr Caryn Rosmarin Consultant Microbiologist/Infection Control	Ext. 8241 or mobile via switchboard
Microbiology Results line	020 3246 0316
Microbiology Laboratory **NB:** **ALWAYS TELEPHONE THE LAB WHEN SENDING AN URGENT SPECIMEN**	020 3246 0316/8
INFECTION CONTROL	
Infection Control Nurses/Practitioners	Ext. 5653/ 8930/ 8840 Bleeps 273 & 275
PHARMACY	
Antibiotic pharmacist	Bleep 026
VIROLOGY	
Virology Office Specialist Registrar Consultant	0203 246 0293/1097 (based at Royal London) Bleep 0184 (based at Royal London) via RLH switchboard
PUBLIC HEALTH	
Health Protection Unit – HPU - for notifiable diseases North East and Central	020 7811 7100
OUT OF HOURS (includes weekends, Bank holidays and 5.30 pm – 9.30 am on weekdays) **CONTACT ON-CALL STAFF THROUGH THE NEWHAM SWITCHBOARD**	
Microbiology & Infection Control advice	On-call Microbiology Specialist Registrar
all Laboratory investigations **ALWAYS call to process URGENT out-of-hours specimens**	Duty BMS (BioMedical Scientist) Microbiology or Virology
Virology Clinical advice	On-call Virologist
Public Health queries or notifications	07623 541 417

GENERAL PRINCIPLES ON ANTIBIOTIC CHOICE IN ADULT INPATIENTS

- Always discuss with microbiologist or antimicrobial pharmacist if unsure
- Doses may need to be adjusted in renal or liver impairment – discuss with pharmacy
- Ensure microbiology samples are taken prior to starting antibiotics when feasible
- Always rationalise antibiotics according to M,C&S results if available
- Consider iv to oral switch as soon as possible
- ALWAYS DOCUMENT ALLERGIES ON DRUG CHART PRIOR TO PRESCRIBING

Guidance for confirmed or suspected penicillin allergy

True IgE dependent penicillin allergy is rare (0.05%), but serious (5-10% mortality). There is no apparent association between true penicillin allergy and atopy. Features of this severe penicillin allergy include those of an **anaphylactic** reaction e.g. **bronchospasm**, **urticaria**, **oedema**, **hypotension.** In such cases DO NOT prescribe penicillins. All antibiotics containing penicillin are highlighted in **RED** in the policy for ease of identification.

Other β-lactams (cephalosporins and/or carbapenems) should be avoided in patients with a true severe penicillin allergy unless their benefit clearly outweighs the risk (i.e. life-threatening infection with no other adequate alternative), and only after discussion with microbiology. This is due to the fact that approximately 10% of these patients will have a cross-allergy to the other β -lactams. These other β -lactams are highlighted as **ORANGE** in the policy.

Milder forms of 'allergy' usually involve a mild rash in about 1-10% of patients. 85% of patients who report this type of penicillin allergy can tolerate it if given again. It is therefore important to record the type of allergic response as rash only or anaphylaxis. This may be important in future use for potentially life threatening conditions.

Antibiotics that are safe to use are highlighted in **GREEN**.

Reminder of definitions of sepsis

SEPSIS

high suspicion of, or proven **infection**

AND

2 or more of the following **SIRS** (systemic inflammatory response syndrome) **criteria**:

1. Heart rate > 90 beats/min
2. Temperature < 36 °C or > 38 °C
3. Respiratory rate > 20 breaths/min or, PaCO2 less than 4.3Kpa
4. White blood cell count < 4 x109 or > 12 x109 cells/L, or > 10% band forms

SEVERE SEPSIS

Sepsis (according to above definition)

Plus

acute organ dysfunction &/or hypotension

SEPTIC SHOCK

severe sepsis despite adequate fluid resuscitation

Respiratory Tract Infections

1. Community acquired pneumonia (CAP)

Aetiology: Commonly *Strep pneumoniae*, *Haemophilus influenzae.* More rarely *Mycoplasma pneumoniae*, *Legionella* spp, *Chlamydia* spp, *Coxiella burnetii.* Also consider *Staph aureus* if recent influenza infection; *TB* if no response to treatment or in at risk group.

Diagnosis based on **clinical** & **x-ray signs**

The BTS guidelines define CAP as:
- Acute lower respiratory symptoms
- New focal chest signs and, if in hospital, new CXR changes
- ≥ 1 systemic feature (fever, shivers, aches and pains or temperature ≥ 38°C)
- No other explanation for illness

Send sputum for M,C&S, urine for pneumococcal Ag & blood cultures before starting antibiotics.
The objective should be to confirm a diagnosis of pneumonia with chest radiography and initiate antibiotic therapy for the majority of patients with CAP within 4 h of presentation to hospital.

Initial **Treatment** based on severity and risk factors. One of the commonly used severity scores based on core poor prognostic features is **CURB65** score **(1 point for each feature)**

Confusion (Mental Test Score of 8 or less, or new disorientation for person, place or time)
Urea > 7mmol/L
Respiratory rate ≥30 breaths/min
Blood pressure systolic < 90 mmHg or diastolic ≤ 60 mmHg
Age ≥ **65** Years

ALWAYS DOCUMENT SCORE IN PATIENT NOTES.
Patients with a **score of 0-1** should be managed as having **mild** CAP and may be managed with oral antibiotics.
Patients with a **score of 2** should be managed as having **moderate** CAP and should receive iv antibiotics initially.
Patients with a **score of 3 or more** should be managed as having **severe** CAP.
If CURB-65 of 4-5 Consider **ITU**
Please note: CURB65 is a guide and may not be applicable for all patients e.g. young patients presenting with pneumonia. This score may not be relevant in patients incapable of mounting an adequate host response to infection.

Other adverse prognostic features to note include:
1. Presence of co-existing disease
2. Hypoxaemia (SaO2 <92% or PaO2 <8 kPa) regardless of FiO2
3. Bilateral or multi-lobar involvement on the chest radiograph

Treatment:

Mild/Moderate CAP

Amoxicillin 1g tds po /iv
+ **Clarithromycin** 500mg bd po /iv

PENICILLIN ALLERGY
Clarithromycin 500mg bd po /iv

Severe CAP

Benzyl Penicillin 1.2g qds iv + **Clarithromycin** 500mg bd iv
OR
(ONLY if known COPD/ Chronic lung disease/ Recent course of amoxicillin)
Co-amoxiclav (amoxicillin/clavulanic acid) 1.2g tds iv
+ **Clarithromycin** 500mg bd po/iv

PENICILLIN ALLERGY
Vancomycin iv (for dose see TDM chart) + **Clarithromycin** 500mg bd iv
OR
Restricted to intubated patients or those on non-invasive assisted ventilation (NIV).
Levofloxacin 500mg bd iv
For other patients, discuss with microbiology

Switch to oral when clinical improvement and apyrexial >48 hours. (If on iv **Benzyl Penicillin or** iv **Amoxicillin** switch to oral **Amoxicillin** 1g tds po when clinically indicated)

Duration of therapy:

5-10 days depending on severity and response
14-21 days therapy for pneumonia caused by *Legionella*, *Mycoplasma* or *Chlamydia*

The antibiotic policy for the treatment of CAP at NUHT differs from the BTS guidelines because of the local need to minimise the risk of *Clostridium difficile* infection by avoiding the routine use of cephalosporins and quinolones which are major risk factors for *Clostridium difficile* infection (CDI). This strategy is endorsed by the BSAC. These drugs may still be prescribed for certain patients after discussion with microbiology.

Weblinks: http://www.brit-thoracic.org.uk/Portals/0/Clinical%20Information/Pneumonia/Guidelines/CAPGuideline-full.pdf
http://jac.oxfordjournals.org/content/64/6/1123.full

2. Hospital acquired pneumonia (HAP)

Aetiology: As for CAP **plus** Gram negative and multi-resistant organisms (eg. MRSA, ESBLs)

Diagnosis based on **clinical** & **x-ray signs.**

Send sputum for M,C&S, urine for pneumococcal Ag & blood cultures before starting antibiotics.

Initial **Treatment** should be based on recent microbiology results (if present) and recent antibiotic courses. Discuss with microbiology if either of these are present. If neither of these is present, or unknown, treat as follows:

Treatment:

Tazocin (**Piperacillin + tazobactam**) 4.5g tds iv

If previous or current **MRSA** in nose, throat or sputum
ADD Vancomycin iv (for dose see TDM chart)

PENICILLIN ALLERGY
Discuss with microbiology
Vancomycin iv stat (for dose see TDM chart)
PLUS Gentamicin 5mg/kg iv stat

Duration of therapy: 5-10 days depending on severity and response

3. Aspiration pneumonia

Aetiology: Aspiration may cause an initial chemical pneumonitis rather than infective pneumonia. Common infective agents are oral flora including anaerobes.

Diagnosis based on **clinical evidence of aspiration** & **x-ray signs**

Treatment:

Add Metronidazole 500mg tds iv (or 400mg tds po) to antibiotics for additional anaerobic cover

This is NOT necessary to add if patient is on **Co-amoxiclav** **or** **Tazocin** **which provide good anaerobic cover**

4. Infective Exacerbation of COPD

(for treatment of pneumonia in a patient with COPD, refer to CAP or HAP guideline above)
Aetiology: Commonly viral, *Haemophilus influenza, Chlamydia pneumonia*, *Moraxella catarrhalis, Strep pneumoniae*

Diagnosis:
Send sputum for respiratory virus PCR, M,C&S, urine for pneumococcal Ag before starting antibiotics.

Treatment:
Antibiotics have been shown to be effective **ONLY** if there is a history of at least 2 of the following**:**
- increased dyspnoea
- increased sputum purulence
- increased sputum volume

The role of antibiotic therapy is debated even for severe disease (NEJM 359:2355,2008)

1st line:

Doxycycline 200mg po stat then 100mg daily po

2nd line:

Amoxicillin 500mg tds po
Or
Clarithromycin 500mg bd po

Use a different class of antibiotic if a recent course of 1st line in the previous 3 months

Duration of therapy: 5 days

Weblink: http://www.nice.org.uk/nicemedia/pdf/CG012_niceguideline.pdf

Genito - Urinary Tract Infections

1. Lower Urinary Tract Infection (UTI)

Aetiology: Commonly *E.coli*, other coliforms, enterococci, *Staph saprophyticus* (young women)

Diagnosis: Use urine dipstick to exclude UTI: -ve nitrite and leucocyte 95% predictive value.
Collect MSU/CSU specimen before starting antibiotics. Also take blood cultures if ↑ temp/systemically unwell.
Recurrent UTI: consider urology referral; for men - refer after single UTI.

All catheters become colonised with bacteria. A positive urine dipstick or the presence of an organism in a catheter specimen of urine is not an indication for treatment in the absence of evidence of clinical infection eg ↑ temp, WCC or CRP. **Consider catheter removal as soon as possible to avoid this becoming a source of infection**.

Treatment:

Men/ Non-pregnant: 1st Line:

Nitrofurantoin MR 100mg bd po
(if renal impairment use 2nd line or contact microbiology)

2nd Line:

Trimethoprim 200mg bd po (if no previous antibiotic treatment)
OR
Gentamicin 2-3mg/kg od iv

Pregnant: 1st Line

Cephalexin 500mg bd po

2nd Line:

SEVERE PENICILLIN ALLERGY
Nitrofurantoin MR 100mg bd po **(NOT in last trimester)**
OR
Trimethoprim 200mg bd po **(NOT in first trimester)**

Urinary Catheter in-situ:

Gentamicin 2-3mg/kg od iv
When **changing catheter in the presence of a UTI**, give the **Gentamicin** dose 30 minutes before removal.
If **MRSA** present in the urine **ADD Teicoplanin** 400mg iv STAT

If evidence of severe sepsis

ADD Gentamicin 5-7mg/kg iv STAT. (**If already using Gentamicin as primary agent to treat to UTI, use this higher dose for the initial STAT dose.) If further doses required monitor levels**.

The incidence of Multi-resistant Gram negatives with ESBLs is increasing especially in elderly patients with recurrent UTIs and indwelling catheters - discuss with Microbiologist if evidence of increasing sepsis or multi-resistant antibiotic pattern on previous isolates.

Always rationalise antibiotics according to urine M, C & S results.
For asymptomatic bacteriuria: Treat only if pregnant or if having urogenital surgery.

Long term prophylactic antibiotics for UTIs to be prescribed only after approval of microbiologist.

Duration of treatment: 7 days in pregnancy or men; 3 days in non-pregnant women (5 days if using nitrofurantoin)

2. Upper Urinary Tract Infection (Pyelonephritis)

Aetiology: Commonly *E.coli*, other coliforms, enterococci, *Staph saprophyticus* (young women)

Diagnosis: Use urine dipstick to exclude UTI: -ve nitrite and leucocyte 95% predictive value.
Collect MSU/CSU specimen before starting antibiotics. Also take blood cultures if ↑ temp/systemically unwell.
Recurrent UTI: consider urology referral; for men - refer after single UTI.

Treatment:

Co-amoxiclav 1.2g tds iv
(**amoxicillin/clavulanic acid**)

PENICILLIN ALLERGY
Gentamicin 3-5mg/kg iv stat and contact Microbiology

If evidence of severe sepsis or indwelling urinary catheter

ADD Gentamicin 5-7mg/kg iv STAT. **If already using Gentamicin as primary agent to treat to UTI, use this higher dose for the initial stat dose. If further doses required monitor levels**.

Always rationalise antibiotics according to urine and blood culture M, C&S results.
Switch to oral when apyrexial >48 hours.
If still pyrexial after 48 hours, consider renal ultrasound to exclude renal abscess or stones.

Duration of therapy:
If uncomplicated, 10-14 days. **If complicated**, discuss with microbiology

Weblink: http://cid.oxfordjournals.org/content/29/4/745.full.pdf

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3. Acute Prostatitis

Aetiology: coliforms, enterococci, *Staph aureus* and rarely anaerobes. Also, if sexually active, *Neisseria gonorrhoea* and *Chlamydia trachomatis*

Diagnosis: It is essential to take an **MSU/CSU and Blood Cultures before starting antibiotics** to guide treatment.

If sexually active and gonorrhoeal or chlamydial infection is possible, refer to Sexual Health immediately wherever possible. They will take the appropriate microbiology specimens and carry out contact tracing. If out-of-hours and gonorrhoeal or chlamydial infection is possible: take midstream urine for routine culture, a urethral swab for gonorrhoea and take a special urethral swab (+diluent) for Chlamydia.

Prostatic massage should not be performed on patients with acute bacterial prostatitis. This may be painful, can precipitate bacteraemia, and is likely to be of little benefit as pathogens are almost always isolated from urine.

Treatment:

Ciprofloxacin 500mg bd po

If evidence of severe sepsis

Consider adding **Gentamicin 5mg/kg iv**

Duration of therapy: 28 days
Refer any case of acute prostatitis to Urology immediately if any evidence of severe sepsis; inadequate response to antibiotics; pre-existing urological conditions or acute urinary retention. All men after recovery should be referred to urology for investigation of their urinary tract to exclude structural abnormality.
Chronic cases should always be managed by Urology or Sexual Health.

Weblink: http://www.bashh.org/guidelines

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4. Acute Epididymo-orchitis

Aetiology: Commonly coliforms. Also, if sexually active, *Neisseria gonorrhoea* and *Chlamydia trachomatis*

Diagnosis: A sexually transmitted cause should always be excluded.
Refer to Sexual Health immediately if sexually active. They will take the appropriate specimens and do contact tracing.
If out-of-hours: Take midstream **urine for routine culture, a urethral swab for gonorrhoea and a first pass urine for Chlamydia, and then start treatment.**
When considering mumps as a possible diagnosis, mumps IgM/IgG serology should be checked.

Treatment:

If sexually active:

Ceftriaxone 2g od iv
Plus
Doxycycline 100mg bd po

If not sexually active or clinical picture suggests coliform more likely (eg urinary catheter in site, BPH with recurrent UTIs)

Ciprofloxacin 500mg bd po

SEVERE PENICILLIN ALLERGY
Ciprofloxacin 500mg bd po
Plus
Doxycycline 100mg bd po
AND discuss with sexual health as high incidence of Ciprofloxacin resistant *Neisseria gonorrhoea*

Duration of therapy: 10-14 days. **Intravenous therapy should be continued until 24 hours after clinical improvement and then switched to oral.** Refer all severe, complicated or chronic cases to Urology.
Weblink: http://www.bashh.org/guidelines

5. Pelvic Inflammatory Disease (includes endometritis, oophoritis, salpingitis)

Aetiology: *Neisseria gonorrhoea, Chlamydia trachomatis*, anaerobes and others. Infection is often polymicrobial with mixed aerobic and anaerobic genital flora.

Diagnosis: A sexually transmitted cause should always be excluded.
Refer to Sexual Health immediately wherever possible if sexually active. They will take the appropriate microbiology specimens and do the contact tracing.
If out-of-hours: Take midstream **urine for routine culture, a urethral swab for gonorrhoea and a first pass urine for Chlamydia, and then start treatment.**

Treatment:

NON-PREGNANT:

Ceftriaxone 2g od iv **Plus** **Doxycycline** 100mg bd po **Plus** **Metronidazole** 400mg bd po/ 500mg bd iv	**SEVERE PENICILLIN ALLERGY** **Clindamycin** 900mg tds iv **Plus** **Gentamicin** 5-7mg/kg od iv **followed by** **Clindamycin** 450mg qds po **OR** **Doxycycline** 100mg bd po **plus** **Metronidazole** 400mg bd po **AND discuss with sexual health as high incidence of Ciprofloxacin resistant *Neisseria gonorrhoea***

PREGNANT:
PID in pregnancy is associated with an increase in both maternal and fetal morbidity. Parenteral therapy is advised although none of the suggested evidence based regimens are of proven safety.

Ceftriaxone 2g od iv **Plus** **Erythromycin** 500mg bd po **Plus minus (only if clinically severe case)** **Metronidazole** 400mg bd po	**SEVERE PENICILLIN ALLERGY** **Discuss with sexual health or microbiology**

Refer severe PID as a gynaecological emergency. Refer mild/moderate cases to Gynaecology if no real response to antibiotics after 3 days or if condition worsens.
Consider removal of an intra uterine contraceptive device in a woman with a diagnosis of PID.
In women at high risk of gonococcal PID, use of a Ceftriaxone-based regimen is preferred to the Quinolone-based regimen because of increasing gonococcal resistance to quinolones in the UK.

Duration of therapy: 14 days. **Intravenous therapy should be continued until 24 hours after clinical improvement and then switched to oral.**

Weblink: http://www.bashh.org/guidelines

6. Bartholin's abscess

Aetiology: Infection is most often polymicrobial with mixed aerobic and anaerobic genital flora. *Neisseria gonorrhoea & Chlamydia trachomatis* in sexually active women.

Diagnosis: A sexually transmitted cause should always be excluded.
Refer to Sexual Health immediately wherever possible if sexually active. They will take the appropriate microbiology specimens and do the contact tracing.
If out-of-hours: Take **midstream urine for routine culture, a urethral swab for gonorrhoea and a first pass urine for Chlamydia, and then start treatment.**

Treatment:
Drainage of abscess should always be considered, and may be sufficient to treat infection without need for antibiotics

Co-amoxiclav 1.2g tds iv (**amoxicillin/clavulanic acid**)	**PENICILLIN ALLERGY** **Discuss with microbiology**

Ref. Journal of Obstetrics & Gynaecology, 2010, Vol. 30, No. 7 : Pages 701-703

Cardiovascular infections

1. Infective Endocarditis (IE)

These guidelines are for **EMPIRICAL** treatment only. Treatment should be tailored to a positive culture result if available**. ALL cases to be discussed with microbiology.**

Aetiology: Depends on risk factors for each individual patient. Commonly for native valve endocarditis, oral streptococci, *Staph aureus (*including MRSA*)*, enterococci, less commonly *Coxiella burnetii* (Q fever).

Diagnosis: This is based on suspicion in patients with a fever, murmur, embolic phenomena, peripheral signs and risk factors. The likelihood of IE is assessed using the Modified Dukes Criteria (see below)

IT IS VITAL TO TAKE 2-3 SETS OF OPTIMALLY FILLED (10ml per set) PERIPHERAL BLOOD CULTURES USING METICULOUS ASEPTIC TECHNIQUE BEFORE STARTING ANTIBIOTICS.
IF PATIENT STABLE TAKE 3 SETS WITH AT LEAST 6 HOURS BETWEEN EACH SET. IF PATIENT ACUTELY UNWELL TAKE 2 SETS AN HOUR APART TO PREVENT DELAY IN STARTING ANTIBIOTICS.

Modified Dukes Criteria for diagnosis of Infective endocarditis
Definite diagnosis: 2 major criteria OR 1 major and 3 minor; OR 5 minor criteria
Possible diagnosis: 1 major and 1 minor; OR 3 minor

Criterion	Diagnostic	Type
Major criteria		
Positive blood culture for infective endocarditis	typical microorganism consistent with IE from two separate blood cultures	viridans streptococci, *Streptococcus bovis* or HACEK group,
		OR community-acquired *S. aureus* or enterococci, in the absence of a primary focus
	OR microorganisms consistent with IE from persistently positive blood cultures, defined as:	two positive cultures of blood samples drawn >12 h apart **OR**
		OR all of three or a majority of four separate cultures of blood (with first and last sample drawn 1 h apart)
		OR a single positive blood culture for *C. burnetii*; or antiphase I IgG antibody titre >1:800
Evidence of **endocardial involvement**	positive echocardiogram for IE	oscillating intracardiac mass on valve or supporting structures, in the path of regurgitant jets, or on implanted material in the absence of an alternative anatomic explanation,
		OR abscess,
		OR new partial dehiscence of prosthetic valve
	OR new valve regurgitation (worsening or changing of pre-existing murmur not sufficient)	
Minor criteria		
Predisposition		predisposing heart condition, previous endocarditis or intravenous drug use
Fever		temperature >38.0°C (100.4°F)
Vascular phenomena		major arterial emboli, septic pulmonary infarcts, mycotic aneurysm, intracranial haemorrhage, conjunctival haemorrhages and Janeway lesions
Immunological phenomena		glomerulonephritis, Osler's nodes, Roth spots and rheumatoid factor
Microbiological phenomena		positive blood culture but does not meet a major criterion as noted above or serological evidence of active infection with

Criterion	Diagnostic	Type
		organism consistent with IE
PCR		broad-range PCR of 16S
Echocardiographic findings		consistent with IE but do not meet a major criterion as noted above

Treatment:

Acute Presentation

Benzyl Penicillin 1.2g 4hrly iv
Plus
Flucloxacillin 2g 4hrly iv (if <85kg use 6hrly)
Plus
Gentamicin 1mg/kg 12hrly iv (for dose adjustment see TDM chart)

Indolent Presentation

Amoxicillin 2g 4hrly iv (if <85kg use 6hrly)
Plus
Gentamicin 1mg/kg 12hrly iv (for dose adjustment see TDM chart)

Penicillin Allergy / Prosthetic Intra-cardiac Device / High Risk for, previously or currently MRSA positive

Vancomycin loading dose 25mg/kg iv infused slowly at a rate of 500mg/hour. Continue with further doses as per TDM chart
Plus
Rifampicin 600mg bd po
Plus
Gentamicin 1mg/kg 8-12hrly iv (for dose adjustment see TDM chart)

The management of infective endocarditis requires close liaison between the Microbiologists, Cardiologists and, where appropriate, Cardiothoracic surgeons. Early surgical consultation is particularly important in prosthetic valve endocarditis or if any signs of cardiac failure.

Duration of therapy: Length of treatment will depend on the organism responsible, its susceptibility, clinical scenario and the response to treatment.

Weblinks:
http://jac.oxfordjournals.org/content/54/6/971.full.pdf
http://www.journals.uchicago.edu/doi/pdf/10.1086/313753
http://www.bsac.org.uk/Resources/BSAC/Endocarditis%2011.pdf
http://jac.oxfordjournals.org/content/early/2011/12/02/jac.dkr450/T1.expansion.html

Central Nervous System Infections

1. Acute Meningitis

Aetiology: Depends on age and risk factors for each individual patient. In adults, commonly *Strep pneumoniae*, *Neisseria meningitides*, *Haemophilus influenzae, enteroviruses*. Less commonly *Listeria monocytogenes, Herpes* viruses, TB. With underlying immune compromise *Cryptococcus neoformans*.

Diagnosis: The exact aetiology of many cases of meningitis (acute bacterial/TB/viral/fungal) is frequently uncertain when initial investigations are undertaken. Therefore it is advisable to take the following samples:

Acute bacterial meningitis: CSF for URGENT M,C & S
CSF for glucose & protein (Blood glucose (taken at the same time as CSF glucose))
Blood culture
Urine for Pneumococcal antigen
Throat swab for meningococcal culture
EDTA sample (2.5-5ml) for meningococcal PCR
Serum for meningococcal serology (acute & convalescent)

If TB meningitis suspected, also send: CSF for TB culture (AFB stain will be done but has a poor sensitivity)
Samples from other sites eg sputum, as appropriate

If viral meningitis/encephalitis suspected, also send: CSF for viral PCR
Throat swab (**using viral swab**) for viral PCR
Stool specimen for viral PCR

If cryptococcal meningitis suspected, also send: CSF for cryptococcal antigen (CRAG)
Serum for cryptococcal antigen (CRAG) if CSF not taken

Treatment:

1st Line

Ceftriaxone 2g bd iv

If pregnant, elderly or immune compromised

Add Amoxicillin 2g 4hrly iv

SEVERE PENICILLIN ALLERGY
Vancomycin 1g bd iv (for dose adjustment see chart)
Plus
Chloramphenicol 12.5mg/kg qds iv (max dose 4g/day)
contra-indicated in 3rd trimester of pregnancy
DISCUSS WITH MICROBIOLOGY

If viral infection unlikely, and no signs of meningococcal disease present

Add Dexamethasone 0.15mg/kg qds iv for 4 days
First dose must be given 15-20 minutes before, or latest with, the first dose of antibiotic

If viral encephalitis or herpes virus meningitis suspected

Add Acyclovir 10mg/kg tds iv
Can be stopped if viral PCR negative

Always seek microbiological advice at the earliest opportunity but do not delay treatment.
Also discuss with Virology if appropriate.

Notify all cases of suspected or confirmed meningitis to Public Health as soon as possible.

Duration: Depends on aetiological agent *Strep pneumoniae* 10-14 days / *Neisseria meningitides* 5-7 days / *Haemophilus influenzae* 7-10 days / *Listeria monocytogenes* 21 days / Herpes virus encephalitis 14-21 days

Weblink: http://www.hpa.org.uk/web/HPAwebFile/HPAweb_C/1194947389261
NEJM 347:1549 & 1613, 2002; NEJM 357:2431 & 2441, 2007; LnID 4:139, 2004

2. Acute Encephalitis

Aetiology: Depends on age and risk factors for each individual patient. Commonly *Herpes* viruses, including HSV and VZV. Imported infections eg West Nile, Japanese B and tick-borne viruses. With underlying immune compromise *Cryptococcus neoformans*. Non infectious causes should also be sought.

Diagnosis: Investigate as for acute meningitis above. **Discuss with Virologist and Microbiologist**.
MRI or CT head essential. Travel, recreational and occupational history essential.

Treatment: Treat as for acute meningitis/encephalitis above until CSF and MRI/CT results available
Notify all cases of suspected or confirmed encephalitis of any infective cause to Public Health

Skin and Soft Tissue Infections

1. Acute Cellulitis

Aetiology: Commonly Group A Strep, *Staph aureus* (including MRSA). Less commonly coliforms, anaerobes.

Diagnosis: **wound swab only if broken skin**
pus sample if abscess or blister
blood cultures if pyrexial and for severity class III and IV.
CRP is useful as a normal level almost always excludes cellulites as a diagnosis.

This is usually made on clinical grounds based on the following **typical** features:
acute and progressive onset.
red, painful, hot, swollen and **tender** area of skin.
Fever
The **leg is the commonest site**
portal of entry may or may not be present, for example, a wound, an ulcer.

Bilateral leg cellulitis is extremely rare.
The **absence of typical clinical features** should make one think of **other differential diagnoses** eg lower leg eczema, oedema with blisters, deep venous thrombosis (DVT), thrombophlebitis and vasculitis

Necrotizing fasciitis (NF) is a rapidly progressive, destructive soft tissue infection involving subcutaneous tissue and fascia. **Skin may initially be spared** and **presenting signs of NF are often non-specific and may resemble cellulitis**. NF is **rare** but has a **high mortality** (±50%). it is essential to avoid delay in appropriate treatment with antibiotics and **urgent surgical exploration and debridement**.

Classification of severity of cellulitis (modified Enron classification)

Class I:	**N**o recorded significant co-morbidities (eg. peripheral vascular disease, chronic venous insufficiency, morbid obesity) No signs of sepsis
Class II:	**D**ocumentation of 1 or more significant co-morbidities (eg. peripheral vascular disease, chronic venous insufficiency, morbid obesity) No signs sepsis
Class III:	**S**igns of Sepsis **No** signs of severe sepsis or septic shock
Class IV:	**S**igns of severe sepsis and/or septic shock **AND/OR** **R**apidly spreading cellulitis **AND/OR** **N**ecrotising fasciitis

Treatment:
Draw demarcation lines around the area of initial cellulitis to monitor progression of spread or resolution.

Mild (Class I)

Flucloxacillin 1g qds po	**PENICILLIN ALLERGY** **Clarithromycin** 500mg bd po	If **MRSA** colonised or previous MRSA infection **Discuss with microbiology** for oral options based on sensitivities

Moderate (Class II)

Flucloxacillin 1g qds po/iv	**PENICILLIN ALLERGY** **Clarithromycin** 500mg bd po/iv	If **MRSA** colonised or previous MRSA infection **Discuss with microbiology** for oral options based on sensitivities

Moderate (Class III)

Benzyl Penicillin 1.2g qds iv **Plus** **Flucloxacillin** 1-2g qds iv	**PENICILLIN ALLERGY** **Clarithromycin** 500mg bd iv **Or** **Clindamycin** 600-900mg tds iv	If MRSA colonised or previous MRSA infection **Vancomycin** 1g bd iv (for dose adjustment see TDM chart) **Plus** **Fusidic acid** 500mg tds po

Severe (Class IV) **URGENT SENIOR SURGICAL CONSULT REQUIRED**

a) Severe cellulitis/necrotising fasciitis (all sites except groin/scrotal/labial region (see b) below)

Benzyl Penicillin 1.2g qds iv **Plus** **Flucloxacillin** 2g qds iv **Plus** **Clindamycin** 1.2g qds iv	**PENICILLIN ALLERGY** **Vancomycin** 1g bd iv (for dose adjustment see TDM chart) **Plus** **Clindamycin** 1.2g qds iv	If **MRSA** colonised or previous MRSA infection **Vancomycin loading dose 25mg/kg iv infused slowly at a rate of 500mg/hour. Continue with further doses as per TDM chart** **Plus** **Fusidic acid** 500mg tds po **Plus** **Clindamycin** 1.2g qds iv

b) If involving groin/scrotal/labial region (Fournier's gangrene)
Antibiotic cover for coliforms and anaerobes should be included as follows

Tazocin 4.5g tds iv (**Piperacillin+tazobactam**) **Plus** **Clindamycin** 1.2g qds iv	**PENICILLIN ALLERGY** **Ciprofloxacin** 400mg bd iv **Plus** **Gentamicin** 5mg/kg od iv (for dose adjustment see TDM chart) **Plus** **Clindamycin** 1.2g qds iv	If **MRSA** colonised or previous MRSA infection **Vancomycin loading dose 25mg/kg iv infused slowly at a rate of 500mg/hour. Continue with further doses as per chart** **Plus** **Ciprofloxacin** 400mg bd iv **Plus** **Clindamycin** 1.2g qds iv

If signs of severe sepsis or septic shock

ADD Gentamicin 5mg/kg od iv (for dose adjustment see chart)

Cases of cellulitis require **isolation in a side room** for the first 48 hours on antibiotics, especially on surgical wards.

Duration: 7-10 days depending on severity and response. Discuss with microbiology.

Weblinks: http://jac.oxfordjournals.org/content/57/4/589.full
http://jac.oxfordjournals.org/content/66/2/387

2. Line related Infection (peripheral or central)

Aetiology: Commonly *Staph aureus* (including MRSA), other skin colonising bacteria. Less common coliforms, yeasts

Diagnosis:
Peripheral line: Remove line immediately. Resite if still necessary
Take line-site swab and blood cultures.
Central line: **Prompt assessment of line & discussion of risk/benefit of removal vs trial of antibiotics with microbiology.**
Take line site swab. Send line tip for culture when removed.
Take blood cultures through the line AND peripherally.

Treatment:
Peripheral cannulae should be re-sited routinely every 72 hours and their necessity reviewed on a daily basis.

Mild infection with no signs of sepsis

Flucloxacillin 1g qds po	**PENICILLIN ALLERGY** **Clarithromycin** 500mg bd po	If **MRSA** colonised or previous MRSA infection Discuss with microbiology for oral options

Moderate to severe infection with signs of sepsis

Flucloxacillin 1-2g qds iv	**PENICILLIN ALLERGY** **Vancomycin** 1g bd iv (for dose adjustment see TDM chart) **AND** discuss with microbiology	If **MRSA** colonised or previous MRSA infection **Vancomycin** 1g bd iv (for dose adjustment see TDM chart) **Plus** **Fusidic acid** 500mg tds po

If coliforms suspected (ITU, tunneled lines)

ADD Gentamicin 5mg/kg od iv (for dose adjustment see TDM chart)

Duration: 7-10 days depending on severity and response. Discuss with microbiology.

3. Infected diabetic foot ulcers and pressure sores

Refer to full Trust guideline for Antibiotic use in diabetic foot disease

Aetiology: Commonly,*Staph aureus*(including MRSA), β-haemolytic streps. Less common coliforms, anaerobes, pseudomonads

Diagnosis: A deep tissue sample for M,C&S is the gold standard. (Tissue biopsy or deep scraping from a cleaned wound or ulcer)
Pus for M,C&S aspirated from the base of a cleaned wound or ulcer
Swabs for M,C&S are not suitable specimens: no gram stain can be performed and false positives are common due to contamination with skin flora. These should be **avoided**!
Blood cultures if signs of systemic illness are present eg fever

Treatment: This is based on severity of infection (mild, moderate, severe), recent exposure to antibiotics, MRSA status and culture results (only if good deep tissue cultures)

	mild	moderate	severe
symptoms	• No signs of sepsis • Pus OR ≥2 signs of inflammation (erythema, pain, warmth, tenderness, induration) • Cellulitis ≤2cm around the ulcer • Infection limited to the skin or superficial tissues	• No signs of sepsis • Cellulitis >2cm around the ulcer • Infection spread beneath superficial subcutaneous tissues • Lymphangitic streaking • Deep tissue abscess • Gangrene • Involvement of muscle, tendon, bone or joint	• Any infection with a) Sepsis, **and/or** b) Metabolic instability (severe hyperglycaemia, azotaemia, acidosis) • Critical foot ischemia in the affected limb may make the infection severe
No Recent Antibiotics (within last 3 months)	1st line **Flucloxacillin** 1g qds po Penicillin Allergy **Clarithromycin** 500mg bd po **Or** **Clindamycin** 300-450mg qds po	1st line **Flucloxacillin** 1-2g qds po/iv **PLUS** **Amoxicillin** 1-2g tds po/iv (**Add Metronidazole** 400mg tds po / 500mg tds iv if signs of **gangrene, deep tissue infection or necrosis**) Alternative **Co-amoxiclav** (**amoxicillin**/ **clavulanic acid**) 625mg tds po/ 1.2g tds iv **Clindamycin** 450-600mg qds po/ iv Penicillin Allergy **Ciprofloxacin** 400mg bd iv **PLUS** **Clindamycin** 450-600mg qds po/ iv Additional (**Add Clindamycin** 1.2g qds iv (or substitute for **Metronidazole**) if **severe spreading cellulitis or gas gangrene** present)	1st line **Co-amoxiclav** 1.2g tds iv (**amoxicillin**/**clavulanic acid**) **PLUS** **Gentamicin** 5mg/kg stat iv if severe sepsis or septic shock Additional (**Add Clindamycin** 1.2g qds iv if **severe spreading cellulitis or gas gangrene** present) Penicillin Allergy **Ciprofloxacin** 400mg bd iv **PLUS** **Clindamycin** 450-900mg qds iv

History of recent antibiotic use	1st line **Co-amoxiclav** 625mg tds po (**amoxicillin/clavulanic acid**) Penicillin Allergy **Clarithromycin** 500mg bd po **PLUS** **Ciprofloxacin** 400mg bd po	1st line **Co-amoxiclav** 1.2g tds iv (**amoxicillin/clavulanic acid**) Penicillin Allergy **Ciprofloxacin** 400mg bd po/iv **PLUS** **Metronidazole** 400mg tds po or 500mg tds iv **PLUS** **Vancomycin** iv (for dose see chart) Additional (**Add Clindamycin** 1.2g qds iv (or substitute for **Metronidazole**) if **severe spreading cellulitis or gas gangrene** present)	1st line **Tazocin** 4.5g tds iv (**Piperacillin+tazobactam**) **PLUS** **Gentamicin** 5mg/kg stat iv if severe sepsis or septic shock Penicillin Allergy **Ciprofloxacin** 400mg bd iv **PLUS** **Vancomycin** iv (for dose see TDM chart) **PLUS** **Metronidazole** 500mg tds iv Additional (**Add Clindamycin** 1.2g qds iv (or substitute for **Metronidazole**) if **severe spreading cellulitis or gas gangrene** present)
for MRSA cover (either positive or high risk)	1st line **USE INSTEAD OF ABOVE** **Rifampicin** 600mg bd po **PLUS** one of the following -**Doxycycline** 100mg bd po **Or** -**Fusidic acid** 500mg tds po **Or** -**Trimethoprim** 100mg bd po (If history of previous antibiotic use **ADD Ciprofloxacin** 400mg bd po)	1st line USE **IN ADDITION** TO ABOVE **Vancomycin** iv (for dose see TDM chart) **PLUS** 2nd agent if osteomyeltis **Fusidic acid** 500mg tds po **Or** **Rifampicin** 600mg bd po Alternative **Linezolid*** 600mg bd po/iv **Or** **Rifampicin** 600mg bd po **PLUS** one of the following -**Doxycycline** 100mg bd po **Or** -**Fusidic acid** 500mg tds po **Or** -**Trimethoprim** 100mg bd po	1st line USE **IN ADDITION** TO ABOVE **Vancomycin loading dose 25mg/kg iv infused slowly at a rate of 500mg/hour. Continue with further doses as per chart** **PLUS** 2nd agent if osteomyeltis **Fusidic acid** 500mg tds po **Or** **Rifampicin** 600mg bd po Alternative **Linezolid*** 600mg bd iv
Duration of treatment	1-2 weeks initially 4-6 weeks minimum for osteomyelitis	2-4 weeks initially 4-6 weeks minimum for osteomyelitis	2-4 weeks initially 4-6 weeks minimum for osteomyelitis

Note: *Linezolid not licensed for prolonged used. Requires monitoring for toxicity.

Weblinks: http://publications.nice.org.uk/diabetic-foot-problems-cg119
Clin Infect Dis 39:885–910/ Clin Infect Dis 39(Suppl 2): S115–S22

4. Surgical wound infection

4.1 Following clean surgery:

Aetiology: *Staph aureus* (including MRSA), Group A Strep

Diagnosis: A deep tissue sample for M,C&S is the gold standard. (Tissue biopsy or deep scraping from a cleaned wound or ulcer)
Pus for M,C&S aspirated from the base of a cleaned wound or ulcer
Swabs for M,C&S are not suitable specimens: no gram stain can be performed and false positives are common due to contamination with skin flora. These should be **avoided**!
Blood cultures if signs of systemic illness are present eg fever

Treatment:
Surgical intervention i.e. debridement or drainage is more important than antibiotics

Mild infection with no signs of sepsis

Flucloxacillin 1g qds po	**PENICILLIN ALLERGY** **Clarithromycin** 500mg bd po **Or** **Doxycycline** 200mg od po	If **MRSA** colonised or previous MRSA infection **Vancomycin** 1g iv stat **AND** Discuss with microbiology for oral options

Moderate to severe infection with signs of sepsis

Flucloxacillin 1-2g qds iv **Plus** **Benzyl Penicillin** 1.2g qds iv	**PENICILLIN ALLERGY** **Vancomycin** 1g bd iv (for dose adjustment see TDM chart) **AND** discuss with microbiology for possible addition of second agent.	If **MRSA** colonised or previous MRSA infection **Vancomycin** 1g bd iv (for dose adjustment see TDM chart) **Plus** **Fusidic acid** 500mg tds po **AND** Discuss with microbiology

If rapidly spreading or patient showing signs of severe sepsis/septic shock

ADD Clindamycin 1.2g qds iv

Suspected and confirmed Group A Strep and MRSA cases require isolation in a **side room**

Duration: 7-14 days depending on severity and response. Discuss with microbiology.

4.2 Following contaminated surgery (eg Gastrointestinal or female genital tract surgery) OR contaminated penetrating traumatic injury:

Aetiology: *Staph aureus* (including MRSA), Group A Strep, coliforms, anaerobes

Diagnosis: A deep tissue sample for M,C&S is the gold standard. (Tissue biopsy or deep scraping from a cleaned wound or ulcer)
Pus for M,C&S aspirated from the base of a cleaned wound or ulcer
Swabs for M,C&S are not suitable specimens: no gram stain can be performed and false positives are common due to contamination with skin flora. These should be **avoided**!
Blood cultures if signs of systemic illness are present eg fever

Treatment:
Surgical intervention i.e. debridement or drainage is more important than antibiotics

Mild infection with no signs of sepsis

Co-amoxiclav 625mg tds po (**amoxicillin/clavulanic acid**)	**PENICILLIN ALLERGY** Discuss with microbiology

If MRSA colonized or previous MRSA infection

ADD Vancomycin 1g bd iv (for dose adjustment see TDM chart)

Moderate to severe infection with signs of sepsis

Co-amoxiclav 1.2d tds iv (**amoxicillin/clavulanic acid**)	**PENICILLIN ALLERGY** Discuss with microbiology

If MRSA colonized or previous MRSA infection

ADD Vancomycin 1g bd iv (for dose adjustment see TDM chart)

If signs of severe sepsis or septic shock

ADD Gentamicin 5mg/kg od iv (for dose adjustment see TDM chart)

Duration: 7-14 days depending on severity and response. Discuss with microbiology.
Suspected and confirmed Group A Strep and MRSA cases require isolation in a side room

5. Bites

Aetiology: Depends on animal. Includes Staphylococci, streptococci, anaerobes, *Pasteurella, Capnocytophgia*

Diagnosis: send deep wound swab only if broken skin, pus sample if pus present, blood cultures if pyrexial.

Treatment:
Debridement is an effective means of preventing infection. Removing devitalized tissue, particulate matter, and clots prevents these from becoming a source of infection.
Antibiotics not indicated if wound > 2 days old and no sign of infection

Co-amoxiclav 625mg tds po
(**amoxicillin**/**clavulanic acid**)

PENICILLIN ALLERGY
ANIMAL BITE
Doxycycline 100mg bd po **Plus** **Metronidazole** 400mg tds po

HUMAN BITE
Clarithromycin 500mg bd po **Plus** **Metronidazole** 400mg tds po

Consider **tetanus** prophylaxis for all wounds.
If animal bite occurred in country with endemic **rabies** discuss post-exposure prophylaxis with Virology urgently.
Human bites pose a risk of transmission of **blood-borne viruses**. Discuss with Virology as soon as possible

Bone and Joint Infections

1. Septic Arthritis

Aetiology: *Staph aureus* (including MRSA), streptococci, *Neisseria gonorrhoea* (if at risk for STDs), coliforms (if iatrogenic/IVDU/malignancy/immunosupression). Less commonly *Neisseria meningitidis, Salmonella* spp., *Brucella* spp. and *Mycobacterium tuberculosis*

Diagnosis: Send a **joint aspirate** for URGENT M,C&S of the synovial fluid. Request examination of joint fluid for AFBs & TB culture if TB suspected. Also send **blood cultures**.

Treatment:
Treatment requires both adequate **drainage** of purulent joint fluid and appropriate antibiotics. **Antibiotic treatment should only be started after blood cultures and a joint aspirate have been taken.**

If prosthetic joint infection, discuss with microbiology before starting any treatment. Appropriate antibiotic therapy is based on culture and sensitivity results from deep tissue samples and management often requires removal and revision of the prosthesis

If organisms are seen on the Gram stain, discuss treatment with Microbiology. If no organisms seen, treat empirically as follows.

Flucloxacillin 1-2g qds iv

PENICILLIN ALLERGY
Clindamycin 600mg qds iv

If **MRSA** colonised or previous MRSA infection
Vancomycin 1g bd iv
(for dose adjustment see TDM chart)
Plus
Fusidic acid 500mg tds po
AND Discuss with microbiology

Duration: 2-4 weeks. Longer for unusual organisms or if prosthetic joint

2. Acute Osteomyelitis

Aetiology: Commonly *Staph aureus* (including MRSA). Rarely coliforms, pseudomonads, *Salmonella* spp.

Diagnosis:
Empiric treatment should only be started after blood cultures (and ideally bone biopsy) have been taken unless patient systemically unwell**.** Needle aspiration under radiological guidance is an alternative if not possible to get biopsy.
Plain X-rays are unreliable, and may appear normal in early osteomyelitis. MRI scan is more sensitive and should

Treatment:
Osteomyelitis should always be managed with advice from Orthopaedics and Microbiology.

Flucloxacillin 2g qds iv
Plus
Fusidic acid 500mg tds po

PENICILLIN ALLERGY
Clindamycin 450mg qds iv
Plus
Fusidic acid 500mg tds po

If **MRSA** colonised or previous MRSA infection
Vancomycin loading dose 25mg/kg iv infused slowly at a rate of 500mg/hour. Continue with further doses as per chart
Plus
Fusidic acid 500mg tds po
AND Discuss with microbiology

Duration: 4-6 weeks. Minimum 2 weeks iv

2. Chronic Osteomyelitis and infected orthopaedic implants

Aetiology: Commonly *Staph aureus* (including MRSA), streptococci, enterococci, mixed infection (Gram negatives and anaerobes). In patients with prosthetic implants coagulase-negative staphylococci are important.

Diagnosis: Bone biopsy for diagnosis is indicated. Good quality samples are essential to guide antibiotic treatment.
Chronic osteomyelitis implies presence of dead bone. Empiric treatment is not indicated and treatment should be based on results of microbiological culture.
In chronic osteomyelitis, organisms isolated from sinus tracts are not predictive of organisms present in the bone.

Treatment:
Osteomyelitis should always be managed with advice from Orthopaedics and Microbiology.
Empiric treatment is not indicated. Treatment should be based on results of culture of appropriate specimens.

Duration: Usually minimum of 12 weeks but often longer.

Gastrointestinal Infections

1. *Clostridium difficile* Infection (CDI)

ALL CDI patients must be re-assessed by their ward team daily to assess severity response to treatment.

Suspected and confirmed cases of CDI require isolation in a side room and barrier nursing with enteric precautions.

Clean hands with SOAP & WATER. *C.difficile* spores are resistant to alcohol, so alcohol hand gel will not provide adequate decontamination.

Diagnosis:
Send diarrhoeal stool sample for *C.difficile* toxin testing.
Check that patient is not receiving laxatives before sending stool sample – if the patient is on laxatives and clinically stable, stop the laxatives first and reassess for resolution of diarrhoea after 24 hours.
Do not send repeat stool samples for 'test of cure'. *C.diff* toxin may be excreted for months

Treatment:
This should be based on clinical suspicion of the diagnosis and according to severity (see below). Do not wait for a positive result before starting treatment. If the result is negative and you still suspect CDI, continue to treat as such, as the testing is not 100% sensitive.

In addition to antibiotic management:

- Correct dehydration & electrolyte abnormalities.
- **Stop anti-peristaltic drugs** e.g. codeine and loperamide (alternative pain relief should be instituted if necessary).
- **Stop all non-essential antibiotics.** If antibiotics essential, discuss low risk options with Microbiologist.
- **Review the use of Proton Pump Inhibitors** and where possible stop
- **Review the use of other medicines that can produce diarrhoea** and where possible stop e.g. acarbose, biguanides, bile salts, colchicines, cytotoxics, dipyridamole, gold preparations, iron preparations, laxatives, leflunomide, magnesium preparations e.g. antacids, metoclopramide, misoprostil, NSAIDs, olsalazine, orlistat, ticlopidine.

Severity classification of *Clostridium difficile* infection

Mild CDI
- <3 type 5-7 stool on the Bristol Stool Chart per day
- WCC not raised

Moderate CDI
- Raised WCC that is <15 x 10^9/L
- 3-5 type 5-7 stool on the Bristol Stool Chart per day

Severe CDI (any one of the below)
- WCC>15 x 10^9/L
- Acutely rising creatinine (i.e. >50% increase above baseline)
- Temperature of >38.5°C
- Evidence of severe colitis (abdominal or radiological signs)
- Bowels open > 7 times per day (may be a less reliable indicator of severity)

Life-threatening CDI (any one of the below)
- Hypotension
- Partial or complete ileus
- Toxic megacolon
- CT evidence of severe disease

Treatment:

Mild CDI
Stopping offending antibiotic may be enough to 'treat' mild CDI. If unable to stop or symptoms continue after stopping, treat as for moderate CDI as below.

Moderate CDI

1st Line
Metronidazole 400mg tds po (or NG or PEG if necessary)

2nd Line
(f no response after 1 week, or symptoms worsen on 1st line)
Vancomycin 125mg qds po (or NG or PEG if necessary)

If no improvement in type or frequency of stool after two weeks of treatment please discuss further treatment options with Microbiology and refer to Gastroenterologists for sigmoidoscopy to exclude alternative diagnoses.
If severity has changed, treat accordingly.

Severe CDI

1st Line
Vancomycin 250mg qds po (or NG or PEG if necessary)

Surgical Consult may be prudent in patients With severe colitis

2nd Line
(if no response after 1 week, or symptoms worsen on 1st line)
Vancomycin 500mg qds po (or NG or PEG if necessary)
Plus/minus
Metronidazole 400mg tds po (or NG or PEG if necessary)

The addition of oral **Rifampicin** 300mg bd oral or **Immunoglobulin** IV (400mg/kg, one dose) or intracolonic **Vancomycin** or other adjunctive therapies may also be considered.

If no improvement in type or frequency of stool please discuss further treatment options with Microbiology and refer to Gastroenterologists for sigmoidoscopy to exclude alternative diagnoses. Surgical Consult may be prudent in patients with severe colitis. If severity has changed, treat accordingly.

Life Threatening CDI

1st Line
Vancomycin 500mg qds po (or NG or PEG if necessary, or rectally using bowel management system)
Plus
Metronidazole 500mg tds iv

The addition of oral **Rifampicin** 300mg bd oral or **Immunoglobulin** IV (400mg/kg, one dose) or intracolonic **Vancomycin** or other adjunctive therapies may also be considered.

Surgical and Critical Care Consult URGENT
Monitor blood lactate. Colectomy should be considered, especially if caecal dilatation >10cm.
Colectomy should be performed before blood lactate rises >5mmol/L, when survival is extremely poor.

Recurrent CDI
Recurrence is common but antibiotic resistance unlikely.
If severe or life threatening treat as above. For mild or moderate recurrence treat as follows

Vancomycin 125mg qds po (or NG or PEG if necessary) x 7 days
Then **Vancomycin** 125mg tds po (or NG or PEG if necessary) x 7 days
Then **Vancomycin** 125mg bd po (or NG or PEG if necessary) x 7 days
Then **Vancomycin** 125mg od po (or NG or PEG if necessary) x 7 days

Duration: 10 days for mild to moderate first episode
14 days for severe or second episode of mild to moderate
28 days for recurrent

Weblink:
http://www.dh.gov.uk/dr_consum_dh/groups/dh_digitalassets/documents/digitalasset/dh_093218.pdf

2. Acute Infective Diarrhoea

Aetiology: viral, *Campylobacter, Salmonella, Shigella, E. coli* 0157, *Cryptosporidium*
If recent travel consider *Giardia*, *Entamoeba histolytica.* If recent antibiotics consider: *Clostridium difficile*

Diagnosis:
Check travel, food, hospitalisation and antibiotic history in previous 2 months.
Send diarrhoeal stool sample for M,C&S (and *C.diff toxin* if appropriate).
If recent travel and bloody diarrhoea, send diarrhoeal stool sample for ova, cysts & parasites (OCP) and amoebic serology to exclude amoebic infection.

Treatment:
Antibiotics not routinely indicated in the management of acute infective diarrhoea.
May be considered if symptoms are severe, there other potentially complicating medical problems present, or at extremes of age.
Discuss with the Microbiology who will advise if antibiotic treatment is appropriate.

Suspected and confirmed cases require isolation in a side room and barrier nursing with enteric precautions.

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3. Enteric Fever

Aetiology: *Salmonella typhi or paratyphi*

Diagnosis:
Check travel and food history.
Send **stool** sample for M,C&S and **blood cultures**.
Look out for complications of enteric fever e.g. bowel perforation, aneurysm, septic arthritis, septic shock

Treatment:

Ceftriaxone 2g od iv	**SEVERE PENICILLIN ALLERGY** **Discuss with Microbiology** **Azithromycin** 500mg od po **Or** **Ciprofloxacin (only if sensitive strain)** 500mg bd po/ 400mg bd iv

Notify to Public Health
Oral switch to be discussed with microbiology and depends on susceptibility of the isolate.

Duration: 14 days for cetriaxone, 7 days for azithromycin, 10 days for ciprofloaxacin

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4. Acute Appendicitis or peri-appendicular abscess

Aetiology: Mixed gut flora, including coliforms, anaerobes and enterococci

Treatment:
Surgical management most important for removal of the source

Co-amoxiclav 1.2d tds iv (**amoxicillin**/**clavulanic acid**)	**PENICILLIN ALLERGY** **Ciprofloxacin** 400mg bd iv **Plus** **Metronidazole** 500mg tds iv

If signs of severe sepsis or septic shock

ADD Gentamicin 5mg/kg od iv (for dose adjustment see chart)

Oral switch to be discussed with microbiology and depends on susceptibility of the isolate.

Duration: 7-10 days

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5. Diverticulitis or diverticular abscess

Aetiology: Mixed gut flora, including coliforms, anaerobes and enterococci

Treatment:
Surgical management most important for removal of the source

Tazocin 4.5g tds iv (**Piperacillin + Tazobactam**)	**PENICILLIN ALLERGY** Discuss with microbiology

If signs of severe sepsis or septic shock

ADD Gentamicin 5mg/kg od iv (for dose adjustment see chart

Duration: 7-10 days

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6. Ascending Cholangitis and Acute Cholecystitis

Aetiology: Mixed gut flora, including coliforms, anaerobes

Diagnosis: Investigate and treat the cause of biliary obstruction

Treatment:
Surgical management important – drainage of abscess or other source management may be required.
Simple inflammatory cholecystitis does not require antibiotic therapy.

Tazocin 4.5g tds iv (**Piperacillin + Tazobactam**)	**PENICILLIN ALLERGY** Discuss with microbiology

If signs of severe sepsis or septic shock

ADD Gentamicin 5mg/kg od iv (for dose adjustment see chart)

Oral switch to be discussed with microbiology and depends on susceptibility of the isolate.

Duration: 7-10 days

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7. Spontaneous Bacterial Peritonitis (SBP)

Aetiology: *E.coli, Klebsiella*, *Strep pneumoniae*, enterococci. Infection is almost always monomicrobial. Polymicrobial infection suggests a surgical cause.

Diagnosis: **Ascitic fluid** for M,C&S, **Urine** for pneumococcal antigen

Treatment:
Refer all cases to Gastroenterology

Tazocin 4.5g tds iv (**Piperacillin + Tazobactam**)	**PENICILLIN ALLERGY** **Ceftriaxone** 2g od iv	**SEVERE PENICILLIN ALLERGY** Discuss with microbiology

If signs of severe sepsis or septic shock

ADD Gentamicin 5mg/kg od iv (for dose adjustment see chart)

Oral switch to be discussed with microbiology and depends on susceptibility of the isolate.

Duration: 10-14 days days

Ref: *Postgrad Med J* 2007;83:379-383 doi:10.1136/pgmj.2006.056168

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8. Post-surgical Intra-abdominal Infection

Aetiology: Mixed gut flora, including coliforms, anaerobes

Diagnosis: Send appropriate samples ie **blood cultures**, **intra-abdominal pus** for M,C&S. **Pus swabs are inadequate** and give falsely negative results as they dry out and organism die before reaching the lab. Drain fluid may just represent colonization and contamination of the drain.

Treatment:
Surgical management important – drainage of abscess or other source management may be required.

In patients who have had no previous course of antibiotic (except stat dose of surgical prophylaxis)

Co-amoxiclav 1.2d tds iv (**amoxicillin/clavulanic acid**)	**PENICILLIN ALLERGY** Discuss with microbiology

In patients who have had previous course of antibiotic

Tazocin 4.5g tds iv (**Piperacillin + Tazobactam**)	**PENICILLIN ALLERGY** **Meropenem** 1g tds iv	**SEVERE PENICILLIN ALLERGY** Discuss with microbiology

If signs of severe sepsis or septic shock

ADD Gentamicin 5mg/kg od iv (for dose adjustment see TDM chart)

Oral switch to be discussed with microbiology and depends on susceptibility of the isolate.

Duration: minimum 7 days. Discuss with Microbiology

9. Acute Pancreatitis

Aetiology: Secondary infection with mixed gut flora possible (occurs in under 10%)

Diagnosis: Send **blood cultures** if patients have systemic signs of infection

Treatment:
Acute idiopathic pancreatitis without necrosis is a sterile process, and antibiotics do not accelerate recovery (except in the presence of intercurrent biliary disease).

The use of any antibiotic prophylaxis in necrotizing pancreatitis is controversial.
Prophylactic antibiotics should only be considered for patients with evidence of more than 30% necrosis of the pancreas on CT

Imipenem 500g qds iv	**SEVERE PENICILLIN ALLERGY** Discuss with microbiology

Enteral feeding reduces the risk of sepsis

Duration: 7-14 days.

Weblink: http://www.bsg.org.uk/pdf_word_docs/pancreatic.pdf
Ref: CCM 32:2524, 2004

Neutropaenic sepsis

Refer to Trust guidelines

http://nuhtportal:2226/Trust%20Policies/Policies%20and%20Guidelines%20-%20Clinical/Cancer%20Services/Guidelines%20on%20Management%20of%20Neutropenic%20Sepsis%20at%20Newham%20University%20NHS%20Trust.pdf

Therapeutic Drug Monitoring (TDM)

Use Formulae to calculate initial dose. Monitor levels and adjust accordingly.

Formulae:

ESTIMATED CREATININE CLEARANCE	$\text{Cr CL} = \frac{(140 - \text{age [yrs]}) \times \text{weight (kg)}}{\text{Creatinine (}\mu\text{mol/l)}} \times$ 1.23 (male) or 1.04 (female)
IDEAL BODY WEIGHT	Male: 50kg + 2.3kg (for every inch above 5ft) = weight in kg Female: 45.5kg + 2.3kg (for every inch above 5ft) = weight in kg
OBESITY ADJUSTMENT	Use if actual body weight (ABW) is >20% above IBW: Dosing weight in kg = IBW + 0.4 (ABW – IBW)

1. Gentamicin

1. Gentamicin is given as a single daily dose except in the treatment of endocarditis. Initial Dose is based on calculation of estimated creatinine clearance using the above calculation. **Do not use eGFR** supplied in chemistry result as it is not accurate enough, especially in the elderly.

2. Select dose as follows
   If CrCl> 70ml/min give 5-7mg/kg OD IV (max daily dose 450mg)
   If Cr Cl > 30 ml/min give 5 mg/kg OD IV
   If Cr Cl ≤ 30 ml/min give 2-3 mg/kg OD IV

3. Monitor levels

When to take blood	How often	Monitoring
Blood for gentamicin levels should be taken 18-22 hours after the dose (2-6 hours before the next dose is due). This is the trough or pre-dose level.	In all patients check trough level before 2nd dose to ensure it is safe to give further doses. Follow dosing adjustments as described below.	If level in adequate range, repeat every 2-3 days if renal function remains stable. In patients with abnormal renal function, check level daily before further doses.

4. Adjust dosing

Adequate	Level too high	Level too low
<1mg/L Repeat same dose once daily so long as renal function remains stable.	**1-2mg/L** Confirm true trough level. If so, reduce the 2nd dose by 25% from the original. Recheck level the following day. **>2mg/L** Confirm true trough level. If so, omit next dose and repeat level and creatinine the next day. Recalculate dose using above equation with new creatinine . Discuss with antimicrobial pharmacist or microbiology when repeat result available. **>6mg/L** This is most likely due to incorrect timing of levels in relation to dose, or from taking level through line used to infuse gentamicin. Omit further doses. Repeat trough level to confirm and contact antimicrobial pharmacist or microbiology.	N/A

2.Vancomycin

1. Initial Dose is made on calculation of estimated of creatinine clearance using the above calculation. **Do not use eGFR** supplied in chemistry result as it is not accurate enough, especially in the elderly.

2. For severe infections with MRSA (eg. endocarditis, osteomyelitis, severe cellulitis), a **loading dose** of 25mg/kg is recommended in the guideline. This should be followed by further doses based on the table below.

3. Select dose and dose interval as follows

CrCl (mL/min)	Starting dose (slow infusion)	Interval
>100	1 gram	8 hours
65-100	1 gram	12 hours
55-65	750mg	12 hours
45-55	1 gram	24 hours
35-45	750mg	24 hours
25-35	500mg	24 hours
<25	500mg stat	Wait for levels

4. Monitor levels
Oral Vancomycin does not require TDM because it is not absorbed systemically.

When to take blood	How often	Monitoring
Blood for vancomycin levels should be taken immediately before the dose is due. This is the trough or pre-dose level. There is no need to withhold the dose waiting for levels UNLESS CrCl is <25ml/min OR a previous level was very high.	This depends on renal function. If CrCl is <25ml/min, check level before giving any further doses. If CrCl is ≥25ml/min, check a steady state level before the 4th dose. **DO NOT withhold the 4th dose waiting for the result of the level.**	If level in adequate range, repeat every 3 days if renal function remains stable. In patients with abnormal renal function, check level daily before further doses, and discuss with antimicrobial pharmacist or microbiology

5. Adjust dosing

Adequate	Level too high	Level too low
10-15mg/L Continue dose so long as renal function remains stable. Check level twice weekly. **15-20mg/L** **This level is adequate for severe infections caused by MRSA (see 2 above) and enterococcal endocarditis**	**>20mg/L** Check renal function and recalculate CrCl. If CrCl has changed, recalculate dose. If no change from original, confirm true trough level. If so, reduce the next dose by 50% from the original. Recheck level the following day. **15-20mg/L (only considered high if treating mild MRSA infection or non-MRSA infection)** Check renal function and recalculate CrCl. If CrCl has changed, recalculate dose. If no change from original, confirm true trough level. If so, reduce the next dose by 25% from the original. Recheck level the following day.	**5-10mg/L** Check renal function and recalculate CrCl. If no change from original, then Increase dose by 50% or reduce interval between doses. If CrCl has changed, recalculate dose. **<5mg/L** Check renal function and recalculate CrCl. If no change from original, then Increase dose by 100% or halve interval between doses.

3. Amikacin

1. Initial Dose is made on calculation of estimated of creatinine clearance using the above calculation. **Do not use eGFR** supplied in chemistry result as it is not accurate enough, especially in the elderly.

2. Select dose and dose interval

   If CrCl > 50ml/min give 15mg/kg OD IV [max daily dose 1.5g]

   If Cr Cl > 20 ml/min give 10-12mg/kg OD IV

   If Cr Cl = 10-20 ml/min give 3-4 mg/kg OD IV

   CrCl below 10ml/min-discuss with microbiology

3. Monitor levels

When to take blood	How often	Monitoring
Blood for amikacin levels should be taken 18-22 hours after the dose (2-6 hours before the next dose is due). This is the trough or pre-dose level.	In all patients check trough level before 2nd dose to ensure it is safe to give further doses. Follow dosing adjustments as described below.	If level in adequate range, repeat every 2-3 days if renal function remains stable. In patients with abnormal renal function, check level daily before further doses.

4. Adjust dosing

Adequate	Level too high	Level too low
<5mg/L Repeat same dose once daily so long as renal function remains stable.	**>5mg/L** Confirm true trough level. If so, omit next dose and repeat level and creatinine the next day. Recalculate dose using above equation with new creatinine. Discuss with antimicrobial pharmacist or microbiology when repeat result available.	N/A

Impact Assessment: Which groups of the population do you think will be affected by this proposal? Please refer to the impact assessment checklist for details.

Double click to open and fill this section.

RAPID IMPACT CHECKLIST - templat

Save document as *(Policy/Document name)* Impact Assessment.doc

RAPID IMPACT CHECKLIST

Empiric Antibiotic Guideline for Adult Inpatients

Which groups of the population do you think will be affected by this proposal? **All** **Other groups :**

• minority ethnic people (including gipsy/travellers, refugees & asylum seekers	• people of low income
• women and men	• people with mental health problems
• people in religious/faith groups	• homeless people
• disabled people	• people involved in criminal justice system
• older people, children & young people	• staff
• lesbian, gay, bisexual & transgender people	• any other groups

N.B. The word proposal is used below as shorthand for any policy, procedure, strategy or proposal that might be assessed.	What positive & negative impacts do you think there might be? **Positive impact on all patients (including groups mentioned above) requiring antibiotics. Improved prescribing practice, improved guide on diagnostic workup. Positive impact on staff involved in prescribing, dispensing and monitoring antibiotic prescribing**
	Which groups will be affected by these impacts? **All patients requiring antibiotics**

What impact will the proposal have on lifestyles? For example, will the changes affect: **NONE**

- Diet and nutrition?
- Exercise and physical activity?
- Substance use: tobacco, alcohol or drugs?
- Risk taking behaviour?
- Education and learning or skills?

Will the proposal have any impact on the social environment? Things that might be affected include: **NONE**

- Social status
- Employment (paid or unpaid)
- Social/family support
- Stress
- Income

Will the proposal have any impact on: **NO**

- Discrimination?
- Equality of opportunity?
- Relations between groups?

Will the proposal have any impact on the physical environment? For example, will there be impacts on:

- Living conditions? **NO**
- Working conditions? **NO**
- Pollution or climate change? **NO**
- Accidental injuries or public safety? **NO**
- Transmission of infectious disease? **YES, Guideline has positive impact on preventing transmission of infectious diseases**

Will the proposal affect access to and experience of services? For example: **NO**

- Health care
- Transport
- Social Services
- Housing services
- Education

Rapid Impact Checklist: Summary Sheet	
1. Positive Impacts (Note the groups affected) • **Positive impact on all patients (including groups mentioned above) requiring antibiotics.** • **Improved prescribing practice** • **Improved guide on diagnostic workup.** • **Positive impact on staff involved in prescribing, dispensing and monitoring antibiotic prescribing** • **Guideline has positive impact on preventing transmission of infectious diseases**	2. Negative Impacts (Note the groups affected) **None**
3. Additional Information and Evidence Required	
4. Recommendations	
5. From the outcome of the RIC, have negative impacts been identified for race or other equality groups? Has a full EQIA process been recommended? If not, why not?	
Manager's Signature: Caryn Rosmarin	**Date:** **December 2011**