Doncaster and Bassetlaw Teaching Hospitals
NHS Foundation Trust

POLICY FOR TREATMENT OF LOWER RESPIRATORY TRACT INFECTIONS

Written by: Dr Nick Lewis, Consultant in Infection

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For Review: July 2028

This document is part of antibiotic formulary guidance

Formulary guidance holds the same status as Trust policy

Contents

Lower Respiratory Tract Infections

AMENDMENTS

Date	Summary of Changes	Author
Sept 2025	Minor amendment to include IV or PO macrolide to antibiotic treatment option for CAP CURB score 3. Inclusion of recommended investigations for moderate and high severity CAP.	Dr B Subramanian
July 2026	Addition of a new section on PCP treatment, including prescribing guidance and safety considerations.	Dr B Subramanian Kar Loon Yee

1) Community acquired pneumonia (CAP)

Definition

Acute respiratory tract illness associated with a CXR showing a new infiltrate, occurring prior to or within first two days of admission to hospital (i.e. acquired outside hospital), **including pneumonia that develops in a nursing home resident.**

CAP should be confirmed by CXR before commencement of antibiotics in the majority of patients. Selected patients with life-threatening disease should be treated based on a presumptive clinical diagnosis of CAP. Sometimes an initial CXR can be normal, so consider repeating after 24 hours if high index of suspicion. If repeat CXR is normal, consider other diagnoses.

Common causative organisms	Microbiological Investigations
Streptococcus pneumoniae *Haemophilus influenzae* Respiratory viruses particularly in children Mycoplasma *Chlamydophila pneumoniae* *Legionella pneumophila* *Staphylococcus aureus* especially following influenza virus infection	Sputum cultures Blood culture (moderate/severe) Legionella urine antigen (in suspected atypical pneumonia) or if CURB ≥3 Mycoplasma serology (in suspected atypical pneumonia) Nasopharyngeal swabs for viral PCR (if indicated) HIV screen (particularly in confirmed pneumococcal pneumonia)

Assess CURB-65 score (one point for each):

- **C**onfusion (new onset)
- **U**rea >7mmol/l
- **R**esp rate >30/min
- **B**lood pressure(SBP<90mmHg or DBP <60mmHg)
- Age >**65** years.

Treatment

CURB65 score	1st line	Penicillin allergy	If MRSA colonised in nose, throat or sputum:	Duration	Comments
0-1 (Low severity)	Amoxicillin 500mg TDS PO	**1st line:** Doxycycline 200mg stat, then 100mg OD PO **OR** **2nd line**: Clarithromycin 500mg BD PO (Erythromycin 500mg QDS po **if pregnant**)	Addition of MRSA-active antibiotic may be indicated – please discuss with Infection Consultant	**5 days** Some organisms may require longer duration: Legionella:**14 days** Mycoplasma:**7-14 days** Staph aureus (incl MRSA):**14-21 days** **If no improvement after 48-72 hours seek advice from Infection consultant**	For CURB score ≥ 2, send appropriate investigations: -Sputum MC&S -Blood cultures -Mycoplasma serology -Urine pneumococcal & legionella antigen -Throat swab for viral PCR if appropriate (e.g. during flu season) -HIV screen for confirmed pneumococcal pneumonia
2 (Moderate severity)	Amoxicillin 500mg-1g TDS PO **AND** Clarithromycin 500mg BD PO (Erythromycin 500mg QDS po **if pregnant**) **OR** (if unable to take orally) Benzylpenicillin 1.2g QDS IV **AND** Clarithromycin 500mg BD IV (Erythromycin 500mg QDS IV **if pregnant**)	Doxycycline 200mg stat, then 100mg OD PO **(If allergic/intolerant to doxycycline, contact Infection Consultant)**			
3-5 (High severity)	Co-amoxiclav 1.2g TDS IV **AND** Clarithromycin 500mg BD IV/**PO** (Erythromycin 500mg QDS IV/PO **if pregnant**)	**Penicillin allergy (non life- threatening)** Cefuroxime 1.5g TDS IV **AND** Clarithromycin 500mg BD IV/PO (Erythromycin 500mg QDS IV/PO **if pregnant**) **Penicillin allergy (anaphylaxis):** Co-trimoxazole 960mg BD PO/IV + Clarithromycin 500mg BD PO/IV			Consider Critical Care review Review with microbiology results and switch to narrow spectrum agent where possible

Notes:

- Antibiotics should be administered within 4 hours of presentation.
- For High Risk Sepsis refer to the Trust sepsis IPOC
- Antibiotics may need renal dose adjustment – refer to Renal Handbook or discuss with Pharmacist

- **Switch to**:
  - A specific narrow spectrum therapy based on Microbiology results should be considered e.g. benzylpenicillin alone for Pneumococcus.
  - Oral therapy after clinical improvement has occurred (usually after 24-48hr of IV therapy), unless sensitivity results indicate that the switch cannot be made.

- **Panton-Valentine Leucocidin (PVL) positive *Staphylococcus aureus* :**
  - Causes necrotising pneumonia, frequently following influenza infection and can occur in young fit patients. Please discuss with Infection Consultant for advice on management if this is suspected.

2) Hospital acquired pneumonia (HAP)

Definition
Pneumonia (see definition above) that occurs ≥2 days after admission and did not seem to have been incubating on admission, with new or progressive consolidation on CXR.

This **does not include** patients with a recent admission to hospital, unless they were **discharged within the previous 48 hours. All other patients should be treated as per CAP guidelines above.**

Ventilator associated pneumonia (VAP) is a type of pneumonia that occurs more than 48hrs after endotracheal intubation.

Common causative organisms	Microbiological Investigations
Pseudomonas aeruginosa *Staphylococcus aureus* *Haemophilus influenzae* *Streptococcus pneumoniae* *Streptococcus sp* Enterobacterales (eg *E.coli, Klebsiella, Enterobacter*)	Blood culture Sputum BAL (if indicated) Viral PCR (if indicated)

Treatment notes:

- Switch to oral treatment as soon as clinical improvement occurs.
- For patients with **previous history of confirmed toxigenic *C.difficile* infection** please discuss with Infection consultant.

‡ **Fluoroquinolone warning**:

- Fluoroquinolones should not be used for mild-moderate infections, unless other antibiotics cannot be used.
- The European Medicines Agency's Pharmacovigilance Risk Assessment Committee has recommended restricting the use of fluoroquinolone antibiotics following a review of side effects mainly involving muscles, tendons, bones, nervous system and in those at high risk of aortic aneurysm.
- **Patients should be warned about these side effects, which are rare but can be disabling and potentially long-lasting.** A Patient Information Leaflet is available here.

Click here for further information.

Treatment

<table>
<tr><th colspan="2">Hospital acquired pneumonia</th><th>If MRSA colonised in nose, throat or sputum:</th><th>Duration</th><th>Comments</th></tr>
<tr><td rowspan="2">1st line</td><td>Co-amoxiclav 1.2g TDS IV (if not taking orally)
OR
Co-amoxiclav PO 625mg TDS</td><td rowspan="3">Addition of MRSA-active antibiotic may be indicated – please discuss with Infection Consultant</td><td rowspan="3">5 days

If no improvement after 48-72 hours seek advice from Infection team</td><td rowspan="2"></td></tr>
<tr><td>Penicillin allergy (non life-threatening)
Cefuroxime 1.5g TDS IV
OR
Cefaclor MR 375mg PO BD</td></tr>
<tr><td rowspan="2">2nd line

If no response after 48hrs to above
OR
Age >65 AND ≥ 5 days treatment with co-amoxiclav or cephalosporin (for any indication) that has finished within the last 2 weeks.</td><td>* Piperacillin-tazobactam 4.5g TDS IV

Oral switch:
Levofloxacin 500mg BD PO ‡</td><td>*If patient has had treatment with > 5 days of co-amoxiclav followed by piperacillin-tazobactam with symptoms unresolved, contact Consultant in Infection

‡ See fluoroquinolone warning above.</td></tr>
<tr><td>Penicillin allergy (life threatening)
Vancomycin (follow Trust guideline for dosing) + Aztreonam 2g TDS IV

Oral Switch: Levofloxacin 500mg BD PO ‡</td></tr>
</table>

3) Aspiration Pneumonia

Definition

Pneumonia, usually of insidious onset, resulting from 'macroaspiration' of oropharyngeal or gastric contents colonised with bacteria. Usually the aspiration is not witnessed; therefore aspiration pneumonia commonly applies to pneumonia in a patient with risk factors for aspiration. These risk factors include altered consciousness, abnormal gag and swallowing reflexes, stroke and gastric disorders such as gastro-oesophageal reflux. It should be distinguished from aspiration pneumonitis, an acute chemical lung injury after the inhalation of regurgitated sterile gastric contents in which aspiration is commonly witnessed.

Please note: in uncomplicated chemical pneumonitis, there is no role for prophylactic antibiotics within 48h of aspiration. There is also a risk of developing antimicrobial resistance.

Common causative organisms	Microbiological Investigations
Anaerobes *Staphylococcus aureus* Gram negative bacilli (including *Pseudomonas*) *Streptococcus pneumoniae* *Haemophilus influenzae*	Blood cultures Sputum cultures

Treatment

<table>
<tr><th colspan="2">Aspiration pneumonia</th><th>Oral switch</th><th>If MRSA colonised in nose, throat or sputum:</th><th>Duration</th><th>Comments</th></tr>
<tr><td>1st line</td><td colspan="5">No treatment.
Many patients with a chemical aspiration pneumonitis do NOT require antibiotic treatment (unless the patient is severely ill). Antibiotics are only recommended if:
• There is no resolution after 48hrs, associated with pulmonary infiltrates on CXR.
• The features are those of a bacterial pneumonia of the more insidious form.</td></tr>
<tr><td>2nd line</td><td rowspan="3">Unless meet criteria for piperacillin + tazobactam below</td><td>Co-amoxiclav 1.2g TDS IV</td><td>Co-amoxiclav 625mg TDS</td><td rowspan="4">Addition of MRSA-active antibiotic may be indicated – please discuss with Infection Consultant</td><td rowspan="4">5 days</td><td rowspan="3"></td></tr>
<tr><td>Penicillin allergy (non life-threatening)</td><td>Cefuroxime 1.5g TDS IV</td><td>Cefaclor MR 375mg BD</td></tr>
<tr><td>Life threatening penicillin allergy (anaphylaxis)</td><td>Vancomycin IV (follow Trust guideline) + Aztreonam 2g TDS IV</td><td>Co-trimoxazole 960mg BD PO</td></tr>
<tr><td colspan="2"><u>Criteria for Piperacillin + tazobactam:</u>

Age >65 years

AND ≥ 5 days treatment with co-amoxiclav or cephalosporin (for any indication) that has finished within the last 2 weeks.</td><td>*Piperacillin + tazobactam 4.5g TDS IV

Penicillin allergy:
Co-trimoxazole 960mg BD IV/PO</td><td>Discuss with Infection consultant</td><td>* If patient has had treatment with > 5 days of co-amoxiclav followed by piperacillin + tazobactam with symptoms unresolved, contact Infection Consultant</td></tr>
</table>

4) COPD/Non-CF Bronchiectasis

Definition

COPD is a chronic, slowly progressive disorder characterised by airflow limitation that is not fully reversible, associated with an abnormal inflammatory response of the lungs to noxious particles or gases.

Bronchiectasis is a chronic disease causing chronic daily cough with viscid sputum production following irreversible dilatation of the bronchi due to bronchial wall damage caused by infection or inflammation.

Exacerbations of COPD/bronchiectasis are defined as a sustained change in the patient's dyspnoea, cough and/or sputum production (colour or volume) beyond day- to-day variability sufficient to warrant a change in management. They may be due to infective or non-infective (e.g. air pollution) causes.

Common causative organisms	Microbiological Investigations
Haemophilus influenzae *Moraxella catarrhalis* *Streptococcus pneumoniae* *Pseudomonas aeruginosa*	Sputum Blood culture (if systemically unwell)

Notes:

‡ **Fluoroquinolone warning**:

- Fluoroquinolones should not be used for mild-moderate infections, unless other antibiotics cannot be used.
- The European Medicines Agency's Pharmacovigilance Risk Assessment Committee has recommended restricting the use of fluoroquinolone antibiotics following a review of side effects mainly involving muscles, tendons, bones, nervous system and in those at high risk of aortic aneurysm.
- **Patients should be warned about these side effects, which are rare but can be disabling and potentially long-lasting.** A Patient Information Leaflet is available here.

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Treatment

Infective exacerbation of COPD/Bronchiectasis		If MRSA colonised in nose, throat or sputum:	Duration	Comments
1st line	Doxycycline 200mg stat, then 100mg OD PO **OR** Amoxicillin 500mg-1000mg TDS PO/IV **OR** Clarithromycin 500mg BD PO/IV	Addition of MRSA-active antibiotic may be indicated – please discuss with Infection Consultant	COPD **5 days** Bronchiectasis **7-14 days**	Only use IV if unable to take orally or patient severely ill. Adjust antibiotic treatment based on culture results
If no previous *Pseudomonas* in sputum **AND** documented resistance to 1st line agents **OR** no response to 1st line agent after 48hrs.	Co-amoxiclav 1.2g TDS IV **OR** 625mg TDS PO **Penicillin allergy (non-life threatening)** Cefuroxime 1.5g TDS IV **OR** Cefaclor MR 375mg BD PO **Penicillin allergy (life threatening)** Co-trimoxazole 960mg BD IV/PO			
Pseudomonas previously isolated from sputum **AND** severely unwell. **OR** *Pseudomonas* previously isolated from sputum **AND** no response to 1st line after 48hrs.	Piperacillin-tazobactam 4.5g QDS IV **Penicillin allergy (non-life threatening)** Ceftazidime 2g TDS IV **Penicillin allergy (life threatening)** Ciprofloxacin 750mg BD PO ‡			‡ See fluoroquinolone warning above.

5) Lung abscess/Empyema thoracis

Definitions

Lung abscess is a localised collection of pus within a cavitating lesion in the lung parenchyma with a CXR that shows a cavity with an air- fluid level. The clinical features include cough with large amounts of foul-smelling sputum often with fever, haemoptysis, weight loss and malaise. Aspiration is the main predisposing factor with bronchial obstruction, bronchiectasis, infarction due to PE with secondary bacterial infection, necrotising pneumonia, tuberculosis and septic embolisation (infective endocarditis or suppurative phlebitis) accounting for the rest.

Empyema thoracis is defined as the presence of pus in the pleural cavity. It may be secondary to pneumonia or may be due to ruptured oesophagus, subphrenic/hepatic abscess, post-thoracic surgery or penetrating injury of the chest.

Common causative organisms	Microbiological Investigations
Anaerobes *Streptococcus milleri* *Staphylococcus aureus* Aerobic gram negative bacilli especially *Klebsiella spp* *Mycobacterium tuberculosis* *Streptococcus pneumoniae* (esp Empyema) In immunocompromised host: -*Pseudomonas aeruginosa, Nocardia* & fungi	Sputum(please specify if TB is suspected) Blood cultures Pus from pleural cavity or lung abscess

Treatment

Lung abscess/Empyema thoracis		If MRSA colonised in nose, throat or sputum:	Duration	Comments
1st line	Co-amoxiclav 1.2g TDS IV	Addition of MRSA-active antibiotic may be indicated – please discuss with Infection Consultant	Please discuss with Infection Consultant as the antibiotic treatment will be prolonged (e.g. until CXR shows small stable lesion or is clear). Treatment may require adjusting after culture results.	Drainage of empyema is critical for source control
2nd line Penicillin allergy (non-life threatening)	Cefuroxime 1.5g TDS IV **AND** Metronidazole 500mg TDS IV			
3rd line Penicillin allergy (life threatening)	Co-trimoxazole 960mg BD IV/PO **AND** Metronidazole 500mg TDS IV (or 400mg TDS PO)			

Notes: Please discuss with Consultant in Infection in following cases:

- For patients with **previous history of confirmed toxigenic *C.difficile* infection**
- **If immunocompromised patient or any risk/suspicion of TB**

6) Pneumocystis jirovecii pneumonia (PCP)

Treatment

***Pneumocystis jirovecii* pneumonia**		**Duration**	**Comments**
1st line	Co-trimoxazole 30mg/kg QDS IV/PO (120mg/kg total daily dose). Dose can be reduced to 90mg/kg/day total from Day 4)	**21 days**	• Consider steroids if hypoxic. (Prednisolone 40mg BD for 5 days, then 40mg OD for 5 days, then 20mg OD for 11 days if initial pO2 is <9.3kPa on air) • Consider addition of Caspofungin as synergistic therapy (70mg loading then 50mg OD if <80kg; 70mg OD if >80kg) • Exclude G6PD deficiency before prescribing Primaquine • Primaquine is not licensed within the UK. • Secondary prophylaxis may be indicated if ongoing immunocompromised
2nd line	Clindamycin 600mg QDS IV **AND** Primaquine 30mg OD PO (Exclude G6PD deficiency)		
3rd line (mild-moderate disease)	Atovaquone 750mg BD PO		

Notes:

High-dose Co-trimoxazole in the treatment of PCP: Important safety considerations

- **Adverse Effects & Monitoring:**
  High-dose Co-trimoxazole may cause bone marrow suppression, renal impairment, and electrolyte disturbances—particularly hyperkalaemia. Rarely, it may cause serious skin reactions such as SJS, TEN or DRESS with eosinophilia– the highest risk period is the first week of treatment.

- **Folate Considerations:**
  - Check serum folate ideally before starting treatment; do not delay antibiotic initiation while awaiting results.
  - Folic acid supplementation does not compromise Co-trimoxazole efficacy[1].
  - Initiate folic acid treatment in patients with confirmed folate deficiency.
  - Consider folic acid supplementation in at-risk groups, including elderly patients, those with chronic alcohol use, rheumatoid arthritis, malnutrition, or other conditions predisposing to deficiency.

- **Monitoring Requirements:**

<u>Inpatients (clinically unstable)</u>

  - FBC, renal function, and U&Es should be monitored ***more frequently than the twice-weekly schedule***, guided by clinical judgement.
  - Monitor urine output to reduce the risk of crystalluria (rare), with increased risk in malnourished patients.

<u>Inpatients (clinically stable) and Outpatients</u>

  - Twice weekly FBC, renal function, and U&Es

- **Interaction Precautions:**
  - Assess for potential drug–drug interactions before starting therapy. For a full list see BNF/SPC.
    - *Methotrexate* – Co-trimoxazole may increase free plasma levels of methotrexate. Both drugs are anti-folate, which increases the risk of bone marrow suppression and pancytopenia. Concurrent use should be avoided.
    - *ACE inhibitors, angiotensin receptor blockers, and potassium-sparing diuretics* – Concurrent use may result in clinically significant hyperkalaemia. Potassium should be monitored closely.
    - *Diuretics (especially thiazides in elderly patients)* – There is a potential increased risk of thrombocytopenia with or without purpura. The manufacturer provides no specific recommendation.
    - *Digoxin* – Co-trimoxazole may increase plasma digoxin levels in elderly patients. Monitor for symptoms of digoxin toxicity such as nausea, anorexia, or visual disturbances, and check serum digoxin levels.

        - *Phenytoin* – Co-trimoxazole may prolong the half-life of phenytoin, resulting in increased serum levels. Monitor for toxicity symptoms including confusion, blurred vision, nystagmus, ataxia, or drowsiness, and adjust the dose if necessary.
        - *Warfarin* – Co-trimoxazole may increase the anticoagulant effect of warfarin. Monitor the INR and adjust the warfarin dose accordingly.
        - *Sulfonylureas (such as gliclazide)* – Hypoglycaemia has been rarely reported. Increase blood glucose monitoring and adjust antidiabetic drug doses if necessary.
    - Pay particular attention to medications recently discontinued, such as Methotrexate. Due to its pharmacokinetics, Methotrexate may persist in the body for several months after cessation[2], increasing the risk of additive toxicity when combined with Co-trimoxazole.

- **Escalation Pathways:**
    - Suspected myelosuppression: Liaise with Haematology for management of bone marrow suppression, including consideration of folinic acid treatment. Consult Microbiology for alternative antimicrobial options if needed.
    - Renal impairment: Consult ward pharmacist for renal dose adjustment.
    - Hyperkalaemia: Initiate treatment and consider alternative therapy in discussion with Microbiology.