See Appendix 1 for the Community Acquired Pneumonia Integrated Care Pathway

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The dose of most antibiotics will depend on the patient’s size, renal and hepatic function and underlying condition and may require adjustment accordingly. (Refer to BNF for further guidance.)

Intravenous (IV) antibiotics should ONLY be used where disease severity demands urgent action or where oral therapy cannot be taken.

In all conditions described below (excluding epiglottitis), a switch from IV to oral therapy should be considered as soon as the clinical response allows, and the temperature has been normal for 24 hours.

The indication for antibiotics should be clearly documented in the medical notes and on the drug chart.

If there is good clinical reason for deviation from Trust guidelines (previous microbiology and antibiotic history) please state rationale clearly in inpatient notes.

If a specific pathogen is identified the spectrum of antibiotic therapy may be narrowed.

Whenever possible, stop or review dates should be specified for antibiotic prescriptions.
1. **Community Acquired Pneumonia (CAP)**

   **Assessment**
   
   **Definition:** Symptoms of acute lower respiratory tract illness (cough and at least one other lower respiratory tract symptom) **PLUS**
   new focal chest signs on examination **PLUS**
   at least one systemic feature (pyrexia, rigors, chest pain) **PLUS**
   new radiographic shadowing consistent with lung infection

   All patients admitted to hospital with suspected CAP must have a chest X-ray (CXR) performed as soon as possible. The CXR should be done in time for antibiotics to be started **within 4 hours of admission**.

   A severity assessment should be carried out using clinical judgement supported by the CURB-65 score:

   - Confusion (Mental Test Score ≤8 or new disorientation in person, time and place)
   - Urea >7 mmol/l
   - Respiratory rate ≥30/min
   - Blood pressure (systolic <90 mmHg or diastolic <60 mmHg)
   - Age >65 years

   The following general investigations should be performed:

   - Oxygen saturation/arterial blood gas
   - Full blood count (FBC)/urea and electrolytes (U&Es)/liver function tests (LFTs)/C-reactive protein (CRP)

   If initial CRP is <20, **do not** give antibiotics unless patient immunocompromised/fulfils high risk sepsis criteria. Re-check CRP if patient concerns.

   The following microbiological investigations should be performed:

   - Blood cultures
   - Sputum – in all patients when productive, as early in the admission as possible
   - Urine for pneumococcal and legionella antigen – in those with moderate/high severity CAP (CURB-65 score ≥2)

   Please note that in order for the urinary antigens to be processed it must state on the request form that there is consolidation on the CXR, and the CURB score must be noted.

   See **Guideline 135 – Appropriate Requesting of Legionella and Pneumococcal Antigen Testing in Urine Samples**.

**Antibiotic Regimens for community acquired pneumonia (with CXR changes):**

If patient has already received treatment, use alternative agent within same clinical category or escalate to next severity level, do not automatically choose the high severity antibiotic unless the severity of the patient merits it.

**High risk/red flag sepsis – clear evidence of respiratory source**

- CXR changes or clear signs/symptoms of respiratory infection, NB. tachypnoea is not specific for respiratory infection; treat according to CAP CURB 3 – 5.
- If no clear evidence of chest source refer to guidelines for infection of unknown source.
<table>
<thead>
<tr>
<th>Low severity CURB-65 = 0 – 1 &lt;3% mortality</th>
<th>Moderate severity CURB-65 = 2 9% mortality</th>
<th>High severity CURB-65 = 3 or more 15 - 40% mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Notes</strong></td>
<td><strong>NB</strong>. Patient must be reviewed by a consultant within 12 hours.</td>
<td><strong>NB</strong>. Patient must be reviewed by a registrar within 4 hours and by a consultant within 12 hours.</td>
</tr>
<tr>
<td><strong>First line treatment</strong></td>
<td><strong>Amoxicillin</strong> 500 mg 8 hourly PO If IV treatment necessary, <strong>benzylpenicillin</strong> 1.2 g 6 hourly IV</td>
<td><strong>Amoxicillin</strong> 500 mg 8 hourly PO If IV treatment necessary, <strong>benzylpenicillin</strong> 1.2 g 6 hourly IV <strong>plus clarithromycin</strong> 500 mg 12 hourly PO/IV¹</td>
</tr>
<tr>
<td></td>
<td><strong>Clarithromycin</strong> 500 mg 12 hourly PO/IV¹ or <strong>doxycycline</strong> 200 mg loading then 100 mg 24 hourly PO</td>
<td><strong>Vancomycin</strong> IV² (see Guideline 241) <strong>plus clarithromycin</strong> 500 mg 12 hourly PO/IV¹</td>
</tr>
<tr>
<td></td>
<td>5 - 7 days⁵</td>
<td>5 - 7 days⁵</td>
</tr>
<tr>
<td><strong>Total duration</strong></td>
<td>Minimum of 5 days - treatment should be discontinued if patient has temperature &lt;37.8°C for 48 hours and does not meet more than one of the following criteria:</td>
<td>5 - 7 days⁵</td>
</tr>
<tr>
<td></td>
<td>- Systolic blood pressure &lt;90 mmHg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Heart rate &gt;100 beats per minute</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Respiratory rate &gt;24 per minute</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Arterial oxygen saturation &lt;90%, or PaO₂ &lt;60 mmHg on room air</td>
<td></td>
</tr>
</tbody>
</table>

¹Bioavailability of oral clarithromycin and moxifloxacin is good and IV administration should only be considered in patients unable to take orally.

²Moxifloxacin should be restricted to cases where other agents cannot be prescribed or have failed. Increased risks of adverse hepatic reactions associated with oral moxifloxacin have been reported.

³Following loading dose, ongoing vancomycin regimen dependent on patient’s creatinine clearance. See Guideline 241 – Intravenous Vancomycin for Adults.

⁴Consider replacing clarithromycin with ciprofloxacin for those with high severity pneumonia not responding to first line therapy.

⁵For patient safety alert information see https://assets.publishing.service.gov.uk/media/5c9364c6e5274a48ed9a9fa/FQ-patient-sheet-final.pdf

⁶Consider longer duration if Gram negative, staphylococcal or legionella pneumonia (14 - 21 days).

The possibility of Panton-Valentine Leukocidin (PVL)-producing Staph. aureus pneumonia should be considered if a relatively young patient presents with high severity pneumonia ± lung cavitation ± multi-organ failure.

Contact the Microbiologists for advice and see Guideline 698 – Management and Control of Panton-Valentine Leukocidin (PVL) associated Staphylococcal Infections.
Vaccination advice
All patients aged >65 years or at risk of invasive pneumococcal disease (as defined in ‘Green Book’) who are admitted with CAP and who have not previously received pneumococcal vaccine should be advised to have the 23-valent pneumococcal polysaccharide vaccine at convalescence via their GP. This recommendation should be included on any discharge summary. The same applies for recommending influenza vaccine – these patients should be offered immunisation during the time of the influenza season.

2. Hospital Acquired Respiratory Infection
This is a heterogeneous group. Tachypnoea alone is not specific for respiratory infection.

Hospital acquired pneumonia (HAP) is defined as for CAP (i.e. requires CXR changes) but developing:
- 5 days or more after hospital admission.
- Within 5 days of discharge where patient has been hospitalised for >24 hours.

For nursing home acquired pneumonia – treat according to CAP guidelines (section 1).

Some patients will have history and examination findings suggestive of respiratory infection but without being septic or having CXR changes. Antibiotic guidance for both groups is provided below.

Potential pathogens are more varied and sensitivities less predictable.

Organisms common in community acquired pneumonia such as *S. pneumoniae* may also cause hospital acquired infections, but Gram-negative bacilli such as *Klebsiella spp.* and *Pseudomonas spp.* are also important. Methicillin resistant *Staph. aureus* (MRSA) may also need to be considered especially in those already known to be colonised.

![Flowchart diagram](image-url)

<table>
<thead>
<tr>
<th>Inpatient for minimum of 5 days or within 5 days of discharge where patient has been hospitalised for &gt;24 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presence of at least two of the following:</td>
</tr>
<tr>
<td>- Pyrexia</td>
</tr>
<tr>
<td>- ↑WBC</td>
</tr>
<tr>
<td>- Purulent secretions</td>
</tr>
<tr>
<td>- ↑O₂ requirement</td>
</tr>
<tr>
<td>Yes</td>
</tr>
<tr>
<td>CXR</td>
</tr>
<tr>
<td>No consolidation</td>
</tr>
<tr>
<td>Re-assess and consider alternative diagnosis</td>
</tr>
<tr>
<td>Send blood cultures and sputum to Microbiology</td>
</tr>
<tr>
<td>New infiltrates</td>
</tr>
<tr>
<td>Treat according to table b) below</td>
</tr>
<tr>
<td>If respiratory infection remains likely but patient does not meet SIRS criteria and there are no new CXR changes, treat according to table a) below</td>
</tr>
</tbody>
</table>
If patient has already received treatment, consider either using alternative agent within same clinical category or escalating to next severity level.

<table>
<thead>
<tr>
<th>First line treatment</th>
<th>Second line treatment or type 1 penicillin hypersensitivity</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>a) Hospital acquired respiratory deterioration likely to be infective: Not septic, no CXR changes</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Amoxicillin</strong> 500 mg 8 hourly PO</td>
<td><strong>Doxycycline 200 mg loading then 100 mg 24 hourly PO</strong></td>
<td>Consider alternative causes. Review after 48 hours. Avoid antibiotics unless felt by senior (SpR/consultant) that infection most likely cause.</td>
</tr>
<tr>
<td><strong>plus doxycycline</strong> 200 mg stat then 100 mg 24 hourly PO</td>
<td></td>
<td></td>
</tr>
<tr>
<td>After 48 hours review and consider step down to co-amoxiclav 625 mg 8 hourly PO</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>or</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Piperacillin/tazobactam</strong> 4.5 g IV 8 hourly if <em>Pseudomonas</em> suspected (previous colonisation of <em>Pseudomonas</em>, cystic fibrosis or bronchiectasis)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>b) Hospital acquired pneumonia (with CXR changes)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Temocillin</strong> (kept in fridge) 2 g 12 hourly IV (provided <em>Pseudomonas</em> not an expected pathogen)</td>
<td><strong>Ciprofloxacin 500 - 750 mg 12 hourly PO (400 mg 12 hourly IV if unable to take orally)</strong></td>
<td>Send sputum cultures and review microbiology history. Discuss with Microbiology if <em>Pseudomonas</em> sp. or extended spectrum beta lactamase (ESBL)/Amp C producing organisms are suspected</td>
</tr>
<tr>
<td><strong>plus doxycycline</strong> 200 mg stat then 100 mg 24 hourly PO</td>
<td><strong>plus clarithromycin 500 mg 12 hourly PO/IV</strong></td>
<td></td>
</tr>
<tr>
<td>After 48 hours review and consider step down to co-amoxiclav 625 mg 8 hourly PO</td>
<td>For this combination, refer to MHRA alert for quinolones - see patient safety information link below</td>
<td></td>
</tr>
<tr>
<td><strong>or</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Piperacillin/tazobactam</strong> 4.5 g IV 8 hourly if <em>Pseudomonas</em> suspected (previous colonisation of <em>Pseudomonas</em>, cystic fibrosis or bronchiectasis)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total duration: 7 days.

For quinolone patient safety alert information see [https://assets.publishing.service.gov.uk/media/5c9364c6e5274a48ed89a9fa/FQ-patient-sheet-final.pdf](https://assets.publishing.service.gov.uk/media/5c9364c6e5274a48ed89a9fa/FQ-patient-sheet-final.pdf)

- If MRSA infection is suspected or patient is known to be MRSA positive, contact Microbiology.
- Clarithromycin and ciprofloxacin have good oral bioavailability, so IV should only be prescribed if unable to take oral medication.
- Review antibiotics in line with microbiology results and clinical progress.
3. **Aspiration Pneumonia**

- Do NOT give antibiotics automatically for acute aspiration event, as this may be chemical pneumonitis.
- Send sputum for culture.
- Stop if no evidence of consolidation on CXR.

<table>
<thead>
<tr>
<th>First line treatment</th>
<th>Second line treatment or type 1 penicillin hypersensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Amoxicillin</strong> 1 g 8 hourly IV plus Metronidazole 500 mg 8 hourly IV +/- Gentamicin IV 7 mg/kg (or 3 mg/kg if risk of/known renal impairment)* (max. 560 mg) IV extended interval dosing if <em>Pseudomonas</em> suspected (previous colonisation of <em>Pseudomonas</em>, cystic fibrosis or bronchiectasis) (see Guideline 48 Gentamicin in Adult)</td>
<td><strong>Clarithromycin</strong> 500 mg 12 hourly IV plus Metronidazole 500 mg 8 hourly IV +/- Gentamicin IV 7 mg/kg (or 3 mg/kg if risk of/known renal impairment)* (max. 560 mg) IV extended interval dosing if <em>Pseudomonas</em> suspected (previous colonisation of <em>Pseudomonas</em>, cystic fibrosis or bronchiectasis) (see Guideline 48 Gentamicin in Adult)</td>
</tr>
</tbody>
</table>

Length of treatment is usually 5 - 7 days.

A potential switch to oral therapy will be dependent on clinical progress especially oral intake issues.

4. **Asthma**

Antibiotic therapy is not necessary unless there is good evidence of concurrent infection, when antibiotic selection should follow the guidelines for exacerbation of COPD.

5. **Infective Exacerbation of Chronic Obstructive Pulmonary Disease (COPD)**

A large proportion of exacerbations of COPD are due to viral infections which do not require antibiotic therapy.

However, if an increased volume of purulent sputum is present, bacterial pathogens such as *S. pneumoniae, H. influenzae* or *Moraxella catarrhalis* need to be considered.

Antibiotic choice depends on any recent treatment in the community, within the last month and the most recent sputum culture and susceptibility results.

Select treatment from the following:

<table>
<thead>
<tr>
<th>First line treatment</th>
<th>Alternative regimens or type 1 penicillin hypersensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Amoxicillin</strong> 500 mg 8 hourly PO (IV only if nil by mouth) or use alternative regimen</td>
<td><strong>Clarithromycin</strong> 500 mg 12 hourly PO/IV (only if nil by mouth) or <strong>Doxycycline</strong> 200 mg stat then 100 mg 24 hourly PO</td>
</tr>
</tbody>
</table>

Total duration: 5 days.

Advice to patient: Symptoms may not be fully resolved by completion of antibiotic course.
6. **Bronchiectasis**

Persistent or progressive condition characterised by irreversibly damaged and dilated thick-walled bronchi. The underlying pathological process results from an event or series of events where severe inflammation leads to damage of the airways.

The presence of mucopurulent or purulent sputum alone or the isolation of a pathogen alone is not necessarily an indication for antibiotic treatment.

Antibiotic therapy is appropriate for:

a) Treatment of acute exacerbations that present with an acute deterioration with worsening symptoms and/or systemic upset.

b) Long term prophylaxis/suppression of infection in patients with frequent exacerbations.

**Always send sputum before starting antibiotics.** Regimens should then be reviewed in the light of microbiology results. If patient unable to produce sputum before starting antibiotics then previous sputum results should be taken into consideration, especially where pseudomonas or resistant organisms have been grown in the past.

**Outpatient Antibiotic Therapy (OPAT)**

A few patients may be suitable for home IV antibiotic therapy depending on the individual's social circumstances, comorbidities and microbiology. Potential cases may be discussed with the consultant microbiologists (SMH ext. 5322) first, then when approved, with the home IV team (telephone 01296 315485).

See [Guideline 67 Established Bronchiectasis Outpatient Parenteral Antimicrobial Therapy (OPAT) Pathway](https://assets.publishing.service.gov.uk/media/5c9364c6e527a48edbf9a9fa/FQ-patient-sheet-final.pdf).

If patient has already received treatment, consider either using alternative agent within same clinical category or escalating to next severity level.

a) **Acute exacerbations**

i) **Mild/moderate infection**

<table>
<thead>
<tr>
<th>First line treatment</th>
<th>Alternative regimens or type 1 penicillin hypersensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>If first presentation or antibiotics not previously been used</td>
<td></td>
</tr>
<tr>
<td><strong>Amoxicillin</strong> 500 mg 8 hourly PO</td>
<td>Clarithromycin 500 mg 12 hourly PO/IV or Doxycycline 200 mg stat then 100 mg 24 hourly PO</td>
</tr>
<tr>
<td>For patients who have had repeated courses of antibiotic for this episode and in the absence of current susceptibility results consider:</td>
<td></td>
</tr>
<tr>
<td><strong>Co-amoxiclav</strong> 625 mg 8 hourly PO or 1.2 g 8 hourly IV (avoid if &gt;80 years)</td>
<td></td>
</tr>
<tr>
<td>N.B. <strong>Ciprofloxacin</strong> 500 – 750 mg 12 hourly PO may need to be considered if <em>Pseudomonas sp.</em> has been isolated from previous sputum samples. Refer to MHRA patient safety alert for quinolones. For patient safety alert information see: <a href="https://assets.publishing.service.gov.uk/media/5c9364c6e527a48edbf9a9fa/FQ-patient-sheet-final.pdf">https://assets.publishing.service.gov.uk/media/5c9364c6e527a48edbf9a9fa/FQ-patient-sheet-final.pdf</a></td>
<td></td>
</tr>
</tbody>
</table>

Length of treatment is usually 7 - 14 days.
ii) Severe infection

<table>
<thead>
<tr>
<th>First line treatment</th>
<th>Second line treatment or type 1 penicillin hypersensitivity</th>
<th>Third line treatment options when culture and sensitivity results available/microbiology recommended</th>
</tr>
</thead>
<tbody>
<tr>
<td>Co-amoxiclav 1.2 g 8 hourly IV (avoid if &gt;80 years)</td>
<td>Ciprofloxacin 750 mg 12 hourly PO (400 mg 12 hourly IV if unable to take orally)</td>
<td>Avoid if type 1 penicillin hypersensitivity</td>
</tr>
<tr>
<td>Or</td>
<td></td>
<td>Ceftazidime† 2 g 8 - 12 hourly IV plus Gentamicin 7 mg/kg (or 3 mg/kg if risk of/known renal impairment)* (max. 560 mg) IV extended interval dosing (see Gentamicin in Adults – Guideline 48)</td>
</tr>
<tr>
<td>Piperacillin/tazobactam 4.5 g IV 8 hourly if Pseudomonas spp. suspected. Dose can be increased if necessary to 4.5 g IV 6 hourly. High-dose oral regimens (e.g. amoxicillin 1 g 8 hourly or amoxicillin 3 g 12 hourly) may be needed in patients with severe bronchiectasis chronically colonised with H. influenzae</td>
<td>Refer to MHRA alert for quinolones - see patient safety information link below</td>
<td>Meropenem should be reserved for organisms resistant to other antibiotics</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Meropenem 1 - 2 g 8 hourly IV</td>
</tr>
</tbody>
</table>

Length of treatment is usually 14 days.
For quinolone patient safety alert information see: https://assets.publishing.service.gov.uk/media/5c9364c6e5274a48ed9a9fa/FQ-patient-sheet-final.pdf

*In obese patients (BMI >30), use adjusted body weight to calculate gentamicin dose (max. 560 mg).
†Single agent treatment with ceftazidime (12 hourly regimen) may be suitable for OPAT therapy.

b) Long term antibiotic therapy (unlicensed)

This may be considered in patients having ≥3 acute exacerbations per year requiring antibiotic treatment or patients with fewer exacerbations but causing severe morbidity. When considering antibiotic prophylaxis, discuss the possible benefits (reduce exacerbations), harms (increased antimicrobial resistance, adverse effects and interactions with other medicines) and the need for regular review.

The choice of long-term therapy should be based on sputum microbiology results when clinically stable. The long-term use of quinolone antibiotics, e.g. ciprofloxacin, is not advised.

Potentially suitable regimens include:

Amoxicillin 500 mg 12 hourly PO
Or clarithromycin 250 mg 12 hourly PO
Or doxycycline 100 mg 24 hourly PO

If no improvement with amoxicillin or doxycycline consider:
Azithromycin 500 mg 24 hourly PO for 6 days, then 250 mg 24 hourly PO for 6 days, then 250 mg 3 times weekly PO.

Azithromycin may be particularly suitable for patients with chronic P. aeruginosa colonisation as it has been shown to have significant immuno-modulatory effects leading to reduced exacerbations, improved spirometry and sputum microbiology. See Guideline 97FM Azithromycin for use in Non-CF Bronchiectasis.

An electrocardiogram (ECG) should be performed before starting azithromycin or clarithromycin and then repeated one month after initiation to monitor for QT prolongation. An ECG should be repeated annually whilst on treatment.

Liver function should be checked one month after commencing continuous azithromycin and then at annual review.
Patients should also be counselled regarding the risk of hearing loss/tinnitus when on long term therapy; audiometry should be checked at baseline and yearly thereafter for the duration of the treatment.

Alternatively some bronchiectatic individuals chronically colonised with *P. aeruginosa* may benefit from nebulised antibiotic therapy, e.g. gentamicin, tobramycin or colistin.

For further details on nebulised drugs, see Guideline 669 – Nebulised Drugs for use in Adults in Hospital.

### 7. Empyema

This is defined as pus in the pleural space.

- Send sputum sample, ideally before starting therapy
- Refer urgently to respiratory team
- Drain fluid and send fluid sample for culture, if possible before starting therapy.
- If infection is suspected but culture is negative, treat empirically, otherwise, treat according to culture and sensitivities
- Antibiotics alone cannot resolve the infection: Drainage or other surgical intervention is required for cure

<table>
<thead>
<tr>
<th>First line treatment</th>
<th>Alternative regimens or type 1 penicillin hypersensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Co-amoxiclav</strong> 1.2 g 8 hourly IV or <strong>Ceftriaxone</strong> 2 g 24 hourly IV If pus putrid, add <strong>metronidazole</strong> 500 mg 8 hourly IV</td>
<td><strong>Clindamycin</strong> 600 mg 6 hourly IV/PO Discuss with microbiology consultant if patient aged &gt;80 years</td>
</tr>
<tr>
<td><strong>Duration:</strong> Review with MC&amp;S or at 14 days if empirical treatment. Optimal duration not known but usually 3 - 6 week total duration.</td>
<td></td>
</tr>
</tbody>
</table>

b) Onset >5 days of admission, with new evidence of consolidation or despite previous antibiotic treatment.

NB – ensure infection flags (e.g. MRSA, ESBL/Amp C) are checked for patient and discuss choice with microbiology consultant if present.

<table>
<thead>
<tr>
<th>First line treatment</th>
<th>Alternative regimens or type 1 penicillin hypersensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Piperacillin/tazobactam</strong> 4.5 g IV 8 hourly</td>
<td><strong>Clindamycin</strong> 600 mg 6 hourly IV/PO plus <strong>Metronidazole</strong> 500 mg 8 hourly IV Discuss with microbiology consultant if patient aged &gt;80 years</td>
</tr>
<tr>
<td><strong>Duration:</strong> Review with MC&amp;S or at 14 days if empirical treatment. Optimal duration not known but usually 3 - 6 week total duration.</td>
<td></td>
</tr>
</tbody>
</table>
8. **Lung abscess**

- A lung abscess is typically diagnosed when a CXR reveals a pulmonary infiltrate with a cavity; an air-fluid level is frequently present.
- Lung abscesses are usually polymicrobial infections, the pathogens usually reflecting the predominantly anaerobic flora of the gingival crevices.
- In the immunocompromised host, however, the most common causes of lung abscess are *Pseudomonas aeruginosa* and other aerobic gram-negative bacteria, *Nocardia spp.*, and fungi, e.g. *Aspergillus sp.*

**Treatment (this is almost always empirical):**

<table>
<thead>
<tr>
<th>First line treatment</th>
<th>Alternative regimen for type 1 penicillin hypersensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Co-amoxiclav</strong> 1.2 g 8 hourly IV</td>
<td><strong>Clindamycin</strong> 600 mg 6 hourly IV/PO <strong>plus</strong> <strong>Metronidazole</strong> 500 mg 8 hourly IV</td>
</tr>
<tr>
<td>Discuss with microbiology consultant if patient aged &gt;80 years</td>
<td>Discuss with microbiology consultant if patient aged &gt;80 years</td>
</tr>
</tbody>
</table>

**Duration:**
Antibiotics should be continued until the CXR shows a small, stable residual lesion or is clear. This usually requires several months of treatment, most of which can be accomplished with an oral regimen on an outpatient basis.

**Surgical intervention** is rarely required. Predictors of a slow response are abscesses associated with an obstructed bronchus, an extremely large abscess (>6 cm in diameter) and abscesses involving relatively resistant organisms.

9. **Pneumocystis Carinii (Jiroveci) Pneumonia (formerly known as PCP)**

a) **Treatment:**

- An opportunistic infection in immunocompromised patients (including HIV)
- Start treatment on suspicion of PCP and refer for bronchoalveolar lavage (BAL)
- Check glucose-6-phosphosphate dehydrogenase (G6PD) level when diagnosis is made. Use dapsone and primaquine with caution in G6PD deficiency.

**First line treatment**

<table>
<thead>
<tr>
<th>Mild-Moderate PCP (PaO₂ &gt;9.3 kPa (70 mmHg), room air and at rest)</th>
<th>Alternative regimen</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Co-trimoxazole</strong> PO 90 mg/kg/day in 3 - 4 divided doses</td>
<td><strong>Trimethoprim</strong> PO 20 mg/kg/day in 2 - 3 divided doses <strong>plus</strong> <strong>dapsone</strong> PO 100 mg 24 hourly <strong>or</strong> <strong>Atovaquone</strong> liquid 750 mg 12 hourly</td>
</tr>
</tbody>
</table>

**Moderate to Severe PCP** (PaO₂ <9.3 kPa (70 mmHg), room air and at rest)

- Start corticosteroid therapy within 72 hours of commencing PCP treatment
- Days 1 - 5: prednisolone 40 mg 12 hourly PO; days 6 - 10 prednisolone 40 mg 24 hourly PO; days 11 - 21 prednisolone 20 mg 24 hourly PO

<table>
<thead>
<tr>
<th><strong>Co-trimoxazole</strong> IV 120 mg/kg/day in 2 - 4 divided doses</th>
<th><strong>Clindamycin</strong> IV/PO 600 mg 6 hourly <strong>plus</strong> <strong>primaquine</strong> PO 30 mg 24 hourly <strong>or</strong> <strong>Pentamidine</strong> 4 mg/kg 24 hourly IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>NB may dose reduce to 90 mg/kg/day after 72 hours</td>
<td><strong>Duration:</strong> Review IV antimicrobials at 72 hours and switch to oral according to response. Treat for a total of 14 - 21 days.</td>
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b) **Prophylaxis**

Co-trimoxazole 480 mg 24 hourly PO (or 960 mg three times a week)

Alternative prophylactic options include:
- Dapsone PO 50 – 100 mg 24 hourly - no toxoplasmosis coverage
- Pentamidine IV 4 mg/kg administered monthly
- Pentamidine nebs 300 mg inhaled monthly
- Atovaquone liquid 750 mg 12 hourly (take with high fat meals for optimal absorption; no toxoplasmosis coverage)

Duration: Liaise with HIV or haematology team, but in general, continue until patient immunocompetent (e.g. CD4 count >200 or risk factors resolved, e.g. post-immunosuppression).

10. **Acute Epiglottitis**

Although rare, this is a serious condition requiring urgent treatment. The most likely causative pathogens are *H. influenzae* or haemolytic streptococci.

Treatment of choice is *ceftriaxone** 2 g 24 hourly IV for 7 - 10 days.

*NB. Ceftriaxone* must not be mixed with calcium-containing solutions (e.g. Hartmann’s or Ringer’s solution) and must not be given at the same time as any calcium containing solutions, even via separate infusion lines. This is due to the potential risk of calcium-ceftriaxone precipitation in vital organs.

11. **Suspected Diphtheria**

For any suspected case of diphtheria, contact the consultant microbiologist immediately for advice on appropriate investigations and management.

12. **References**

1. NICE CG 191. Pneumonia – Diagnosis and Management of Community and Hospital Acquired Pneumonia in Adults. December 2014.
   [https://jamanetwork.com/journals/jamainternalmedicine/fullarticle/2536189](https://jamanetwork.com/journals/jamainternalmedicine/fullarticle/2536189)

See also:
Guideline 48 Gentamicin in Adults*
Guideline 59A Urgent Care Sepsis Screening and Action Tool*
Guideline 59B Urgent Care Maternal Sepsis Tool*
Guideline 59C Inpatient Sepsis Screening and Action Tool*
Guideline 67 Established Bronchiectasis Outpatient Parenteral Antimicrobial Therapy (OPAT) Pathway*
Guideline 97FM Azithromycin for use in Non-CF Bronchiectasis
Guideline 135 Appropriate requesting of Legionella and Pneumococcal Antigen Testing in Urine Samples*
Guideline 211 Diagnosis and Management of Pneumonia in High Cervical Cord Injury Patients*
Guideline 222 Adult and Paediatric Injectables Guide*
Guideline 241 Intravenous Vancomycin for Adults*
Guideline 302 Use of Antivirals during Seasonal Influenza – Treatment and Prophylaxis – Adults and Children*
Guideline 669 Nebulised Drugs for use in Adults in Hospital*
Guideline 698 Management and Control of Panton-Valentine Leukocidin (PVL) associated Staphylococcal Infections*
Guideline 709 Seasonal Influenza Adult Hospital Pathways*
BHT Pol 182 Outpatient Parenteral Antimicrobial Therapy (OPAT)/Home Intravenous (IV) Service Policy*

* BHT users only
Appendix 1

Community Acquired Pneumonia Integrated Care Pathway (Please refer to Trust guideline 133)

- Pneumonia should be considered early in every patient who has respiratory symptoms and features of sepsis and then confirmed with a CXR
- Please use this document in addition to the A&E clerking or specialty clerking proforma on admission to guide your management in the first few hours of admission
- If patient given stat piperacillin/tazobactam in line with sepsis of uncertain origin, revert to CAP antibiotic guidance as soon as pneumonia diagnosis confirmed.

The aim of this pathway is to ensure that all patients get timely and appropriate management (COSTT):

1. CXR within 4 hours of arrival to hospital
2. Oxygen assessment and correction of oxygen sats to >92% (caution to be exercised in COPD)
3. Severity assessment using the CURB-65 score
4. Targeted antibiotics according to the guideline below
5. Timely antibiotics within 4 hours of arrival to hospital

**CURB-65 SCORE**

<table>
<thead>
<tr>
<th>Confusion</th>
<th>Urea &gt;7.0</th>
<th>Resp Rate &lt;30</th>
<th>Systolic BP &lt;90 or Diastolic BP &lt;60</th>
<th>Age ≥65</th>
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Total:

Management guided by CURB-65 score

(Tick boxes to show which management plan followed – all elements are mandatory)

Low severity:
CURB-65 = 0 - 1
<3% mortality
- **Amoxicillin** 500 mg 8 hourly PO, if IV treatment necessary, **Benzylpenicillin** 1.2g 8 hourly IV
- OR if type 1 penicillin hypersensitivity
  - **Clarithromycin** 500 mg 12 hourly PO/IV
  - OR
  - **Doxycycline** 200 mg loading then 100 mg 24 hourly PO

Consider treating at home if social circumstances appropriate and otherwise well

Moderate severity:
CURB-65 = 2
9% mortality
- **Amoxicillin** 500 mg 8 hourly PO, if IV treatment necessary, **Benzylpenicillin** 1.2g 6 hourly IV
  - **Clarithromycin** 500 mg 12 hourly PO / IV
- OR if history of type 1 penicillin hypersensitivity
  - **Doxycycline** 200 mg loading then 100 mg 24 hourly PO
  - **Moxifloxacin** 400 mg 24 hourly PO (avoid if >80 years)

Admit
- Do form for urinary Pneumococcal Ag and Legionella Ags (Please state "consolidation on CXR" and CURB score 2 on request form, otherwise sample will be rejected)

NB. Patient must be reviewed by a consultant within 12 hours

High severity:
CURB-65 = 3 or more
15 - 40% mortality
- **Benzylpenicillin** 1.2g 6 hourly IV
  - **Clarithromycin** 500 mg 12 hourly PO / IV
- OR if history of type 1 penicillin hypersensitivity
  - **Vancocycin** IV (see Trust guideline 241 for vancocycin dosing)
  - **Clarithromycin** 500 mg 12 hourly PO / IV
- Admit
- Early ICU review mandatory if appropriate
- ICU review deemed not appropriate

- Do form for urinary Pneumococcal and Legionella Ags (Please state "consolidation on CXR" and the CURB score on request form, otherwise sample will be rejected)

NB. Patient must be reviewed by a registrar within 4 hours and by a consultant within 12 hours

Regardless of the CURB score, if any of the following are present, early ICU review should be considered: (tick as appropriate)

- Oxygen sats <92% or p<8 on air or requiring FiO2 >40% to keep sats >92%
- Persistent hypotension or high lactate despite adequate fluid resuscitation (*see sepsis pathway, Trust guideline 59A*)
- GCS <8

If guideline has not been followed please indicate here the reason for this:

- Patient too sick
- Patient already had antibiotics before admission
- Other (please specify in notes)