# HOSPITAL ACQUIRED PNEUMONIA IN ADULTS

<table>
<thead>
<tr>
<th>Full title of guideline</th>
<th>Guideline for the Management of Hospital Acquired Pneumonia (HAP) in Adults</th>
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</table>
| Author:                | Wei Shen Lim Respiratory Consultant  
                          Tim Hills Lead Pharmacist Antimicrobials and Infection Control  
                          Shanika Crusz Microbiology Consultant |
| Division & Speciality  | All adult divisions |
| Scope                  | Trust wide for nurses, doctors and pharmacists |
| Explicit definition of patient group to which it applies (e.g. inclusion and exclusion criteria, diagnosis) | Adult patients with hospital acquired pneumonia. |
| Review date            | 31/07/2021 |

<table>
<thead>
<tr>
<th>Changes from previous guideline</th>
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<tbody>
<tr>
<td>- Co-trimoxazole now 2nd line for non-severe HAP</td>
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<tr>
<td>- Duration for non-severe HAP adjusted to 3-5 days</td>
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<tr>
<td>- Co-trimoxazole now 1st line for severe HAP</td>
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<tr>
<td>- Additional advice to support the 24-72 hour review</td>
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<tr>
<td>- Ventilator associated pneumonia/Critical care VAP duration now 5-7 days.</td>
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Jan 19 update
- Addition of advice regarding quinolones and risk of aortic aneurysm and dissection

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<tr>
<th>Statement of the evidence base of the guideline – has the guideline been peer reviewed by colleagues?</th>
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<tbody>
<tr>
<td>- Local microbiological sensitivity surveillance</td>
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<tr>
<td>- Recommended best practice based on clinical experience of guideline developers</td>
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<tr>
<td>- SPC Septrin accessed 12/6/2018</td>
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<td>- Micromedex solutions accessed 12/6/2018</td>
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<tr>
<td>- NICE CG191 Pneumonia in adults accessed 04/08/2017</td>
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<tr>
<td>- International ERS/ESICM/ESCMID/ALAT guidelines for the management of hospital-acquired pneumonia and ventilator-associated pneumonia 2017</td>
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This guideline has been registered with the trust. However, clinical guidelines are guidelines only. The interpretation and application of clinical guidelines will remain the responsibility of the individual clinician. If in doubt contact a senior colleague or expert. Caution is advised when using guidelines after the review date.
Guidelines for the Management of Hospital Acquired Pneumonia (HAP) in Adults

These guidelines are intended for the antibiotic treatment of HAP in immunocompetent adults. Follow neutropenic sepsis guidelines for patients who are neutropenic.

Inpatient with lower respiratory tract infection

New Chest signs suggestive of pneumonia or pulmonary infiltrates on Chest X-ray

- No
  - See separate Bronchitis/ LRTI (non-pneumonic) guidelines

- Yes
  - Onset >48 hours after admission or admission in last 7 days
    - No
      - See separate community acquired pneumonia guidelines
    - Yes
      - Hospital acquired pneumonia
        - On critical care unit
          - No
            - Non-ICU Hospital acquired pneumonia  Pg 6
          - Yes
            - ICU associated Hospital acquired pneumonia (including Ventilator associated pneumonia) Pg 8
Hospital acquired pneumonia

Definition
Hospital acquired pneumonia (HAP) is defined as a pneumonia that occurs 48 hours or longer after hospital admission and excludes any infection that is incubating at the time of admission. Ventilator-associated pneumonia (VAP) is pneumonia developing after at least 48 hours of mechanical ventilation and is a subgroup of HAP.

Clinical features
New and or progressive pulmonary infiltrates on chest X-ray consistent with infection, or which are otherwise unexplained occurring 48 hours or more after hospital admission or admission in last 7 days. Other clinical features are that of a respiratory tract infection, such as fever, purulent sputum or tracheal secretions, core temperature >38.3°C, leucocytosis >12 x 10⁹/L or leucopenia (<4x 10⁹/L) and increased oxygen requirements.

Severe HAP
Assessing severity is the key to deciding general and antimicrobial management. Unlike community-acquired pneumonia (CAP), there are not any published evidence-based guidelines available to aid clinical judgment in assessing the severity of HAP. The following clinical features would suggest severe pneumonia, but these may be present due to underlying disease or other causes e.g. post-operative complications

- New mental confusion
- Respiratory rate 30/min or more
- Hypoxia (PaO₂<8 kPa or SaO₂ <92% on any FiO₂)
- Bilateral or multilobular chest X-ray shadowing
- Blood pressure Systolic BP <90 mmHg or diastolic ≤ 60 mmHg
- Need for ventilatory support
Hospital-acquired pneumonia (not on Critical Care)

**Microbiology**

**Core Bacterial Pathogens (if no previous antibiotics)**

*S. pneumoniae, H. influenzae, S. aureus* and sensitive enteric Gram negative bacilli.

Additional pathogens to consider in certain circumstances

**P. aeruginosa**

In immunocompromised patients, patients who have recently been on ICU, had broad spectrum antibiotic therapy within the last 2 weeks or with structural lung disease e.g. bronchiectasis.

**Anaerobes**

If the patient has a history suggestive of aspiration as a precipitating cause or radiographic evidence of abscess formation.

**MRSA Risk Factors:**

- Known or previous MRSA infection/colonisation.
- Inpatient ≥ 1 week prior to procedure.
- Patient with long term indwelling catheter or central line
- Admitted from a Nursing home or residential home with long term breaks in the skin e.g. leg ulcer or pressure sore

In Nottingham nearly all MRSA strains are sensitive to gentamicin and doxycycline.

**Legionella sp.**

Rare cause of HAP. In immunocompromised patients or if there are signs suggesting an atypical infection, infection with *Legionella sp.* must also be considered and microbiology contacted to discuss the investigation and management of the case, as the standard recommended antibiotic regimens do not cover *Legionella sp.*

**Samples to be taken prior to starting antibiotics**

1) Sputum for culture (if productive cough or produced after physiotherapy if antibiotic therapy will not be delayed).
2) Blood cultures.

Other specimens which may be indicated
Sputum or throat swab for respiratory virus PCR testing if features suggestive of influenza infection during influenza season

**HAP not requiring critical care**

_Caution; antibiotics may require dose adjustment in renal impairment, if unsure discuss with a ward pharmacist or check NUH guideline on antibiotic doses in renal impairment (available on the antibiotic website [http://nuhnet/diagnostics_clinical_support/antibiotics](http://nuhnet/diagnostics_clinical_support/antibiotics) )_

The choice of antibiotic is determined by the likelihood that the pneumonia is secondary to aspiration, the presence of chronic respiratory infection e.g. bronchiectasis, any recent broad spectrum antibiotics and recent microbiology results.

Routine antibiotic treatment is **not** indicated for aspiration, unless there is persistence of chest signs, or fever 48 hours after the episode of aspiration, when the patient should be treated for aspiration pneumonia see below.

Prior microbiology results should be taken into consideration when selecting the appropriate therapy from the options given below. Medical microbiology advice is available if required. If the patient is known to be colonised/ previously infected with multi resistant Gram negative bacilli (MRGNB) or MRSA please discuss antibiotic choice with microbiology. Ensure that in those patients with structural lung disease (e.g.bronchiectasis) that previous microbiology is reviewed and prescribe accordingly.

If the patient has already received broad spectrum antibiotics (e.g.co-amoxiclav, levofloxacin) in the last 7 days please discuss with microbiology.
**Non Severe HAP**  If patient clinically stable and not requiring IV antibiotics

All patients with previous *C. difficile* (both toxin or PCR positive) require documented microbiology approval prior to using levofloxacin

<table>
<thead>
<tr>
<th>1&lt;sup&gt;st&lt;/sup&gt; Line</th>
<th>2&lt;sup&gt;nd&lt;/sup&gt; Line (if recent course of doxy or otherwise unsuitable)</th>
<th>If NBM (convert to oral when taking oral medication) *</th>
</tr>
</thead>
<tbody>
<tr>
<td>PO Doxycycline 100mg bd for 3-5 days</td>
<td>PO Co-trimoxazole 960mg BD for 3-5 days</td>
<td>IV Levofloxacin 500mg od</td>
</tr>
<tr>
<td>PLUS (if aspiration) PO Metronidazole 400mg tds</td>
<td>PLUS (if aspiration) PO Metronidazole 400mg tds</td>
<td>PLUS (If aspiration) IV Metronidazole 500mg tds</td>
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<tr>
<td></td>
<td>(Convert to 1&lt;sup&gt;st&lt;/sup&gt; or 2&lt;sup&gt;nd&lt;/sup&gt; line choice when taking oral medication) total 3-5 days IV and oral</td>
<td></td>
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<td></td>
<td>Note levofloxacin is associated with a small increased risk of aortic aneurysm and dissection, see <a href="#">MHRA alert</a></td>
<td></td>
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</table>

All patients should have a 24-72 hour antibiotic review.

Do not routinely treat with antibiotics for >3 days in patients with low probability of HAP and no clinical deterioration within 72 h of symptom onset. The term “low probability of HAP” refers to a clinical presentation not highly suggestive of pneumonia at symptom onset and remaining not highly suggestive of pneumonia after 72 hours. Consider alternative diagnoses.
**Severe HAP** (not requiring critical care)

All patients with previous *C. difficile* (both toxin or PCR positive) require documented microbiology approval prior to using cefuroxime or levofloxacin

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<th>1&lt;sup&gt;st&lt;/sup&gt; Line</th>
<th>2&lt;sup&gt;nd&lt;/sup&gt; Line</th>
<th>3&lt;sup&gt;rd&lt;/sup&gt; Line</th>
</tr>
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<tbody>
<tr>
<td><strong>PO Co-trimoxazole 1.44g (3 x 480mg tablets) bd usual course up to 5 days</strong>&lt;sup&gt;*&lt;/sup&gt;</td>
<td><strong>PO Levofloxacin 500mg bd usual course up to 5 days</strong>&lt;sup&gt;*&lt;/sup&gt;</td>
<td><strong>IV Cefuroxime 1.5g tds changing to PO Doxycycline 100mg bd usual total course up to 5 days</strong></td>
</tr>
<tr>
<td>plus (if aspiration)</td>
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<td>plus (if aspiration)</td>
</tr>
<tr>
<td><strong>PO Metronidazole 400mg tds</strong></td>
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<tr>
<td><strong>Advantages:</strong></td>
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</tr>
<tr>
<td>Lower risk for <em>C. difficile</em></td>
<td>Very good oral bioavailability (90-100%)</td>
<td>Higher-risk for <em>C. difficile</em>.</td>
</tr>
<tr>
<td>Very good oral bioavailability (90-100%)</td>
<td>IV not usually required*</td>
<td>Requires IV/PO switch to a different preparation.</td>
</tr>
<tr>
<td>IV not usually required*</td>
<td><strong>Disadvantages:</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Disadvantages:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skin rashes are common.</td>
<td>Potentially higher-risk for <em>C. difficile</em>.</td>
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<tr>
<td>Can increase serum potassium (monitor if on other sparing agents)</td>
<td>Can cause tendon damage especially in the elderly.</td>
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<tr>
<td>IV preparation requires significant dilution (500ml), and there have been intermittent supply problems, only use IV if levofloxacin is contra-indicated and supplies are available in pharmacy</td>
<td>Can prolong QT interval.</td>
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</table>

*If the patient meets criteria for **high-risk red sepsis** the 1<sup>st</sup> dose of co-trimoxazole 1.44g or levofloxacin 500mg (+/- metronidazole 500mg) should be given intravenously. If the patient is NBM or is unable to absorb orally, IV co-trimoxazole 1.44g bd or IV levofloxacin 500mg bd should be used converting to oral as appropriate.

Cont…SEE PAGE BELOW
All patients should have a 24-72 hour antibiotic review.

Do not routinely treat with antibiotics for >3 days in patients with low probability of HAP and no clinical deterioration within 72 h of symptom onset. The term “low probability of HAP” refers to a clinical presentation not highly suggestive of pneumonia at symptom onset and remaining not highly suggestive of pneumonia after 72 hours. Consider alternative diagnoses.
HAP requiring Critical Care/Ventilator associated pneumonia (VAP)

The clinical features that suggest VAP i.e. purulent secretions and new and/or persistent infiltrate on CXR which is otherwise unexplained, increased oxygen requirement, blood leucocytosis (>10 x 10^9/L) or leucopenia (<4 x 10^9/L), core temperature >38.3°C can mimic acute respiratory distress syndrome, which may lead to an over- or under-diagnosis of VAP. Positive tracheal secretions cultures are non-specific and should not be used alone to guide therapy, whereas bronchoalveolar lavage specimens have been shown to be helpful.

In patients who are admitted to critical care from the community and ventilated for less than 4 days the range of likely pathogens is different to those who are admitted from a ward or ventilated for 4 days or more.

**Microbiology**

**Community admission ventilated less than 48h**
Likely causative organisms are *H. influenzae, S. pneumoniae, S. aureus* and sensitive enteric Gram-negative bacilli if no prior antibiotic therapy.

**Inpatient or ventilated for more than 48h**
Likely causative organisms are Gram-negative bacilli including *Pseudomonas aeruginosa*, rarely MRSA and *Legionella sp.*, and other organisms. Infecting organisms are more likely to be multi-resistant if the patient has received prior broad-spectrum antibiotic therapy.

**Samples to be taken prior to starting antibiotics**
1) Tracheal aspirate for culture and ideally a Bronchoalveolar lavage (BAL), If BAL taken ring microbiology and ask for urgent processing of the specimen.
2) Blood cultures- all line sites and peripheral
3) Urine for pneumococcal antigen testing (and legionella antigen if atypical features or suggestive history)
4) Sputum or throat swab for respiratory virus PCR if features suggestive of influenza infection during influenza season
Critical Care Unit Antibiotic treatment for HAP and VAP

Review recent microbiology sections of the critical care patient records, as an antibiotic plan may have been made on the daily ward round.

1. Community admission ventilated less than 48h
   Follow community-acquired pneumonia guideline

2. Inpatient or ventilated for more than 48h and antibiotic naïve (i.e. no courses of antibiotics in last 7 days)

   **IV Piperacillin/Tazobactam 4.5g tds** for 5-7 days
   
   **Or** if non–severe penicillin allergy **IV Meropenem 500mg qds for 5-7 days**
   
   Severe penicillin allergy: discuss with microbiology

   **If known MRSA colonisation, add:**

   **PO or IV Linezolid 600mg bd** for 7 days (if not contraindicated by drug interactions- discuss with pharmacy).

   NB: Oral bioavailability of linezolid is approximately 100% in patients who are absorbing. For enteral administration linezolid tablets should be crushed and dispersed as linezolid suspension may block feeding tubes.

   **If Linezolid contraindicated, add:**

   **IV Vancomycin** for 7 days. Refer to antibiotic website for dosing or use vancomycin dosing calculator available on the antibiotic website [monitor levels and aim for a pre dose (trough) level of 15-20 mg/L.]

   *If known colonisation with piperacillin/ tazobactam resistant organisms or severe allergy with beta-lactam antibiotics (i.e. penicillins, cephalosporins and carbapenems) and no plan has been documented on the microbiology ward round, discuss with a senior clinician and a medical microbiologist if required.*
3. Inpatient or ventilated for more than 48h and recent course of antibiotics in last 7 days

**IV Meropenem 500mg qds** for 5-7 days (Not if severe penicillin allergy e.g. anaphylaxis, immediate onset urticarial or angioedema)

If known MRSA colonisation or MRSA infection strongly suspected add

**PO or IV Linezolid 600mg bd** for 7 days (if not contraindicated by drug interactions- discuss with pharmacy).

NB: Oral bioavailability of linezolid is approximately 100% in patients who are absorbing. For enteral administration linezolid tablets should be crushed and dispersed as linezolid suspension may block feeding tubes.

If Linezolid contraindicated add

**IV Vancomycin** for 7 days. Refer to antibiotic website for dosing or use vancomycin dosing calculator available on the antibiotic website [monitor levels and aim for a pre dose (trough) level of 15-20 mg/L.]

*If known colonisation with meropenem resistant organisms or severe allergy with beta-lactam antibiotics (i.e. penicillins, cephalosporins and carbapenems) and no plan has been documented on the microbiology ward round, discuss with a senior clinician and a medical microbiologist if required.*

**On-going review and length of treatment**
Antibiotic treatment should be reviewed at 48 hours when microbiology results become available. If sensitive organisms isolated, treatment should be de-escalated on microbiology advice. If cultures taken before antibiotics are negative the need for antibiotics should be reviewed in light of the patient’s clinical picture.

Patients with a low probability of VAP (e.g. Clinical Pulmonary Infection Score ≤6) and are clinically stable at 72h should not routinely receive antibiotics for >3 days. Consider alternative diagnoses.

Usual duration 5-7 days.
Shorter courses may be given depending upon the rate of clinical, radiological and laboratory improvement.
Longer courses may be given in patients with slow clinical response and those with underlying immunodeficiency, cystic fibrosis, empyema, lung abscess, cavitation or necrotising pneumonia and upon microbiology advice/for specific organisms eg *S. aureus*. 