Pneumonia (hospital-acquired): antimicrobial prescribing

NICE National Institute for Health and Care Excellence

Background

Hospital-acquired pneumonia develops 48 hours or more after hospital admission

In this guideline, hospital-acquired pneumonia does not include pneumonia developing after intubation (ventilator-associated)

Follow the NICE guideline on community-acquired pneumonia if symptoms start within 48 hours of admission

Prescribing considerations

Consider following the NICE guideline on community-acquired pneumonia for choice of antibiotic if symptoms start within 3 to 5 days of admission and not at higher risk of resistance

When choosing an antibiotic(s), take account of:

- **severity of symptoms and signs (based on clinical judgement*)**
- **number of days in hospital before onset of symptoms**
- **the risk of developing complications, for example if the person has a relevant comorbidity (such as severe lung disease or immunosuppression)**
- **local hospital and ward-based antimicrobial resistance data**
- **recent antibiotic use**
- **recent microbiological results, including colonisation with multi-drug resistant bacteria**
- **recent contact with health or social care setting before current admission**
- **the risk of adverse effects with broad spectrum antibiotics, including *Clostridium difficile* infection**

Give oral antibiotics first line if possible

Review intravenous antibiotics by 48 hours and consider switching to oral antibiotics if possible

***No validated severity assessment tools were available for hospital-acquired pneumonia at the the time of publication**

Pneumonia (hospital-acquired)

- Offer an antibiotic(s) within 4 hours of establishing a diagnosis
- Send a sample (sputum sample, nasopharyngeal swab or tracheal aspirate) for microbiological testing

When microbiological results available:

- review the choice of antibiotic(s), and
- change the antibiotic(s) according to results, using a narrower spectrum antibiotic, if appropriate

Reassess if symptoms:

- **do not improve as expected, or**
- **worsen rapidly or significantly**

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Seek specialist advice from a microbiologist for:

- symptoms that are not improving as expected with antibiotics, or
- multi-drug resistant bacteria

Follow the NICE guideline on care of dying adults in the last days of life for adults approaching the end of life

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When exercising their judgement, professionals and practitioners are expected to take this guideline fully into account, alongside the individual needs, preferences and values of their patients or the people using their service. It is not mandatory to apply the recommendations, and the guideline does not override the responsibility to make decisions appropriate to the circumstances of the individual, in consultation with them and their families and carers or guardian.

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Choice of antibiotic: adults aged 18 years and over

Antibiotic[1]	Dosage and course length[2]
First choice oral antibiotic for non-severe symptoms or signs and not at higher risk of resistance[3] (guided by microbiological results when available)	
Co-amoxiclav	500/125 mg three times a day for 5 days then review[4]
Alternative oral antibiotics for non-severe symptoms or signs and not at higher risk of resistance[3], if penicillin allergy or if co-amoxiclav unsuitable. Base choice on specialist microbiological advice and local resistance data. Options include:	
Doxycycline	200 mg on first day, then 100 mg once a day for 4 days (5-day course) then review[4]
Cefalexin (caution in penicillin allergy)	500 mg twice or three times a day (can be increased to 1 to 1.5 g three or four times a day) for 5 days then review[4]
Co-trimoxazole[5,6]	960 mg twice a day for 5 days then review[4]
Levofloxacin[6] (only if switching from IV levofloxacin with specialist advice; consider safety issues[7])	500 mg once or twice a day for 5 days then review[4]
First choice IV antibiotics if severe symptoms or signs (for example, of sepsis) or at higher risk of resistance[3]. Review IV antibiotics by 48 hours and consider switching to oral antibiotics as above for a total of 5 days then review[4]. Base choice on specialist microbiological advice and local resistance data. Options include:	
Piperacillin with tazobactam	4.5 g three times a day (increased to 4.5 g four times a day if severe infection)
Ceftazidime	2 g three times a day
Ceftriaxone	2 g once a day
Cefuroxime	750 mg three or four times a day (increased to 1.5 g three or four times a day if severe infection)
Meropenem	0.5 to 1 g three times a day
Ceftazidime with avibactam	2/0.5 g three times a day
Levofloxacin[6] (consider safety issues[7])	500 mg once or twice a day (use higher dosage if severe infection)
Antibiotics to be added if suspected or confirmed MRSA infection (dual therapy with an IV antibiotic listed above)	
Vancomycin[5]	15 to 20 mg/kg two or three times a day IV, adjusted according to serum vancomycin; loading dose of 25 to 30 mg/kg for serious illness (maximum 2 g per dose)
Teicoplanin[5]	Initially 6 mg/kg every 12 hours for 3 doses, then 6 mg/kg once a day
Linezolid[5] (if vancomycin cannot be used; specialist advice only)	600 mg twice a day orally or IV

[1]See BNF for appropriate use and dosing in specific populations, for example, hepatic impairment, renal impairment, pregnancy and breast-feeding, and administering intravenous (or, where appropriate, intramuscular) antibiotics.
[2]Oral doses are for immediate-release medicines.
[3]Higher risk of resistance includes symptoms or signs starting more than 5 days after hospital admission, relevant comorbidity such as severe lung disease or immunosuppression, recent use of broad spectrum antibiotics, colonisation with multi-drug resistant bacteria and recent contact with health or social care setting before current admission.
[4]Review treatment after a total of 5 days of antibiotics and consider stopping the antibiotic if clinically stable.
[5]See BNF for information on monitoring of patient parameters and therapeutic drug monitoring.
[6]Not licensed for hospital-acquired pneumonia, so use is off-label. The prescriber should follow relevant professional guidance, taking full responsibility for the decision. Informed consent should be obtained and documented. See the General Medical Council's Good practice in prescribing and managing medicines and devices for further information.
[7]See MHRA advice for restrictions and precautions for using fluoroquinolones due to very rare reports of disabling and potentially long-lasting or irreversible side effects affecting musculoskeletal and nervous systems. Warnings include stopping treatment at first signs of a serious adverse reaction (such as tendonitis), prescribing with caution for people over 60 and avoiding coadministration with corticosteroids (March 2019).

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Choice of antibiotic: children and young people over 1 month and under 18 years

Antibiotic[1]	Dosage and course length[2]
First choice oral antibiotic if non-severe symptoms or signs and not at higher risk of resistance[3] (guided by microbiological results when available)	
Co-amoxiclav	1 to 11 months, 0.5 ml/kg of 125/31 suspension three times a day for 5 days then review[4] 1 to 5 years, 10 ml of 125/31 suspension[5] three times a day or 0.5 ml/kg of 125/31 suspension three times a day for 5 days then review[4] 6 to 11 years, 10 ml of 250/62 suspension three times a day or 0.3 ml/kg of 250/62 suspension three times a day for 5 days then review[4] 12 to 17 years, 500/125 mg three times a day for 5 days then review[5]
Alternative oral antibiotic if non-severe symptoms or signs and not at higher risk of resistance[3], for penicillin allergy or if co-amoxiclav unsuitable	
Clarithromycin	1 month to 11 years: Under 8 kg, 7.5 mg/kg twice a day for 5 days then review[4]; 8 to 11 kg, 62.5 mg twice a day for 5 days then review[4] 12 to 19 kg, 125 mg twice a day for 5 days then review[4]; 20 to 29 kg, 187.5 mg twice a day for 5 days then review[4] 30 to 40 kg, 250 mg twice a day for 5 days then review[4] 12 to 17 years, 500 mg twice a day for 5 days in total then review[4]
Other options may be suitable based on specialist microbiological advice and local resistance data	
First choice IV antibiotics if severe symptoms or signs (for example, symptoms or signs of sepsis) or at higher risk of resistance[3]. Review IV antibiotics by 48 hours and consider switching to oral antibiotics as above for a total of 5 days then review[4]	
Antibiotic choice based on specialist microbiological advice only and local resistance data. Options include:	
Piperacillin with tazobactam	1 month to 11 years, 90 mg/kg three or four times a day (maximum 4.5 g per dose four times a day) 12 to 17 years, 4.5 g three times a day (increased to 4.5 g four times a day if severe infection)
Ceftazidime	1 month to 17 years, 25 mg/kg three times a day (50 mg/kg three times a day if severe infection; maximum 6 g per day)
Ceftriaxone	1 month to 11 years (up to 50 kg), 50 to 80 mg/kg once a day (use dose at higher end of range if severe infection; maximum 4 g per day) 9 to 11 years (50 kg and above), 2 g once a day 12 to 17 years, 2 g once a day
Antibiotics to be added if suspected or confirmed MRSA infection (dual therapy with an IV antibiotic listed above)	
Teicoplanin[6,7]	1 month, initially 16 mg/kg for 1 dose, then 8 mg/kg once daily, subsequent dose to be given 24 hours after initial dose (doses given by IV infusion) 2 months to 11 years, initially 10 mg/kg every 12 hours IV for 3 doses, then 6 to 10 mg/kg once daily IV 12 to 17 years, initially 6 mg/kg every 12 hours IV for 3 doses, then 6 mg/kg once daily IV
Vancomycin[6,7]	1 months to 11 years, 10 to 15 mg/kg four times a day, adjusted according to serum vancomycin; 12 to 17 years, 15 to 20 mg/kg two or three times a day, adjusted according to serum vancomycin, loading dose of 25 to 30 mg/kg for serious illness (maximum 2 g per dose)
Linezolid[8] (if vancomycin cannot be used; specialist advice only)	3 months to 11 years, 10 mg/kg three times a day orally or IV (maximum 600 mg per dose) 12 to 17 years, 600 mg twice a day orally or IV

[1]See BNFC for appropriate use and dosing in specific populations, for example, hepatic impairment, renal impairment, pregnancy and breast-feeding, and administering intravenous (or, where appropriate, intramuscular) antibiotics.
[2]Oral doses are for immediate-release medicines. Prescribers to use age bands with other factors such as severity and child's size in relation to the average for children of the same age.
[3]Higher risk of resistance includes onset of symptoms more than 5 days after hospital admission, relevant comorbidity such as severe lung disease or immunosuppression, recent use of broad spectrum antibiotics, colonisation with multi-drug resistant bacteria and recent contact with health or social care setting before current admission.
[4]Review treatment after a total of 5 days and consider stopping antibiotics if clinically stable.
[5]Or 5 ml of 250/62 suspension.
[6]See BNFC for information on monitoring of patient parameters.
[7]See BNFC for information on therapeutic drug monitoring.
[8]Linezolid is not licensed in children and young people under 18 years. The prescriber should follow relevant professional guidance, taking full responsibility for the decision. Informed consent should be obtained and documented. See the General Medical Council's Good practice in prescribing and managing medicines and devices for further information.