

Community-Acquired Pneumonia in Adults - Microbiology Full Clinical Guideline

Reference number: CG-ANTI/2023/006

Introduction

- The pathogens of pneumonia can be inoculated via:
 - Micro-aspirates of microorganisms colonising the oropharyngeal tract.
 - A haematogenous mechanism of transmission:
 - Another focus of infection culminates in bacteraemia; the microorganism disseminates via the blood to inoculate the lung.
 - A contiguous mechanism of transmission:
 - Another focus of infection disseminates locally and inoculates the lung.
 - Inhalation of infectious aerosols/droplets.
- One of the potential outcomes of:
 - Microbial inoculation of the pulmonary alveoli; and
 - The subsequent pulmonary inflammatory response

Is the cycle of congestion-red hepatization-grey hepatization culminating in the formation of serous/suppurative exudates.
- With the multi-faceted (mucociliation, tight junctions, etc.) nature of host defences, community-acquired pneumonia (CAP) is associated with:
 - Heavy microbial inoculums; and/or
 - Virulent microorganisms; and/or
 - Impaired host defences.
- Common agents of CAP include bacteria and viruses.
- Bacterial causes are commonly divided into:
 - Typical (e.g. *Streptococcus pneumoniae*, *Haemophilus influenzae*, and *Moraxella catarrhalis*); and
 - Atypical (e.g. *Mycoplasma pneumoniae*, *Chlamydophila pneumoniae*, *Chlamydophila psittaci*, and *Legionella* species).
- Viral causes include:
 - Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2):
 - Please note [local](#) and [national](#) guidance regarding coronavirus disease 2019 (COVID-19).
 - Adenovirus.
 - Influenza A virus and influenza B virus:
 - Please note [local](#) and [national](#) guidance regarding influenza.
 - Parainfluenza virus.
 - Respiratory syncytial virus.
- Symptoms and signs of CAP may include:
 - Pleuritic pain, breathlessness, purulent cough, haemoptysis; hypoexpansion, increased fremitus, dullness, and bronchial breathing and crackles.
- Temperatures > 38 ° C or < 36 ° C, respiratory rate > 20 breaths/minute, heart rate > 90 beats/minute, and hypotension can denote progression of localised infectious disease into sepsis and septic shock.

Investigation

Past

- Review the past microbiology results, with specific reference to previous respiratory samples:
 - Culture positive for *Streptococcus pneumoniae*, *Haemophilus influenzae*, and *Moraxella catarrhalis*:
 - Noting susceptibility or resistance to first and second line options for CAP.

Present

- Radiology:
 - Chest x-ray (CXR).
- Microbiology:
 - ± Sputum culture:
 - If purulent cough.
 - Swab for SARS-CoV-2*.
 - ± Swab for influenza viruses:
 - If in the influenza season*.
 - ± Blood cultures:
 - If episode(s) of fever.
 - If the differential diagnosis includes bloodstream infection, sepsis, or septic shock.
 - If for initiation of treatment with intravenous antibiotics.
 - ± Urine *Legionella* antigen:
 - If [risk factors for legionellosis](#)*; or
 - If the CURB65 is ≥ 2 *.
 - NB If the *Legionella* antigen is positive:
 - Respiratory sample, e.g. sputum, for *Legionella* culture.
 - ± Urine pneumococcal antigen:
 - If the CURB65 is ≥ 2 *; or
 - If a positive result will influence management*, i.e. stopping empiric and starting directed antibiotics.
 - * NB1 If available, point-of-care investigation in accident and emergency, medical assessment unit, etc., is recommended ± laboratory testing.
 - NB2 In collaboration with the medical/respiratory consultant:
 - If a positive result will influence management (e.g. stopping empiric and starting directed antibiotics):
 - First line, if productive/purulent cough:
 - Sputum for *Mycoplasma pneumoniae* PCR.
 - Second line:
 - Throat swab (green top Σ -VIROCULT®) for *Mycoplasma pneumoniae* PCR.
 - If negative, case by case, in discussion with microbiology/virology, *Chlamydomphila pneumoniae* and *Chlamydomphila psittaci* PCR.
- Blood sciences:
 - Full blood count (FBC), C-reactive protein (CRP), lactate, urea and electrolytes (U&Es), and liver function tests (LFTs).

Classification

- The severity of CAP may be calculated with the CURB65 scoring system.
- The CURB65 scoring system is comprised of:

"Confusion (abbreviated Mental Test score 8 or less, or new	1 point
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disorientation in person, place or time)	
“Raised blood urea nitrogen (over 7 mmol/litre)”	1 point
“Raised respiratory rate (30 breaths per minute or more)”	1 point
“Low blood pressure (diastolic 60 mmHg or less, OR systolic less than 90 mmHg)”	1 point
“Age 65 years or more”	1 point

- CURB65 scores of:

0-1	Low risk of death
2	Intermediate risk of death
3-5	High risk of death

- Please note, the electronic prescribing and medicines administration (EPMA) systems of the emergency departments in Burton/Derby include CURB65 calculators to enable scoring.

Treatment

Calculate the CAP severity, with the CURB65 scoring system:

- Via the EPMA system/hospital guideline; and
 - Enter the CURB65 score onto the electronic patient record (EPR)/into the medical notes.

Low severity, e.g. CURB65 ≤ 1: empiric, per oral antibiotics

- With the rationale of enabling *Streptococcus pneumoniae* (the commonest cause of CAP) activity, per oral antibiotics in the community:

First line	Amoxicillin 500 mg -1 g* 8 hourly
Second line, if penicillin allergy	Doxycycline** 200 mg loading dose, 100 mg 24 hourly thereafter
Third line, if penicillin allergy and if doxycycline is contraindicated	Clarithromycin** 500 mg 12 hourly
Fourth line, if penicillin allergy and if doxycycline and clarithromycin are contraindicated	Co-trimoxazole 960 mg 12 hourly
Fifth line, if penicillin allergy (non-immediate without systemic involvement penicillin allergy) and if doxycycline, clarithromycin, and co-trimoxazole are contraindicated	Cefaclor 500 mg 8 hourly
* Respiratory (1 g) and microbiology (500 mg) opinions vary regarding amoxicillin dose	
** Doxycycline and clarithromycin both have atypical bacterial activity re CAP	

Moderate severity, e.g. CURB65 2: empiric, per oral antibiotics

- With the rationale of enabling both typical and atypical bacterial activity re CAP, per oral antibiotics ± in hospital:

First line	Amoxicillin 1 g 8 hourly AND Clarithromycin 500 mg 12 hourly
Second line, if penicillin allergy	Doxycycline* 200 mg loading dose, 100 mg 24 hourly thereafter
Third line, if penicillin allergy and if doxycycline is contraindicated	Co-trimoxazole 960 mg 12 hourly AND Clarithromycin 500 mg 12 hourly
Fourth line, if penicillin allergy and if doxycycline, co-trimoxazole, and clarithromycin are contraindicated	Levofloxacin 500 mg 12 hourly

High severity, e.g. CURB65 ≥ 3: empiric, intravenous antibiotics

- With the rationale of enabling both typical and atypical bacterial activity re CAP, intravenous antibiotics in hospital:

First line	Co-amoxiclav 1.2 g 8 hourly AND Clarithromycin 500 mg 12 hourly (or per oral)
Second line, if non-immediate without systemic involvement penicillin allergy	Cefuroxime 1.5 g 8 hourly AND Clarithromycin 500 mg 12 hourly (or per oral)
Third line, if immediate rapidly evolving or non-immediate with systemic involvement penicillin allergy	Co-trimoxazole 960 mg 12 hourly AND Clarithromycin 500 mg 12 hourly
Fourth line, if immediate rapidly evolving or non-immediate with systemic involvement penicillin allergy and if co-trimoxazole and clarithromycin are contraindicated	Levofloxacin 500 mg 12 hourly

Directed antibiotics (with susceptibilities): typicals

- Intravenous, [according to susceptibilities](#):

	First line	Second line, if non-immediate without systemic involvement penicillin allergy	Third line, if immediate rapidly evolving or non-immediate with systemic involvement penicillin allergy
<i>Streptococcus pneumoniae</i>	Benzylpenicillin 1.2 g 6 hourly	Cefuroxime 1.5 g 8 hourly	Glycopeptide (vancomycin or teicoplanin), dose as per hospital guidelines , vancomycin target pre dose level 15-20 mg/l, teicoplanin target pre dose level 15-30 mg/l
<i>Haemophilus influenzae</i>	Narrowest spectrum of amoxicillin 1 g 8 hourly or co-amoxiclav 1.2 g 8 hourly	Cefuroxime 1.5 g 8 hourly	Co-trimoxazole 960 mg 12 hourly
<i>Moraxella catarrhalis</i>	Co-amoxiclav 1.2 g 8 hourly	Cefuroxime 1.5 g 8 hourly	Co-trimoxazole 960 mg 12 hourly

- After 2 days of intravenous antibiotics, if the patient is afebrile, observations stable, and inflammatory markers downward trending, collaborate with the senior(s) regarding per oral step down.

- Per oral, [according to susceptibilities](#):

	First line	Second line, if penicillin allergy	Third line, if penicillin allergy and if doxycycline is contraindicated
<i>Streptococcus pneumoniae</i>	Amoxicillin 500 mg -1 g* 8 hourly	Doxycycline 200 mg loading dose, 100 mg 24 hourly thereafter	Clarithromycin 500 mg 12 hourly
<i>Haemophilus influenzae</i>	Narrowest spectrum of amoxicillin 1 g 8 hourly or co-amoxiclav 625	Doxycycline 200 mg loading dose, 100 mg 24 hourly	Co-trimoxazole 960 mg 12 hourly

	mg 8 hourly plus amoxicillin 500 mg 8 hourly	thereafter	
<i>Moraxella catarrhalis</i>	Co-amoxiclav 625 mg 8 hourly	Doxycycline 200 mg loading dose, 100 mg 24 hourly thereafter	Clarithromycin 500 mg 12 hourly
* Respiratory (1 g) and microbiology (500 mg) opinions vary regarding amoxicillin dose			

Duration of antibiotics: typicals

- Low/Moderate severity CAP, e.g. CURB65 ≤ 2:
 - Antibiotics 5 days:
 - If no microbiology evidence (e.g. blood cultures) of invasive bacterial disease; and
 - If clinically stable:
 - Temperature ≤ 38 ° C for ≥ 48 hours; and
 - Respiratory rate ≤ 20 breaths/minute; and
 - Arterial oxygen saturation ≥ 90%; and
 - Heart rate ≤ 90 beats/minute; and
 - Systolic blood pressure ≥ 90 mmHg.
- High severity CAP, e.g. CURB65 ≥ 3:
 - Antibiotics ≥ 5 days:
 - Final duration to be tailored to the patient in collaboration with the medical/respiratory consultant; or
 - If microbiological evidence (e.g. blood cultures) of invasive bacterial disease, final duration to be tailored to the patient in collaboration with the microbiology consultant.

Directed antibiotics: atypicals

- Intravenous:

	First line	Second line	Third line
<i>Mycoplasma pneumoniae</i>	If available, azithromycin 500 mg loading dose, 250 mg 24 hourly thereafter	If intravenous azithromycin is unavailable, levofloxacin 500 mg 12 hourly	If intravenous azithromycin is unavailable and if levofloxacin is contraindicated, discuss with a microbiology consultant
<i>Chlamydophila pneumoniae</i> / <i>Chlamydophila psittaci</i>	If available, azithromycin 500 mg loading dose, 250 mg 24 hourly thereafter	If intravenous azithromycin is unavailable, levofloxacin 500 mg 12 hourly	If intravenous azithromycin is unavailable and if levofloxacin is contraindicated, clarithromycin 500 mg 12 hourly
<i>Legionella</i> spp	Levofloxacin 500 mg 12 hourly	If levofloxacin is contraindicated and if available, azithromycin 500 mg 24 hourly	If levofloxacin is contraindicated and if intravenous azithromycin is unavailable, clarithromycin 500 mg 12 hourly

- After 2 days of intravenous antibiotics, if the patient is afebrile, observations stable, and inflammatory markers downward trending, collaborate with the senior(s) regarding per oral step down.

- Per oral:

	First line	Second line	Third line
<i>Mycoplasma pneumoniae</i>	Azithromycin 500 mg loading dose, 250 mg 24 hourly thereafter	Doxycycline 100 mg 12 hourly	Levofloxacin 500 mg 12 hourly
<i>Chlamydophila pneumoniae</i>	Azithromycin 500 mg loading dose, 250 mg 24 hourly thereafter	Doxycycline 100 mg 12 hourly	Levofloxacin 500 mg 12 hourly
<i>Chlamydophila psittaci</i>	Doxycycline 100 mg 12 hourly	Azithromycin 500 mg loading dose, 250 mg 24 hourly thereafter	Levofloxacin 500 mg 12 hourly
<i>Legionella</i> spp	Levofloxacin 500 mg 12 hourly	Azithromycin 500 mg 24 hourly	Doxycycline 100 mg 12 hourly

Duration of antibiotics: atypicals

- *Mycoplasma pneumoniae*:
 - With azithromycin 5 days.
 - With doxycycline:
 - If immunocompetent: 7 days.
 - If severe CAP or immunocompromised: 14 days.
 - With [levofloxacin](#):
 - If immunocompetent: 7 days.
 - If severe CAP or immunocompromised: 14 days.
- *Chlamydophila pneumoniae*:
 - With azithromycin 5 days.
 - With doxycycline 10 days.
 - With [levofloxacin](#) 10 days.
- *Chlamydophila psittaci*:
 - With doxycycline 10 days.
 - With azithromycin 5 days.
 - With [levofloxacin](#) 10 days.
- *Legionella* spp:
 - With [levofloxacin](#):
 - If immunocompetent: ≥ 7 days.
 - If severe CAP or immunocompromised: ≥ 14 days.
 - With azithromycin:
 - If immunocompetent: ≥ 7 days.
 - If severe CAP or immunocompromised: ≥ 14 days.
 - With doxycycline:
 - If immunocompetent: ≥ 7 days.
 - If severe CAP or immunocompromised: ≥ 14 days.

Management

Clinical concerns re CAP

Investigation

- Radiology: CXR
- Microbiology: (1) ± sputum culture (e.g. if purulent cough); (2) swab for SARS-CoV-2; (3) ± swab for influenza viruses (e.g. if in the influenza season); (4) ± blood cultures (e.g. if episode[s] of fever; or, if the differential diagnosis includes bloodstream infection, sepsis, or septic shock; or, if for initiation of treatment with intravenous antibiotics); (5) ± urine *Legionella* antigen (e.g. if [risk factors for legionellosis](#) or if the CURB65 is ≥ 2); (6) ± urine pneumococcal antigen (e.g. if the CURB65 is ≥ 2 or if a positive result will influence management, i.e. stopping empiric and starting directed antibiotics)
 - NB In collaboration with the medical/respiratory consultant: if a positive result will influence management (e.g. stopping empiric and starting directed antibiotics), ± *Mycoplasma pneumoniae* PCR (first line, if productive/purulent cough, sputum; second line, throat swab [green top Σ-VIROCULT®]). If *Mycoplasma pneumoniae* PCR negative, case by case, in discussion with microbiology/virology, ± *Chlamydia* PCR
- Blood sciences: FBC, CRP, lactate, U&Es, and LFTs

CURB65 score (enter onto the EPR or into the medical notes)

- “Confusion (abbreviated Mental Test score 8 or less, or new disorientation in person, place or time)”: 1 point
- “Raised blood urea nitrogen (over 7 mmol/litre)”: 1 point
- “Raised respiratory rate (30 breaths per minute or more)”: 1 point
- “Low blood pressure (diastolic 60 mmHg or less, **OR** systolic less than 90 mmHg)”: 1 point
- “Age 65 years or more”: 1 point

Treatment

Low severity, e.g. CURB65 ≤ 1

Empiric per oral antibiotics in the community (please note, page 2)

Moderate severity, e.g. CURB65 2

Empiric per oral antibiotics ± in hospital (please note, page 2)

High severity, e.g. CURB65 ≥ 3

Empiric intravenous antibiotics in hospital (please note, page 3)

Directed antibiotics with culture and susceptibilities (please note, pages 3-5)

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Document control

Development of guidelines:	Dr Tom Bewick, Dr Cariad Evans, Kayleigh Lehal, Dr Peter Slovak, Dr Mohammad Raza
Consultation with:	Lead Antimicrobial Pharmacist, Microbiology Consultant, Respiratory Consultant, Virology Consultants
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Key contacts:	Dr Peter Slovak, Microbiology Consultant p.slovak@nhs.net Kayleigh Lehal, Lead Antimicrobial Pharmacist kayleigh.lehal@nhs.net Dr Tom Bewick, Respiratory Consultant tom.bewick1@nhs.net