

DIAGNOSIS AND PROGNOSIS

- In adult CAP patients, the Pneumonia Severity Index (PSI) is preferred over CURB-65 as an adjunct to clinical judgment to guide the initial site of treatment (eg, need for hospitalization).
- Direct admission to the ICU is recommended for patients with hypotension requiring vasopressors or respiratory failure requiring mechanical ventilation.
- Testing:
 - Blood cultures and/or expectorated sputum samples for stain and culture are not recommended in adults with CAP managed in the outpatient setting.
 - Pretreatment blood culture¹ and/or expectorated sputum samples for culture and gram stain should be obtained in hospitalized patients who:
 - Are classified as severe CAP, especially if intubated, or
 - Are being empirically treated for MRSA or *P. aeruginosa*, or
 - Were previously infected with MRSA or *P. aeruginosa*, especially those with prior RTI
 - Were hospitalized and received parenteral antibiotics, whether during the hospitalization event or not, in the last 90 days
 - Influenza testing is recommended when influenza viruses are circulating in the community. Rapid influenza molecular assay is preferred over rapid influenza diagnostic test.
 - Serum procalcitonin levels should not be used to determine the need for initial antibiotic therapy. Empiric antibiotic therapy should be initiated in adults with clinically suspected and radiographically confirmed CAP regardless of serum procalcitonin level.
 - Against routine urine testing for *Legionella* and pneumococcal antigen, except in *Legionella* outbreak, recent travel, or severe CAP.

SEVERE CAP CRITERIA

Patient must fulfill either 1 major criterion or ≥3 minor criteria.

Minor criteria:

- Respiratory rate ≥30 breaths/min
- PaO₂/FiO₂ ratio ≤250
- Multilobar infiltrates
- Confusion/disorientation
- Uremia (BUN ≥20mg/dL)
- Leukopenia (WBC <4000 cells/μL)²
- Thrombocytopenia (platelets <100,000 cells/μL)
- Hypothermia (T<36°C)
- Hypotension requiring aggressive fluid resuscitation

Major criteria:

- Septic shock requiring vasopressors
- Respiratory failure requiring mechanical ventilation

OUTPATIENT EMPIRIC TREATMENT³

No comorbidities or risk factors for MRSA or *P. aeruginosa*⁴

- Amoxicillin 1g three times daily or
 - Doxycycline 100mg twice daily
- OR**
- Macrolide** (only if local pneumococcal resistance is <25%):
- Azithromycin 500mg on Day 1, then 250mg daily or
 - Clarithromycin 500mg twice daily or
 - Clarithromycin ER 1000mg daily

Comorbid conditions (chronic heart, lung, liver, or renal disease, diabetes, alcoholism, malignancies, asplenia)

- β-Lactam PLUS macrolide or doxycycline:**
- Amoxicillin/clavulanate 500mg/125mg three times daily or
 - Amoxicillin/clavulanate 875mg/125mg twice daily or
 - Amoxicillin/clavulanate 2000mg/125mg twice daily or
 - Cefpodoxime 200mg twice daily or
 - Cefuroxime 500mg twice daily
- PLUS
- Azithromycin or clarithromycin or doxycycline (same dosing above)
- OR**
- Respiratory fluoroquinolone:**
- Levofloxacin 750mg daily or
 - Moxifloxacin 400mg daily or
 - Gemifloxacin 320mg daily

INPATIENT EMPIRIC TREATMENT³

Nonsevere CAP

Standard Regimen

- β-Lactam PLUS macrolide**
- Ampicillin/sulbactam 1.5-3g every 6hrs or
 - Cefotaxime 1-2g every 8hrs or
 - Ceftriaxone 1-2g daily or
 - Ceftaroline 600mg every 12hrs PLUS
 - Azithromycin 500mg daily or
 - Clarithromycin 500mg twice daily or
 - Doxycycline 100mg twice daily⁵
- OR**
- Respiratory fluoroquinolone:**
- Levofloxacin 750mg daily or
 - Moxifloxacin 400mg daily

Prior respiratory isolation of MRSA

- Add MRSA coverage and obtain cultures/nasal PCR to confirm need for continued MRSA therapy or for de-escalation
- Vancomycin 15mg/kg every 12hrs (adjusted based on levels) or
 - Linezolid 600mg every 12hrs

Recent hospitalization and IV antibiotics and locally validated risk factors for MRSA

- Obtain cultures but withhold MRSA coverage unless positive culture. If rapid nasal PCR is available, add MRSA coverage if PCR is positive (while awaiting culture results)

Prior respiratory isolation of *P. aeruginosa*

- Switch to antipseudomonal β-Lactam⁶ and obtain cultures to confirm need for continued *P. aeruginosa* therapy or for de-escalation
- Piperacillin-tazobactam 4.5g every 6hrs or
 - Cefepime 2g every 8hrs or
 - Ceftazidime 2g every 8hrs or
 - Imipenem 500mg every 6hrs or
 - Meropenem 1g every 8hrs or
 - Aztreonam 2g every 8hrs

Recent hospitalization and IV antibiotics and locally validated risk factors for *P. aeruginosa*

- Obtain cultures but initiate coverage for *P. aeruginosa* only if positive culture

Severe CAP

Standard Regimen

- β-Lactam PLUS macrolide** (same agents as nonsevere)
- OR**
- β-Lactam PLUS fluoroquinolone** (same agents as nonsevere)

Prior respiratory isolation of MRSA or recent hospitalization and IV antibiotics and locally validated risk factors for MRSA

- Add MRSA coverage and obtain cultures/nasal PCR to confirm need for continued MRSA therapy or for de-escalation

Prior respiratory isolation of *P. aeruginosa* or recent hospitalization and IV antibiotics and locally validated risk factors for *P. aeruginosa*

- Switch to antipseudomonal β-Lactam⁶ and obtain cultures to confirm need for continued *P. aeruginosa* therapy or for de-escalation (same regimen as nonsevere)

OTHER TREATMENTS

- Routine corticosteroid use is not recommended in nonsevere or severe CAP, but may be considered in CAP patients with refractory septic shock.
- Additional anaerobic coverage for suspected aspiration pneumonia is not recommended unless lung abscess or empyema is suspected.
- Anti-influenza treatment (eg, oseltamivir) should be prescribed for all adults with CAP who test positive for influenza, whether inpatient or outpatient, and independent of duration of illness before diagnosis.

(continued)

TREATMENT DURATION

- Duration of antibiotic therapy should be guided by a validated measure of clinical stability (eg. normal vital signs [HR, RR, BP, O₂ saturation, and temperature], ability to eat, and normal mentation), and antibiotic therapy should be continued until the patient achieves stability and for no less than a total of 5 days.⁷
- Duration of therapy for CAP due to suspected or proven MRSA or *P. aeruginosa* should be 7 days.
- Routine follow-up chest imaging is not recommended in patients whose symptoms have resolved within 5-7 days.

CHANGES FROM PREVIOUS GUIDELINE

Recommendation	2007 Guideline	2019 Guideline
Sputum and blood culture	Patients with severe disease	Patients with severe disease and all inpatients empirically treated for MRSA or <i>P. aeruginosa</i>
Macrolide therapy	Strong recommendation for outpatients	Conditional recommendation for outpatients based on resistance levels
Use of procalcitonin	Not addressed	Not recommended to determine need for initial antibiotic therapy
Use of corticosteroids	Not addressed	Avoid use. May be considered in refractory septic shock
Use of HCAP category	Accepted	Recommend abandoning category. Increased emphasis on de-escalation of therapy if cultures are negative
Standard empiric therapy for severe CAP	β -Lactam + macrolide OR β -Lactam + fluoroquinolone are equally accepted	β -Lactam + macrolide OR β -Lactam + fluoroquinolone are equally accepted, but stronger evidence in favor of β -Lactam + macrolide
Routine use of follow-up chest imaging	Not addressed	Against use. Perform lung cancer screening as clinically indicated if patient is eligible

NOTES

Key:

BP = blood pressure

BUN = blood urea nitrogen

CAP = community-acquired pneumonia

ER = extended-release

ESBL = extended-spectrum β -lactamase

HCAP = healthcare-associated pneumonia

HR = heart rate

MRSA = methicillin-resistant *Staphylococcus aureus*

PCR = polymerase chain reaction

RR = respiratory rate

RTI = respiratory tract infection

T = temperature

WBC = white blood cell

¹ Recommended against routine collection of blood cultures in hospitalized CAP patients.

² Due to infection alone and not another source (eg, not chemotherapy-induced).

³ Antibiotic recommendations for the empiric treatment of CAP are based on selecting agents effective against: *S. pneumoniae*, *H. influenzae*, *M. pneumoniae*, *S. aureus*, *Legionella species*, *C. pneumoniae*, and *M. catarrhalis*.

⁴ Risk factors include prior respiratory isolation of MRSA or *P. aeruginosa* or recent hospitalization AND receipt of IV antibiotics in the last 90 days.

⁵ Use doxycycline for patients with contraindications to both macrolides and fluoroquinolones.

⁶ Does not include coverage for ESBL-producing Enterobacteriaceae, which should be considered only on the basis of patient or local microbiological data.

⁷ Longer duration of antibiotic therapy is recommended for pneumonia complicated by meningitis, endocarditis, and other deep-seated infections, or infection with other less-common pathogens (eg, *B. pseudomallei*, *M. tuberculosis*, or endemic fungi).

REFERENCES

Metlay JP, Waterer GW, Long AC, et al. Diagnosis and treatment of adults with community-acquired pneumonia. An Official Clinical Practice Guideline of the American Thoracic Society and Infectious Diseases Society of America. *Am J Respir Crit Care Med*. October 2019; 200(7):45-67. DOI: 10.1164/rccm.201908-1581ST.