



Community Acquired Pneumonia

Francis Kane, MD
Assistant Professor-Clinical
Division of General Internal Medicine
The Ohio State University Wexner Medical Center

MedNet21
Center for Continuing Medical Education

 **THE OHIO STATE UNIVERSITY**
WEXNER MEDICAL CENTER

Objectives

- Pneumonia definitions
- Epidemiology
- Microbiology
- Clinical Pathway
 - Diagnosis
 - Site of care
 - Treatment
 - Stewardship considerations

Community Acquired Pneumonia

Pulmonary infection acquired outside of a hospital environment

Nosocomial Pneumonia

HCAP (health care-associated pneumonia) has fallen from grace and no longer recognized in ATS / IDSA guidelines

Hospital-acquired pneumonia: pulmonary infection occurring at least 48 hours after admission

Ventilator-associated pneumonia: pulmonary infection occurring at least 48 hours after endotracheal intubation

CAP Epidemiology



A year in the U.S.:

5 million cases
1.2 million hospitalizations
55,000 deaths



Setting:

70% outpatient
30% inpatient

CAP Epidemiology

Age Group	Incidence of Pneumonia-Related Hospitalizations (95% CI) <i>no. of cases per 10,000 adults per year</i>
18-49 yr	6.7 (6.1-7.3)
50-64 yr	26.3 (24.1-28.7)
65-79 yr	63.0 (56.4-70.3)
≥80 yr	164.3 (141.9-189.3)

Jain S, Self WH, Wunderink RG, et al. Community-Acquired Pneumonia Requiring Hospitalization among U.S. Adults. *N Engl J Med*. 2015;373(5):415-427. doi:10.1056/NEJMoa1500245

Causative Agents

- High proportion without organism found
 - Difficulty in obtaining samples
 - Low sensitivity of diagnostic tests
 - Antibiotic use prior to collection
 - Viruses not investigated

Microbial Causes of CAP

Streptococcus pneumoniae

Mycoplasma Pneumoniae

Haemophilus influenzae

Chlamydia pneumoniae

Legionella pneumophila

Respiratory Viruses

- Influenza A / B
- Metapneumovirus
- Adenovirus
- Respiratory syncytial virus
- Parainfluenza
- Coronavirus (COVID-19)

“Typical” versus “Atypical”



Typical pathogens

S. pneumoniae, *Haemophilus influenzae*, *S. aureus*



Atypical pathogens

- cannot be cultured on standard media / seen on gram stain
- intrinsic resistance to β -lactams

Mycoplasma pneumoniae,
Chlamydia pneumoniae,
Legionella pneumophila

Respiratory viruses

- Influenza, adenoviruses, human metapneumoviruses, respiratory syncytial virus, coronaviruses

Clinical Manifestations

Constitutional

- Febrile
- Tachycardia
- Chills

Cough

- Productive or non-productive

Dyspnea

Pleuritic chest pain

Physical exam (sensitivity / specificity 58 / 67%)

- Tachypnea
- Accessory muscle use
- Tactile fremitus
- Percussion vary from dull to flat
- Crackles, bronchial breath sounds, pleural friction rub

Diagnostic Criteria

IDSA Guideline Criteria



New pulmonary
infiltrate on chest
image



Respiratory
symptoms
(at least 1)



At least one
other symptom /
finding of illness

CAP Clinical Pathway

Diagnosis and Site of Care

- Hypoxia

- Pneumonia
Severity Index

- CURB-65

Pneumonia Severity Index (PSI/PORT)

- | | | |
|---|--------------------------|--|
| <ul style="list-style-type: none"> ▪ 20-point scoring system <ul style="list-style-type: none"> ▪ Age / Sex ▪ co-morbidities ▪ Vitals ▪ labs (BUN, glucose, pH, pO₂) | Class I (low risk) | Physical examination findings, no comorbidities or laboratory findings |
| | Class II (low risk) | ≤70 points |
| | Class III (low risk) | 71–90 points. |
| | Class IV (moderate risk) | 91–130 points |
| | Class V (high risk) | >130 total points |
- Five risk categories

CURB-65

- | | | |
|--|------------------|--|
| <ul style="list-style-type: none"> ▪ 2 categories (severe [3-5] or non-severe[0-2]) ▪ In Europe there is use of CRB-65 (do not use blood urea) | Variable | Value |
| | Confusion | New disorientation person, place or time |
| | Urea | BUN >19 mg/dL |
| | Respiratory rate | ≥30 |
| | Blood pressure | Systolic < 90 mmHg, and/or diastolic ≤ 60 mmHg |
| Age | ≥ 65 years | |

CAP: Severe features

Major criteria (1 needed)

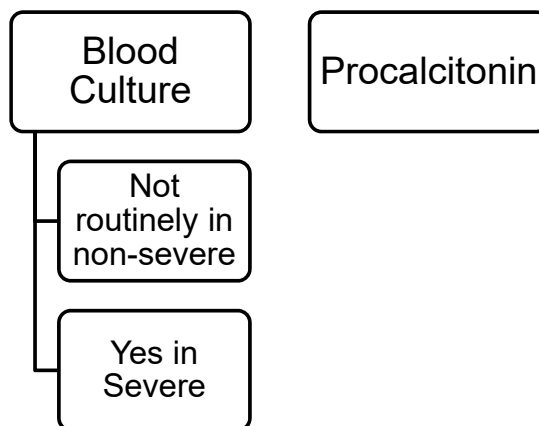
- Need for vasopressors
- Need for mechanical ventilation

Minor criteria (3 needed)

- Tachypnea
- P/F <250
- Multilobar infiltrates
- Confusion/disorientation
- Uremia (>20)
- Leukopenia
- Thrombocytopenia
- Hypothermia
- Hypotension requiring aggressive fluids

Diagnostic Testing

Bloodwork



Diagnostic Testing

Respiratory

Respiratory Culture

- Not routinely if non-severe, routinely if severe
- Yes if:
 - Hospitalization with IV Abx in last 90 days
 - Anti-MRSA or pseudomonal coverage initiated
 - Advanced structural lung disease

MRSA nasal swab

- Hospitaliation with IV Abx in the last 90 days
- Anti-MRSA coverage initiated
- Severe and h/o MRSA colonization or infection in the past year

Diagnostic testing

Viral

**Flu / COVID
swabs**

- If presence in community, potential exposure

**Respiratory
Viral Panel**

- In severe infection if available

CAP Pathway: Diagnostic Testing

Urine

- Legionella
 - Determine based on epidemiologic factors
- Pneumococcus
 - Not routinely in non-severe

Antibiotic Selection

Outpatient – no comorbidities

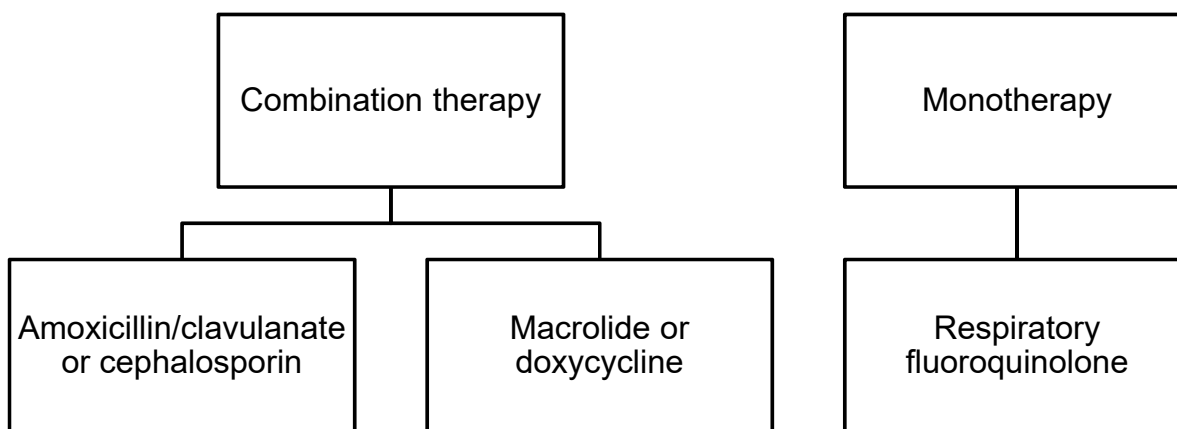
High dose
Amoxicillin

Doxycycline

Macrolide
(Azithromycin,
clarithromycin)

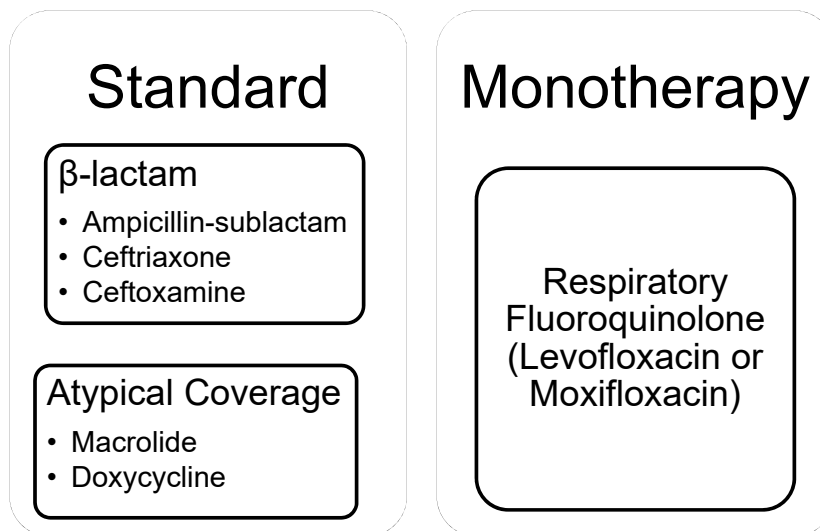
Antibiotic Selection

Outpatient – with co-morbidities



Antibiotic Selection

Inpatient – non-severe



Antibiotic Selection

Inpatient – non-severe MRDO coverage

MRSA coverage

- Vancomycin
- Linezolid

Anti-pseudomonal = adjust β -lactam

- Piperacillin / tazobactam
- Cefipime
- Ceftazadine
- Imipenem
- Meropenem

Antibiotic Selection

Inpatient - Severe

Standard regimen is the same as non-severe

- Do not recommend fluoroquinolone monotherapy, can be in combination with β -lactam

Anti-MRSA / Anti-Pseudomonal Coverage

- Hospitalization with IV Antibiotics in the past 90 days
- Otherwise same decision factors as non-severe

Antibiotic Selection

Duration



Minimum 3-5 days

Most patients achieve stability within the first 48-72 hours so 5 days is typically appropriate



MRSA or *P. aeruginosa* minimum 7 days



Longer courses

Complicated by infection at other sites (meningitis, endocarditis, etc)
Infection by less-common pathogen (eg *Burkholderia*, *Mycobacterium tuberculosis*)

Follow-up

Stewardship Considerations

- Assess for clinical stability / improvement (vitals, oxygenation, mental status)
- Determine pathogen-directed therapy based on culture data
- Procalcitonin
- MRSA Nasal Swab

Antibiotic Selections

Oral De-escalation

No MDRO risk factors:

- Amoxicillin + clavulanate (500 + 125 mg TID or 875/2000 + 125 mg BID)
- Cefpodoximine 200 mg PO BID
- Cefuroxime 500 mg PO BID

MDRO Risk Factors

- Levofloxacin 750 mg PO q24h

Antiviral

COVID

Ambulatory:

- nirmatrelvir/ritonavir (PO), Remdesivir (IV), monoclonal Abs if circulating susceptible

Hospitalized

- Not hypoxemic: if high risk remdesivir x3 days
- Hypoxemic: corticosteroids, remdesivir
 - IL-6 inhibitors (tocilizumab) in progressive / severe with high inflammatory markers
 - JAK inhibitors (barticitinib) in severe

Antiviral

Influenza

- Neuraminidase inhibitors (oseltamivir, inhaled zanamivir, IV peramivir, baloxavir)

Discharge Considerations



Vaccination (in eligible populations)

Pneumococcal
Influenza
COVID-19
RSV



Smoking cessation



Ensure proper therapy for control of chronic conditions

References

1. ATS/IDSA Guidelines for Diagnosis and Treatment of Adults with Community-acquired Pneumonia. Published , 10/1/2019. *American Journal of Respiratory and Critical Care Medicine*, Volume 200, Issue 7, 1 October 2019, Pages e45-e67. <https://www.atsjournals.org/doi/full/10.1164/rccm.201908-1581ST>
2. Kalil AC, Metersky ML, Klompas M, et al. Management of Adults With Hospital-acquired and Ventilator-associated Pneumonia: 2016 Clinical Practice Guidelines by the Infectious Diseases Society of America and the American Thoracic Society [published correction appears in Clin Infect Dis. 2017 May 1;64(9):1298. doi: 10.1093/cid/ciw799] [published correction appears in Clin Infect Dis. 2017 Oct 15;65(8):1435. doi: 10.1093/cid/cix587] [published correction appears in Clin Infect Dis. 2017 Nov 29;65(12):2161. doi: 10.1093/cid/cix759]. *Clin Infect Dis*. 2016;63(5):e61-e111. doi:10.1093/cid/ciw353
3. Wortham JM, Shapiro DJ, Hersh AL, Hicks LA. Burden of Ambulatory Visits and Antibiotic Prescribing Patterns for Adults With Community-Acquired Pneumonia in the United States, 1998 Through 2009. *JAMA Intern Med*. 2014;174(9):1520–1522. doi:10.1001/jamainternmed.2014.3456
4. Mandell LA, Niederman MS. Pneumonia. In: Loscalzo J, Fauci A, Kasper D, Hauser S, Longo D, Jameson J. eds. *Harrison's Principles of Internal Medicine, 21e*. McGraw-Hill Education; 2022. Accessed October 14, 2024. <https://accessmedicine.mhmedical.com/content.aspx?bookid=3095§ionid=263547796>
5. Zaki HA, Hamdi Alkahlout B, Shaban E, et al. The Battle of the Pneumonia Predictors: A Comprehensive Meta-Analysis Comparing the Pneumonia Severity Index (PSI) and the CURB-65 Score in Predicting Mortality and the Need for ICU Support. *Cureus*. 2023;15(7):e42672. Published 2023 Jul 29. doi:10.7759/cureus.42672
6. Pakhale S, Mulpuru S, Verheij T JM, Kochen MM, Rohde GGU, Bjerre LM. Antibiotics for community-acquired pneumonia in adult outpatients. *Cochrane Database of Systematic Reviews* 2014, Issue 10. Art. No.: CD002109. DOI: 10.1002/14651858.CD002109.pub4. Accessed 15 October 2024.
7. Raz-Pasteur A, Shasha D, Paul M. Fluoroquinolones or macrolides alone versus combined with β -lactams for adults with community-acquired pneumonia: Systematic review and meta-analysis. *Int J Antimicrob Agents*. 2015 Sep;46(3):242-8. doi: 10.1016/j.ijantimicag.2015.04.010. Epub 2015 Jun 3. PMID: 26092096.
8. Furukawa Y, Luo Y, Funada S, et al. Optimal duration of antibiotic treatment for community-acquired pneumonia in adults: a systematic review and duration-effect meta-analysis. *BMJ Open*. 2023;13(3):e061023. Published 2023 Mar 22. doi:10.1136/bmjopen-2022-061023
9. Adarsh Bhimraj, Rebecca L Morgan, Amy Hirsch Shumaker, Lindsey R Baden, Vincent Chi-Chung Cheng, Kathryn M Edwards, Jason C Gallagher, Rajesh T Gandhi, William J Muller, Mari M Nakamura, John C O'Horo, Robert W Shafer, Shmuel Shoham, M Hassan Murad, Reem A Mustafa, Shahnaz Sultan, Yngve Falck-Ytter, Infectious Diseases Society of America Guidelines on the Treatment and Management of Patients With COVID-19 (September 2022), *Clinical Infectious Diseases*, Volume 78, Issue 7, 15 June 2024, Pages e250–e349, <https://doi.org/10.1093/cid/ciac724>