ANTIBIOTIC PROTOCOL FOR ADULT COMMUNITY-ACQUIRED PNEUMONIA EMPIRIC THERAPY

This pathway is to be used in adult (>18 yo), immunocompetent patients only. An Infectious Diseases consult is recommended when dealing with complicated patients or immunocompromised patients (e.g., hematopoetic stem cell or solid organ transplant). All dosages based on normal renal/hepatic function.

If patient has any of the following characteristics, use the Antibiotic Protocol for Adult NOSOCOMIAL Pneumonia Empiric Therapy:

- Hospitalization for 2 d or more in the preceding 90 d
- Residence in a nursing home or extended care facility
- Family member with multidrug-resistant pathogen
- Immunosuppressive disease and/or therapy
- Home wound care
- Home infusion therapy
- Chronic dialysis within 30 d
- Antimicrobial therapy within 90 d

A. Not being admitted

1. No Modifying Factors Present (see below)

Azithromycin 500 mg PO qday **OR**
Doxycycline* 100 mg PO q12h

2. Modifying Factors Present (age > 65 years, alcoholism, malignancy, asplenia, chronic heart/lung/liver/renal disease, diabetes mellitus, exposure to a child in a daycare center)**

Moxifloxacin* 400 mg PO qday **OR**
Cefuroxime or amoxicillin or amoxicillin/clavulanate **PLUS** azithromycin or doxycycline*
Cefuroxime 500 mg PO q12h
Amoxicillin 1 gram PO q8h
Amoxicillin/clavulanate 2 grams (extended release) PO q12h
Azithromycin 500 mg PO qday
Doxycycline* 100 mg PO q12h

B. Admitted to the Hospital***

1. General Medical Ward (non-ICU)

Moxifloxacin* 400 mg PO/IV qday **OR**
Ceftriaxone **PLUS** azithromycin or doxycycline*
Ceftriaxone 1 gram (2 grams if > 80 kg) IV qday
Azithromycin 500 mg PO/IV qday
Doxycycline* 100 mg PO/IV q12h

2. ICU (No Pseudomonas Risk Factors Present)

Ceftriaxone 1 g (2 g if > 80 kg) IV qday **PLUS EITHER** azithromycin 500 mg PO/IV qday or moxifloxacin* 400 mg PO/IV qday
Penicillin allergy: aztreonam 2 grams IV q8h plus moxifloxacin* 400 mg PO/IV qday

3. Pseudomonas Risk Factors Present (structural lung disease, >10mg prednisone/day, malnutrition)

Either General Ward or ICU

Cefepime 1 gram IV q6h**** **OR**
Piperacillin/tazobactam 3.375 grams IV q8h, infused over 4 hours **OR**
Meropenem 500 mg IV q6h
Penicillin allergy: aztreonam 2 grams IV q6h
PLUS EITHER
Ciprofloxacin* 400 mg IV q8h **OR**
Aminoglycoside **PLUS** Azithromycin
Aminoglycosides – Gentamicin/tobramycin 5-7 mg/kg IV qday*****
Azithromycin 500 mg PO/IV qday

* Not recommended for use during pregnancy.
** Moxifloxacin is preferred due to reduced local susceptibility to the β-lactam options. Among the β-lactams, cefuroxime is preferred.
*** If community-associated methicillin-resistant *S. aureus* (CA-MRSA) is suspected, add vancomycin 15 mg/kg IV q12h or linezolid 600 mg IV/PO q12h. Trough levels for vancomycin should be approximately 15 mg/L – Consult the pharmacist.
**** Cefepime 2g IV q8h if neutropenia
*****Trough level for gentamicin/tobramycin once-daily dosing should be 0 mg/L – Consult the pharmacist.

Check pneumococcal and influenza vaccination eligibility and status.
Give vaccinations if indicated.

Community-Acquired Pneumonia Pathway

PURPOSE:

To provide a framework for the initial evaluation and management of the immunocompetent, adult patient with bacterial causes of CAP based on recent literature and guidelines. Delays in the initiation of appropriate antibiotic therapy can increase mortality, and therapy should not be postponed for the purpose of performing diagnostic studies in patients who are clinically unstable. Antibiotics should be administered as soon as possible, while the patient is in the emergency department (Core measures require administration within 4 hours of presentation.).

DEFINITION:

Community-Acquired Pneumonia (**CAP**) is defined as pneumonia that occurs within 48 hours of hospital admission or in a patient presenting with pneumonia who does not have any of the characteristics of healthcare associated pneumonia (hospitalized in an acute care hospital for two or more days within 90 days of the infection; resided in a nursing home or long-term care facility; received recent intravenous antibiotic therapy, chemotherapy, or wound care within the past 30 days of the current infection; or attended a hospital or hemodialysis clinic).

Severe CAP can be defined by eleven criteria: (1) need for invasive mechanical ventilation, (2) septic shock with the need for pressors, (3) respiratory rate $\geq$ 30 breaths/min, (4) $Pa_{O2}/Fi_{O2} < 250$, (5) multilobar infiltrates, (6) confusion/disorientation, (7) uremia (BUN $\geq$ 20 mg/dL), (8) leukopenia (WBC < 4000 cells/mm^3), (9) thrombocytopenia (platelets < 100,000 cells/ mm^3), (10) hypothermia (core temperature < 36°C), (11) hypotension requiring aggressive fluid resuscitation. The need for ICU admission can be defined by using a rule requiring the presence of one of the factors numbered 1-2 or three of the factors numbered 3-11.

DIAGNOSIS AND MANAGEMENT:

All patients thought to have pneumonia should have a chest X-ray and pulse oximetry performed. All admitted patients should have an assessment of gas exchange (oximetry or arterial blood gas), complete blood cell count and differential, and complete metabolic panel. Clinical indications for more extensive testing of patients admitted to the hospital are found below.

Indication	Blood Culture	Sputum Culture	*Legionella* urinary antigen	Pneumococcal urinary antigen	Other
ICU admission	X	X	X	X	X[a]
Failure of outpatient antibiotics		X	X	X	
Cavitary infiltrates	X	X			X[b]
Leukopenia	X			X	
Active alcoholic	X	X	X	X	
Chronic severe liver disease	X			X	
Severe obstructive/structural lung disease		X			
Asplenia	X			X	
Travel within prior 2 weeks			X		X[c]
Positive *Legionella* urinary antigen result		X[d]	NA		
Positive pneumococcal urinary antigen result	X	X		NA	
Pleural effusion	X	X	X	X	X[e]

[a]Endotracheal aspirate or bronchoalveolar lavage if intubated.
[b]Fungal and tuberculosis cultures.
[c]*Legionella*, *Coccidioides*, *Hantavirus*, *Burkholderia pseudomallei*, avian influenza, and SARS are all potential considerations depending on the area of travel.
[d]Special media for *Legionella*.
[e]Thoracentesis and pleural fluid cultures.

Therapy should not be delayed if a sputum culture cannot be obtained. HIV serology, with consent, should be considered, especially for patients aged 15-54 years. For patients with severe CAP, pre-treatment blood cultures, urinary antigens for *Legionella* and *S. pneumoniae*, and sputum culture should be ordered. Empiric antibiotics should be initiated while awaiting culture and susceptibility results.

The decision to admit a patient should be based on clinical judgment with consideration of age, co-morbid conditions, and factors that may compromise the safety of home care. Additionally, a CURB-65 score may be calculated

to assist in patient disposition decisions. If a CURB-65 score is used, outpatient care is recommended for a score of 0-1, inpatient care for a score of 2, and ICU care for a score of 3 or more (see appendix A). The PORT Severity Index is another score that may be calculated to assist in patient disposition decisions. If a PORT score is used, home care is recommended for risk classes I, II, and III (see appendix B).The recommended discharge criteria are that, during the 24 h prior to discharge, the patient should have no more than one of the following characteristics: temperature > 37.8°C, pulse > 100 bpm, respiratory rate > 24 breaths/min, systolic blood pressure < 90 mm Hg, and blood oxygen saturation <90%.

ANTIBIOTIC SELECTION:

The key decision in initial empiric therapy is whether the patient has risk factors for healthcare associated pneumonia, in which case the Antibiotic Protocol for Adult NOSOCOMIAL Pneumonia Empiric Therapy must be used. Additional factors that must be considered are the treatment site for the patient (inpatient/outpatient, general ward/ICU), the presence of modifying factors, and the presence of risk factors for pseudomonas or CA-MRSA.

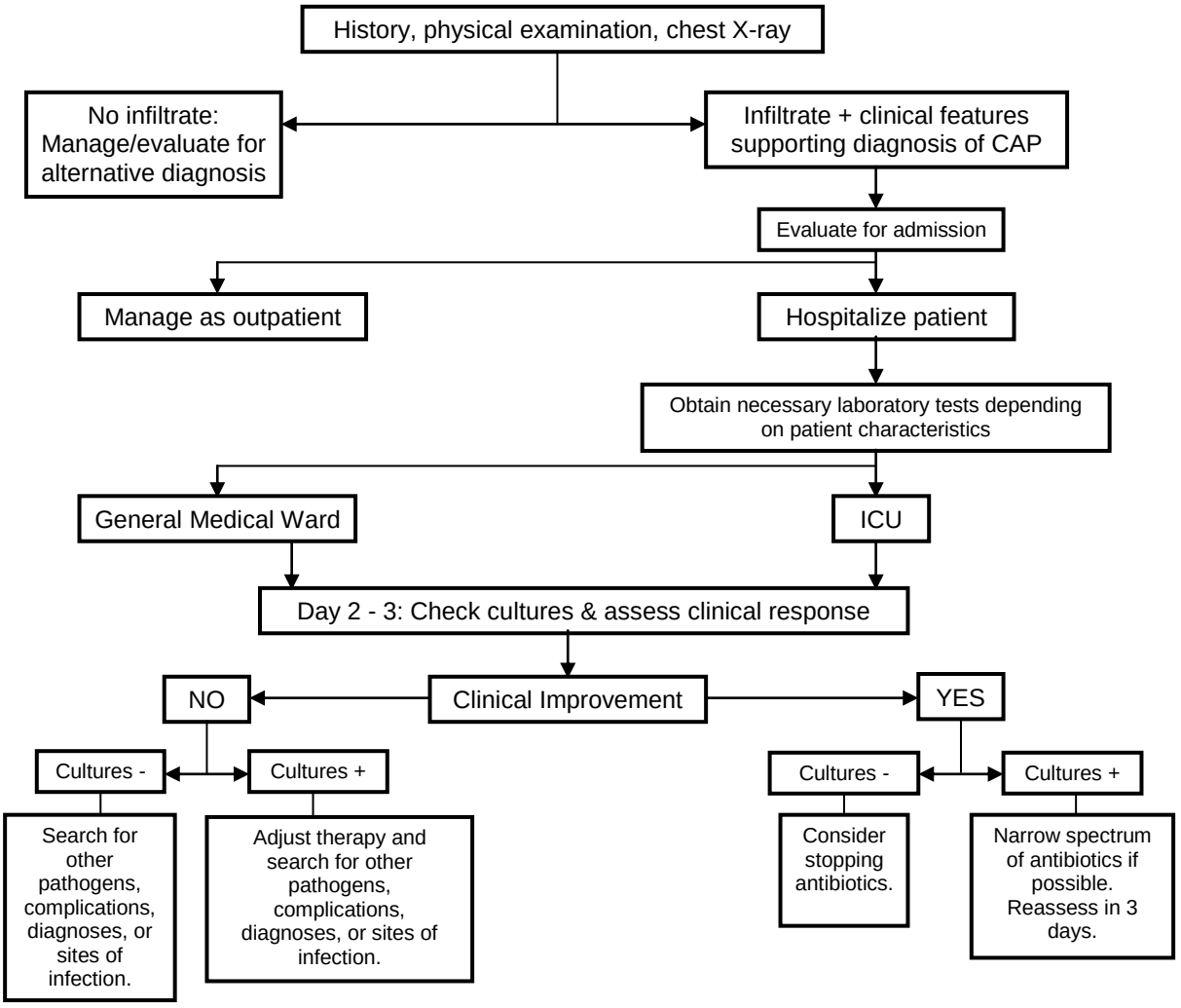
It is not necessary to start all CAP patients on intravenous therapy if they can tolerate oral therapy. However, if the patient is being admitted to the ICU, it is typically recommended that the patient receive at least 24 hours of intravenous therapy. Doxycycline, moxifloxacin, ciprofloxacin, and azithromycin all have excellent oral bioavailability.

CONTINUATION OF THERAPY:

Broad-spectrum empiric antibiotic therapy must be accompanied by a commitment to choose pathogen-specific therapy once the culture and susceptibility results are known, which is usually within 48 – 72 hours. Clinical improvement usually becomes apparent after the first 48–72 hours of
therapy, and therefore, the selected antimicrobial regimen should not be changed during this time unless progressive deterioration is noted or initial microbiologic studies so dictate.

The nonresponding patient should be evaluated for noninfectious mimics of pneumonia, unsuspected or drug-resistant organisms, extrapulmonary sites of infection, and complications of pneumonia and its therapy. Diagnostic testing should be directed to whichever of these causes is likely.

ALGORITHM:



APPENDIX A

CURB-65 Scoring System:

Patient Characteristic	Points assigned[a]
Confusion (based on specific mental test or disorientation to person, place, or time)	1
BUN level > 7 mmol/L (20 mg/dL)	1
Respiratory rate ≥ 30 breaths/min	1
Low blood pressure (systolic < 90 mmHg or diastolic ≤ 60 mmHg)	1
Age ≥ 65 years	1

[a] A total point score for a given patient is obtained by adding the points for each patient characteristic.

Score	Recommended site of care
0	Outpatient
1	Outpatient
2	Inpatient, wards
≥3	Inpatient, ICU

APPENDIX B

The Pneumonia PORT prediction rule:

1. Classify patient into risk class I if they are aged ≤ 50 years, have no neoplastic disease, liver disease, cerebrovascular disease, renal disease, or congestive heart failure, and have normal or only mildly abnormal vital signs and normal mental status.
2. Use the tables below to calculate a PORT score for those patients in risk classes II – V and determine site of care.

Patient Characteristic	Points asssigned[a]
Demographic factor	
Age	
Male	# of years of age
Female	# of years of age - 10
Nursing home resident	+10
Comorbid illnesses	
Neoplastic disease[b]	+30
Liver disease[c]	+20
Congestive heart failure[d]	+10
Cerebrovascular disease[e]	+10
Renal disease[f]	+10
Physical examination findings	
Altered mental status (disorientation, stupor, or coma)	+20
Respiratory rate > 30 breaths/min	+20
Systolic blood pressure < 90 mm Hg	+20
Temperature < 35°C or > 40°C	+15
Pulse > 125 beats/min	+10
Laboratory or radiographic findings	
Arterial pH < 7.35	+30
Blood urea nitrogen > 30 mg/dL	+20
Sodium < 130 mEq/L	+20
Glucose > 250 mg/dL	+10
Hematocrit < 30%	+10
Arterial partial pressure of oxygen < 60 mm Hg[g]	+10
Pleural effusion	+10

[a] A total point score for a given patient is obtained by adding the patient's age in years (age – 10 for females) and the points for each applicable patient characteristic.

[b] Any cancer except basal or squamous cell cancer of the skin that was active at the time of presentation or diagnosed within 1 year of presentation.
[c] A clinical or histologic diagnosis of cirrhosis or other form of chronic liver disease such as chronic active hepatitis.
[d] Systolic or diastolic ventricular dysfunction documented by history and physical examination, as well as chest radiography, echocardiography, Muga scanning, or left ventriculography.
[e] A clinical diagnosis of stroke, transient ischemic attack, or stroke documented by MRI or computed axial tomography.
[f] A history of chronic renal disease or abnormal blood urea nitrogen and creatinine values documented in the medical record.
[h] An oxygen saturation value < 90% on pulse oximetry or intubation before admission is also considered abnormal.

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Risk class	# of points	Mortality %	Recommended site of care
I	NA	0.1	Outpatient
II	≤ 70	0.6	Outpatient
III	71-90	2.8	Outpatient
IV	91-130	8.2	Inpatient
V	> 130	29.2	Inpatient

Revised: Trevor Van Schooneveld MD, April 2011