

Management of Pneumonia

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Community Acquired Pneumonia

“the captain of the men of death”

Sir William Osler



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Impact of CAP

- 4-6 million cases annually
- 10 million physician visits
- 600,000 hospitalizations
- 64 million days of restricted activity
- Mortality
 - Outpatient – 1%
 - Inpatient – 12%
 - ICU – 50%



Infect Dis Clin N Am 2004;18:761

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Risk Factors for CAP

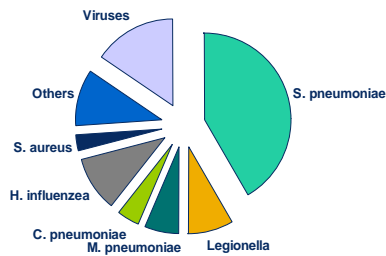
- Increasing age
- COPD
- Renal insufficiency
- Congestive Heart Failure
- Coronary artery disease
- Diabetes
- Malignancy
- Chronic neurological disease
- Chronic liver disease



Infect Dis Clin N Am 2004;18:761

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Pathogens: CAP



NEJM 1995;333:1618

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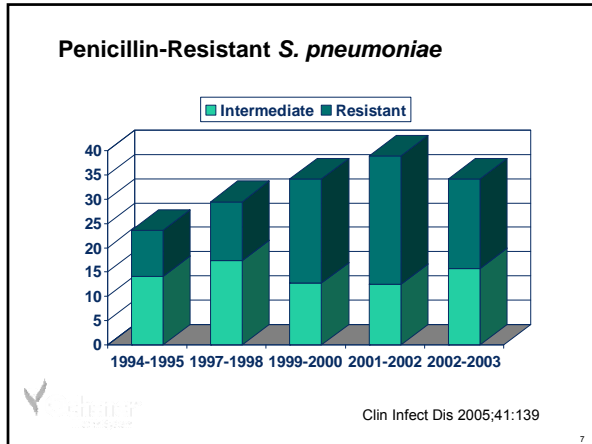
Cause of CAP

Ambulatory Patient	Hospitalized	ICU
<i>S. pneumoniae</i>	<i>S. pneumoniae</i>	<i>S. pneumoniae</i>
<i>M. pneumoniae</i>	<i>M. pneumoniae</i>	<i>S. aureus</i>
<i>H. influenzae</i>	<i>C. pneumoniae</i>	Legionella
<i>C. pneumoniae</i>	<i>H. influenzae</i>	<i>H. influenzae</i>
Viruses	Legionella	Gram-negative bacilli
	Aspiration	
	Viruses	



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S. pneumoniae resistance Rates

	Intermediate	Resistant
Azithromycin	1.3	27.4
Ceftriaxone	5.3	1.6
Clindamycin	0.1	9.3
Levofloxacin	0.1	0.7
Tetracycline	0.6	15.6
TMP/SMZ	6.6	25.4

Clin Infect Dis 2005;41:139


Pneumonia Severity Index

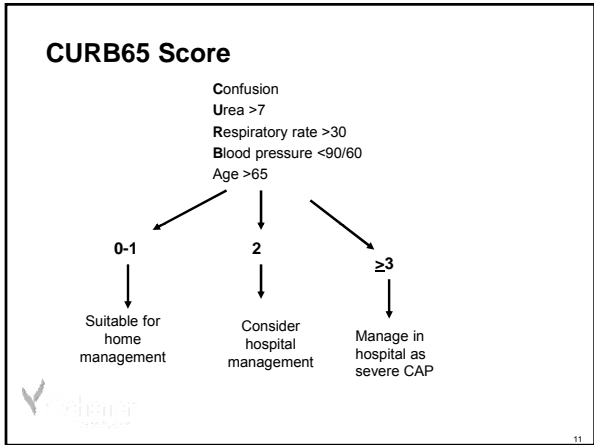
● Demographics	● Physical Exam	
—male age	— Alt. Mental	10
—female age-10	— RR ≥ 30	20
—NH 10	— SBP < 90	20
● Comorbidities	— Temp < 35 or ≥ 40	15
—cancer 30	— Pulse ≥ 125	10
—liver disease 20	● Laboratory	
—CHF 10	— Art. pH < 7.35	30
—Cerebrovasc 10	— Na < 130	20
—Renal dx. 10	— BUN ≥ 30	20
	— Glucose ≥ 250	10
	— HCT < 30	10
	— PaO ₂ < 60	10
	— Pleural effusion	10


NEJM 1997;336:243

Pneumonia Severity Index

Class	Score	30-day Mortality	Treatment
I		<0.5%	Outpatient
II	<70	0.5-1.9%	Outpatient
III	71-90	2-4	Inpatient short stay
IV	91-130	4-12%	Inpatient
V	>130	>12%	Inpatient


 NEJM 1997;336:243 10



- ### Principles of Empiric Antimicrobial Therapy
- Recent antibacterial use
 - Most likely pathogens
 - Local susceptibility patterns
 - Potential for inducing drug resistance
 - Medical comorbidities
 - Cost effectiveness
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Outpatient therapy

- Previously healthy, no use of antibacterials
- Azithromycin / clarithromycin or doxycycline
- Presence of comorbidities, use of antibacterials
- Respiratory quinolone or high dose amoxicillin plus macrolide




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Inpatient Therapy

- General ward
- Respiratory quinolone or β -lactam plus macrolide
- No risk for drug resistance
- Monotherapy




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Inpatient Therapy: ICU

- *Pseudomonas* not a consideration
- β -lactam plus azithromycin or respiratory quinolone
- *Pseudomonas* is consideration
- Antipseudomonal β -lactam plus cipro/levo



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Respiratory Quinolones

- Gemifloxacin (Factive) – no IV; causes rash
- Levofloxacin (Levaquin) – high dose
- Moxifloxacin (Avelox)



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Beta-lactam Agents

- Beta-lactam agents
 - Ceftriaxone or cefotaxime
 - Ampicillin/sulbactam (Unasyn)
 - Ertapenem (Invanz)
- Antipseudomonal beta-lactams
 - Piperacillin/tazobactam (Zosyn)
 - Cefepime (Maxipime)
 - Meropenem or imipenem



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CaMRSA Treatments


- | | |
|-------------------------------|---------------------|
| ● Vancomycin | ● Linezolid (Zyvox) |
| — Poor penetration | — Good penetration |
| — Slow response | — Oral therapy |
| — High troughs 15-20 mcg/mL | — Monitor CBC |
| — 1 gm q12h does not fit all! | — Econotoxicity |



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Duration of Therapy


- Minimum of 5 days
 - Should be afebrile for 48-72 hours
- IV to PO switch – 48 hours
 - Afebrile for 8 hours
 - Able to take PO
 - Decreasing RR and WBC



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Impact of DRSP on Mortality from Pneumonia

- Spain 1995: showed no impact of resistance and treatment
- Little impact on mortality
 - Discordant therapy no impact
 - Death after 4 days – significant if resistant organism
- Pharmacodynamics of cephalosporins



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Pneumonia Core Measures



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Quality Standards


- Arterial oxygenation measurement within 24 hours of hospital admission
- Blood cultures prior to antibiotics if going to the ICU
- Antibiotic regimen consistent with current guidelines
- Antibiotics administered within 6 hours
 - Door to drug
- Smoking cessation information
- Pneumococcal and influenza vaccination



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Pneumonia Measures


- Documentation of Pneumonia in the medical record
- Documentation of Oxygenation assessment
 - May be done with pulse ox or ABG
- Blood cultures within 24 hours prior to admission or after hospital arrival
- Blood cultures preformed prior to first dose of antibiotics
 - Patients sick enough to be in ICU should receive blood cultures
 - Blood culture results can be used to optimize antibiotics



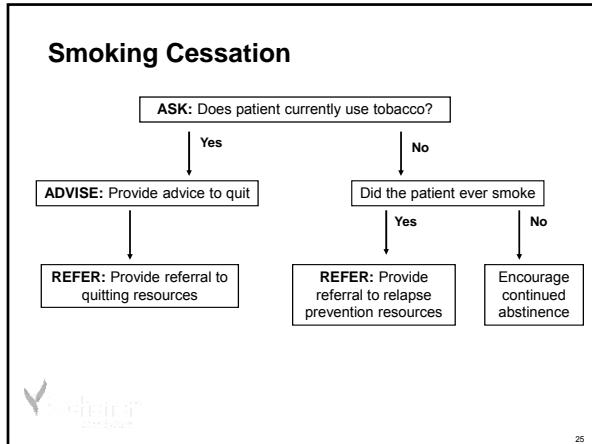
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Pneumonia Measures


- Antibiotic timing
 - First dose administered within 6 hours of arrival
 - Door to drug
 - Evidence has shown that there is a 15 to 30% reduction in mortality
- Antibiotic Selection
 - *Pseudomonas* or MRSA risk factors
 - Receiving appropriate antibiotics reduces mortality




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- ### Referral Resources
- 1-800-QUIT-NOW
 - www.smokefree.gov
 - www.quitline.com
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- ### Pneumonia Measures
- Pneumococcal Vaccination
 - Influenza vaccination
 - Standing Orders for nursing and pharmacist to initiate
 - Does not require a physician signature
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Health Care Associated Pneumonia



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Definitions


- Hospital-acquired pneumonia (HAP)
 - Occurring \geq 48 hours post-hospital admission
- Ventilator-associated pneumonia (VAP)
 - Occurring $>$ 48-72 hours post-intubation
- Health care associated pneumonia (HCAP)
 - Includes HAP and VAP
 - Pneumonia in patients
 - Hospitalized for \geq 2 days in an acute care facility within 90 days of infection
 - Residing in NH or LTC
 - Hemodialysis
 - Receiving immunosuppressive therapy or wound care



Am J Respir Crit Care Med 2005;171:388
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Epidemiology of HAP

- Second most common nosocomial infection
- Significant morbidity and mortality
 - Crude mortality 30% to 70%
 - Attributable mortality 33% to 50%
- Increased hospital costs
 - Increased LOS 7-9 days
 - $>$ \$40,000 per patient



Am J Respir Crit Care Med 2005;171:388
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Risk Factors for Multi-Drug Resistant Organisms

- Prior antimicrobial use within 90 days
- Current hospitalization for ≥ 5 days
- High frequency of antibiotic resistance in community or unit
- Presence of risk factors for HAP
- Family member with infection involving MDR pathogen
- Immunosuppressive disease or therapy



Am J Respir Crit Care Med 2005;171:388

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ATS/IDSA Guidelines Guideline Defining Principles

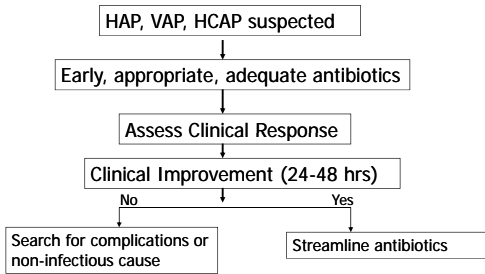
- Use early, appropriate antibiotics in adequate doses
- Avoid excessive antibiotics by de-escalation of initial therapy
- Shorten duration of therapy to minimum effective period
- Use local microbiologic data to adapt treatment recommendations



Am J Respir Crit Care Med 2005;171:388

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Initial Management Based on Clinical Response



Infect Dis Clin N Am 2004;18:93

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Empiric Antibacterial Therapy

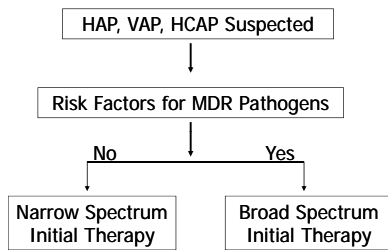
- Need for adequate therapy
 - Adequate antibiotic – mortality = 17.7%
 - Inadequate antibiotic – mortality = 42%
- “Adequate therapy” – antibiotics are susceptible to the organisms cultured
- Inadequate therapy – bacterial resistance



Chest 1999;115:462

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Algorithm for Initiating Empiric Therapy



Infect Dis Clin N Am 2004;18:93

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Initial Therapy: Without Risk for MDR Pathogen

- | | |
|-----------------------------|---------------------------|
| ● Common Pathogens | ● Recommended antibiotics |
| — <i>S. pneumoniae</i> | — Ceftriaxone |
| — <i>H. influenzae</i> | OR |
| — MS <i>S. aureus</i> | — Ertapenem (Invanz) |
| — <i>E. coli</i> | OR |
| — <i>Klebsiella</i> (ESBL-) | — Cipro/Levo/Moxi |
| — <i>Enterobacter</i> | OR |
| — <i>Proteus</i> | — Amp/sulbactam |
| — <i>Serratia</i> | |



Am J Respir Crit Care Med 2005;171:388

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Initial Therapy: Risk for MDR Pathogen

- Common Pathogens
 - *Pseudomonas*
 - *Klebsiella* (ESBL+)
 - *Acinetobacter*
 - MR *S. aureus*
- Recommended Antibiotics
 - Zosyn or Meropenem or Cefep/ceftaz
 - PLUS
 - Cipro/Levo or gent/tobra/amikacin
 - PLUS
 - Linezolid or vanco



Am J Respir Crit Care Med 2005;171:388

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Short Course Empiric Therapy

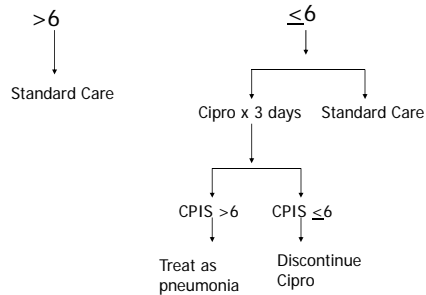
- Strategy to minimize antibiotic use for pulmonary infiltrates
- Used a scoring system to determine threshold for antibiotic use
- Randomized to
 - Standard care – physician's discretion
 - Ciprofloxacin 400 mg q8h



Am J Respir Crit Care Med 2000;162:505

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Clinical Pulmonary Infection Score



Am J Respir Crit Care Med 2000;162:505

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Short Course Empiric Therapy

- Results
 - Trend toward decreased mortality
 - Trend toward shorter ICU stay
 - Decreased superinfections
 - Decreased therapy costs
- Early termination of study
- The true benefit ?



Am J Respir Crit Care Med 2000;162:505

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Duration of Therapy

- Clinical improvement seen in 72 hours
 - If no improvement, consider antibiotic changes or wrong diagnosis
- ? Utility of serial CPIS
- Usual duration 7 to 10 days if not *Pseudomonas*
 - For *Pseudomonas* consider up to 14 days



Am J Respir Crit Care Med 2005;171:388

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Pneumonia

- Continues to be a burden to health care
- Causes high morbidity and mortality
- Enhance 'quality' of care



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