Pneumonia: Are We Missing the Mark?
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Objectives
- Diagnose Pneumonia
- Evaluate severity of illness tools and site of care decisions
- Review diagnostic tests in pneumonia
- Examine criteria for when to utilize diagnostic testing
- Analyze the use of quantitative cultures, biomarkers, and antibiogram
- Apply guidelines for prescribing antibiotics for treatment of CAP, HAP, and VAP
- Describe pneumonia prevention recommendations: Smoking cessation & flu and pneumococcal immunization

Pneumonia
- Community Acquired Pneumonia (CAP) affects 5.6 million patients a year
- 6th leading cause of death in people > 65 years of age
- Averages 10.6 per 1,000 per working adults aged 18-64 yrs.
- 1 million hospital admissions, 10-20% require ICU
- 140,000 readmissions a year, 1 in 5 within 30 days
- 50,000 deaths annually
- Both influenza pneumonia & bacterial pneumonia are associated with post pneumonia cardiac events including arrhythmias, worsening heart failure, and myocardial infarction.
- An elder adult can take months to recover; the mortality rate/risk remains elevated for 5 years post pneumonia.
Hospital Acquired/ Ventilator Associated Pneumonias

- Hospital acquired pneumonia and ventilator associated pneumonia account for 22% of all HAI.
- Pneumonia has the highest morbidity and mortality rates of all nosocomial infections.
- 50% of HAP patients suffer from respiratory failure, pleural effusions, septic shock, renal failure, and empyema.
  - VAP estimated to occur in 9–28% of mechanically ventilated patients,
  - VAP has a mortality rate of 3–17%.
  - VAP estimated to prolong the duration of mechanical ventilation by up to 11 days, increase hospitalization stay by 6–25 days, and increase health care cost by $12,000 to $40,000 per episode.

(Kallet, 2015)

Diagnosis

Clinical Diagnosis
- Cough
- Fever & Chills
- Fatigue
- Sputum
- Shortness of Breath
- Pleuritic chest pain
- 30% of elderly do not have cough, fever, sputum, or elevated wbc

Physical Exam
- Rales/ Bronchial breath sounds
- May be missing in elderly population

Definitive diagnosis = Chest radiograph / CT
Diagnostic testing only if alters standard management care (antibiotic coverage)

Pneumonia Chest X-ray
Site of Care Decision

- Hospital Admission most costly
- Inpatient care for pneumonia 25% more costly than outpatient care
- Costs an estimated $8.4 - 10 billion yearly
- Mean all age cost per inpatient episode $11,148-$51,219
- Mean all age cost per outpatient episode $2,212
- Benefits of outpatient treatment include
  - Resume to normal activity sooner
  - 80% prefer outpatient therapy
  - Less risk for acquired infections

Severity of Illness

Initial Assessment of Severity
- Hospital vs. Outpatient
  - CURB-65/CRB-65
    - Confusion, uremia, resp rate, low, blood pressure, age
    - 0-1 outpatient
    - > 2 inpatient (>3 ICU)
  - Pneumonia Severity Index (PSI)
    - Classifies patients into 5 mortality risk classes
    - Recommends I-II outpatients
    - III observation/short stay
    - IV/V Hospitalization/Inpatient

Site of Care Decision Considerations

- Complications of pneumonia
- Exacerbation of underlying disease
- Rare illness (Sickle cell, neuromuscular disease)
- Signs or symptoms of severe CAP
- Borderline score thresholds (CURB/CRB/PSI)
- Psychosocial needs
- Intractable vomiting
- Injection drug abuse
- Psychiatric Illness
- Homelessness
- Poor overall functional status
- Cognitive dysfunction
- Ability to take oral medication & outpatient support
CURB 65/ CRB65 Severity Score

Site of Care

(Please refer to the original table for detailed scoring criteria)

PNEUMONIA SEVERITY INDEX

Mandatory Pulmonary Classifications

(Provide space for additional patient information)

PSI Classifications

(Provide space for additional patient information)
Criteria for Severe Community Acquired Pneumonia

Minor criteria
- Respiratory rate >30 breaths/min
- PaO2/FiO2 ratio <250 (ratio arterial oxygen partial pressure to fractional inspired oxygen) – requires arterial blood sample
- Multilobar infiltrates – requires CXR
- Confusion/disorientation
- Uremia (BUN level >20 mg/dL)
- Leukopenia (WBC count, <4000 cells/mm3)
- Thrombocytopenia (platelet count, <100,000 cells/mm3)
- Hypothermia (core temperature, <36 degrees C)
- Hypotension requiring aggressive fluid resuscitation

Major criteria
- Invasive mechanical ventilation
- Septic shock with the need for vasoressors

(IDSA & ATS, 2007 & 2016)

SMART COP
Severe CAP Score of 5 or >

(IDSA & ATS, 2007 & 2016)

Criteria for Diagnostic Testing
- Intensive care unit admission
- Failure of outpatient antibiotic therapy
- Cavitary infiltrates
- Known / suspected Leukopenia
- Active alcohol abuse
- Chronic severe liver disease
- Severe obstructive/structural lung disease
- Asplenia (anatomic or functional)
- Recent travel (within past 2 weeks)
- Positive Legionella
- Positive pneumococcal
- Pleural effusion

(IDSA & ATS, 2007 & 2016)
Pneumonia Diagnostic Testing

Rapid Point of Care testing
- Influenza A/B (rapid/ useful for antiviral treatment/ high false negative)

Blood cultures (Most common isolate S. pneumoniae)
- Positive 20-25% inpatients Pneumococcal Pneumonia
- Patients with Severe CAP (Most often S. aureus, P. aeruginosa, and other gram negative bacteria)
- Asplenia, complement deficiencies, chronic liver disease, leukopenia.

Sputum cultures (Most common S. pneumoniae)
- Gram stain / culture
- If good sample / obtained within 6-12 hrs of antibiotics
- Patients with Severe CAP (COPD pts/ alcoholism) higher risk gram negative pathogens, P. Aeruginosa.

Urinary antigen tests- Severe CAP
- Legionella pneumophila (continues to be + for weeks)
- S. pneumoniae (rapid test and detect can still be detected 3 days after antibiotic therapy)

Enzyme linked immunosorbent assay (ELISA)
- Urine sample/ detects pneumococcal cell wall polysaccharide in 77-88% patients with bacteremic pneumococcal pneumonia
- 64% nonbacteremic pneumonia
- ELISA for legionella urinary antigen + 74% Legionella pneumophila serotype1

PCR Assay
- Detects Respiratory viruses including influenza, Mycoplasma Pneumoniae, Chlamydia pneumoniae
- 20-40% of CAP hospitalized patients.

Use of Quantitative Cultures, Biomarkers

Recommendations in Suspected Hospital Acquired Pneumonia (non-VAP)
- Respiratory Cultures
  - Consider sputum cough induction / expectoration
  - Nasotracheal suction
- Blood Cultures
- Target antibiotic treatment to results of microbiology results

Not Recommended at this time for decision on antibiotic therapy
- Procalcitonin (PCT) - clinical criteria is recommended over the use of serum PCT + clinical criteria
  - PCT (0.1 ug/l) used to guide antibiotic discontinuation
- C reactive protein (CRP) - clinical criteria is recommended over the use of CRP+ clinical criteria
- Soluble Triggering Receptor Expressed on Myeloid Cells (sTREM-1) (requires bronchial lavage) clinical criteria is recommended over the use of sTREM-1+ clinical criteria
Prescribing Antibiotics

- Hospitals disseminate a local antibiogram specific to their intensive care population
- Empiric treatment is developed to treat the distribution of local pathogens and susceptibilities for inpatients and outpatients
- Recommended shorter Length of therapy – 7 days.

Prescribing Antibiotics

- Hospital with antibiogram specific to their ICU population
- Empiric treatment for local pathogens and susceptibilities

Etiology of Community Acquired Pneumonia

<table>
<thead>
<tr>
<th>OUTPATIENT</th>
<th>INPATIENT NON ICU</th>
<th>INPATIENT ICU</th>
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<tbody>
<tr>
<td>Streptococcus pneumoniae</td>
<td>S. pneumoniae</td>
<td>S. pneumoniae</td>
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<tr>
<td>Mycoplasma pneumoniae</td>
<td>M. pneumoniae</td>
<td>Staphylococcus aureus</td>
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<td>Haemophilus influenzae</td>
<td>C. Pneumoniae</td>
<td>Legionella species</td>
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<td>Chlamydia pneumoniae</td>
<td>H. influenzae</td>
<td>Respiratory viruses</td>
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<td>Respiratory viruses</td>
<td>Aspiration</td>
<td>Gram-negative bacilli</td>
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<td></td>
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<td>H. Influenzae</td>
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<td></td>
<td></td>
<td>Potentially GNR</td>
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</tbody>
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(IDSA & ATS, 2007 & 2016)
Definitions of the different types of Pneumonia

• CAP: patient currently residing in the community with no specific risk factors for resistance
• HAP: patient residing in the hospital for at least 48 hours and develops a new infiltrate after 48 hours of admission
• VAP: patient developing a pneumonia after at least 48 hours of being ventilated


Antibiotics for CAP

• Outpatient without comorbidities:
  – Doxycycline
  – Azithromycin
• Outpatient with comorbidities:
  – Moxifloxacin
• Inpatient–Non–ICU:
  – Ceftriaxone + Azithromycin
  – Moxifloxacin
• Inpatient–ICU:
  – Ceftriaxone + Azithromycin
  – Cefepime + Azithromycin
  – Vancomycin + Azithromycin
  – Worried about QT prolongation → Switch azithromycin to doxycycline

(IDSA & ATS, 2007 & 2017)

Antibiotics for HAP & VAP

(IDSA & ATS, 2007 & 2017)
What about GNR & MRSA

- When to expect MRSA on the inpatient or outpatient:
  - Outpatients:
    - Recurrent cellulitis
    - Chronic indwelling catheters (PICC’s, foley’s, ports, etc)
    - Living in a long term care facility with greater than 40% colonization in the home
    - Chronic dialysis
  - Inpatients:
    - Same risk factors as above except, greater than 40% colonization in the ICU
- When to expect Multi drug resistant (MDR) gram negative rods (GNR)
  - Receiving chronic (2 or more antibiotics IV or oral in the last 90 days)
  - Living in a long term care facility with known MDR organisms

Who remembers HCAP (Healthcare Associated Pneumonia)?

- Well, it no longer exists...
- The 2017 IDSA/ATS Guideline update eliminated the term HCAP
- HCAP previously were defined as:
  - Being exposed to a hospital or receiving broad spectrum abx within the previous 90 days
- HCAP patients now are treated as CAP patients
- Is that always appropriate???
  - NO
- Lets discuss (IDSA & ATS, 2007 & 2017)

Vaccination

### Influenza 2016-2017 updates
- All persons > 8 months without contraindications
- 2017-18 Season: quadrivalent / bivalent influenza vaccines
- Live attenuated influenza vaccine not recommended this season due to ineffectiveness against H1N1 during 2013-14 & 2015-16
- Pregnant women may receive vaccine
- (USDHS, MMWR, 2017)

### Pneumococcal Vaccination
- Prevnar 13 / PCV13
- Pneumovax 23/PPSV23
- Over the age of 65 (both PCV 13 & PPSV23)
- PCV13 first when possible
- PCV 13 & PPSV23 > age of 19 Give to High risk concurrent disease/ immunocompromising conditions
  - asplenia
  - CSF leak
  - cochlear implants
  - (ACIP, 2014)
Smoking

Smoking cessation is ideal for all CAP patients who smoke. All smokers should be offered smoking cessation education programs, counseling, and treatment, as well as follow-up.

Oral Care

Hospitals and several research studies have found that oral care reduces non-ventilator hospital-acquired pneumonia (NV-HAP) rates by 40% to 60%.

References

References


Questions