Pneumocystis Pneumonia (PCP): Part 1

• Background and Biology
• Risk factors
• Clinical Manifestations
• Diagnosis
Background and Biology
First identified in 1909 by Chagas; reported as part of the life cycle of *Trypanosoma cruzi*

Recognized as separate organism in 1912; named *Pneumocystis carinii*

1940’s and 50’s: cause of pneumonia epidemics in premature and malnourished infants

1980’s and 90’s: leading cause of death in AIDS

Biology

- Initially classified as protozoa; now fungus
- Each species infected with unique strain:
  - *Pneumocystis carinii*: rats
  - *Pneumocystis jirovecii* (yee-row-vet-zee): humans
- Worldwide distribution
- Ubiquitous exposure: nearly all infected in infancy

Gilroy SA, Bennett NJ. Smin Respir Crit Care Med 2011;32(6):775-82.
Biology: Reactivation vs. New Infection

**Reactivation**
- Most colonized by infancy
- Disease in animals if immunosuppressed
- Clusters of cases with same genotype

**New Infection**
- Animals develop infection when exposed
- Repeat infection different strains
- Most colonized by infancy

Risk Factors
Risk Factors

• Key = Immunosuppression
  - Multicenter AIDS Cohort Study:
    • Incidence with CD4 count 201 to 350 = 0.5%
    • Within 6 months of falling below 200 = 8.4%
    • Within 12 months of falling below 200 = 18.4%
    • Within 6 months of developing thrush = 29.5%

• Environmental factors?
• Exposure to infected or colonized persons?

2) Djawe K et al. Clin Infect Dis 2012 Nov 5; [e-pub ahead of print]
Risk Factors

- Factors associated with development of PCP:
  - CD4 count <200 cells/mm³
  - CD4 percentage <14%
  - Previous episode of PCP
  - Oral thrush

CDC MMWR: Guidelines for Prevention and Treatment of Opportunistic Infections in HIV-Infected Adults and Adolescents; April 2009 (Vol 58)
Clinical Manifestations
## Clinical Manifestations

<table>
<thead>
<tr>
<th>Symptoms (usually subacute)</th>
<th>Signs</th>
<th>CXR Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fever</td>
<td>Hypoxia (especially with exertion)</td>
<td>Diffuse, bilateral, hazy infiltrates (“butterfly”)</td>
</tr>
<tr>
<td>Dyspnea (“door-stop”)</td>
<td>Tachypnea, Tachycardia</td>
<td>Pneumothorax</td>
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<tr>
<td>Dry cough</td>
<td>Inspiratory crackles</td>
<td>Pleural effusion, lobar infiltrate, nodules less common</td>
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<tr>
<td>Pleuritic chest pain</td>
<td>Elevated A-a gradient</td>
<td>*CXR normal in 25%</td>
</tr>
<tr>
<td>Malaise</td>
<td>*Chest exam normal in 50%</td>
<td>*CXR normal in 25%</td>
</tr>
</tbody>
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Diagnosis
Diagnosis

- Gold standard: identification of organism on stain of respiratory secretions or tissue
- Induced sputum: sensitivity <50-90%
  - Generally not improved by repeating
- Bronchoscopy with BAL: sensitivity 90-99%
- Lung biopsy: sensitivity 95-100%

2) CDC MMWR: Guidelines for Prevention and Treatment of Opportunistic Infections in HIV-Infected Adults and Adolescents; April 2009 (Vol 58)
Diagnosis: Non-Invasive Tests

<table>
<thead>
<tr>
<th><strong>LDH</strong></th>
<th><strong>PCR</strong></th>
<th><strong>Beta-Glucan</strong></th>
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</table>
| • Not specific  
• Prognostic? | • Infection vs. colonization?  
• Not commercially available | • Sensitivity 92.8%  
• Specificity 75%  
• PPV 96.3%  
• NPV 60.0% |

1) Gilroy SA, Bennett NJ. Smin Respir Crit Care Med 2011;32(6):775-82.
Summary of Diagnostic Evaluation

- CXR, if normal and high suspicion → chest CT
- ABG, beta-glucan, +/- LDH
- Induced sputum, if negative → bronchoscopy/BAL
- Lung biopsy if still unclear

dpd.cdc.gov