Pneumonia

Cline: ch. 33 ; ch. 34

Brady pp 583; 694

(+/or other standard paramedic text)

Objectives

- Discuss the frequency and mortality of pneumonia
- Discuss the meaning of the terms typical and atypical pneumonias and discuss how these present to the paramedic
- Discuss the evaluation of host factors that can predispose a patient to pneumonia
- Discuss the Pneumonia Severity Index
- Discuss persons at risk for TB and the risk of TB for the emergency clinician
- Discuss TB epidemiology, screening, and standard Dx and Tx of inactive or latent TB

Pneumonia in Years Past

- In antiquity, Hippocrates characterized pneumonia as
  - acute illness with chest pain, or with severe dyspnea
- In 1880, Pasteur discovered a common cause of lobar pneumonia
  - a bacterium *S. pneumoniae*

Bacterial Pneumonia Mortality

- Sixth leading cause of death in US
- Most common infectious cause of death
- Mortality rate
  - Outpatient pneumonia pts : 1% mortality
  - Hospitalized pneumonia pts : up to 25%
- Nosocomial pneumonia : the leading cause of hospital-acquired infection deaths

Pneumonia

- Definition
  - inflammation and consolidation of the lung tissue due to an infectious agent
- Community-acquired
  - pneumonia that develops outside the hospital setting
- Nosocomial or hospital-acquired pneumonia
  - pneumonia that develops 72 hrs or more after admission to the hospital

Typical and Atypical Pneumonias

- Typical
  - typical inflammation
    - mucus, cough
    - fever
  - *S pneumoniae* (pneumococcus)
- Atypical
  - aypical presentation
  - non productive cough
  - usually no sudden high fever

Typical and Atypical Organisms

- Typical organisms
  - *S pneumoniae* (pneumococcus)
    - Most common
  - *Haemophilus*
  - *Staphylococcus* species
- Atypical refers to pneumonia organisms
  - *Mycoplasma*
  - *Chlamydia*
  - *Legionella*

Pathogenesis of Typical Pneumonia

- Bacteria in nasopharynx (e.g., *S pneumoniae)* - carried harmlessly and totally asymptomatically in 50% of healthy persons.
- Invasive disease may be triggered by immunocompromise, or viral illnesses (e.g., influenza)
  - pneumococcal irritation of respiratory epithelium
  - pneumococcal attachment onto irritated- activated epithelium receptors
  - pneumococci spread from alveolus to alveolus

Atypical Infection

Pathogenesis

- Aspiration or inhalation
- Organisms attach to respiratory epithelial cells
- Then slowly begin to cause injury
- Pathogenetic mechanisms may be more immune-mediated, rather than direct bacterial- injury
  - host defense activation: both cellular and humoral
- Atypical organisms often spread beyond lobar boundaries ; frequently ***bilateral***

Nosocomial Pneumonia

- Aspiration
  - Major role in nosocomial pathogenesis
  - Approx. 50% of healthy subjects aspirate during sleep
  - Even higher percentage of the severely ill routinely aspirate
- Hospitalized patients : oropharynx colonized with pathologic bacteria
  - Within a few days of admission

Frequency:

- Community-acquired pneumonia
  - In US, CAP remains a common illness
  - Approx 4.5 million cases annually
  - 20% (700,000) result in hospitalization
  - 6th leading cause of death
- Nosocomial pneumonia
  - Incidence of 5 per 1000 hospitalizations
  - 25% of patients in intensive care units (ICUs) develop pneumonia

Incidence and Mortality - Effect of Age on Pneumonia

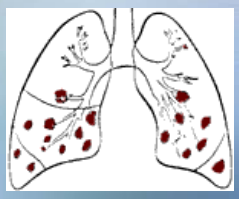
- Mortality increases with age
  - Is the patient over 50 yrs of age? Age is an independent variable associated with increased pneumonia mortality
  - High mortality rate (37.7%) in elderly.
- Incidence increases with age
  - < 45 : 94 cases per 100,000
  - > 65 : 280 cases per 100,000
- In recent yrs, increasingly (incr 33% / 10 yr) a cause of hospitalization
  - 1984 : 36 cases per 100,000
  - 1995 : 48 cases per 100,000

Lobar Pneumonia

Physical Findings
- Acutely Ill
  - increased WOB
  - central cyanosis
- Lobar Pneumonia
  - localized to single lobe of 1 lung
  - pus, mucus, and other liquid
- e.g., Pneumococcal

Bronchial Pneumonia

- Non-lobar
- Bilateral
- Patches of infectious infiltrates in both lungs
- Usually viral
  - e.g., influenza
- May be atypical bacterial
  - e.g., mycoplasma
- Auscultation
  - very few ausc signs
  - often: only rales



- Canadian Lung Association

Viral Pneumonias

- Half of all pneumonias : viral origin
- Most viral pneumonias are patchy and self-limiting
- Potentially severe
  - SARS or influenza viral pneumonias may be fatal
  - viruses invade both lungs
  - almost none of typical physical signs of lung consolidation
- High risk patients
  - pregnancy
  - pre-existing heart or pulmonary disease

History

- Present illness
  - Hx can help with diagnosis
  - Surprisingly poor predictor of *severity*
- Predisposing host factors
  - Lung pathologies
    - Cancer
    - COPD
    - Smoking (a variety of mechanisms), impairs host defenses against infection
  - Other

Host factors

- Evaluation of host factors often provides a clue to specific bacterial diagnosis :
  - Diabetic ketoacidosis
    - *S aureus*
  - Alcoholism
    - *Klebsiella*
  - Chronic obstructive lung disease
    - *M catarrhalis*
  - Sickle cell disease
    - *S pneumoniae* or *H influenzae*
  - HIV infection (CD4 cell count > 200/mL)
    - *Cryptococcus; tuberculosis*
  - CD4 cell count of fewer than 200 cells/mL may indicate
    - *Pneumocystis*

The History and Pneumonia Severity

- Risk Factors
  - Age
  - Male
  - Cancer
  - Liver disease
  - CHF
  - Stroke
  - Renal disease
  - Nursing home

The History and Pneumonia Severity

Severity Index* risk factors
- Age
- Male
- Cancer
- Liver disease
- CHF
- Stroke
- Renal disease
- Nursing home

Common sense risk factors
- COPD
- DM
- HIV
- Alcoholism
- Cardiac disease
- Renal disease
- Absence of supportive care at home

*Severity Index : ACUP PORT
Ann Emer Med 2001 Jul;38(1):107-113

Physical Examination

- Gen / VS
  - *Altered mental status*
  - Fever or *hypothermia* (temperature >38.5°C or <36°C)
  - Tachypnea (respiratory rate >18 breaths per min)
  - Tachycardia or bradycardia
  - Central cyanosis
- Findings of consolidation
  - Dullness to percussion / decreased breath sounds
  - Rales or crackles
  - Egophony
  - Whispering pectoriloquy
  - Pleural friction rub

FYI: Unusual Physical findings of Unusual Etiologies

- Bullous myringitis
  - *Mycoplasma pneumoniae*
- Cerebellar ataxia
  - *Chlamydia pneumoniae*
  - *M tuberculosis*

Physical Findings and Pneumonia Severity Index or Risk

- Gen / VS
  - Altered mental status
  - Fever or hypothermia
    - >40°C (104 °F) or
    - <36°C (95 °F)
  - Tachycardia > 125
  - Tachypnea > 30
  - BP < 90 mmHg

Field Management of Pneumonia

- Purely supportive, irrespective of Severity Index
  - O3, M3,
  - SAMPLE + PMH
  - PE
- IV fluids
  - for dehydration
- In severe cases
  - BVM assist, or ET
- Do not "give antipyretic such as acetaminophen…"
  - as this will interfere with risk stratification

Respiratory Failure

Defined as :
- Need for mechanical ventilation or
- 100% O2 still unable to maintain Sat greater 90%

Tuberculosis (TB)

- Emergency clinicians at risk
- Infection is "easy to miss" - gradual and insidious
- TB illustrates several important principals of community health
  - Basic public health and preventative medicine
  - Consequences of under funding of public services
  - Screening for latent disease depends upon disease prevalence and test (PPD) sensitivity

TB

- Has plagued humans for thousands of years
  - TB has been found in bones from 10.000 yr ago
  - In ancient Greece, TB was called a "phthisis" illness or wasting away illness
  - "Consumption" deaths during 17th and 18th centuries
    - TB caused up to 25% of all deaths in Europe
- Koch: established cause and effect relationship
- Began to decline in the US, around 1900, because of
  - improved public health [TB quarantining sanatoriums, such as the Black Mountain Franklin Humanitarian Home, one of the sans in the mountains]
  - improved living conditions.

Koch and TB

- In 1882, discovered the *Mycobacterium tuberculosis*
- Koch criteria for establishing cause and effect relationship in infectious diseases:
  - The microbe must be present in every case of the disease
  - The microbe must be isolated from the diseased host and then grown in a laboratory culture medium
  - The disease must be reproduced when a pure culture is then introduced to a non diseased "susceptible host."
  - The microbe must be recoverable from an experimentally infected host.
- Within 20 years, an aggressive public health approach began to result in a steady decline in TB in the US

Epidemiological Factors of TB

Elimination of TB from the US

- Steady decline year after year until 1984
- Incidence climbed between 1984 -1992
- 67,000 "unnecessary" preventable cases of TB
- Cost to NYC, in the 80's, $ 1 billion
- Renewed funding of and attention to basic public health [CDC's strategy finally implemented]
  - Reduced the incidence during the next 8 yrs, between 1992 - 2000
    - 45% decrease from the peak in the 80's
    - Lowest in US history

Worldwide TB

- Elimination of TB globally
  - not realistic with current approach
- More than 1/3 of the world's population is infected
- Each year worldwide:
  - 8 million new cases
  - 2 million new cases
- Immigrants:
  - persons at high risk for contagion (and therefore the need for PPD screening)

Transmission of TB

- Airborne microbe is passed person to person
  - 1 - 5 organisms, each1-5 micron, inoculate via inhaled respiratory droplets
    - During cough, or even in talking, droplets of saliva or mucus are expelled into air, and can then be inhaled.
- Infectious particles reach first the alveoli (primary infection)
- Lymphatic: then macrophage WBCs engulf the bacteria and moving the TB into lymph system
- Hematogenous: then from the lymph system TB moves into the bloodstream; eventually spreading to extrapulmonary organs

Inactive or Latent TB + PPD

Latent TB

- A positive skin test
  - prior inhalation of the TB bacteria
  - you've caught TB
- No symptoms
  - disease is inactive, or immunologically controlled
  - infected, but not contagious (do not transmit the disease to others)

Persons at High Risk for TB

- Immigrants
- Health care professionals
- Homeless
- Long-term care facility workers
- Persons at high risk for rapid progression
  - HIV
  - DM
  - Renal failure
  - Injection- drug abusers
  - Organ transplant patients
  - Contacts of TB patients

Latent Phase TB - High Risk

Persons at risk for TB should screened :

- Detection of TB latent phase and
- Treatment for TB latent phase
  - for the individual: preventing complications
  - for the public health: prevention of spread of TB

TB Screening

- 5 units of PPD injected intradermally
- Induration (not erythema)
  - horizontal measurement at 48 - 72 hr
- Positive
  - 5 mm
    - high risk exposure [high prevalence population]
    - immunocompromised [steroids, HIV,…]
  - 15 mm
    - low risk [low prevalence population]
  - 10 mm
    - everyone else

Clinical Course of TB

Clinical infection with TB

- Simple, primary, self-limited pneumonia
  - seeds other organs
    - which are sites of reactivation TB
- Onset : insidious
- Symptoms : non-specific
  - weight loss
  - fever
  - night sweats

TB Diagnosis

- Symptoms : lung-specific
  - Cough
  - Pleuritic chest pain
  - Hemoptysis
- Standard for Dx of TB
  - Tuberculin skin testing

TB Treatment

- Multi-drug regimen : must take for 6-9 mos.
- Standard therapy for active TB
  - Isoniazid
  - Rifampin
  - Pyrazinamide
  - Ethambutol
  - Spectinomycin
- Compliance
  - Unrelated to education, income, ethnicity
  - DOT (direct observation)

Difficulties of TB Treatment

- Long duration required (TB organisms grow very slowly and die very slowly)
- Multiple drugs may be needed to reduce likelihood of resistant organisms.
- Prescribing doses twice a week helps assure compliance.
  - most common cause of treatment failure: compliance / not drug-resistance
  - may lead to emergence of drug-resistant organisms

Summary

We have discussed :

- factors that influence pneumonia severity and mortality
- Presentations of typical and atypical pneumonias
- The risk of TB for the emergency clinician
- The risk not only to health care professions, but also to the public health, if TB screening and treatment of latent TB is under funded or mismanaged
- TB screening and using prevalence to help determine what defines a positive TB screening test
- Multi-drug regimen for 9 mos, in the event that a paramedic's skin test becomes positive