Pneumonia ID Primer

Overview:

Pneumonia is classically defined as infection of the lung parenchyma, usually caused by bacteria or viruses, due to inhalation/microaspiration of pathogens to the sterile alveoli. However recent data suggest there is a lung microbiome that’s similar to the oropharyngeal microbiome which represents a paradigm shift towards alveolar dysbiosis as a driver of pneumonia in addition to micro-/macroaspiration of pathogens1.

Definitions:

* Community acquired pneumonia (CAP) is acquired outside the hospital
* HAP refers to pneumonia acquired after 48 hours of hospitalization
* VAP refers to pneumonia acquired after 48 hours of intubation
* Healthcare Associated Pneumonia (HCAP) no longer used as it was too sensitive and nonspecific

Clinical Features:

* Typically characterized by fever, cough, SOB
* Defining pneumonia is surprisingly difficult
* Clinical characteristics: PPV of fever, crackles, tachycardia, and O2 sat <95% only 20%2
* Even on CXR as many as 33% of patients admitted with pneumonia have an initial ‘negative’ CXR3
* CURB 65 or pneumonia severity index helpful in prognostication/disposition planning

Microbiology of CAP

* Classically broken into 2 categories:
  + Typical: Strep pneumoniae, H influenzae, Moraxella catarrhalis, Staph aureus
  + Atypical: Legionella, Mycoplasma pneumoniae, Chlamydia pneumoniae (all with intrinsic B-lactam resistance)
* EPIC study in US looking at etiology of pneumonia in adults showed only 1/3 of CAP cases have a culprit pathogen identified4
  + Of those with pathogen detected 60% were viral only, 40% were bacterial or bacteria-virus
  + Order of most common: Rhinovirus, flu, *S. pneumo*, hMPV, PIV, corona, mycoplasma, *Staph aureus*
* Impact of Covid on this distribution is uncertain. Moderately high rates of secondary infections, particularly invasive pulmonary aspergillosis (as high as a quarter of severe cases requiring prolonged intubation)5
* Aspiration pneumonia: Can be difficult to differentiate aspiration pneumonitis and aspiration pneumonia. In aspiration pneumonia with lung abscess anaerobes are common, when abscess isn’t present anaerobes are not major drivers

Microbiology of HAP/VAP

* Wide range of culprit pathogens, skews more towards bacterial and polymicrobial than CAP though hospital acquired rhinovirus, influenza and PIV do occur
* From CDC VAP data: S. aureus (24%), Enterobacterales (24%), P aeruginosa (17%), Acinetobacter (7%), Stenotrophomas maltophila (6%)6
* HAP etiologies are similar however there were lower rates of Acinetobacter (3%) and Steno (1%)7

Diagnostics

* Imaging – CXR and/or CT chest
* If mild/outpatient influenza testing during flu season. Covid testing depending on prevalence
* For CAP requiring hospitalization:
  + Sputum gram stain and culture, blood culture reasonable
  + Urine strep antigen, consider urine legionella testing (only detects L. pneumophila serotype 1)
* Procalcitonin? A biomarker that can help distinguish between bacterial infection and other causes of infection/inflammation.
  + Should not be used to determine whether to initiate antibiotics for CAP
  + May have a role in antibiotic discontinuation in combination with clinical assessment that can decrease exposure to antibiotics8. Some algorithms used:
    - Stop when procal <0.25 ng/mL and clinical improvement or alternate explanation
    - Stop when procal has decreased 80% from peak level

Treatment

* Outpatient CAP depends on severity and presence of comorbidities. If mild and no comorbid conditions can try doxy or amoxicillin x5 days. If comorbidities present amox/clav + doxy or azithro x5 days
* Inpatient treatment of CAP should empirically cover typical and atypical etiologies. Ceftriaxone + Azithro or Levofloxacin x5 days.
* For mild HAP cases tailor based on risk factors for pseudomonas and MRSA. If none can use same regimen as CAP x 7 days
* Treatment of VAP should generally include anti-pseudomonal coverage, GNRs, and MSSA. Decision to cover MRSA based on local prevalence of MRSA and can be informed by MRSA nares (NPV 93-98%)9
  + Cefepime + Vancomycin x 7 days
* Steroids? Controversy around the use of steroids for CAP requiring hospitalization. Some evidence that it can reduce duration of hospitalization and mortality benefit in selected patients (5% ARR, NNT 20 for severe PNA)10. General consensus is we need a large RCT and for now not routinely used

Prevention

* Vaccination! Vaccines exist for Strep pneumoniae, H influenzae, influenza, and COVID
* Smoking cessation

Exposure and etiology associations:

* Bakersfield: Coccidioidomycosis
* Morbilliform rash in refugee/humanitarian disaster: Measles
* HIV, CD4 <200: PJP
* Aerosolized water (eg water fountain): Legionella
* Parrot: Chlamydia psittaci
* Hot tub: Hypersensitivity MAC
* Cabin in Yosemite, rodent urine: Hantavirus
* Exposure to animal urine, conjunctival suffusion: Leptospirosis
* Bat guano: Histoplasmosis
* Camels in the middle east: MERS-CoV
* Unpasteurized milk: Brucellosis
* Hunting rabbits: Tularemia
* Animal hide in middle east: Anthrax
* Goat or sheep placenta: Q fever (Coxiella burnetiid)
* HIV in Southeast Asia: Talaromyces marneffei

References:

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