

Team Medicine

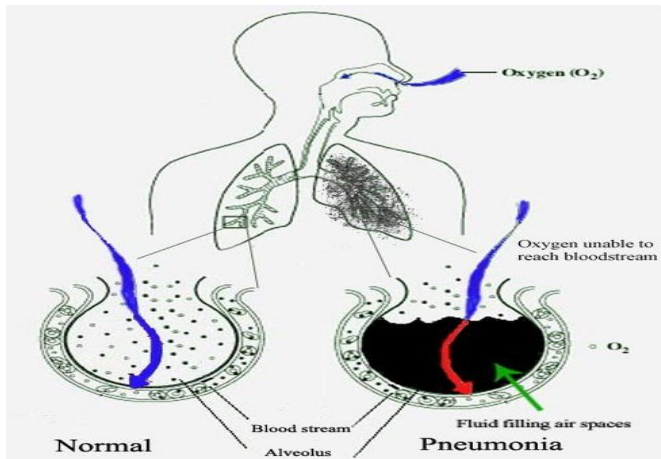
Community-Acquired Pneumonia

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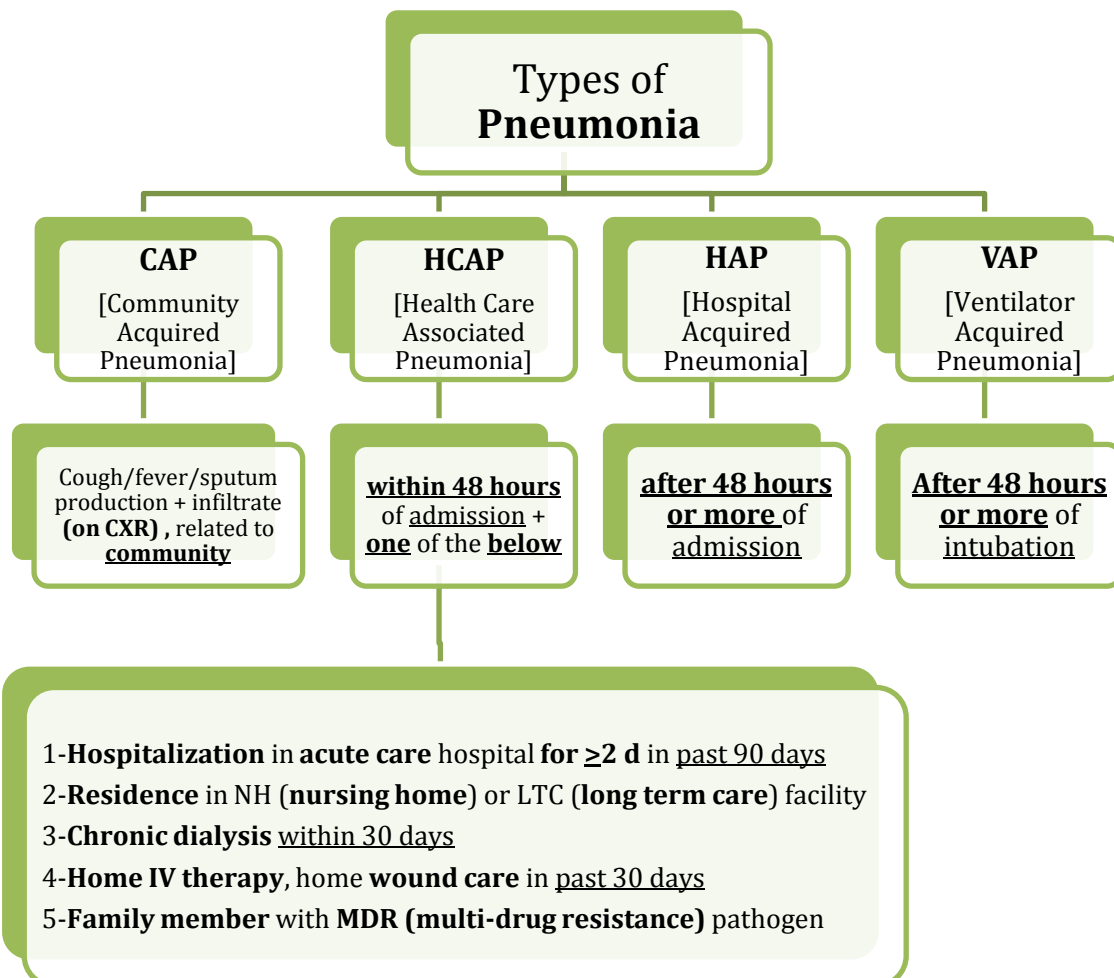
What is Pneumonia?

Pneumonia is an inflammatory condition of the lung characterized by **inflammation** of the **parenchyma of the lung (alveoli)**, abnormal alveolar filling with fluid, causing air space disease (consolidation and exudation)



- In pneumonia you have: Inflammation, alveolar filling with pus & exudates → consolidation.
- Oxygen exchange is impaired

Pneumonia Definitions [Types]:



Epidemiology:

- Few and unclear population-based statistics on the condition alone
- Pneumonia & influenza = 6th leading causes of death in the world
- Single most common cause of infection-related mortality
- Age-adjusted death rate = 22 per 100,000 per year
- Mortality rate: 1-5% out-patients, 12% in-patients, 40% ICU
- Death rates increase with comorbidity and age
- Affects race and sex equally

Pathogenesis:

3 main mechanisms by which bacteria reaches the lungs:

1) Inhalation 2) Aspiration 3) Hematogenous spread

- 1) **Primary inhalation:** when organisms bypass normal respiratory defense mechanisms, or when the patient inhales organisms that colonize the upper respiratory tract or respiratory support equipment.
- 2) **Aspiration:** occurs when the patient aspirates secretions of colonized upper respiratory tract.
 - Stomach: reservoir of GNR (gram -ve rods) that can ascend, colonizing the respiratory tract.
- 3) **Hematogenous:** originate from a distant source and reaches the lungs via the blood stream.

- Inhalation:
TB, viruses, Legionella
- Microaspiration from nasopharynx:
S. Pneumonia
- Aspiration:
Anaerobes **(and some gram -ve)**
- Bloodborne:
Staph endocarditis, septic emboli
- Direct extension:
Trauma **(could be iatrogenic, e.g. thoracic surgery)**

Pathogens:

- Even with extensive diagnostic testing, most investigators cannot identify a specific etiology for CAP in $\geq 50\%$ of patients.
- CAP is usually caused by a single organism
- A variety of bacteria, viruses, and fungi can cause it:
- **Streptococcus pneumoniae is the most common pathogen 60-70% of the time [in all types of cases mentioned below]**

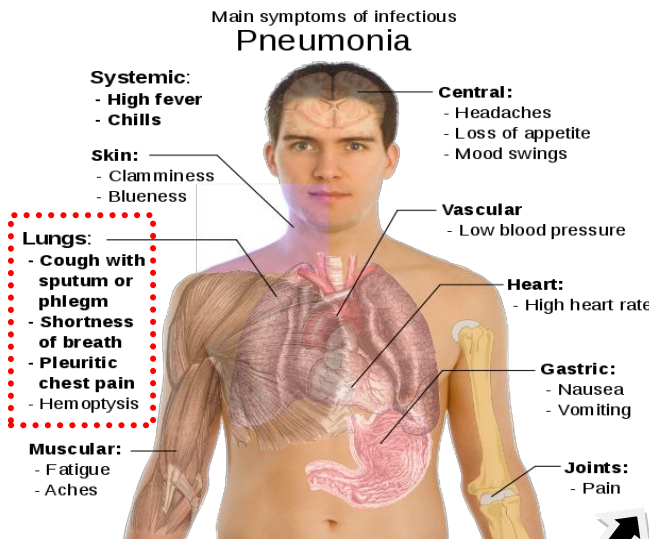
Outpatient	Strept. pneumoniae Mycoplasma / Chlamydoiphila H. influenzae Respiratory viruses
Inpatient, non-ICU	Strept. pneumoniae Mycoplasma / Chlamydoiphila H. influenzae Legionella Respiratory viruses
ICU	Strept. pneumoniae Staph aureus, Legionella Gram -ve bacilli, H. influenzae

* Note: the ordering in each box is from the most common to the least common

- The sicker the patient is, the more likely they have staph aureus, gram -ve rods, or legionella, and the less likely they have an atypical infection.

Signs & Symptoms:

- Don't forget ABC and V/S (vital signs) including O₂ saturation.



<u>Clinical Signs</u>		Positive LR	Negative LR
<u>General Appearance</u>	Cachexia	4.0	NS
	Abnormal mental status	2.2	NS
<u>Vital signs</u>	Temp >37.9C	2.2	0.7
	RR > 28/min	2.2	0.8
	HR >100 bpm	1.6	0.7
<u>Lung findings</u>	Percussion dullness	3.0	NS
	Reduced breath sounds	2.3	0.8
	Bronchial breath sounds	3.3	NS
	Aegophony	4.1	NS
	Crackles	2.0	0.8
	Wheezes	NS	NS

* **LR**= Likelihood Ratio
 * **NS**= not significant

* Likelihood Ratio e.g. if someone who have cachexia this means he is 4 times more likely to have Pneumonia than someone who don't have cachexia.

* Aegophony: Tell patient to say "Bee", sounds like "Bay" during auscultation. To learn more: [Click Here](#)

From McGee S, Evidence-based physical diagnosis, 2nd edition. St Louis: Saunders, 2007

Investigations:

- CXR [Chest X-ray]**
- CBC with diff**
- Sputum gram stain, culture susceptibility**
- Blood Culture**
- ABG**
- Urea / Electrolytes**
- Sputum AFB and TB culture
- Sputum fungal culture
- Special stain, eg. Silver stain, India Ink
- LFT
- CT chest
- Pleural fluid analysis
- Bronchoscopy
- Urine Legionella Ag
- Serology, eg Q fever

• The gold standard is CXR >> without x-ray you can't diagnose Pneumonia.
 • In the investigations the first six are the important ones (done routinely) [starting with CXR until urea/electrolyte]. The rest are not routinely done.

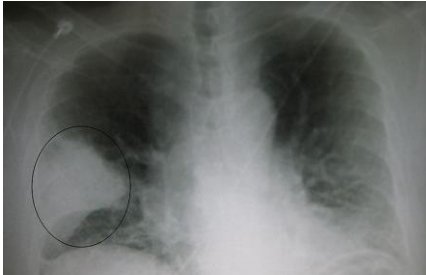
Clinical Diagnosis: CXR

- Demonstrable infiltrate by CXR or other imaging technique
 - Establish Dx and presence of complications (pleural effusion, multilobar disease)
 - May not be possible in some outpatient settings
 - **CXR**: classically thought of as the **gold standard**

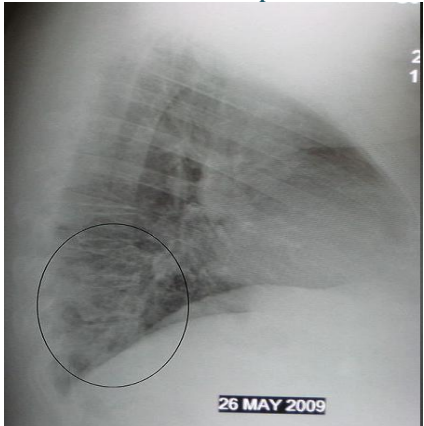
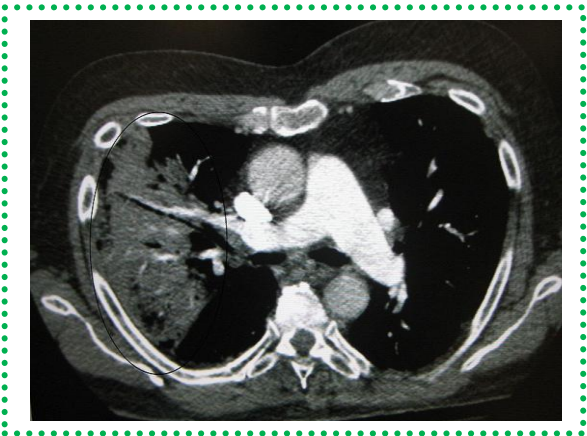
Infiltrate Patterns

Pattern	Possible Diagnosis
Lobar	S. pneumo, Kleb, H. flu, GN
Patchy	Atypicals, viral, Legionella
Interstitial	Viral, PCP, Legionella
Cavitary	Anaerobes, Kleb, TB, S. aureus, fungi
Large effusion	Staph, anaerobes, Kleb

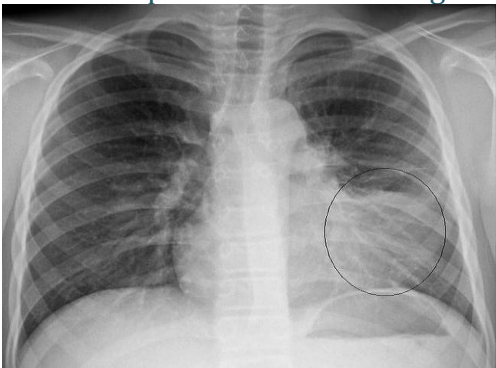
A chest X-ray showing a very prominent wedge shaped pneumonia in the right lung
Lobar pneumonia



Lateral CXR: RLL pneumonia

PA CXR: pneumonia of the lingula



Empiric out-patient management in previously healthy patients:

- **Organisms:** *S. pneumoniae*, *Mycoplasma pneumoniae*, viral, *Chlamydia pneumoniae*, *H. influenzae*
- **Recommended abx [antibiotics]:**
 - Advanced generation macrolide (azithromycin or clarithromycin); or doxycycline
- **If abx within past 3 months:**
 - Respiratory quinolone (moxifloxacin, levofloxacin), OR
 - Advanced macrolide + amoxicillin
 - Or:
 - Advanced macrolide + amoxicillin-clavulanate
 -
- **Comorbidities:** cardiopulmonary disease or immunocompromised state

- **Organisms:** *S. pneumoniae*, viral, *H. influenzae*, aerobic gram -ve rods, *S. aureus*
- **Recommended Abx:**
 - Respiratory quinolone
 - Or:
 - Advanced macrolide
- **If Recent Abx: (when patients have recent use of antibiotics)**
 - Respiratory quinolone
 - Or:
 - Advanced macrolide + beta-lactam

- **Organisms:** all of the above plus polymicrobial infections (+/- anaerobes), *Legionella*
- **Recommended Parenteral Abx:**
 - Respiratory fluoroquinolone, OR
 - Advanced macrolide plus a beta-lactam
- **If Recent Abx:**
 - As above: regimen selected will depend on nature of recent antibiotic therapy. **(on the past three months). (e.g. if they have received Respiratory fluoroquinolone on the past three months give them Advanced macrolide plus a beta-lactam)**

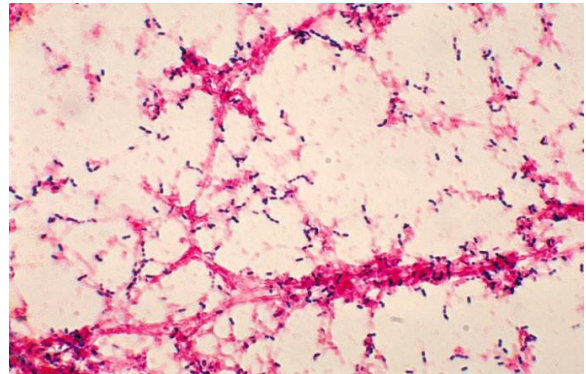
Complications of Pneumonia:

- Bacteremia
- Respiratory and circulatory failure
- Pleural effusion (Parapneumonic effusion), empyema, and abscess
 - Pleural fluid always needs analysis in setting of pneumonia (do a thoracentesis)
 - **Always needs drainage:** Chest tube, surgical (**video-assisted thoracoscopy**)

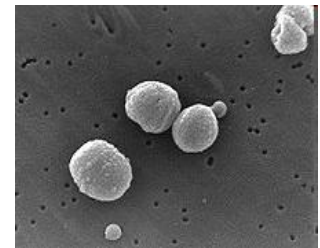
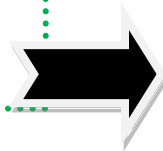
Streptococcus Pneumonia & Haemophilus influenza:

Streptococcus Pneumonia:

- Most common cause of CAP
- Gram positive diplococci
- “Typical” symptoms (e.g. malaise, shaking chills, fever, rusty sputum, pleuritic chest pain, cough)
- Lobar infiltrate on CXR
- 25% bacteremic



Streptococcus pneumonia capsule gives you shinning . mucoid colonies.



Risk factors for S.pneumonia

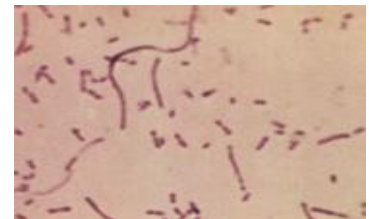
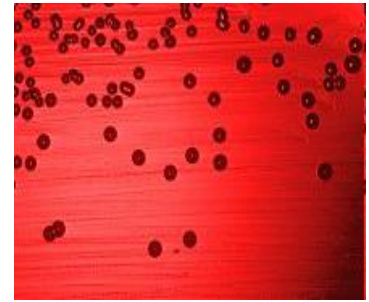
- **Splenectomy** (Asplenia)
- Sickle cell disease, hematologic diseases
- Smoking (**you have 100% time chance to get S.pneumonia**)
- Bronchial Asthma and COPD
- HIV
- ETOH [ethanol use (alcoholics)]

S. Pneumonia Prevention

- **Pneumococcal conjugate vaccine (PCV)** is a vaccine used to protect infants and young children:
 - 13 serotypes of Streptococcus (**before last year it was 7 serotypes**)
- **Pneumococcal polysaccharide vaccine (PPSV)**
 - 23 serotypes of Streptococcus
- **PPSV is recommended** (routine vaccination) for those **over the age of 65**
- For both children and adults in special **risk categories**:
 - Serious pulmonary problems, eg. Asthma, COPD
 - Serious cardiac conditions, eg., CHF
 - Severe Renal problems
 - Long term liver disease
 - DM requiring medication
 - Immunosuppression due to disease (e.g. HIV or SLE) or treatment (e.g. chemotherapy or radio therapy, long-term steroid use
 - Asplenia

Haemophilus influenzae:

- Nonmotile, Gram negative rod
- **Secondary infection** on top of **Viral disease, immunosuppression, splenectomy** patients
- Encapsulated type b (Hib)
 - The capsule allows them to resist phagocytosis and complement-mediated lysis in the nonimmune host
- Hib conjugate vaccine



Specific Treatment

- **Guided by susceptibility testing** when available
- **S. pneumonia:**
 - β -lactams Cephalosporins, eg Ceftriaxone, Penicillin G
 - Macrolides eg. Azithromycin
 - Fluoroquinolone (FQ) eg. levofloxacin
 - Highly Penicillin Resistant: Vancomycin
- **H. influenzae:**
 - Ceftriaxone, Amoxicillin/Clavulanic Acid (Augmentin) (**don't use Amoxicillin alone because H. influenzae secrete beta-lactamase**), FQ, TMP-SMX

CAP Atypicals:

- Mycoplasma pneumonia
- Chlamydia pneumonia
- Legionella
- Coxiella burnetii (Q fever)
- Francisella tularensis (tularemia)
- Chlamydia psittaci (psittacosis).

[first 3 are NON-zoonotic, last 3 are zoonotic, so ask about animals]

EXTRA INFO:

Legionella acquired its name after it was noticed to cause an outbreak among members attending a meeting for the American Legion

- Approximately 15% of all CAP
- 'Atypical': not detectable on gram stain; won't grow on standard media
- Unlike bacterial CAP, often extrapulmonary manifestations [**in addition to symptoms mentioned previously**]:
 - Mycoplasma: otitis, nonexudative pharyngitis, watery diarrhea, erythema multiforme, increased cold agglutinin titre
 - Chlamydia: laryngitis (**hoarseness of voice**)
- Most don't have a bacterial cell wall \rightarrow Don't respond to β -lactams
- Therapy: macrolides, tetracyclines, quinolones (intracellular penetration, interfere with bacterial protein synthesis)

Q fever:

- *Coxiella burnetti*
- Exposure to farm animals or parturient cats
- Epidemic in Middle east, recent large outbreaks in Iraq, and Occupied territories (Israel)
- Acute Pneumonia, severe headache, hepatitis
- Diagnosis: complement fixation, new NAAT
- Chronic: endocarditis, FUO, granuloma in liver
- Treatment: Doxycycline, Rifampin, hydroxychloroquine

Tularemia:

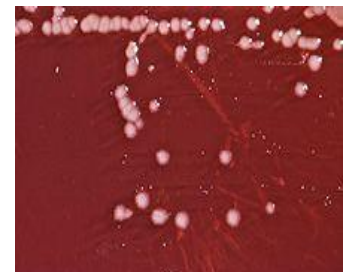
- *Francisella tularensis*
- Rabbits, squirrels, rodents
- Landscapers, Hunters
- Treat: streptomycin

Psittacosis:

- *Chlamydophila psittaci*
- Exposure to birds
- Bird owners, pet shop employees, vets
- 1st: Tetracycline
- Alt: Macrolide

Who is at risk for Pseudomonal Pneumonia?

- Immunocompromised pts (HIV, solid organ or bone marrow transplant, neutropenic, chronic oral steroids)
- Alcoholics
- Frequent prior antibiotic use
- Recent hospital admission
- **Structural lung abnormalities**
 - **Cystic fibrosis, bronchiectasis, severe COPD**
(have recurrent Pseudomonal infection)
- Rare in previously healthy patients
- Gram stain/sputum culture (if good quality) is usually adequate to exclude need for empiric coverage



Who is at risk for Acinetobacter Pneumonia?

- **Community**-Acquired Pneumonia:
 - Alcoholics
 - Smoking
 - Chronic lung disease
 - DM
 - Residence in tropical developing country

- **Hospital**-Acquired Pneumonia:
 - Length of hospital stay
 - Surgey
 - Wounds
 - Previous infection (independent of previous Abx use)
 - Fecal colonization with Acinetobacter
 - Treatment with broad spectrum antibiotics
 - Indwelling central intravenous or urinary catheters
 - Admission to burns unit or **ICU**
 - Parenteral nutrition
 - Mechanical ventilation

- **Acinetobacter: 80% of its gene encodes for resistance->resistant to most antibiotics.**
- **It is not resistant to two antibiotics and we use only one of them which is polymyxin (the class of drugs): colistin (drug)**
- **Patients as soon as they admit to the ICU within 48 hours they become colonized with this organism**

EXTRA INFO:
 The most famous species of Acinetobacter is Acinetobacter Baumannii nicknamed "Iraqibacter" due to its spread among American soldiers in Iraq.

"Remember these Associations"

Asplenia	Strept pneumo, H.flu
Alcoholism	Strept pneumo, oral anaerobes, Klebsiella pneumoniae , Acinetobacter, M. TB
COPD/smoking	H. influenzae, Pseudomonas, Legionella, Strep pneumo, Moraxella catarrhalis, Chlamydophila pneumoniae
Aspiration	Klebsiella, E. Coli, oral anaerobes
HIV	S. pneumo, H. influ, P. aeruginosa, M. TB, Pneumocystis Pneumonia (PCP) , Crypto, Histocytosis, Aspergillus, atypical mycobacteria
Recent hotel, cruise ship	Legionella
Structural lung disease (bronchiectasis)	Pseudomonas, Burkholderia cepacia , Staph aureus

ADDITIONAL: [Step-Up to medicine]
 Legionella: in renal failure, transplant, smokers or chronic lung disease

Pneumonia: Medical floor or ICU?

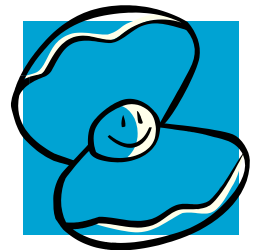
- 1 major or 3 minor criteria= severe CAP→ICU
- Major criteria:
 - Invasive ventilation, septic shock on pressors
- Minor criteria:
 - RR>30; multilobar infiltrates; confusion; BUN >20; WBC <4,000; Platelets <100,000; Temp <36, hypotension requiring aggressive fluids, PaO₂/FiO₂ <250.
- No prospective validation of these criteria

CAP In-patient therapy:

- General medical floor:
 - Respiratory quinolone OR
 - IV β-lactam PLUS macrolide (IV or PO)
 - β-lactams: cefotaxime, ceftriaxone, ampicillin; ertapenem
 - May substitute doxycycline for macrolide
- ICU:
 - β-lactam (ceftriaxone, cefotaxime, Amox-clav) PLUS EITHER quinolone Or: azithro
 - Penicillin-allergic: respiratory quinolone PLUS aztreonam
- Pseudomonal coverage :
 - Antipneumococcal, antipseudomonal β-lactam (pip-tazo, cefepime, imip, mero) PLUS EITHER (cipro or levo) OR (aminoglycoside AND Azithro) OR (aminoglycoside AND respiratory quinolone)
- CA-MRSA coverage: Vancomycin or Linezolid
- All of these regimens cover strep pneumo and cover atypicals

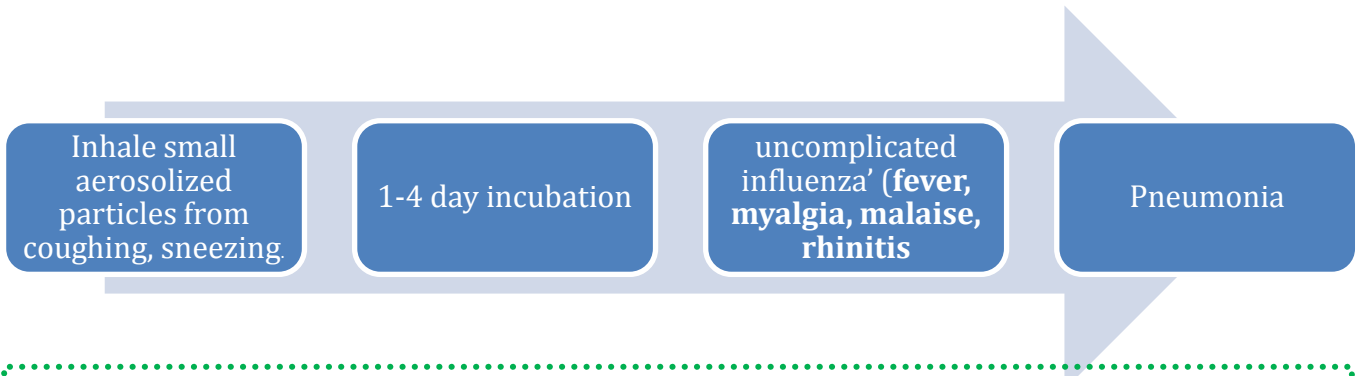
CAP Inpatient Therapy: Pearls

- Give 1st dose Antibiotics in ER (no specified time frame)
- Switch from IV to oral when pts are hemodynamically stable and clinically improving
- Discharge from hospital:
 - As soon as clinically stable, off oxygen therapy, no active medical problems
- Duration of therapy is usually 7-10 days:
 - Treat for a minimum of 5 days
 - Before stopping therapy: afebrile for 48-72 hours, hemodynamically stable, RR <24, O₂ sat >90%, normal mental status
 - Treat longer if initial therapy wasn't active against identified pathogen; or if complications (lung abscess, empyema, **Parapneumonic effusion**).
 - **Parapneumonic effusion:- you treat it until it is completely drained (even if it takes you months or just 1 week)**



CAP: Influenza

- More common cause in children
 - RSV, influenza, parainfluenza
- Influenza most important viral cause in adults, especially during winter months



Myalgia is quite specific for influenza.->if someone has flu-like illness present with these kinds of muscle ache immediately think of Influenza.
Complicated influenza can give Pneumonia

- Adults ≥ 65 account for 63% of annual influenza-associated hospitalizations and 85% of influenza-related deaths
- **Recent** worldwide pandemic of **H1N1** Influenza A (2009-2010)
- Last year epidemic in Saudi Arabia (2010-2011)
- H1N1 risk factors
 - **pregnant, obesity, cardipulmonary disease, chronic renal disease, chronic liver disease**
- CXR findings often subtle, to full blown ARDS [Adult respiratory distress syndrome]
- Respiratory (or Droplet) isolation for suspected or documented influenza (Wear mask and gloves)
- NP [nasopharyngeal] swab for, Rapid Ag test Infl A,B. H1N1 PCR RNA
- Current Seasonal Influenza Vaccine prevents disease (given every season)
- Bacterial pneumonia (*S. pneumo*, *S. aureus*) may follow viral pneumonia

Influenza: Therapy

Neuraminidase inhibitors	Oseltamivir / Tamiflu	75mg po bid	Influenza A, B
	Zanamivir / Relenza	10mg (2 inhalations) BID	
Adamantanes	Amantadine / Symmetrel	100mg po bid	Influenza A
	Rimantadine / Flumadine	100mg po qd	

- H1N1 resistant to Adamantanes
- Neuraminidase inhibitors:
 - 70-90% effective for prophylaxis
 - Give within 48h of symptom onset to reduce duration/severity of illness, and viral shedding
 - Osteltamivir dose in severe disease 150mg bid

MERS-CoV:

- New novel Corona Virus first described in September 2012
- Titled Middle East Respiratory Syndrome Corona Virus (MERS-CoV)
- 149 laboratory-confirmed cases
- 63 deaths
- Most cases in Saudi Arabia 125 cases, 53 deaths

Summary:

- In pneumonia you have inflammation and alveolar filling with pus & exudates
- Pneumonia is the single most common cause of infection-related mortality
- CAP:- Streptococcus pneumoniae is the most common pathogen.
- In Clinical Signs:- lung findings are important in pneumonia specially bronchial breath sound and Aegophony
- Without CXR you can't diagnose Pneumonia
- Acinetobacter Pneumonia:- polymyxin colistin is the only drug we use against it
- Coxiella burnetii (Q fever), Francisella tularensis (tularemia), Chlamydia psittaci (psittacosis) are CAP atypical & all of them are zoonotic