# Community-acquired pneumonia

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| Most common causative agents<br>Pts w/ CAP must be treated w/ empirical agent that covers all of those | S. pneumoniae, C. pneumoniae, M. pneumoniae, S. aureus, H. influenza, Legionella species, Moraxella catarrhalis, Respiratory viruses | | |
| DURATION OF TREATMENT : | a minimum of 5 days, and should be afebrile for 2-3 days<br>Longer duration if initial empiric treatment wasn't effective and complicated by extra pulmonary infx like meningitis and endocarditis | ***Timing for first antibiotic dose***<br>for patients admitted through the emergency department the first antibiotic dose should be administered while still in the emergency department | |
| Recommendations depend on: | 1.The treatment setting: inpatient/outpatient<br>2. The severity of infection.<br>3. The presence of comorbidities.<br>4. The presence of risk factors for drug-resistant pathogens. | | |
| **Outpatient settings** | | **Other informations** | |
| pts w/o Comorbid conditions or risk factors for drug resistant pathogens | MONOTHERAPY :<br>Amoxicillin/ Doxycycline/ Macrolide (Azithro, Clarithromycin) | **Macrolide monotherapy has shown resistance and should not be used if local rates of pneumococcus resistance is greater than 25%** | |
| pts w/ comorbid conditions : Heart/kidney/Lung/Malignancy /DM/ Immunosuppression | MONOTHERAPY :<br>Respiratory fluroquinolone (Levo,Moxi,Gemifloxacine)<br>---------- OR ----------<br>COMBINATION THERAPY:<br><Amoxicillin-Clavulanate or Cephalosporine> PLUS <Macrolide or Doxycycline> | | |
| **inpatient settings** | | | |
| pts w/ non severe pneumonia | B-Lactam PLUS Macrolide<br>---------- OR ----------<br>***Fluroquinolone alone***<br>----------ALTERNATIVE----------<br>B-Lactam PLUS Doxycycline | **B-Lactams : Cefotaxime/ Ceftriaxone/ Ampicillin-Sulbactam** | |
| pts w/ Severe pneumonia<br>PARENTERAL THERAPY | Only Combination<br>B-Lactam PLUS <Macrolide or Fluroquinolone> | ***Switch from IV to oral therapy:***<br>1. when they are haemodynamically stable + improving clinically + able to ingest medication +have a normally functioning gastrointestinal tract<br>2. Pts should be discharged as soon as they are clinically stable have no other active medical problems and have a safe environment for continued care<br>inpatient observation while receiving oral therapy is not necessary | |
| | MRSA COVER : Vancomycin or LineZolid<br>----------AND/OR ----------<br>Psuedomonas COVER : Piperacillin-tazobactam, cefepime, levofloxacin, imipenem, or meropenem<br>----------PLUS----------<br>Ciprofloxacin or Levofloxacin | WHEN TO COVER MRSA + PSEUDOMONAS in your empiric therapy ?<br>MRSA and P. aeruginosa are not common causative agents<br>**those are the risk factors indictes giving agents that covers them :**<br>**1. Prior respiratory isolation of the pathogen.**<br>**2. Hospitalization with receipt of parenteral antibiotics within the last 3 months.**<br>**3. locally validated (epidemiology) prevelance of those pathogens in community** | |

## Clinical caveats in selecting an empiric antibiotic regimen

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| 1. The administration of antibiotics shouldn't be delayed for the purpose of performing diagnostic tests | 2. If the patient received antibiotics in the recent past the new antibiotic should be from a different class | 3. When an appropriate and adequate initial antibiotic regiment is a started the duration of therapy should be shortened except for pseudomonas aeruginosa |
| 4. False negative cultures occurs in patients who have been taking antibiotics for 24 t-72 hours before collection of respiratory specimens | 5. Inhaled antibiotics maybe used adjunct to systemic antibiotics they are not effective as sole therapy | 6. Organisms like E. coli / Klebsiella Enterobacter = produce extended-spectrum beta-lactamase these are usually susceptible to carbapenems |

# Hospital-Acquired pneumonia

**Treatment duration: 7-day course/Except if it's pseudomonas = 2 weeks**

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| **causative agents** | P. aeruginosa, S. aureus (MSSA, MRSA), Klebsiella pneumoniae, E. coli. Others: Serratia marcescens, Stenotrophomonas maltophilia, and Acinetobacter | ONLY A SUGGESTION : PTS W/ HAP NON-VAP TO BE TREATED ACCORDING TO MICROBIOLOGICAL STUDIES RATHER THAN BEING TREATED EMPIRICALLY |
| | **MSSA should be covered UNLESS patient has high risk factors for MRSA:**<br>**1. IV antibiotics within the preceding 90 days**<br>**2.exposure to a hospital unit where more than 20% of the s.aureus isolates are MRSA**<br>**3.high risk of death need for ventilatory support due to septic shock** | |
| **Empiric treatment for HAP** | High risk for MRSA infection → | **vancomycin or linezolid (same as VAP)** |
| | No risk factors for MRSA infection + Proven MSSA → | **oxacillin, nafcillin, or cefazolin** |
| | MSSA (Empiric) → | **piperacillin-tazobactam, cefepime, levofloxacin, imipenem, or meropenem** |

# Ventilator-associated pneumonia

**Treatment duration: 7-day course/Except if it's pseudomonas = 2 weeks**

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| **causative agents** | P. aeruginosa, S. aureus (MSSA, MRSA), Stenotrophomonas maltophilia, Acinetobacter Enterobacteriaceae (E. coli, Klebsiella, Enterobacter, Citrobacter) are less commonly seen in VAP than in hospitalacquired pneumonia (HAP). | | |
| **Empiric treatment for VAP = Cover for S. aureus, Pseudomonas aeruginosa, and other gram-negative bacilli** | Empiric for MSSA/ Pseudomonas<br>USE ANTI-PSEUDOMONAL AGENTS : → | Piperacillin-tazobactam, cefepime, levofloxacin, imipenem, or meropenem | |
| | Proven MSSA (culture results) -- However if u used one of the Anti pseudomonals you don't need to switch to those → | Oxacillin, nafcillin, or cefazolin | |
| | MRSA → | vancomycin or linezolid<br>LINEZOLID OVER VANCOMYCIN WHEN :<br>1. pts w/ renal insufficiency<br>2. pts infected w/ MIC MRSA | |
| | **If patient has structural lung disease increasing the risk of gram-negative infection (cystic fibrosis or bronchiectasis )** | **2 antipseudomonal agents are recommended** → | Double drug coverage for pseudomonas combine agents with a high degree of antipseudomonal activity and low resistance <piperacillin-tazobactam or cefepime or ceftazidime or imipenem or meropenem or aztreonam><br>***----plus----***<br><levofloxacin or ciprofloxacin or aminoglycosides (Amikacin /gentamicin/ tobramycin) or polymyxins (polymyxin B/ Colistin) |
| | A single antibiotic with activity against pseudomonas should be administered EXCEPT in patients with risk factors for multi- drug-resistant organisms =<br>**2 antipseudomonal agents are recommended** | 1. IV antibiotic use within the preceding 90 days<br>2. septic shock or ARDS proceeding VAP onse. five or more days of hospitalisation prior to VAP onset<br>3.acute renal replacement therapy prior to VAP onset<br>4.patient is located in a unit where more than 10% of gram-negative isolates are resistant<br>5.patient in ICU where antibiotic sensitivity rates are not available | |
| | **limit the use aminoglycosides and colistin : used only for gram negative bacilli that proved to be sensitive** | In VAP the use of inhaled ABX is limited : Aminoglycosides and colistin (polymixins) — should be limited , used ***only after isolation of MO***-> and it's evident that it's susceptible to those agents ?? **Because they have poor penetration to lung tissue and very nephrotoxic/** so if other agents could be used then avoid those — given for no more than 5 days w/ high tx failure risk — also if given inhaled u must give them IV at the same time | suggested to use both inhaled and systemic antibiotics, rather than inhlaed antibiotics alone<br>**e.g : Colistin inhalation PLUS Polymyxin B parenteral** |

## CONSIDERATIONS FOR BOTH HAP AND VAP:

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| monotherapy with an antibiotic to which the isolate is susceptible → | NOT in septic shock, or NOT at a high risk for death, and for whom the results of antibiotic susceptibility testing are known |
| combination therapy with 2 antibiotics to which the isolate is susceptible → | In septic shock or at a high risk for death when the results of antibiotic susceptibility testing are known |
| **HAP/VAP Caused by extended-spectrum β-lactamase producing gram-negative bacilli (Klebsiella species, E. coli, Proteus mirabilis, Acinetobacter, and Pseudomonas aeruginosa)** → | Therapy should be based upon the results of antimicrobial susceptibility testing<br>use Carbapenemes if if they are sensitive to it |
| **HAP/VAP due to carbapenem-resistant pathogens** → | If sensitive to polymyxins: IV polymyxin (colistin or polymyxin B), with adjunctive inhaled colistin |
| **HAP/VAP caused by Acinetobacter species** → | Carbapenem or ampicillin/sulbactam<br>If sensitive to polymyxins: IV polymyxin (colistin or polymyxin B), with adjunctive inhaled colistin → Do not use tigecycline ( high adverse effect profile) |

**antibiotic therapy should be de-escalated (broad to narrow spectrum) rather than fixed (kept broad)**

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## Neonatal Pneumonia

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| **causative agents** | **Hospital acquired :**<br>organisms are acquired from maternal genital tract or nursery<br>**ONSET :**<br>1. within hours of birth as part of generalised sepsis syndrome<br>2. or after 7 days in NICU among infants who require a prolonged endotracheal intubation because of lung disease | 1. Gram-positive cocci: Group A + B streptococcus MSSA + MRSA | 2, Gram-negative bacilli (E. coli + Klebsiella + Proteus) | Tx: Vancomycin and a broad-spectrum β-lactam drug such as meropenem, piperacillin/tazobactam, or cefepime. |
| | | 3. Serratia, Citrobacter, Bacillus, Pseudomonas : in infants who have received broad-spectrum antibiotics | | |
| | | Chlamydia --> Gram-negative coccobacillus = Exposure during delivery may cause chlamydial pneumonia at 2 to 18 week | mother and father must be treated for chlamydia | Erythromycin or azithromycin leads to rapid resolution<br>Erythromucin = hypertrophic pyloric stenosis in neonates |

## Community acquired pneumonia and children

the most likely cause depends on the age of the child

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| Preschool-aged children → | ***Streptococcus pneumonia*** → | And complicated bacterial pneumonia should be treated with amoxicillin | Immunisation with the 13 -Valent pneumococcal conjugate vaccine is important in reducing the severity of childhood pneumococcal infection |
| Older children → | ***Mycoplasma pneumonia*** → | Macrolides | |

### Recommended empirical treatment of childhood CAP

| ***Inpatient empiric treatment*** | ***Outpatient empiric treatment*** |
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| ***60 days to 5 years of age*** | ***60 days to 5 years of age*** |
| Cefuroxime (2 weeks)<br>In critically ill patients: Cefuroxime + erythromycin 10-14 days, or cefotaxime + cloxacillin 10-14 days | Amoxicillin (7-10 days) OR, if allergic, Azithromycin (5 days) or clarithromycin (7-10 days), or erythromycin (7-10 days) |
| ***5 to 16 years of age*** | ***5 to 16 years of age*** |
| Cefuroxime + erythromycin 10-14 days, or azithromycin for 5 days. | Azithromycin (5 days) |

Good Luck
Manar Saddam