Treatment of Community Acquired Pneumonia and Nursing Home Acquired Pneumonia.

Hospital Physicians consult local order sets for treatment of CAP or NHAP requiring admission

Do not use monotherapy with either clarithromycin or azithromycin
51% of streptococcus pneumoniae are resistant in the BC Lower Mainland

Get a Chest X Ray to confirm pneumonia before prescribing an antibiotic

Consider if symptoms can be attributed to a viral prodrome or other conditions which do not warrant antibiotics (e.g h*eart failure)*

1) Treat other causes first and plan confirmatory tests (i.e. CXR, WBC) before antibiotic prescription
2) Consider viral etiology (oseltamivir if within 48hrs) if symptoms suggestive, during influenza season.

Consider risk factors, pneumonia severity and if in nursing home

If pneumonia diagnosis is in doubt (i.e. CXR unobtainable or other possible causes):

1) Consider providing delayed antibiotic prescription to be filled if not better in 2-3 days ;
2) Consider downside of antibiotic therapy: 1) side effects including *C. difficile* infection risk, 2) antimicrobial resistance for patient and community and 3) adverse reactions like arrhythmia or drug interactions

If the patient has these risk factors: respiratory disease, heart failure, renal disease, HIV, immunosuppression or malignancy, use **Amoxicillin 1g PO TID for 5-7 days** (to provide optimal treatment of likely target pathogen S.pneumoniae). If the patient has had hospitalization in past 3 months or alcoholism or diabetes* use **Amoxicillin-clavulinic acid 875mg BID** (for expanded coverage of gram negative pathogens, be aware this may reduce activity vs. strep pneumomiae) (see reverse for explanation).
Choose a different class of antibiotic if received in past 3 months. Write eGFR on prescription so pharmacist can dose adjust (if less than 30ml/min). **If the patient is in a nursing home**, may add **doxycycline 200mg then 100mg PO BID** for additional coverage of chlamydiae pneumoniae; doxycycline has less potential to cause arrhythmias than macrolides (and quinolones) and less interaction risk (duration of therapy 7 days in nursing home)

For CAP without risk factors: Use any of the following 3 options, in order of preference, to target S.pneumoniae (Choose a different class of antibiotic if received in past 3 months)

Amoxicillin 1g PO TID x 5-7 days (preferred choice)

Write pharmacist to dose adjust if eGFR less than 30ml/min

Cefuroxime 500mg PO BID x 5-7 days (second choice; consider TID if more than 90Kg).Can use if patient has mild skin/GI reaction, delayed (onset more than 48hours) penicillin /cephalosporin allergy. Write pharmacist to adjust if eGFR less than 30ml/min

Doxycycline 200mg, then 100mg PO BID x 5-7 days (third choice) Can use for patients with cephalosporin or penicillin allergy including anaphylaxis

If patient has early (within 48h) or serious beta-lactam allergy

Do not use quinolones first line. Quinolones are associated with increased risk of tendonitis, peripheral neuropathies (Health Canada warning Jan 2015). May use **levofloxacin 750mg daily**; if beta-lactam allergy (within 48hrs) or patient has co-morbid risk factors or recent failure to other antibiotics. Possibly, less risk for clostridium difficile infection than moxifloxacin. Write pharmacist to adjust if eGFR less than 50ml/min

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Rationale for antibiotic recommendations

Likely pathogens causing CAP (without risk factors): *Streptococcus pneumoniae* is the most likely pathogen causing CAP in patients without risk factors (for other pathogens). The order of preference of antibiotics is therefore based on antibiotic % susceptibility to *S. pneumoniae*.

S. pneumoniae has at least 80% susceptibility to the antibiotic choices listed. All agents listed will also have > 70% activity against H. influenzae, but activity against S. pneumoniae is the priority concern in choosing order of preference.

Amoxicillin: Amoxicilin is regarded as the antibiotic of choice as S. pneumoniae only, is the most important pathogen to target. S. pneumoniae is 99% susceptible to amoxicillin (BC LifeLabs 2017). Amoxicillin is also narrower in spectrum than cefuroxime and has better bioavailability (see below). For these three reasons amoxicillin is preferred over cefuroxime. In order to have the best pharmacokinetics (most time at a level that kills the organism) the recommended dose is **1g TID for optimal treatment of S.pneumo**. This is important to consider as using amoxicillin-clavulinic acid is less likely than amoxicillin 3 g per day to meet the optimal target dosing if the patient has S. pneumoniae.(see below for CAP with risk factors).

Cefuroxime: Although S. pneumoniae has a reported 99% susceptibility to cefuroxime, cefuroxime is less bioavailable than amoxicillin. The usefulness of this agent is as an alternative for patients with a mild delayed penicillin/amoxicillin allergy. In addition, it will cover beta-lactamase producing Hemophilus influenza so it is a reasonable choice for CAP. (The dosing of cefuroxime in this guideline reflects local expert opinion that higher dosing (TID) is required to compensate for the bioavailability of oral cefuroxime but most published guidelines do reflect BID dosing. We have chosen to recommend higher TID dosing if the patient is more than 90Kg to avoid any risk of treatment failure).

Doxycycline: Doxycycline has good enough coverage (estimated that *S.pneumoniae* is at least 80% susceptible). Importantly, doxycycline can be used if patients have a severe allergy to amoxicillin/penicillin or cefuroxime. Also, for younger and less ill patients doxycycline is a good choice as pneumonia in this group is more likely to be caused by "atypical organisms" (C. pneumoniae, M. pneumoniae etc.) covered by doxycycline without losing much coverage of "typical" pathogens.

Likely pathogens causing CAP (with risk factors): Patients with the listed risk factors have increased likelihood of an expanded spectrum of causative pathogens which include *H. influenzae, Staphyloccus aureus*, Enterobacteraciae and "atypicals." However, in this guideline we have stressed that it is most important to cover the **"typical"** pathogens and to **consider** adding doxycycline **only** if they have risk factors for resistance or are thought likely to have "atypical" organisms (e.g. are in a nursing home).

We favour the use of agents with the best coverage of *S. pneumoniae* so we still recommend amoxicillin rather than cefuroxime or doxycycline. We have also included amoxicillin-clavulanic acid for at risk patients because of its expanded coverage against*, Enterobacteraciae and Staphylococcus aureus* and better coverage for beta-lactamase producing *H. influenzae* (than amoxicillin). In addition, amoxicillin-clavulinic acid would be preferred to ensure broader coverage Gram negative pathogens If patients have alcoholism or recent hospitalization. But it is important to note that amoxicillin-clavulinic acid 875mg BID is providing **less coverage against Strep pneumoniae than amoxicillin 1g TID**. *Some guidelines would advocate to cover for staph aureus if the patient has diabetes or post influenza pneumonia so amoxicillin-clavulinic acid alone or amoxicillin – doxycycline would achieve that.

Double coverage: We have suggested that the clinician could consider adding coverage to treat atypical pathogens in patients from nursing homes. The addition of doxycycline will cover "atypical" organisms as well as *Staphylococcus aureus, and beta-lactamase positive H. influenzae*. Some guidelines require atypical coverage but more recent data indicate that clinical outcomes are not changed in mild pneumonia – hence in this guideline atypical coverage is suggested as optional.