SHC Clinical Pathway: Inpatient Pneumonia (Community-Acquired, Hospital-Acquired and Ventilator-Associated)

Background:
These recommendations apply primarily to immunocompetent patients although many principles can be extrapolated to the immunocompromised patient population.

Definitions:
- Community-acquired pneumonia (CAP) = signs/symptoms develop **prior to or within 48 hours of admission.**
- Hospital-acquired pneumonia (HAP) = signs/symptoms develop **after 48 hours of admission.**
- Ventilator-associated pneumonia (VAP) signs/symptoms develop within 48 hours of intubation through 48 hours after extubation.

Diagnosis:
- Must have BOTH:
  - A **new or worsening** infiltrate on chest imaging
  - **New or worsening** cough, dyspnea or purulent sputum production.

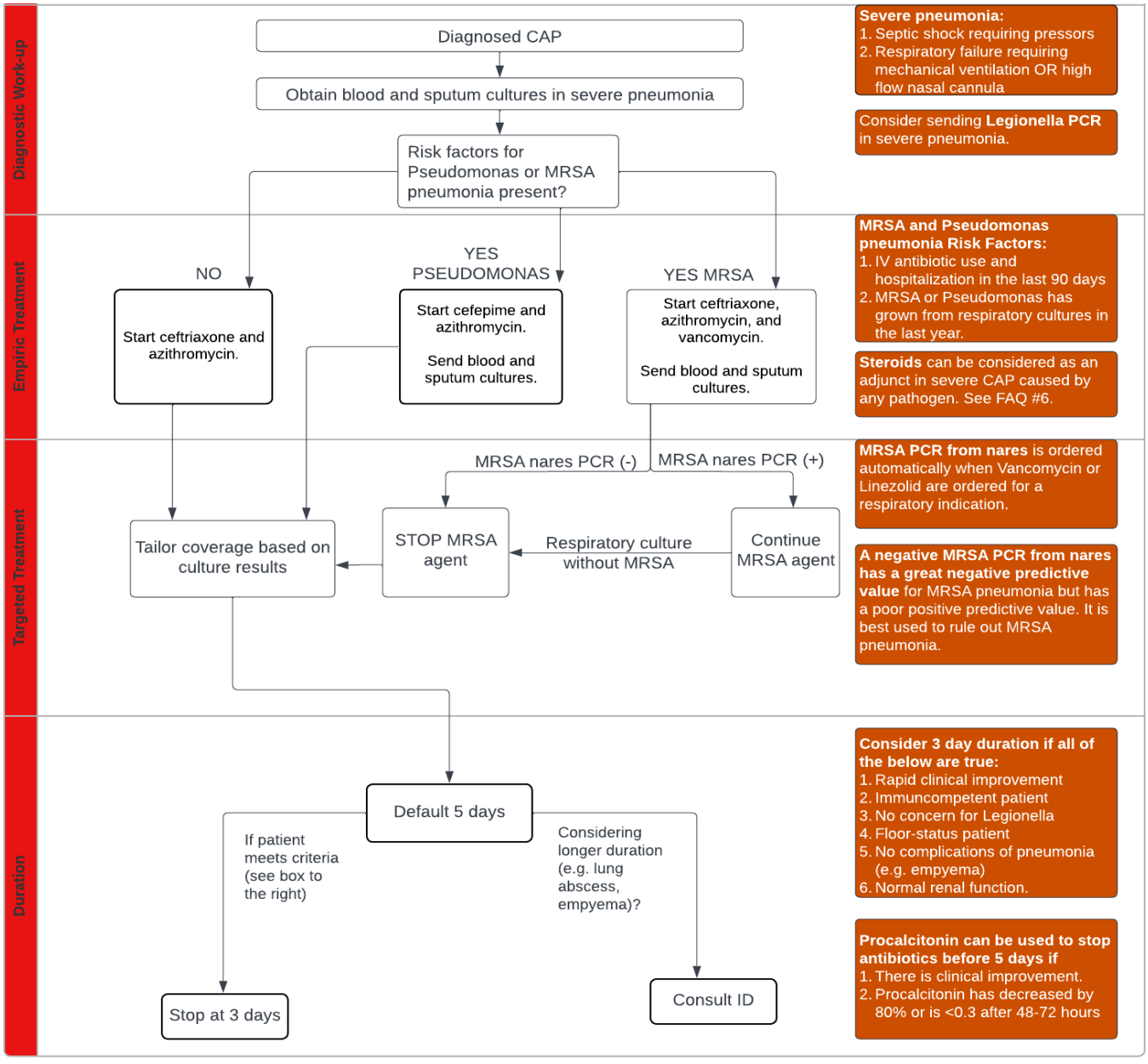
Initial work-up:
- Blood and sputum cultures should be obtained in all cases of HAP/VAP and in severe CAP or CAP with risk factors for MRSA or Pseudomonas. *See* CAP *clinical pathway for characterization of severe pneumonia*.
  - Note, **positive sputum or even BAL cultures cannot make or confirm a diagnosis of pneumonia** even with an isolated fever or leukocytosis as colonization of the respiratory tract with various pathogens is common.
    - National guidelines regard non-invasive sampling as equivalent to BAL, however if there is concern for opportunistic infection, BAL may be preferred.
  - Sputum and blood cultures are not indicated for non-severe CAP
  - Consider viral pneumonia work-up, including influenza and COVID-19.

Empiric therapy:
- CAP: In the absence of allergies, **ceftriaxone and azithromycin** are the mainstay of treatment.
  - Consider MRSA or pseudomonas coverage IF: the patient has been hospitalized and received IV antibiotics within the last 90 days or if they have grown MRSA or Pseudomonas from sputum cultures within the last year.
  - If anti-MRSA treatment is initiated, MRSA PCR should be obtained and followed for de-escalation.
- HAP/VAP: In the absence of allergies, an anti-pseudomonal agent (piperacillin-tazobactam or cefepime) + vancomycin are advised as empiric therapy.
- Please see FAQ #5 for guidance on antibiotic choice in the setting of drug allergies.

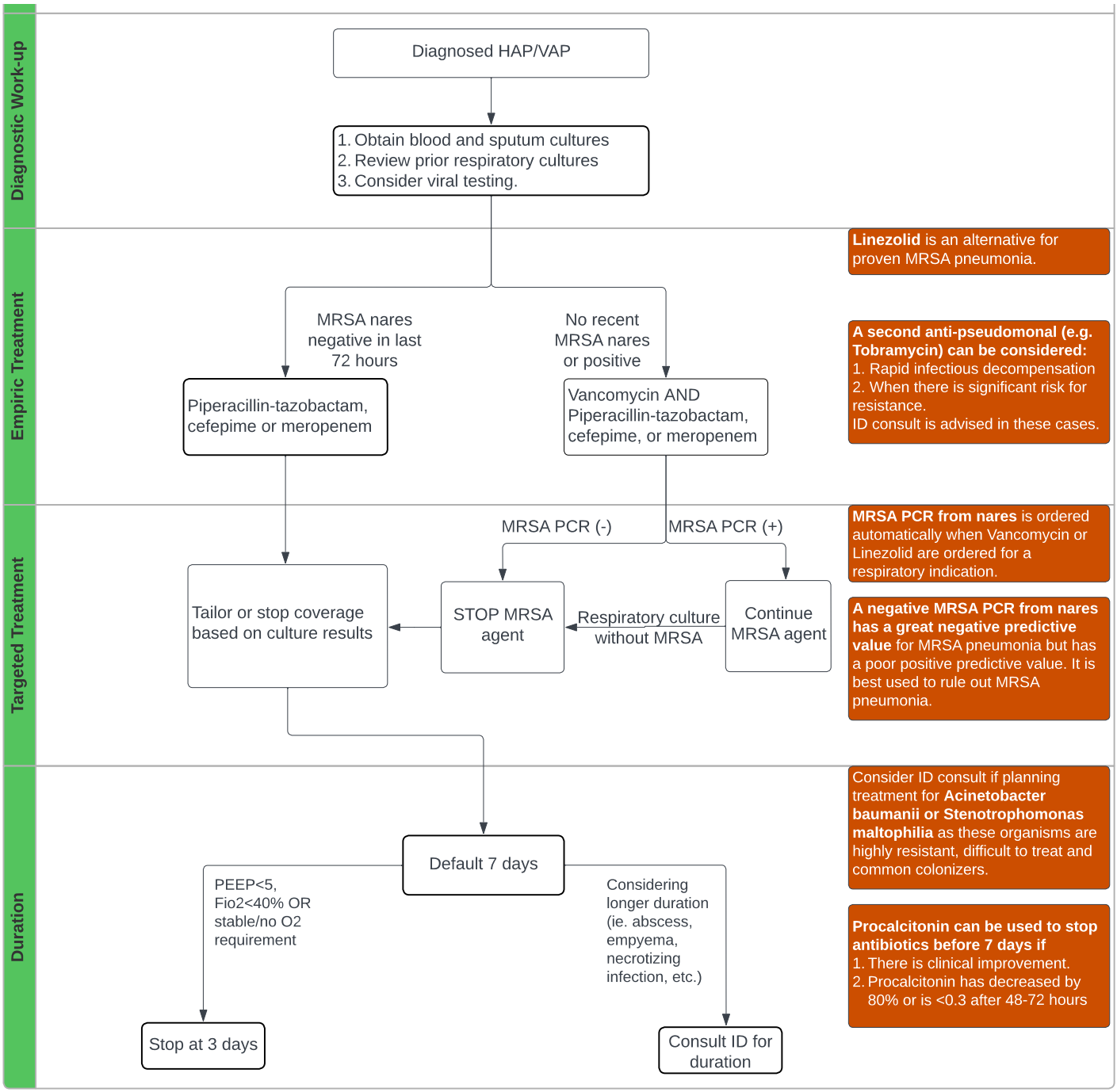
De-escalation:
- **All empiric regimens should be tailored to culture results.**
- **Nasal MRSA PCR has an excellent negative predictive value for MRSA pneumonia**. If nasal MRSA PCR is negative, vancomycin can be discontinued in patients for which this agent was started empirically.
- Tailoring antibiotics to the organism that grows is critical to ensuring that the patient is adequately covered but not on an unnecessarily broad regimen.
  - In cultures with mixed respiratory flora, microbiology will note cases in which the culture does NOT contain MRSA or *Pseudomonas aeruginosa* in the milieu. In these cases anti-pseudomonal and/or anti-MRSA antibiotics may be safely transitioned to alternative agents.
  - If a patient's sputum cultures grow a pan-susceptible E. coli, discontinuation of anti-pseudomonal and anti-MRSA coverage is safe and preferred in favor of a narrower regimen (e.g. Ceftriaxone).

Duration:
- In most cases, treatment for CAP is 5 days and for HAP/VAP is 7 days.
  - There are certain groups that benefit from a 3 day regimen instead. *Please see FAQ #8 and reference 14*

SHC Clinical Pathway Community Acquired Pneumonia



SHC Clinical Pathway: Hospital-Acquired and Ventilator-Associated Pneumonia



SHC Clinical Pathway: Pneumonia FAQ's

1. Does a positive respiratory culture mean my patient has pneumonia?

A positive respiratory culture alone, even from ETT or BAL, is NOT indicative of invasive infection in the absence of pulmonary symptoms, even with isolated fever or leukocytosis.

2. How should procalcitonin be used in the management of pneumonia?

Procalcitonin should not be considered in the initial decision to start empiric therapy in a patient with suspected bacterial pneumonia and should never be used to escalate therapy. If, at 48-72 hours after diagnosis, the procalcitonin is <0.3 or has decreased by at least 80% from baseline, bacterial infection is unlikely and antibiotics should be stopped. Please note, COVID-19 can be associated with an elevated procalcitonin even in the absence of concomitant bacterial pneumonia. For more details on procalcitonin, see FAQ HERE

3. My patient has COVID-19. Should I be concerned about co-infection or super-infection with bacterial or fungal organisms?

We do not recommend empiric use of antibiotics for patients infected with COVID-19 unless there is clear radiologic or clinical evidence of bacterial/fungal concomitant infection. The prevalence of co-infection varies in the published literature.[1, 2, 3] Regardless it is clear that antibiotics are over-used.[1] This ultimately increases risk of selecting for resistant organisms and exposing patients to risk of harm through adverse effects of unnecessary antibiotics. If antifungals or antibiotics are indicated, we would recommend tailoring them to available microbiological data (e.g. sputum cultures).

4. When should I consider Legionella?

Legionella is an atypical pathogen that can cause severe pneumonia. It can be lobar and multifocal and may lead to ARDS. Legionella testing is recommended for patients with severe pneumonia only (septic shock requiring pressors or respiratory failure requiring mechanical ventilation or high flow nasal cannula). For better sensitivity, we recommend sending Legionella PCR from sputum over Legionella urine antigen.

5. What if my patient has a severe penicillin or cephalosporin allergy? Azithromycin intolerance?

First, confirm that the patient truly has an allergy. Documented allergies in the EMR are often incorrect. If the patient reports a non-urticarial rash to penicillins but no history of anaphylaxis, it is safe to prescribe cephalosporins. Please see further guidance on this HERE

If a true, severe allergy has been confirmed: Ceftriaxone + azithromycin → Levofloxacin monotherapy.

Severe CAP at risk for Pseudomonas: Ceftriaxone + azithromycin → Aztreonam + levofloxacin.

- Please note that neither agent has reliable coverage of MSSA.
- Azithromycin does not need to be added if the patient is receiving levofloxacin as this covers atypical organisms.

Severe CAP at risk for MRSA: Ceftriaxone + azithromycin → Ceftriaxone + azithromycin + vancomycin.

If avoidance of Azithromycin is preferred due to prolonged QTc, Doxycycline may be considered as an alternative agent for atypical coverage as it does not prolong QTc.

6. What is the role for steroids in community-acquired pneumonia?

Several studies have shown varied results[7,8,9] and guidelines recently recommended steroid use in hospitalized patients with severe CAP. One notable study was a large, multicenter French study that demonstrated mortality benefit and lower likelihood of intubation in patients who received steroids within 24 hours of ICU admission[7]. The study excluded patients who were in septic shock, had influenza pneumonia, were admitted to the floor and who were immunocompromised. Of note, there is little data to support corticosteroid use in patients who are not critically ill.

7. How should a MRSA nares be used?

An MRSA PCR can help with de-escalation in HAP/VAP and high-risk CAP. Please note this test is not orderable by physicians and is automatically ordered by pharmacists when vancomycin or linezolid is ordered for a pulmonary indication. MRSA nares culture is less sensitive than PCR and is not preferred for clinical decision making. A negative MRSA nares PCR makes MRSA pneumonia very unlikely and can be used to safely stop MRSA coverage. A positive MRSA nares PCR is not diagnostic of MRSA pneumonia and MRSA coverage can still be stopped if respiratory cultures do not grow MRSA. MRSA nares protocol can be found HERE and FAQ can be found HERE.

8. When is a duration of three days for CAP appropriate?

A multicenter French study showed non-inferiority of three days of beta-lactam therapy compared to eight days of beta-lactam therapy in patients admitted to non-ICU wards with CAP. [4,5].There were many exclusion criteria for this study. [6]

Based on this data, we would recommend a 3 day course for floor-status, immunocompetent patients with uncomplicated pneumonia who respond quickly to therapy, normal renal function and no concern for Legionella or aspiration pneumonia.

Please note, these guidelines differ from those of HAP/VAP, please see clinical pathway on page 3.

9. What if my patient with CAP is not improving?

If, after 48-72 hours of therapy, your patient is not improving or worsening clinically, first re-consider whether the cause of symptoms is infectious. Common mimic of bacterial pneumonia include pulmonary edema, aspiration pneumonitis, viral pneumonia, COPD exacerbation and inflammatory disease (e.g. ILD flare).

If the suspicion for infection remains high, it may be reasonable to add coverage for MRSA (typically Vancomycin) and Pseudomonas aeruginosa (typically cefepime or piperacillin-tazobactam)[10], particularly if good-quality respiratory cultures are unable to be obtained.

10. When should I cover anaerobes for a patient with aspiration pneumonia?

It is no longer recommended to routinely cover for anaerobes in aspiration pneumonia, even in severe cases**.** The exception is when the patient has evidence of an empyema, necrotizing pneumonia or a lung abscess (the latter two of which are typically diagnosed on CT). In these cases, anaerobic coverage with piperacillin-tazobactam alone or the addition of metronidazole to typical pneumonia coverage is appropriate.

11. What is the preferred agent for gram negative coverage in HAP/VAP?

Reviewing the patient's previous recent culture data prior to initiation of antibiotics can prove to be highly useful in selecting an empiric agent. Piperacillin-tazobactam and Cefepime are reasonable choices and specific antibiotic choices should be pending prior culture/sensitivity data as well as review of the hospital-wide antibiogram. Meropenem should not be used as initial therapy unless there is significant concern for the presence of an extended spectrum beta lactamase (ESBL) producing Enterobacterales. If there is concern for a carbapenem-resistant organism, the infectious diseases team should be consulted. Once cultures have resulted, antimicrobials can be tailored to the organism grown.

12. What is the preferred agent for MRSA?

Linezolid and vancomycin are both good empiric agents for MRSA coverage. While some early studies have found linezolid to be superior to vancomycin for MRSA pneumonia, these had significant methodological issues and were followed by the larger, randomized ZEPHyR trial which did NOT find any difference in mortality between the two agents. Patient-specific factors for contraindications or risk for adverse events should be used to guide selection. Per policy at SHC, linezolid is restricted to patients with proven MRSA pneumonia. Daptomycin does not typically have activity in the lung parenchyma and should not be used.

III. References

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