Evaluation and Management of Community Acquired Pneumonia With a Moderate to Large Parapneumonic Effusion Clinical Practice Guideline

AIM

- Standardize evaluation and management strategies for children with moderate to large parapneumonic effusions in the setting of community acquired pneumonia receiving care at SSM Health facilities
- Optimize patient outcomes and healthcare utilization for children with complicated pneumonia

CXR with Concern for Moderate to Large Parapneumonic Effusion, as evidenced by:

- Formal radiology read on CXR of Medium/Moderate or Large parapneumonic effusion
- Effusion > 1/4 the hemithorax on an upright AP CXR
- Effusion > 1cm from the chest wall measured on a lateral decubitus CXR
- Other imaging (if obtained, not needed for diagnosis) with radiology read of moderate to large parapneumonic effusion

- **Obtain Blood culture (preferably prior to starting IV antibiotics)**
- **Obtain CBC, CMP, Influenza/RSV/COVID PCR**
- **Establish IV access**
- **Start appropriate IV antibiotics (*see Page 2*)**

Obtain Ultrasound of the Chest (if no prior advanced imaging evaluating effusion)

US demonstrating fluid > 1cm from the chest wall with septations/locations
OR
US demonstrating fluid > 2cm from the chest wall in the presence of significant respiratory distress (need for HFNC, CPAP, BiPAP, or intubation)

NO → • Continue appropriate IV antibiotics

YES →
- Consult Interventional Radiology for Chest Tube Placement, within 24 hours (Pediatric Surgery will place chest tube if IR unavailable), consider repeat Chest US if needed
- Send Pleural Fluid Studies: Cell Count w/ differential, Bacterial Culture, Bacterial PCR
- Consider Alteplase via chest tube every 24 hours for 3 doses (*see Page 3*)
- CXR 24 hours following chest tube insertion
- Keep Chest tube to suction for duration of Alteplase course
- Continue IV antibiotics

Re-assess within 48 hours

NOT IMPROVING OR WORSENING → (Consult Interventional Radiology for Chest Tube Placement)

IMPROVING →
- Assess Discharge Criteria (*See Page 3*), discharge when met and follow-up arranged
- Transition to appropriate oral antibiotic (*See Page 3*)

Re-assess CXR and Clinical Status within 24 hours of Alteplase completion

IMPROVING IMAGING AND IMPROVING CLINICAL STATUS →
- Continuously assess chest tube discontinuation criteria, remove once met (*see Page 3*)
- Continue IV antibiotics

CHEST TUBE REMOVED → (Assess Discharge Criteria, discharge when met and follow-up arranged; Transition to appropriate oral antibiotic)

NOT IMPROVING OR WORSENING →
- Obtain repeat imaging (US vs CT chest with IV contrast) based on multi-disciplinary discussion (radiology, surgery)
- Evaluate culture results, adjust antibiotics if indicated
- Evaluate for tube patency
- Consider repeat CBC, CMP, CRP if clinically indicated
- Continue IV antibiotics
- VATS per Pediatric Surgery
  - Can consider tube re-adjustment or additional alteplase after multi-disciplinary discussion and CT findings in select patients

Re-assess CXR and Clinical Status within 48-72 hours of selected intervention

IMPROVING IMAGING AND CLINICAL STATUS → (Continuously assess chest tube discontinuation criteria, remove once met; Continue IV antibiotics)

NOT IMPROVING OR WORSENING →
- Multi-disciplinary discussion, further evaluation and management as indicated

EXCLUSION CRITERIA

- Age ≤ 60 days or ≥ 18 years
- Immunocompromised patients
- Sickle cell disease
- Cystic fibrosis
- Cyanotic congenital heart disease
- Presence of pulmonary abscess or necrotizing pneumonia
- Patient being discharged from the emergency department
- Small parapneumonic effusion

USE WITH CAUTION

This guideline may be applied to patients with the following conditions on a case-by-case basis, but may not be appropriate to be routinely applied

- Presence of neuromuscular disease or airway clearance impairment
- Presence of artificial airway (see Ventilator and Artificial Airway Associated Tracheitis and Pneumonia CPG)
- Patients with severe illness, severe sepsis, or requiring admission to the pediatric ICU
- Patients requiring home oxygen therapy

Additional Evaluation and Management Considerations	
Symptom Assessment/ Evaluation	Provide appropriate respiratory support for hypoxemia, tachypnea, and respiratory distress
Disposition	Admit to Hospital (Inpatient Ward, TCU, or PICU as indicated by clinical status and respiratory support needs)
Additional Lab Evaluation	Consider: MRSA Nasal PCR swab, full respiratory PCR, CRP, Procalcitonin (not indicated in all cases)
Consultations	- Pediatric Surgery (Need not be emergent) - Pediatric Pulmonology - Pediatric Infectious Disease (if assistance with initial antibiotic choice desired)
Fluids/Diet	- NPO pending US Chest result and surgical consult - Provide Appropriate IV fluid resuscitation and start isotonic maintenance fluids

SIGNS OF CLINICAL IMPROVEMENT

- Decrease in oxygen support (if applicable)
- Decrease in chest pain
- Decrease in respiratory distress (tachypnea, work of breathing)
- Improving fever curve
- Improving appetite
- Downtrending CRP (if being checked)

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Evaluation and Management of Community Acquired Pneumonia Complicated by Parapneumonic Effusion Clinical Practice Guideline

ADDITIONAL GUIDELINE CONSIDERATIONS

- Daily CXR is not indicated in all patients; CXR frequency to be determined by surgery/IR/primary team
- Younger children (< 2 years of age) are at higher risk for additional complications and more severe course, including pulmonary infarction, necrosis, abscess development, and hypoalbuminemia
- Broadening of antibiotic therapy should be done cautiously, in multidisciplinary collaboration, as most patients fail to improve as a result of inadequate drainage rather than antibiotic resistance/non-response
- Daily labs (CBC, CRP, procalcitonin) are likely of low yield and of less value than clinical indicators alone, including fever, respiratory symptoms, chest pain, appetite, activity level, and chest tube output
- Abrupt loss of chest tube output with clinical worsening or non-improvement should warrant investigation of tube occlusion

INITIAL ANTIMICROBIALS

Empiric Therapy (All Patients)

- Ceftriaxone 75mg/kg (max 2000mg) IV every 24 hours
- If cephalosporin Allergy:
  - Levofloxacin
    - > 6 months to 5 years: 16 to 20mg/kg/day in two doses divided every 12 hours, IV or PO (max 750mg per day)
    - ≥ 5 years of age: 8-10mg/kg/day every 24 hours, IV or PO (max 750mg per day)

DISCLAIMER
All dosing recommendations are based on normal renal function. Dosing adjustments may be required for patients with known or inspected renal impairment and pharmacy consultation is recommended

Atypical Organism Coverage Desired?

Empiric atypical coverage is not required for every patient with parapneumonic effusion. Consider coverage in patients with:

- Positive respiratory PCR for *Mycoplasma pneumoniae*, *Chlamydia pneumonia*, or *Bordetella pertussis*
- Known high community disease burden of atypical organisms with other clinical suspicion

YES

- Azithromycin (PO or IV): 10mg/kg (max 500mg) day 1, then 5mg/kg (max 250mg) day 2-5

Recommend PO if the patient is able to tolerate liquid medication
Patients on levofloxacin do not require additional atypical coverage

MRSA Coverage Desired?

Empiric MRSA coverage is not required in every patient with parapneumonic effusion. Consider initial coverage in patients with:

- Severe illness
- ICU admission
- High risk of MRSA disease (prior MRSA infection, recent hospital stay or surgery, residential facility)
- Influenza positive

MRSA Nasal PCR has a high negative predictive value and may be used to stop empiric MRSA coverage earlier than 24 to 48 hours in select patients. The decision to stop empiric MRSA coverage should be guided by culture results, risk factors, and clinical trajectory

YES

- Vancomycin IV (dosing per pharmacy) for severely ill patients
- Linezolid IV or PO for patients who are not severely ill
  - < 12 years of age: 10mg/kg (max 600mg) IV or PO every 8 hours
  - ≥ 12 years of age: 600mg IV or PO every 12 hours

Clindamycin IV not recommended as initial coverage due to potential for high local resistance patterns; refer to local antibiogram

Antiviral Therapy Required?

COVID-19 or Influenza A/B Positive with complicated pneumonia

YES

- Influenza A/B: Oseltamivir (Oral suspension or Capsules)
  - < 1 year: 3mg/kg orally twice daily for 5 days
  - ≥ 1 year :
    - ≤ 15kg: 30mg orally twice daily for 5 days
    - 15.1kg to 23kg: 45mg orally twice daily for 5 days
    - 23.1kg to 40kg: 60mg orally twice daily for 5 days
    - ≥ 40.1kg OR 13 years or older: 75mg orally twice daily for 5 days
- COVID-19: Refer to SSM System Guidance on treatment criteria and recommendations

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CHEST TUBE MANAGEMENT

ALTEPLASE ADMINISTRATION

Alteplase is associated with shorter LOS and chest tube duration without increased risk of adverse outcomes, but may not be indicated in all cases of free-flowing effusions

Dose

≥30kg: 4mg in 40mL of 0.9% saline
<30kg: 0.1mg/kg (maximum 3mg) in 20mL 0.9% saline

Frequency

Administer first dose after chest tube placement, then every 24 hours for 3 total doses (hour 0, 24, and 48)

Administration

Administer intrapleural, clamp and dwell for 1 hour after each administration

Alteplase need not be administered by surgery, but should be administered by a trained provider in administration or a provider under guidance from a trained provider

Contraindications

Bronchopulmonary fistula, Air leak

CHEST TUBE DISCONTINUATION CRITERIA

- **Signs of Clinical Improvement (*See Page 1*)**
- **Chest tube output < 1mL/kg/24 hours in the setting of tube patency**
- **No air leak**

DISCHARGE, ORAL ANTIBIOTICS, AND FOLLOW-UP

DISCHARGE CRITERIA

- **Off supplemental oxygen for reasonable time period**
- **Pain resolved or significantly improved and manageable with oral medications**
- **Ability to tolerate full oral intake and maintain hydration**
- **Ability to tolerate oral antibiotics**
- **Fever curve improving**
- **Acceptable imaging findings following chest tube removal (no or minimal stable pneumothorax, no increased fluid collection or consolidation)**
- **Family has comprehension of follow up plan and disease process, ability to communicate with the medical team (phone), and reliable transportation**

ORAL ANTIBIOTICS

Oral Transition

Transition to oral therapy is recommended when the patient is clinically improving, their chest tube has been removed, and they are able to tolerate oral therapy. Oral recommendations are provided based on IV therapy selection and should be guided by available susceptibility information on any culture data

- **Ceftriaxone**
  - **Amoxicillin-Clavulanate (Augmentin) 80-90mg/kg/day divided BID (max dose 2g Amoxicillin component every 12 hours)**
    - **Use 600-42.9mg/5mL for liquid formulation**
- **Levofloxacin: Oral Levofloxacin***
- **Linezolid: Oral linezolid***
- **Vancomycin: Oral Linezolid* (may consider clindamycin in select cases)**

*** = May require prior authorization, plan discharge accordingly**

Total Duration of Therapy

Intervention required: 7 days from last fever or 7 days from chest tube removal
No intervention: 14 total days from admission

FOLLOW-UP RECOMMENDATIONS

Pediatric Pulmonology
- **Follow up in 2-4 weeks**

Pediatric Surgery
- **Follow up typically only for patients requiring VATS, 1-2 months**

Primary Care Physician
- **Within 7 days**

- **Recommend patients have antibiotics in-hand prior to discharge, especially if less common medications are being used or may require prior authorization**
- **Return precautions**
  - **Worsening fever**
  - **Worsening chest pain**
  - **Worsening respiratory symptoms (tachypnea, work of breathing)**
  - **Inability to tolerate oral medications**

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