# Complicated Pneumonia Pathway: ED and Inpatient Management

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Children's Healthcare of Atlanta

**Complicated Pneumonia[1]**
Presence of Moderate to Large Effusion or Empyema on imaging

- **Obtain labs: CBC with diff, CRP, BMP, Blood Culture[2]**
- **Begin Antibiotics[A] (Order MRSA PCR nasal swab if starting MRSA antibiotic coverage)**
- **IV Fluids if indicated**

**Admit: Inpatient or ICU[3]**

**Consult Surgery**
- **Ultrasound (within 24 hours, obtain in ED if feasible)**
- **Chest Tube (in ED if feasible)**

*ICU patients or those on respiratory support will have chest tube placed in ICU*

**Daily Chest X-Ray and routine labs are not recommended**

Ultrasound Characteristics

**Free Flowing Fluid**

**Insert Chest Tube**
- **Consider thoracentesis**
- **Consider** Fibrinolysis with tPA[5] if CXR not improved post-placement

**Presence of loculations, septations, or empyema:**

**Chest Tube with Fibrinolysis & tPA[5]**

**Connect Chest Tube to - 20cm/$H_2O$ seal suction**
*PICU physicians may place Chest Tube without surgery consult*

## Plan of Care

- Continue IVF and Antibiotic Therapy[A]
- Oxygen to maintain 02 saturations ≥ 90% while awake or ≥ 88% while asleep *(brief desats <88 are expected and acceptable)*
- Continuous Pulse Ox monitoring if on oxygen
- *Increased airway clearance is not routinely necessary for patients with complicated pneumonia[4]*
- Pain management per physician
- Peripheral line access preferred before use of PICC line unless otherwise clinically indicated
- Encourage oral intake. *If patient is not eating, enteral feeds are recommended before TPN*

**Repeat CXR**

Is Patient Improving 48-72 hrs after intervention?

**NO**

**Surgical Failure:**
Worsening or increased oxygen requirement or respiratory distress 48-72 hrs post surgical intervention

**Repeat CXR**

If CXR not improving or worsening, consider repeat US or additional imaging[2]

**Does US or CT show persistent fluid collection with loculations/ septations?**

**NO**

**YES**

**Consider second course of tPA vs Decortication procedure**

**YES**

**Consider removing Chest Tube:**
- Drainage is decreased
- No air leak – if there is an air leak, consider water seal for 4-6 hrs before removing
- Repeat CXR may not be needed unless respiratory distress develops

**Consider advancing to ORAL Antibiotics:**
- Improving Fever Curve
- Tolerating PO intake
- Decreasing Oxygen Requirements

**Discharge Home:**
- Improving fever curve and down trending inflammatory markers
- Chest Tube removed
- Off Oxygen
- Stable work of breathing
- Tolerating PO intake

## [1]Definition

- ≥ 2 Months -18 Years of Age
- Signs and symptoms of community acquired pneumonia (viral and bacterial)

**Moderate effusion**
- 1-2 cm rim of fluid or > ¼ but less than ½ hemithorax opacified on Chest X-Ray (CXR), upright preferred

**Large effusion**
> ½ hemithorax opacified on CXR, upright preferred

## Exclusion Criteria

- Immunocompromised
- Cystic Fibrosis
- Sickle Cell
- Infants <2 months of age
- Nosocomially Acquired Pneumonia (>48 hrs)
- Medically Complex Patients
- Suspected Aspiration Pneumonia

## [2]Diagnostic Testing

**Consider:**
MRSA PCR nasal swab: may be used to aid in de-escalation from anti-MRSA agents
- Respiratory Viral Panel (RVP): Identification of virus does not exclude other infectious etiologies
- Sputum Cultures: If patient is able to produce sputum, consider sputum culture
- Chest CT scan: Indicated only in patients with
  - Large body habitus
  - US findings discrepant with clinical findings
- Presence or location of lung abscess may impact surgical decision making

## [3]Consider PICU Admission

- FiO2>50% on HFNC
- HFNC exceeding floor flow limit
- PCO2 >55 mmHg
- Fluid Refractory Shock

## [4]Bronchodilator Use

- The use of albuterol and other bronchodilators is not routinely indicated.
- Consider in cases of acute wheezing or significant history of asthma.

## [5]Fibrinolysis With tPA

**tPA: 4 mg every day X 3 doses through chest tube**
- tPA volume administered should be based on patient/effusion size
- First dose is at time of Chest Tube insertion, then daily
- Dwell time of tPA is 1 hour. Clamp for 1 hour after tPA.

## Consults

Consider Consults for:
- Nutrition: If unable to tolerate oral feeding
- Pulmonology: If invasive intervention and for follow-up after discharge
- Infectious Disease: Guidance on length of therapy and transition to oral antibiotics

## Complicated Pneumonia Pathway Medication Chart[A]

| Severity | Drug | Dosage | Max Dose | Duration |
|---|---|---|---|---|
| Mild-to-Moderate Illness[B] | Ceftriaxone | 75 mg/kg/dose IV every 24 hours | 2000 mg/dose | 7 days from drainage of effusion OR resolution of fever in undrained effusions |
| Mild-to-Moderate Illness with Cephalosporin Allergy[C] | Levofloxacin | 10 mg/kg/dose PO (preferred if able) or IV:<br><5 years old: every 12 hours<br>≥5 years old: every 24 hours | 750 mg/dose | |
| Severe Illness | Ceftriaxone **PLUS** MRSA coverage (Clindamycin OR Vancomycin) **AND** collect MRSA PCR swab | 75 mg/kg/dose IV every 24 hours | 2000 mg/dose | Dependent on source control and clinical response[D] |
| Severe Illness with Cephalosporin Allergy[C] | Levofloxacin **PLUS** MRSA coverage (Clindamycin OR Vancomycin) **AND** collect MRSA PCR swab | 10 mg/kg/dose PO (preferred if able) or IV:<br><5 years old: every 12 hours<br>≥5 years old: every 24 hours | 750 mg/dose | |
| MRSA Agents | Clindamycin | 13 mg/kg/dose PO (preferred if able) or IV every 8 hours | 900 mg/dose (IV)<br>600 mg/dose (PO) | |
| | Vancomycin with Pharmacokinetic Monitoring Consult | 15 mg/kg/dose IV every 6 hours | 1000 mg/dose | |
| Community-acquired MRSA pneumonia is rare. Consider adding clindamycin in stable patients with lung abscess or empyema. Vancomycin is preferred in septic shock, necrotizing pneumonia, or history of clindamycin resistance. Collect MRSA PCR nasal swab as soon as possible when initiating clindamycin or vancomycin. If MRSA PCR result is negative, discontinuation of the anti-MRSA agent is recommended. | | | | |
| Atypical Coverage[E] | Azithromycin[F] | 10 mg/kg/dose PO (preferred if able) or IV every 24 hours | 500 mg/dose | 3 days |

[A]Antibiotic recommendations are for empiric therapy only. For patients with culture and susceptibility data, antibiotics should be targeted as appropriate. Prompt IV to PO switch is encouraged for patients who can tolerate enteral administration.

[B]Mild-to-moderate illness is defined as a small or moderate-sized effusion, without abscess, empyema, necrotizing pneumonia, or the need for ICU admission.

[C]Most patients with non-severe penicillin allergies will tolerate ceftriaxone. Avoid ceftriaxone in patients with allergies to cephalosporins.

[D]Duration of therapy should be 7 – 10 days for most cases of parapneumonic effusion. Consider longer durations for lung abscess or necrotizing pneumonia. Typically, 14 – 28 days of therapy is sufficient. **Infectious Diseases consultation is recommended for guidance.**

[E]Empiric atypical coverage is not routinely recommended. Consider adding if Mycoplasma positive on RVP.

[F]If levofloxacin is used, further atypical coverage with azithromycin is not necessary.

**Do not escalate antibiotic coverage due to persistent fever alone, as fever is expected for 48-72 hours even after starting appropriate antibiotic therapy. Consider further workup prior to alteration of antibiotics.**

**Patients should be treated for at least 7 days after resolution of fever.**

**For influenza treatment recommendations please refer to CDC Guidelines**