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Pneumonia & Parapneumonic Effusion Clinical Pathway

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Table of Contents

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Pneumonia and Parapneumonic Effusion Clinical Pathway

Rationale

This clinical pathway was developed by a consensus group of JHACH physicians, pharmacists, PAs and APRN(s) to standardize the management of pneumonia in otherwise healthy infants and children (age greater than 90 days). The goal of this guideline is to decrease morbidity and mortality from community acquired pneumonia (CAP) in our patients. This pathway targets children evaluated in the emergency center or hospitalized for simple or complicated pneumonia.

This guideline addresses the following clinical questions or problems:

1. When does an infant or child with CAP require admission to the hospital?
2. When does an infant or child with CAP require ICU admission?
3. What diagnostic laboratory and radiology testing should be done in a child with suspected CAP?
4. Which anti-infective therapy should be provided to a child with CAP?
5. When might a patient require adjunctive, non-anti infective therapy for CAP (e.g. surgical or procedural).
6. Which consultants should be involved in the treatment of a child with CAP?

Note: Although fungal and mycobacterial etiologies (both tuberculous and non-tuberculous) are known to cause CAP, the incidence of these infections is uncommon in the US and are typically linked to specific high-risk exposure situations. This clinical pathway does not address the management of these and other uncommon etiologies of pneumonia.

Background

CAP is an acute pulmonary infection acquired in the community as opposed to being health care-acquired[6]. Pediatric CAP can be caused by various infectious pathogens. Clinical manifestations and disease severity can vary according to the pathogen and host.
Symptoms of pneumonia typically include fever, respiratory distress, tachypnea and evidence of parenchymal involvement (found on physical exam or on radiography).

Pediatrics pneumonia is a common condition. It is the leading infectious cause of death in children worldwide, causing 14% of deaths of children < 5 years of age, and 22% of all deaths in children aged 1 to 5 years. In the United States, the incidence of childhood pneumonia is approximately 30–40 per 100,000.

Presentation and Disposition (Site of care)

CAP should be considered in children presenting with fever and symptoms of lower respiratory disease including but not limited to cough, tachypnea or respiratory distress.

When to consider admission for further evaluation

General Indications for hospitalization may include (but not limited to):

- Hypoxia (oxygen saturations less than 92% considering patients physiology Qp:Qs ~1)
- Infants 3-6 months of age with suspected respiratory bacterial infection
- Tachypnea (Infants to 12 months, RR>70 breaths/min) (children RR>50 breaths/min)
- Respiratory Distress (apnea, grunting, difficulty breathing, poor feeding)
    - signs of dehydration, inability to maintain hydration or oral intake
    - poor perfusion with prolonged capillary refill time (>2 seconds)
    - infants and children with toxic appearance /suspected or confirmed to have an infection with a virulent organism (such as MRSA or group A streptococcus)
    - underlying conditions that may predispose patients to a serious course such as cardiopulmonary disease, genetic syndromes, neurocognitive disorders, metabolic disorders, immunocompromised host, sickle cell disease
    - failure of outpatient therapy (trial of 48-72 hours with no response)
    - caretaker unable to provide appropriate observation or to comply with prescribed home therapy

Considerations for admission to the pediatric intensive care unit (PICU) may include (but not limited to):

- severe respiratory distress or impending respiratory failure (such as intubation, mechanical ventilation, positive pressure ventilation, tracheostomy dependent +/- ventilator support)
- patients with mechanical ventilation at home (such as Bipap, Cpap via nasal or nasal oral mask) with new diagnosis with pneumonia requiring increased settings or duration of time of respiratory support is increased from baseline prescribed time (such as 24/7 bipap needed, when previously only nocturnal)
- recurrent apnea or slow or irregular respirations

- cardiovascular compromise (as indicated with tachycardia, inadequate blood pressure, pharmacological support of blood pressure or perfusion)
- altered mental status due to hypercarbia or hypoxemia
- pediatric early warning score (PEWS ≥ 6)

Consult cardiovascular intensive care unit (CVICU) for patients with history of heart disease including (but not limited to):

- Heart transplant
- Congenital heart disease (especially pre-repair and post repair with residual disease)
- Cardiomyopathy

Diagnosis

What are helpful laboratory tests and radiographic studies should be used in a child with suspected CAP?

Laboratory testing:

For patients being managed in the outpatient setting:

- Blood cultures are not routinely recommended for fully immunized healthy children who are discharged from the emergency center but could be considered for unimmunized patients as indicated.
- Consider: Respiratory pathogen panel if it will change patient management

For patients being admitted to the hospital:

- Blood culture should be obtained on all hospitalized patients for presumed bacterial CAP
- CBC with differential
- PCR for SARS CoV 2 and influenza A/B
- Nasal PCR or culture for MRSA screening should be considered in patients who have severe pneumonia, or who have concomitant influenza
- Consider: Respiratory pathogen panel if it will change patient management
- For patients with parapneumonic effusions who require drainage of pleural fluid, culture and gram stain of the pleural fluid is recommended. Analysis of the fluid for white blood cell count wit differential is also helpful to differentiate bacterial from mycobacterial and malignant etiologies
- PPD or interferon-release assay (IGRA) for *M. tuberculosis* if patient has risk factors for this disease.

Imaging:

Radiologic studies:

- Routine chest radiographs are not necessary to confirm CAP in children well enough to be treated as outpatients. CXRs do not reliably differentiate between viral and bacterial pneumonia.
- Chest radiographs (2 views), should be obtained in children with hypoxemia, with significant respiratory distress and in those with failed initial antibiotic therapy. (Children requiring admission to the hospital for CAP, therefore should have chest radiographs obtained).
- Repeated chest radiographs are not routinely required in children with CAP who are improving clinically. However, repeated chest radiography should be considered in patients who have deteriorating symptoms after initiation of antimicrobial therapy.
- Daily chest radiographs are not routinely recommended in patients with chest tubes if they remain clinically stable. Consideration to repeated chest radiographs in this situation should be at the discretion of the clinician.

Clinical Management:

Which anti infective therapy should be used in the treatment of suspected CAP?

Classification	Preferred Initial Therapy	Alternative Initial Therapy	Duration Of Therapy And Comments
Outpatient, uncomplicated pneumonia (presumed typical bacterial pathogens)	**Previously healthy, appropriately immunized:** Amoxicillin 90mg/kg/DAY divided BID-TID* (max daily dose: 3000mg)	**Consider if patient received Amoxicillin within 30 days and/or if patient not vaccinated against *H.influenzae* type b:** Amoxicillin/clavulanate 90mg/kg/DAY divided BID-TID* **Non-severe penicillin allergy:** 1st line: clindamycin 13mg/kg/dose PO TID (max dose: 600mg) 2nd line: levofloxacin 6 months to <5 years: 10mg/kg/dose PO q12h (max daily dose: 750mg) >5 years: 10mg/kg/dose PO q24h (max dose: 750mg)	**Duration**: 5 days total May consider longer treatment of 7 days for patients who are immunocompromised or have chronic lung disease (NOT including asthma) *TID dosing regimen preferred Oral cephalosporins are less active against *S. pneumoniae* compared to high-dose Amoxicillin **Target pathogen**: *Streptococcus pneumoniae*
Outpatient, uncomplicated pneumonia, presumed atypical	Azithromycin 10 mg/kg/dose PO x1 (max 500 mg/dose) on day 1, then 5 mg/kg/dose PO q24h (max 250 mg/dose) on days 2-5		Azithromycin has poor activity against *S.pneumoniae* Levofloxacin has activity against *S.pneumoniae* and atypical pathogens so no additional agents targeting atypicals are needed when levofloxacin is used.
Inpatient, moderate uncomplicated	**Appropriately immunized children:** Ampicillin 50 mg/kg/dose IV q6h (max: 2000 mg/dose) **OR** If tolerating PO and no concerns for enteral absorption: Amoxicillin 30mg/kg/dose PO q8h (max dose: 1000mg) **For patients who are not appropriately immunized:** Ceftriaxone 50mg/kg/dose IV q24h (max dose: 2000mg)	**Non-severe penicillin allergy**: Ceftriaxone 50mg/kg/dose IV q24h (max dose: 2000mg) **Severe penicillin or cephalosporin allergy**: Levofloxacin 6 months to <5 years: 10mg/kg/dose IV/PO q12h (max daily dose: 750mg) >5 years: 10mg/kg/dose IV/PO q24h (max dose: 750mg)	**Duration**: 5 days total (inpatient + discharge antibiotics) for previously healthy children if improvement by day 3 of therapy Longer treatment durations (i.e. 7-10 days) for patients who are immunocompromised, have chronic lung disease (NOT including asthma), or if poor clinical response to initial therapy **Target pathogen**: *Streptococcus pneumoniae*

Classification	**Preferred Initial Therapy**	**Alternative Initial Therapy**	**Duration Of Therapy And Comments**
Inpatient, moderate pneumonia, complicated (pleural empyema or moderate or large effusions. Does NOT include children with small, simple effusions)	Ceftriaxone 100mg/kg/dose IV q24h (max dose: 2000mg) **PLUS** Clindamycin 13mg/kg/dose IV/PO q8h (max dose: 600mg) **OR** Vancomycin if history of MRSA colonization or infection or patients with concomitant influenza (vancomycin dosing per Epic order set)	**Severe penicillin or cephalosporin allergy:** Levofloxacin 6 months to <5 years: 10mg/kg/dose IV/PO q12h (max daily dose: 750mg) >5 years: 10mg/kg/dose IV/PO q24h (max dose: 750mg) **PLUS** Clindamycin 13mg/kg/dose IV/PO q8h (max dose: 600mg) **OR** Vancomycin if history of MRSA colonization or infection or patients with concomitant influenza (vancomycin dosing per Epic order set)	**CONSULT ID** **Duration:** 7 days from drainage of effusion or 7 days from afebrile for moderate-large or complex effusions not amendable to drainage **Target pathogens:** *Streptococcus pneumoniae, Streptococcus pyogenes* (Group A Strep)*, Staphylococcus aureus* (MRSA or MSSA) Clindamycin: ~80% of MSSA and ~82% of MRSA isolates are susceptible to clindamycin
Inpatient, severe pneumonia, complicated or uncomplicated (Includes patients with severe respiratory distress or failure in the ICU. Includes children with or without effusion/ empyema)	Ceftriaxone 100mg/kg/dose IV q24h (max dose: 2000mg) **PLUS** Vancomycin, *dosing per Epic vancomycin order set*	**Allergy to preferred therapy:** Levofloxacin 6 months to <5 years: 10mg/kg/dose IV/PO q12h (max daily dose: 750mg) >5 years: 10mg/kg/dose IV/PO q24h (max dose: 750mg) **PLUS** Vancomycin, *dosing per Epic vancomycin order set*	**CONSULT ID** **Duration**: to be determined in consultation with ID

Peripherally Inserted Central Catheter (PICC) Line indications:

- Longer antibiotic courses
- Poor peripheral IV access

Adjunctive therapy for CAP (surgical/procedural): How to identify and manage a patient with a parapneumonic effusion or otherwise complicated pneumonia:

Parapneumonic effusion may be suspected in children with CAP who present with prolonged fever, chest or abdominal pain. Physical examination might reveal dullness to percussion, diminished breath sounds at the site of the effusion or a change in quality of the breath sounds in the affected lung field. A chest radiograph should be used to identify evidence of fluid in the pleural space. If plain films are not conclusive, consideration can be given to chest ultrasound or CT scan of the chest.

Management of pleural effusion should be made in consultation with interventional radiology or surgery specialists. In general, the decision to drain the effusion is largely based upon the size of the effusion. Small effusions may be managed medically with antibiotics. For larger fluid collections, chest thoracostomy with fibrinolytics or video assisted thoracoscopic surgery (VATS).

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Initial Evaluation of Pneumonia Clinical Pathway

Exclusion criteria:
≤90 days old,
Cystic fibrosis, chronic lung disease (except asthma), immunodeficiency or immunosuppressive therapy, aspiration pneumonia, tracheostomy, hospital acquired pneumonia, sickle cell disease

Patient with signs/symptoms of pneumonia (clinical lung findings or positive chest x-ray) that does NOT meet exclusion criteria

Does the patient have signs of respiratory distress, hypoxia, or ill appearing, or symptoms requiring hospital admission?

No

Mild (Uncomplicated) Pneumonia

Patients without retractions, grunting, nasal flaring, or apnea; pulse oximetry > 90% on room air, and non-toxic appearance; may include children with small, simple effusions

Does patient meet discharge criteria for outpatient care?
- able to tolerate oral medications/fluids
- adequate observation/follow-up care
- no moderate-large effusion if chest x-ray was obtained

Yes

Discharge with close follow up and return precautions

Outpatient Treatment Recommendations for Community Acquired Pneumonia

No

Admit to appropriate unit
- Floor Indications
- PICU Indications
- CVICU Indications

- Obtain COVID/other viral testing per hospital policy, consider RVP if it will change management
- Consider chest x-ray
- Consider IV fluids (IVF) if patient unable to tolerate PO

Yes

Moderate or Severe Pneumonia

- Obtain Chest X-Ray (frontal and lateral)
- Treat with oxygen and provide cardiorespiratory support as needed
- IV placed, consider IV Fluids (IVF) as indicated
- Obtain: CBC, Blood Culture
- Viral testing *(Obtain RPP for concern of Mycoplasma- school aged, adolescents, unvaccinated, immunocompromised)*
- Start Antibiotics
- Admit to appropriate unit
  - Floor Indications
  - PICU Indications
  - CVICU Indications

Follow Evaluation of Complicated Pneumonia Clinical Pathway

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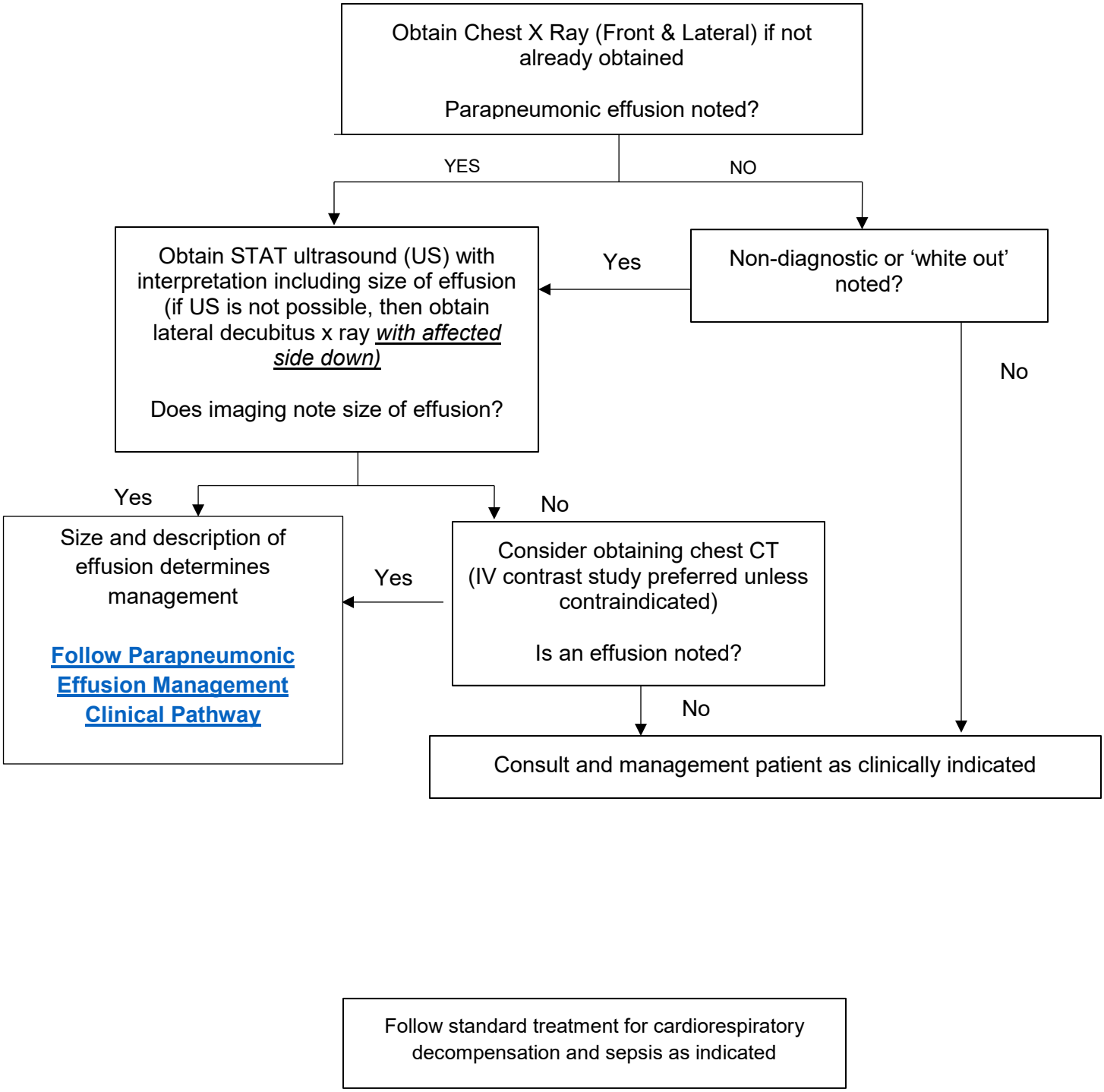
Evaluation of Complicated Pneumonia Clinical Pathway



Follow standard treatment for cardiorespiratory decompensation and sepsis as indicated

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Parapneumonic Effusion Management Clinical Pathway

Note: management determined by size of effusion & thoracic opacification

Small/Non-drainable

<10 mm or <1/4 thorax

- Treat with Antibiotics
- Routine consult Infectious Disease (ID) and Pulmonology if needed
- Imaging at discretion of team

Responding to Antibiotics? (After 48 hours)

No

Reassess Effusion Size and determine if drainable: Moderate, Large)

Yes

Continue Antibiotics

Moderate/Drainable
(Complicated Pneumonia)

>10 mm **and** >1/4, <1/2 thorax

- STAT Consult BOTH Surgery & Interventional Radiology (IR) who will collaborate care
- Routine consult Infectious Disease (ID) and Pulmonology if needed

Degree of Respiratory Compromise

Minimal

Abx alone or Chest US and thoracentesis/chest tube (If condition worsens proceed to large effusion algorithm)

Significant, or prolonged illness or septic*

*follow standard treatment for cardiorespiratory decompensation and sepsis as indicated

Large/Drainable
(Complicated Pneumonia)

>10 mm **and** >1/2 thorax

- STAT Consult BOTH Surgery & Interventional Radiology (IR) who will collaborate care
- Routine consult Infectious Disease (ID) and Pulmonology if needed

- Drain pleural fluid (add-laboratory analysis of fluid & send for analysis)
- Consider PICC line as indicated

Simple effusion?

Yes

Chest tube or Chest tube w/fibrinolytics (per consultants)

No

Follow Loculated Effusion Clinical Pathway

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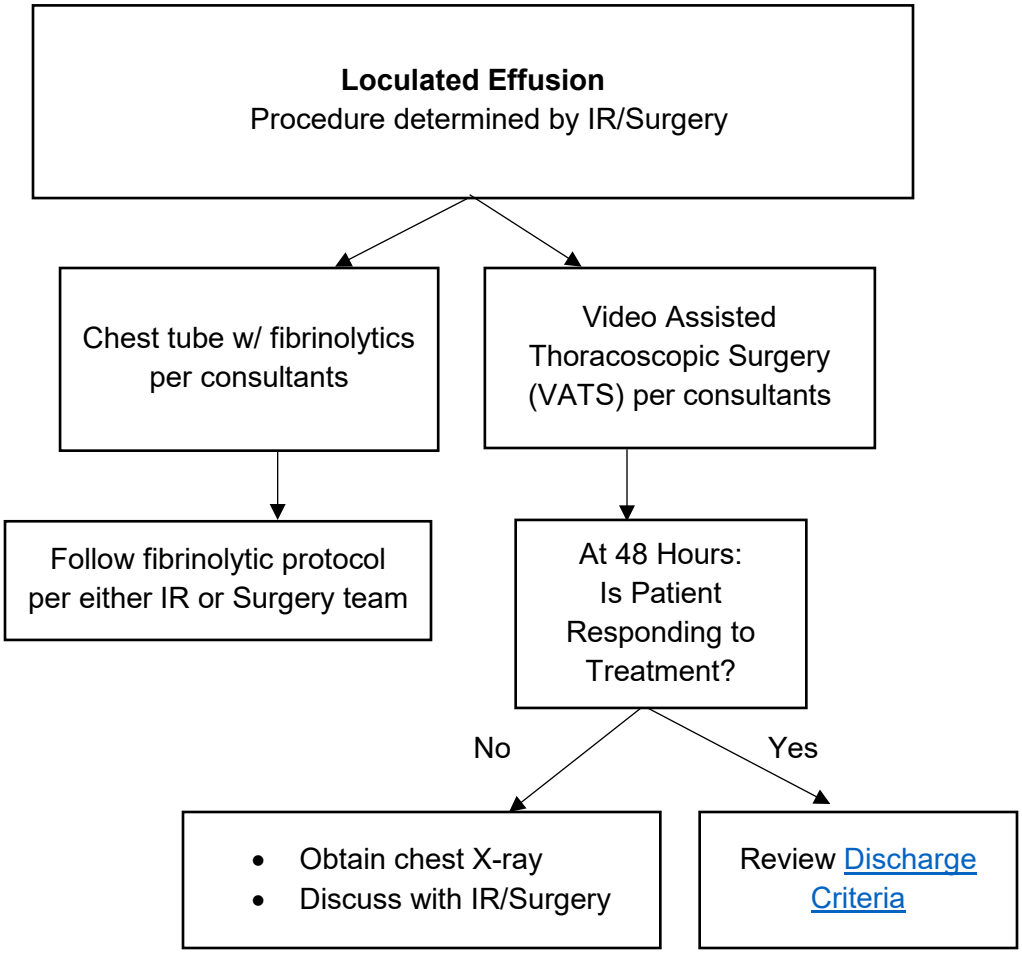
Loculated Effusion Management Clinical Pathway



Involvement of Subspecialty Teams

- Infectious Disease- routine consult within 24 hours for antibiotic choice, management and duration of therapy, additional workup as needed
- Interventional Radiology (IR)- consult STAT or Urgent for IR guided procedures based on imaging, will co-manage with surgical team
- Pulmonology- routine consult within 24 hours of admission of complicated pneumonia so they can follow admission and have continuity of care at discharge.
- Surgery- consult STAT or Urgent for surgical procedures, will co-manage with IR team

Discharge Criteria

Discharge may be considered when there is overall clinical improvement, such as return to previous level of activity, mental status, and appetite.

- Afebrile 12-24 hours
- Pulse oximetry reading greater than 90% for 12- 24 hours
- Documentation which shows the patient is tolerating their home anti-infective plan (oral or IV)
- Home oxygen therapy if needed
- For children who had a chest tube and meet the requirements previously mentioned, discharge is appropriate after the chest tube has been removed 12-24H with no evidence of clinical deterioration
- Children with barriers to care such as inability to comply with therapy should be have barriers addressed prior to discharge

Documentation Reminders

- Per Utilization Management

Outcome Measures

- Length of stay in the emergency center
- Overall length of stay in hospital
- Time to intervention for moderate to severe effusions
- Duration of therapy
- CHA uncomplicated pneumonia “low value care” metrics of ≥3 months to <18 years of age, excluding bronchiolitis, asthma, croup, under immunized, sepsis/bacteremia and complicated pneumonia
    - % of patients where Blood cultures obtained
    - % of patients treated with antibiotic other than amoxicillin or ampicillin
    - % of patients who have CRP, ESR obtained

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Pneumonia and Parapneumonic Effusion Clinical Pathway

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Disclaimer

Clinical Pathways are intended to assist physicians, physician assistants, nurse practitioners and other health care providers in clinical decision-making by describing a range of generally acceptable approaches for the diagnosis, management, or prevention of specific diseases or conditions. The ultimate judgment regarding care of a particular patient must be made by the physician in light of the individual circumstances presented by the patient.

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