Complicated Pediatric CAP guideline SIU-SOM

This guideline applies to children 90 days of age and older. All neonates with pneumonia should be hospitalized and treated with empiric antimicrobial therapy similar to neonatal sepsis treatment.

DEFINITIONS

Community Acquired Pneumonia: Infection of airways and lung tissue caused by a multitude of organisms, including a viral and bacterial etiology, which was acquired outside of the hospital.

Pleural effusion: Excess fluid between the visceral and parietal pleurae that cover the lungs.

Complicated Pneumonia: Pneumonia with significant effusion empyema, necrotizing pneumonia, severe or impending respiratory failure, and/or signs and symptoms of sepsis or shock.

Parapneumonic effusion: A type of pleural effusion that arises as a result of a pneumonia, lung abscess, or bronchiectasis. Parapneumonic effusions evolve through three stages:

- **Exudative:** sterile, free-flowing fluid, 2-5 days after the onset of the effusion
- **Fibro-purulent:** deposition of fibrin over the visceral and parietal pleurae, fluid becomes loculated or septated, 5-10 days after the onset of the effusion.
- **Organized:** A thick and stiff pleural peel or rind develops and is attached to both visceral and parietal pleurae, 10-14 days after the onset of the effusion.

Parapneumonic effusions are also classified by size:

- *Small effusion*: < 10 mm rim of fluid on lateral decubitus or less than one-fourth of the hemi thorax opacified on an upright chest radiography
- *Moderate effusion:* more than one fourth but less than half of the hemi thorax opacified
- *Large effusion:* more than half of the hemi thorax opacified
- *Significant effusion*: > 10 mm rim of fluid on a lateral decubitus film or greater than one-fourth of the hemi thorax opacified on an upright chest radiograph (moderate and large)

Parapneumonic effusion are also classified as complicated or uncomplicated

- *Uncomplicated parapneumonic effusion*: exudative phase; simple, free flowing fluid in the pleural space
- *Complicated parapneumonic effusion*: fibrinopurulent stage; characterized by development of fibrinous adhesions (septations), increased neutrophils, and presence of bacteria

Empyema: A parapneumonic effusion with purulent material (pleural fluid leukocytosis > 50.000WBC/ul and/or positive bacterial culture) caused by the infection spreading from the lung tissue into the pleural space

Toxic-appearing

- Lethargy: level of consciousness characterized by poor or absent eye contact or as the failure of a child to recognize parents or interact with persons or objects in the environment
- Signs of poor perfusion or marked hypoventilation
- Hyperventilation
- Cyanosis

Inclusion Criteria

- 90 days through 18 years of age with signs, symptoms or other finding of complicated pneumonia acquired by exposure to organisms in the community

Exclusion Criteria

- Immunocompromised host
- Children less than 90 days of age
- Aspiration pneumonia
- Ventilator associated pneumonia
- Hospital acquired pneumonia
- Chronic pleural effusion
- Tracheostomy dependent patients

CLINICAL ASSESSMENTS

Assessment elements should include:

- Immunization history (less than 2 doses of Hib vaccine, no influenza vaccine, no pneumococcal vaccine and no Bordetella Pertussis vaccine)
- Comorbidities: asthma/previous history of wheezing; seizures/neuromuscular diseases, heart disease, prematurity/BPD, sickle cell disease, immunocompromised status
- TB exposure including exposure to anyone with a chronic cough
- History of foreign body aspiration risk
- Travel history
- Consider exposure to unusual pathogens including tularemia (ticks/rabbits), plague (squirrels/prairie dogs/dead animals), and fusobacterium (history of sore throat)
- Other ill contacts including family members or day care/school exposures

Table 1. World health Organization Age-Specific Criteria for Tachypnea

Age	Approx. normal resp. rates (breaths/min)	Tachypnea threshold (breaths/min)
2-12 months	25-40	50
1-5 years	20-30	40
5 years or older	15-25	30

Should patient be hospitalized?

The PIDS/IDSA guideline offers specific recommendations for hospitalization for children and infants with CAP
1. Moderate to severe CAP: respiratory distress including tachypnea for age, dyspnea, retractions, grunting, nasal flaring, apnea, altered mental status and/or hypoxemia (<90% on room air).
2. Infants less than 3-6 months of age suspected of bacterial pneumonia.
3. Children/infants suspected of pneumonia with Staphylococcus aureus as a pathogen (empyema, pneumatocele, multiple abscesses, rapidly progressive pneumonia)
4. Children/infants with concerns for compliance with therapy.

Table 2. Criteria for CAP severity of Illness

Clinicians should consider care in an ICU or a unit with continuous cardiorespiratory monitoring for the child having ≥ 1 major or ≥ 2 minor criteria

Major Criteria
Invasive mechanical ventilation
Fluid refractory shock
Acute need for NIPPV
Hypoxemia requiring FiO2 greater than inspired concentration or flow feasible in general care area
Minor criteria
Respiratory rate higher than WHO classification for age
Apnea
Increased work of breathing (eg, retractions, dyspnea, nasal flaring, grunting)
PaO2/FiO2 ratio <250
Multilobar infiltrates
PEWS score (Pediatric Early Warning Score) > 6
Altered mental status
Hypotension
Presence of effusion
Comorbid conditions (eg, HgbSS, immunosuppression,
Unexplained metabolic acidosis

DIAGNOSTIC TEST/STUDIES

Initial Radiologic Studies

- CXR AP and lateral
- Chest Ultrasound if moderate or severe pleural effusion present

Initial Laboratory Studies

Recommended

- CBC with differential

- Obtain C-reactive protein (CRP) and/or ESR (after diagnosis of complicated pneumonia is confirmed); CRP or ESR may be used to help monitor response in patients who are not typically improving with initial therapy or those who present with systemic illness concerning for sepsis
- Blood cultures should be obtained in hospitalized children with complicated pneumonia; the yield of identifying bacteremia is higher than in uncomplicated pneumonia; 2 recent studies report positive blood cultures in 10% and 18% of patients

Consider

- Viral studies and testing for atypical bacteria

- Film array respiratory panel (NP multiplex PCR): only order if results would change management
- The NP PCR can detect Mycoplasma pneumoniae, Chlamydophila pneumoniae and *Bordetella pertussis*
- Children with a negative test should not be treated for atypical bacteria.

- Sputum sample:

- Consider obtaining a sputum Gram stain and culture on high quality specimens when managing children capable of producing an adequate sample (typically 8yrs or older)
- A high quality sputum is usually defined by the presence of less than 10 squamous epithelial cells and greater than 25 WBCs per low power field

- Tracheal aspirate:

- Obtain a tracheal aspirate Gran stain and culture at the time of intubation or soon after

- Pleural fluid:

- Pleural fluid may be obtained for both diagnostic and/or therapeutic indications. In a patient without respiratory distress but in whom an analysis of the pleural fluid would be diagnostically useful, a thoracentesis can be performed by interventional radiology (or pediatric intensivist) without leaving in an indwelling chest tube.
- Gram stain and bacterial culture of pleural fluid should be performed whenever a pleural fluid specimen is obtained.
- If gram stain and culture are negative at 24 hours, send pleural fluid for vial culture
- Analysis of the pleural fluid white blood cell (WBC) count, with cell differential analysis, is recommended primarily to help differentiate bacterial from mycobacterial etiologies and from malignancy.
- Analysis of pleural fluid parameters, such as pH and levels of glucose, protein, and lactate dehydrogenase, rarely change patient management and are not recommended.
- When clinically indicated, obtain AFB and fungal staining and culture (also from sputum)

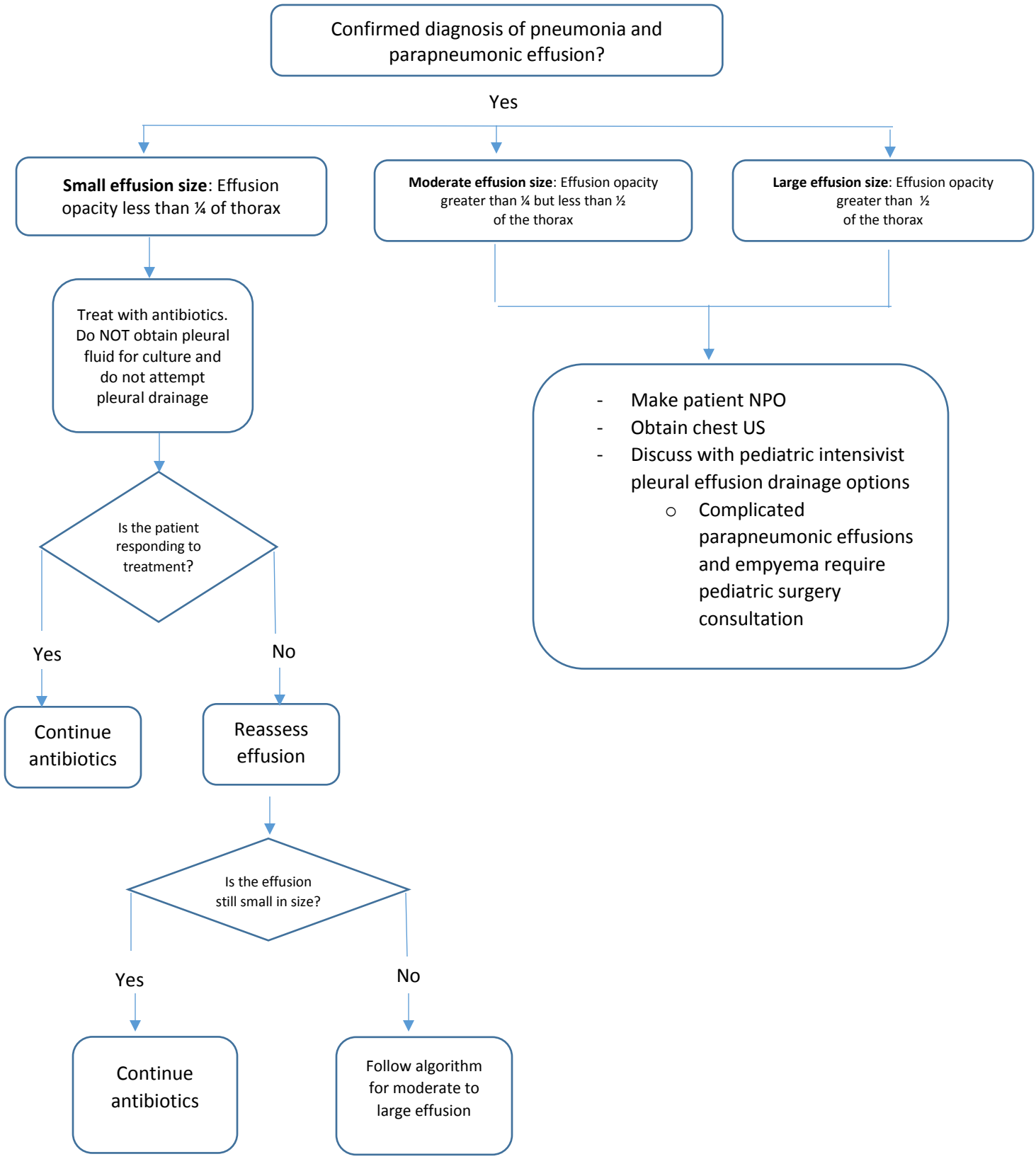
- Tuberculin Skin Testing (TST)/Quantiferon Testing

- Testing should be conducted in children with a history of exposure to tuberculosis, chronic cough, personal or family travel in areas where tuberculosis is prevalent, immigrants, international adoptees, homeless, incarcerated persons and if any visitors from overseas. Infants and post-pubertal adolescents are at increased risk for progression of latent TB to tuberculosis LRTI with other predictive factors including immunodeficiency, use of immunodeficiency drugs including high dose corticosteroids, chemotherapy, diabetes mellitus, chronic renal failure and malnutrition
- Testing for TB is indicated by tuberculin skin test (TST) in children less than 5 years of age. For children greater than 5 years of age, Quanti-FERON- TB Gold assay can be used
- TB isolation precautions and notification of Infection Prevention and Control nurse is required if TB is strongly suspected or confirmed

SIU SCHOOL of MEDICINE

Children's St. John's Hospital

TREATMENT



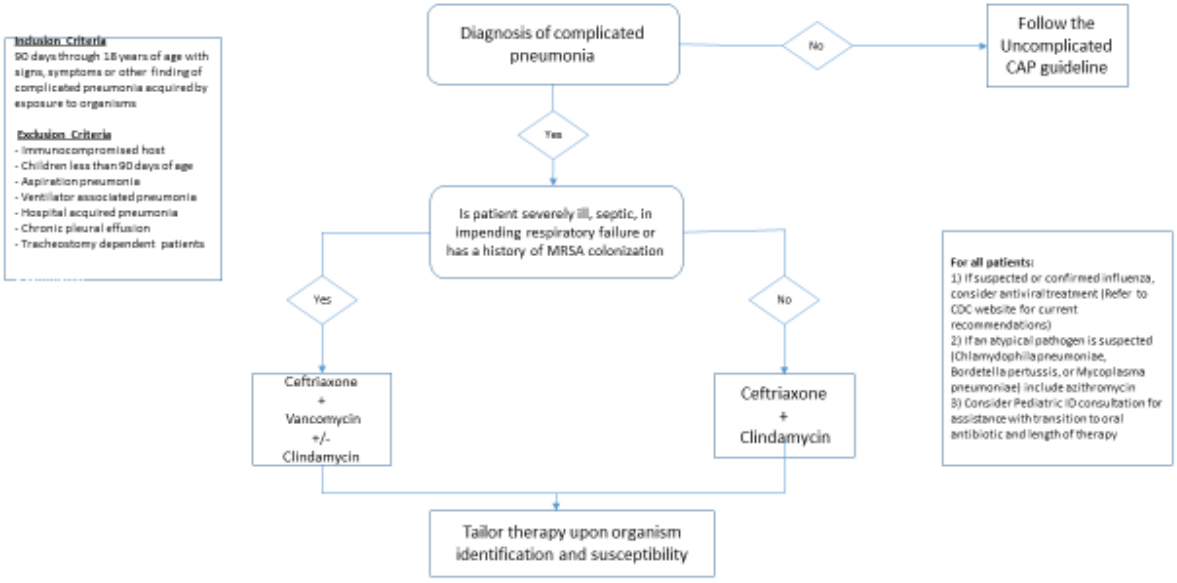
Last reviewed on 11-1-17

Table 3. Complicated CAP Antimicrobials – Dosing and Implications of Therapy

Antibiotic	Recommended Dose	Implications of Therapy
Ampicillin (IV)	200mg/kg/day divided q6h (max: 8,000mg/day)	-Does not cover MSSA, MRSA, or *M. catarrhalis*. -From 2014-2016, ~27% of *H. influenzae* were resistant.
Ampicillin/ Sulbactam (IV)	200mg/kg/day divided q6h (max: 8,000mg/day)	Does not cover MRSA.
Azithromycin (IV or PO)	10mg/kg/day for 5 days (max: 500mg/day)	-ONLY indicated for coverage of atypical pneumonias as 48% *S. pneumoniae* isolates were resistant from 2014-2016 -If the NP PCR is ordered and *Mycoplasma pneumoniae, Chlamydophila pneumoniae*, or *Bordetella pertussis* are not detected, it is strongly encouraged to discontinue azithromycin therapy.
CefTRIAXone (IV)	75 mg/kg/day q24h (max: 2,000mg/day)	-Can be used for non-serious penicillin-allergic patients. -If a PO transition is warranted, it is recommended that either amoxicillin or amoxicillin-clavulanate be prescribed given the unfavorable. pharmacokinetic profile of oral cephalosporins in the treatment of *Streptococcus pneumoniae*.
Clindamycin (IV or PO)	30-40mg/kg/day divided every 8 hours (max PO: 1,800mg/day, max IV: 2,700mg/day)	-Between 2014-2016, ~16% of our *S. pneumoniae* were resistant. -Between 2014-2016, 14% of our MSSA and 15% of our MRSA were resistant.

		-Highly bioavailable, consider transitioning to oral therapy if patient can tolerate.
Levofloxacin (IV or PO)	-Age 6 months to less than 5 years: 20mg/kg/day divided q12h (max: 750mg/day) - Age 5 years and older: 10 mg/kg/day q24h (max: 750mg/day)	-Can be used in patients with severe β-lactam allergies. - Levofloxacin adequately covers both *Mycoplasma pneumoniae* and *Chlamydophila pneumoniae*. Additional atypical coverage with azithromycin is not necessary. -Highly bioavailable, consider transitioning to oral therapy if patient can tolerate.
Vancomycin (IV)	Dosing variable for age, renal function, and past requirements. Please refer to vancomycin protocol.	-Therapeutic drug monitoring: goal trough = 15-20 mcg/mL (refer to vancomycin protocol)
Oseltamivir	-Less than 1 year of age: 3 mg/kg per dose orally every 12 hours for 5 days -Less than or equal to 15 kg: 30 mg orally every 12 hours for 5 days - Greater than 15 kg up to 23 kg: 45 mg orally every 12 hours for 5 days - Greater than 23 kg up to 40 kg :60 mg orally every 12 hours for 5 days - Greater than 40 kg: 75 mg orally every 12 hours for 5 days	

Complicated CAP Empiric Antibiotic Treatment Algorithm



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