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Provincial Drugs & Therapeutics
Antimicrobial Stewardship Subcommittee

To:	Health PEI Physicians, Nurse Practitioners, Pharmacists, Nurses
From:	PD&T Antimicrobial Stewardship Subcommittee
Date:	Feb 20th, 2025
Re:	**UPDATES: Empiric Antimicrobial Management of Pneumonia**

The Antimicrobial Stewardship Subcommittee (ASSC) developed new Empiric Antimicrobial Management of Pneumonia Guidelines in the fall of 2024. After a thorough three-month review, we have updated these guidelines and associated order sets to improve usability and simplify their application. Many of the changes involved were minor formatting. Significant changes are outlined below.

These updates were done in collaboration with Dr. Emily MacAdam, reviewed by Health PEI's ASSC and approved by PD&T.

Highlight of Changes

- **Adult Chemical Pneumonitis and Aspiration Pneumonia:**
  - This guideline still includes background information and clinical pearls. However, the suggested management now links to either community-acquired or hospital-acquired pneumonia, depending on the patient setting.
  - Routine addition of anaerobic coverage is not recommended unless treating an empyema or lung abscess
- **Community Acquired Pneumonia:**
  - To simplify the empiric treatment table, options are organized by site of care as opposed to CRB-65 score: Outpatient, Inpatient (non-ICU), Inpatient (ICU)
  - Removal of amoxicillin-clavulanate (may be unnecessarily broad)
  - Removal of moxifloxacin (higher risk of C. diff compared to levofloxacin)
  - Ceftriaxone dosing changed from 2g IV q24h to 1g IV q24h which is appropriate for respiratory infections
  - Addition of *Pseudomonas* section
- **Hospital Acquired Pneumonia**:
  - Ceftriaxone dosing changed from 2g IV q24h to 1g IV q24h (as above)
  - In MRSA section – removal of oral options
- **Ventilator Associated Pneumonia:**
  - This guideline has been removed as the content is duplicated in the hospital acquired pneumonia guideline.

You can find these guidelines, along with other Health PEI empiric treatment guidelines, on the Health PEI Microbiology website: www.healthpei.ca/src/microbiology, or on the Firstline App.
For questions please contact Fiona Mitchell (Provincial Antimicrobial Stewardship Pharmacist; 894-2587; fcmitchell@ihis.org or Dr. Emily MacAdam (Infectious Disease Physician) emimacadam@ihis.org

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Adult Chemical Pneumonitis & Aspiration Pneumonia

Key Messages

- Most people with aspiration **DO NOT** develop pneumonia and can be managed with a **watch and wait approach** - If patient is stable, monitor for signs and symptoms for 48 hours; antibiotics are not required.
- Antibiotic treatment for patients who develop fever, leukocytosis, and infiltrates in the first 48 hours after an aspiration event is likely unnecessary and may only select for resistant organisms
- Piperacillin/tazobactam is NOT first line therapy for hospital acquired "aspiration" pneumonia and should be reserved for patients that are critically ill.
- Routine addition of anaerobic coverage is not recommended unless treating an empyema or lung abscess

Background

- **Aspiration/Chemical Pneumonitis** - an inflammatory response to chemical injury caused by inhalation of sterile gastric contents.
- **Aspiration Pneumonia** - an infectious process caused by the inhalation of oropharyngeal secretions that are colonized by pathogenic bacteria. Slow onset/non-acute process with persistent fever and hypoxemia.
- **Risk factors for aspiration pneumonia:** dysphagia; degenerative neurologic diseases (e.g. dementia, post-stroke, Parkinson's disease, multiple sclerosis); anatomical abnormality or mechanical interference of upper gastrointestinal tract (e.g. enteral feeding, nasogastric tube, endotracheal intubation); esophageal disorders (e.g. strictures, vomiting + small bowel obstruction, achalasia); altered level of consciousness (e.g. acute alcohol or substance abuse, seizures, CNS depressants, etc.); and cardiac arrest

Most Common Organisms

- **Aspiration/Chemical Pneumonitis –** sterile process, no organisms involved.
- **Aspiration Pneumonia** - Usual pathogens (depending on clinical scenario): *S. pneumoniae, H. influenzae, S. aureus*, Enterobacteriaceae, *Pseudomonas aeruginosa* (nosocomial), oral anaerobes, Streptococcus spp. Role of anaerobes controversial and historically has been overemphasized.

Treatment Criteria and Considerations

Aspiration/Chemical Pneumonitis

Description

- Episode of macroaspiration is often witnessed and typically occurs in patients with decreased level of consciousness
- Characterized by a sudden onset of prominent dyspnea, tachycardia, hypoxemia, low-grade fever, and crackles or diffuse wheeze
- Symptoms may range from mild to severe and can develop within 2 to 5 hours
- Pulmonary infiltrates are apparent on x-ray

Management

⇨ Prophylactic antimicrobial therapy is **NOT** indicated
⇨ Corticosteroids do not have a proven benefit
⇨ Recommend supportive care with humidified oxygen and chest physio
⇨ Reassess patient in 24-48 hours – may consider antibiotic therapy if signs and symptoms lasting greater than 48 hours (i.e. fever, cough, leukocytosis), x-ray evidence of infiltrate AND risk factors (receiving gastric acid suppression or enteral feeds, has a small bowel obstruction or gastroparesis)

Rapid clinical improvement within 24 to 48 hours typically indicates lack of pneumonia – if antimicrobial therapy was initiated then consider discontinuing

Clinical Pearls

- Employ measures to reduce future aspiration episodes (encouraging quality oral care, elevate head of bed, minimize time in supine position and reassess medications associated with CNS depression; consider swallowing assessment)

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Aspiration Pneumonia

Description

- Most are indistinguishable from CAP and HAP
- Slow onset over several days after aspiration event
- Usually a clinical diagnosis in a patient with predisposing risk factors to aspiration, compatible radiographic evidence occurring in dependent lung segment and characteristic clinical history indicative of infection (e.g. fever, cough, tachypnea, dyspnea, purulent sputum etc.)
- Right lower lobe most commonly implicated in ambulatory patients.
- Posterior upper and superior lower lobes most commonly implicated in bed bound patients

Management

Community Acquired	If meets treatment criteria, refer to empiric treatment table in Health PEI Community Acquired Pneumonia guideline
Hospital Acquired	If meets treatment criteria, refer to empiric treatment table in Health PEI Hospital Acquired Pneumonia guideline

Clinical Pearls

- Most clinically important anaerobes are adequately covered by amoxicillin-clavulanate, piperacillin-tazobactam and meropenem
- Routine addition of anaerobic coverage is not recommended unless treating an empyema or lung abscess
- Atypical coverage is not required in aspiration pneumonia
- Sputum samples are unsuitable due to inevitable contamination by normal flora.
- Do not treat Candida spp found in sputum unless systemic candidiasis suspected (e.g. neutropenic, transplant patients, etc.)
- For immunocompromised patients, recommend consulting infectious disease

These guidelines are an adaptation of New Brunswick Anti-infective Stewardship Committee **Adult Chemical Pneumonitis & Aspiration Pneumonia**

References:

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Community Acquired Pneumonia in Adults

Definition

- **Community acquired pneumonia (CAP):** acute infection acquired in community or within 48 hours of admission to hospital.

Most Common Organisms

- **Most common bacterial pathogens:** *Streptococcus pneumoniae*, *Haemophilus influenzae, Moraxella catarrhalis, Mycoplasma pneumoniae, Chlamydia pneumoniae* and *Legionella pneumophila.*
- **If post-influenza, alcoholism, COPD or nursing home:** *Enterobacterales (Enterobacteriaceae), Staphylococcus aureus*
- **Viruses** can be a causative pathogen or may also be present in the setting of a co-infection.

Diagnostic Considerations

- Differential diagnoses: acute exacerbation of COPD, acute bronchitis, heart failure, and pulmonary embolism
- Infiltrate on chest radiograph with supportive clinical findings:
  - Symptoms include new onset fever, cough, sputum production, dyspnea, tachypnea, pleuritic chest pain
  - Physical findings consistent with signs of air space disease (e.g. crackles, bronchial breath sounds)
  - If no infiltrate on initial x-ray, patients should be reassessed within 48 to 72 hours if a high clinical suspicion of pneumonia remains
- **Risk stratify using clinical judgement or the CRB-65 score:**

CRB-65	
Criteria	**Points**
Confusion: new onset based on a specific mental test, or disorientation to person, place or time	1
Respiratory rate 30 breaths or more per minute	1
Low **B**lood pressure: systolic less than 90 mm Hg OR diastolic less than 60 mm Hg	1
Age **65** years old or greater	1

Score	**Risk of Mortality**	**Suggested Management**
0	Less than 2%	Outpatient
1-2	About 9%	Consider hospital assessment ± admission
Greater or equal to 3	Greater than 19%	Hospital admission

Microbiological Testing

- **Legionella urinary antigen:** Consider in severe CAP (requiring ICU admission) or if patient is associated with a local Legionella outbreak
- **Sputum culture**: if high severity CAP or copious sputum production
- **Blood cultures**: (2 sets) if high severity CAP or sepsis syndrome.
- Depending on clinical context and local epidemiology, consider investigations for atypical pathogens and viruses (e.g. influenza, SARS-CoV-2)

Management Considerations

- **Empiric coverage of atypical bacteria** (e.g. *Legionella, Mycoplasma*):
  - Outpatient setting: not routinely recommended
  - Non-ICU hospitalization: benefit is unclear and there is risk of adverse effects, especially in patients with a predisposition for QTc prolongation from macrolides and multiple adverse effects from fluoroquinolones (i.e. levofloxacin)
  - ICU patients: coverage for *Legionella* is routinely recommended (see below)
  - Clinical features favouring "atypical" bacteria (*Mycoplasma* or *Chlamydophila*): gradual onset and presentation, absence of septic shock, non-lobar pneumonia, family cluster, cough persisting more than 5 days without acute clinical deterioration, absence of sputum production, and normal or minimally elevated white-cell count.
- **Aspiration pneumonia**
  - Antimicrobial prophylaxis at the time of aspiration is not beneficial. Provide supportive care and reassess in 48 hours for signs and symptoms of pneumonia
  - See Health PEI Adult Chemical Pneumonitis and Aspiration Pneumonia guideline for background information and management considerations.
- Respiratory Fluoroquinolones
  - In order to reduce increasing fluoroquinolone resistance and prevent adverse events (e.g., QT interval prolongation), use of a respiratory fluoroquinolone should be reserved for when cephalosporins or penicillins cannot be used.

IV-to-PO Conversion

- **Evaluate for IV-to-PO conversion within 48 hours** of initiating treatment.
- Consider oral antibiotics when patient is clinically improving (i.e. tolerating oral intake, hemodynamically stable, afebrile for at least 24 hours) – see Health PEI IV-to-PO Guideline for more details.

Duration

- Usual duration of therapy: **5 days**
- Longer treatment duration may be required in certain circumstances (e.g. extrapulmonary infections, empyema, lack of clinical improvement)
- Infections caused by *P. aeruginosa*, resistant Gram-negative bacteria or *S. aureus* require at least 7 days; Infectious Diseases or Medical Microbiology consultation should be considered.
- Azithromycin dosing and duration of therapy depends on its indication for use:
  - When using 500 mg IV/PO once daily in non-critically ill patients, 3 days of therapy is adequate.
  - When using in patients that are critically ill, 5 days of therapy is adequate.
  - In patients with infections caused by Legionella, longer durations may be required

Prevention

- Review patient vaccine record to ensure they are up to date with all eligible vaccinations

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Empiric Treatment

Setting	Preferred Empiric Regimen	Alternate Empiric Regimen
Outpatient	amoxicillin 1000 mg PO q8h* **OR** doxycycline 100 mg PO q12h	**Penicillin allergy:** doxycycline 100 mg PO q12h **OR** cefuroxime axetil 500 mg PO q12h* **When above options cannot be used:** levofloxacin 750 mg PO q24h*§
Inpatient (Non-ICU)	amoxicillin 1000 mg PO q8h* **OR** ampicillin 2 g IV q6h* **OR** cefuroxime axetil 500 mg PO q12h***OR** ceftriaxone 1 g IV q24h	**Penicillin allergy:** cefuroxime axetil 500 mg PO q12h * **OR** ceftriaxone 1 g IV q24h **When above options cannot be used:** levofloxacin 750 mg IV/PO q24h*§
	+/- Atypical coverage: if strong suspicion of atypical pathogens and if not receiving a fluoroquinolone: • doxycycline 100 mg PO q12h α **OR** • clarithromycin 500 mg PO q12h* **OR** • azithromycin 500 mg PO/IV q24h§ x 3 days	
ICU	ceftriaxone 1 IV q24h **PLUS one of:** • azithromycin 500 mg IV q24h **OR** • levofloxacin 750 mg IV/PO q24h*§ (preferred if *Legionella* isolated)	

Consider risk factors for the following when treating CAP requiring hospitalization:	**Regimen Adjustment**
MRSA: Prior respiratory isolation or known/suspected colonization with MRSA	**ADD** vancomycin IV to empiric regimen (see Health PEI Firstline app or IV manual for dosing)
Pseudomonas: [Prior respiratory isolation of *Pseudomonas* **OR** recent hospitalization] **AND** receipt of parenteral antibiotics in the last 90 days	Piperacillin/tazobactam* 4.5 g IV q6h +/- Atypical coverage

*Dose adjustment required in renal impairment

§ Special authorization required from PEI Pharmacare

α Preferred if prolonged QT

References:

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Hospital Acquired Pneumonia in Adults

Definition

- **Hospital Acquired Pneumonia (HAP):** pneumonia that develops 48 hours or more after admission to hospital.
- **Ventilator Associated Pneumonia (VAP):** Pneumonia that develops 48 hours or more after endotracheal intubation.

Most Common Organisms

- *S. aureus* (MSSA or MRSA), Gram-negative bacilli (e.g., *E. coli*, *H. influenzae, K. pneumoniae*, *Enterobacter spp., P. aeruginosa*), or *S. pneumoniae.*
- *Enterococcus* and *Candida* are commonly isolated in sputum cultures of hospitalized patients; however, these organisms are generally considered colonizers and do not warrant antimicrobial therapy

Diagnostic Considerations

- A diagnosis of HAP generally requires:
  - Demonstration of an infiltrate on chest imaging AND
  - Compatible signs or symptoms, such as dyspnea/tachypnea/hypoxia, cough, purulent sputum, or fever
- **Microbiological analyses:** Blood cultures x 2 sets PLUS sputum culture, and ± Legionella urinary antigen.

Treatment Considerations

- **Empiric double coverage of *Pseudomonas aeruginosa***:
  - Consider only for patients who are critically ill (i.e. septic shock or requiring ventilatory support) (see empiric treatment table)
  - Used to maximize the likelihood of having at least one active antimicrobial (due to increased risk of resistance with *Pseudomonas*).
  - Re-evaluate use after 48 hours. If *Pseudomonas* is isolated, step-down to monotherapy (according to susceptibility data).
    - Maintaining double coverage once susceptibilities are known is not required
  - Use of aminoglycosides (e.g., tobramycin and gentamicin) as monotherapy for the treatment of pneumonia is NOT recommended (even if susceptibility is confirmed).
- DO NOT use DAPTOmycin to treat pneumonia; DAPTOmycin is inactivated by pulmonary surfactant. If MRSA infection, use vancomycin (or linezolid if vancomycin is ineffective or inappropriate).

Duration of Therapy

- Usual duration of therapy is 7 days
- Longer duration indicated for abscess, empyema, or severely immunocompromised

IV-to-PO Conversion

- **Evaluate for IV-to-PO conversion within 48 hours** of initiating treatment.
- Consider oral antibiotics when patient is clinically improving (i.e. tolerating oral intake, hemodynamically stable, afebrile for at least 24 hours) – see Health PEI IV-to-PO Guideline for more details.

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Empiric Treatment

Risk Factors	Empiric Treatment Regimen∞
NO Risk Factors	amoxicillin-clavulanate 875 mg PO q12h* **OR** ceftriaxone 1 g IV q24h **OR** levofloxacin 750 mg IV/PO q24h*§
Presence of ANY ONE of the following risk factors for Multi-drug resistant Gram-negative pathogens or poor outcomes: – Requiring ICU care: septic shock and/or mechanic intubation – In ICU when symptoms appear, or transferred from ICU in the last 48 hours – Prior intravenous antibiotic use within 90 days – Immunosuppression – Structural lung disease (e.g., bronchiectasis, cystic fibrosis) – Colonization or recent prior infection with *Pseudomonas* or other resistant Gram-negative bacilli (e.g., Extended spectrum beta-lactamases (ESBL) or AmpC)	piperacillin-tazobactam 4.5 g IV q6h* **<u>If true immediate penicillin allergy▲ OR history of ESBL or Amp C:</u>** meropenem 500 mg IV q6h* (consider 2 g IV q8h if septic shock) **<u>If severe delayed reaction‡ to a beta-lactam:</u>** levofloxacin 750 mg IV q24h*§ **PLUS** tobramycin** 7 mg/kg IV q24h* **PLUS** vancomycin IV* α
Consider risk factors for the following:	**Regimen Adjustment**
MRSA: Prior respiratory isolation or known/suspected colonization with MRSA	**ADD** vancomycin IV* α to empiric regimen
Pseudomonas: Consider double coverage for *Pseudomonas aeruginosa* if critically ill (i.e. septic shock or requiring ventilatory support)	**<u>ADD to either piperacillin-tazobactam or meropenem (not necessary if already receiving levofloxacin plus tobramycin), options include:</u>** tobramycin** 7 mg/kg IV q24h* **OR** ciprofloxacin 400 mg IV q8h*

∞ If microbial cause of infection known, treat according to culture and sensitivity.

* Dose adjustment required in renal impairment.

** If obese (20% greater than IBW); dosing weight = IBW + 0.4 (ABW-IBW). See Health PEI IV manual or Firstline app for more information

α See Health PEI IV manual or firstline app for dosing

§ Special authorization required from PEI Pharmacare

▲ Immediate, IgE mediated allergies include, but are not limited to, anaphylaxis, urticaria, angiœdema, hypotension, bronchospasm, stridor, and pruritic rash. Refer to the Health PEI Beta-Lactam Allergy guidelines to determine which beta-lactams share similar side chains.

‡ Severe delayed hypersensitivity reactions to beta-lactams are caused by mechanisms that are not well known and require that subsequent use of beta-lactams be avoided. Severe delayed hypersensitivity reactions can include interstitial nephritis, immune hepatitis, hemolytic anemia, serum sickness, severe cutaneous reactions such as Stevens-Johnson syndrome, toxic epidermal necrolysis, and drug rash with eosinophilia and systemic symptoms (DRESS).

These guidelines are an adaptation of New Brunswick Anti-infective Stewardship Committee

Hospital Acquired Pneumonia in Adults May 2023

References:

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