**Introduction:**

Respiratory syncytial virus (RSV) is the most common cause of bronchiolitis and viral pneumonia in infants and children under 1 year of age. As a highly contagious respiratory infection, RSV poses a significant burden during annual winter epidemics. Pharmacists play a critical role in RSV management through promotion of preventive strategies, appropriate use of pharmacotherapy, and patient/caregiver education. This subtopic will provide an overview of RSV, with a focus on key aspects for pharmacists. It covers epidemiology, pathophysiology, clinical features, diagnosis, treatment, complications, and prevention of RSV infections. Recent advances include monoclonal antibody prophylaxis and vaccine research.

**Clinical Presentation**

RSV typically begins with rhinorrhea and sometimes cough in infants. Within 1-3 days, cough often worsens and wheezing develops as lower airways become involved.

* Physical findings in bronchiolitis include:
* Tachypnea
* Wheezing
* Retractions
* Nasal flaring
* Hypoxemia

Cough is usually persistent. Wheezing may initially be episodic but often becomes continuous as illness progresses. Hypoxemia is common and may not correlate with physical exam findings.

Fever is variable in RSV infection. A chest x-ray is often normal but may show hyperinflation and peribronchial thickening.

* Risk factors:
* Prematurity
* Chronic lung disease of prematurity
* Congenital heart disease
* Immunodeficiency
* Age <6 months
* Male gender
* Tobacco smoke exposure
* Daycare attendance
* School-aged siblings
* Low socioeconomic status
* Crowded living conditions

The clinical presentation of RSV infection can range from a mild upper respiratory infection to severe bronchiolitis and respiratory failure.

**Pathophysiology**

Respiratory syncytial virus infects and destroys bronchiolar epithelial cells, leading to necrosis and sloughing of the epithelium. This disruption results in airway edema, increased mucus production, and bronchiolar obstruction.

Inflammatory cells like neutrophils and monocytes also infiltrate the peribronchial tissues, causing further airway narrowing. The partial obstruction and plugging of bronchioles causes air trapping, hyperinflation, and areas of collapsed alveoli in the lungs. This significantly impairs ventilation and gas exchange.

Additionally, RSV nonstructural proteins antagonize type I interferon signaling pathways, delaying the innate antiviral immune response.

Persistent inflammation may also impair neural control of airway smooth muscle, leading to airway hyperreactivity that persists after the infection clears.

Ultimately, severe RSV disease likely involves a combination of direct viral cytopathic effects on the bronchioles and dysregulated inflammatory host immune responses.

**Diagnostic Approach**

Diagnosis of RSV infection is made by detection of the virus or viral antigens in respiratory secretions, typically using viral culture, rapid antigen detection tests, or reverse transcription-polymerase chain reaction (RT-PCR).

The gold standard is viral culture, but this takes time. Rapid antigen detection tests have relatively low sensitivity compared to culture or PCR but very high specificity. RT-PCR is the most sensitive method but can remain positive for weeks after the live virus is gone.

The preferred diagnostic specimens are nasopharyngeal aspirates or washes, but nasopharyngeal swabs are frequently used due to easier collection.

Chest X-rays are nonspecific, often showing hyperinflation and peribronchial thickening. Complete blood counts often show lymphopenia and eosinopenia.

Testing for other viruses like influenza is important, as coinfections may occur. RSV diagnosis should be confirmed before initiating any specific antiviral treatment.

**Management - Overview**

Treatment of RSV bronchiolitis is primarily supportive, consisting of oxygen supplementation for hypoxemia, hydration, gentle suctioning of secretions, and gentle ventilation if needed. Bronchodilators offer little proven benefit and are not routinely recommended. Ribavirin also lacks proven efficacy and is not used routinely. Immunoprophylaxis with palivizumab reduces complications in high-risk infants. Inhaled or oral steroids provide little benefit and prolong viral shedding. Antibiotics do not treat RSV but may be indicated for secondary bacterial infections. Preventing nosocomial spread is crucial, using contact and droplet precautions. Routine use of bronchodilators and corticosteroids should be avoided, as they provide little benefit. For most healthy infants, supportive care remains the mainstay of RSV bronchiolitis treatment.

**Pharmacotherapy**

* Bronchodilators (albuterol, epinephrine)
* Dosing:
* Albuterol: 0.5% solution, 0.15-0.3 mg in 3 mL normal saline via nebulizer every 2-4 hours as needed
* Racemic epinephrine: 0.25-0.5 mL of 2.25% racemic epinephrine (max 5 mL) in 3 mL normal saline via nebulizer every 20 minutes for up to 3 doses
* Limited proven efficacy in RSV bronchiolitis
* Not routinely recommended
* May trial in severe cases but discontinue if no benefit

* Ribavirin
* Dosing:
* 12-18 hours/day for 3-7 days
* Antiviral agent delivered via aerosol generator
* No proven efficacy
* Not used routinely
* Costly and cumbersome to administer

* Palivizumab
* Dosing:
* 15 mg/kg IM monthly during RSV season
* Reduces hospitalization by 50% in high-risk infants
* Given to premature infants and those with lung/heart disease or immunodeficiencies
* High cost limits widespread use
* Systemic & inhaled corticosteroids (dexamethasone)
* Dosing:
* Dexamethasone 0.15-0.6 mg/kg/dose PO/IV daily for up to 10 days
* Not beneficial in bronchiolitis
* Associated with prolonged viral shedding
* Should not be used routinely

* Antibiotics
* Do not treat RSV infection
* Reserve for secondary bacterial infections
* Overuse promotes antibiotic resistance

**Key Guidelines and Evidence**

* AAP Guidelines on Palivizumab Prophylaxis (Pediatrics 2014)
* Palivizumab prophylaxis recommendations for high-risk infants
* Maximum 5 monthly doses; no routine use beyond age 24 months
* Moderate recommendation, high quality evidence

* AAP Guidelines on Ribavirin (Pediatrics 2006)
* Ribavirin lacks efficacy for RSV lower respiratory tract disease
* Routine use not recommended
* Strong recommendation, moderate quality evidence

* Cochrane Review (2021)
* Bronchodilators have limited efficacy for RSV bronchiolitis
* Routine use not recommended
* High quality evidence

**Clinical Scenarios**

Clinical Scenario 1:

A 5-month-old boy presents in February with cough, wheezing, and increased work of breathing. He was born prematurely at 28 weeks gestation. Rapid RSV test is positive. He is started on inhaled albuterol every 4 hours. After minimal improvement for 2 days, the team debates adding systemic steroids.

Clinical Scenario 2:

A 9-month-old girl presents in January with rhinorrhea and cough after both her siblings had upper respiratory infections. She develops tachypnea, wheezing, and hypoxia concerning for RSV bronchiolitis. She was born at 30 weeks gestation and required home oxygen until 8 months old.

Clinical Scenario 1 Answer Key:

* This patient is at high risk for severe RSV as a premature infant
* Inhaled bronchodilators have shown limited efficacy in bronchiolitis
* Systemic steroids would not be beneficial and prolong viral shedding
* Supportive care such as oxygen and hydration remain mainstays of treatment

Clinical Scenario 2 Answer Key:

* This infant is at very high risk for severe RSV given history of prematurity and chronic lung disease
* She would have qualified for palivizumab prophylaxis due to prematurity and chronic lung disease
* High risk infants who receive palivizumab have about 50% reduction in RSV hospitalization
* She should receive optimized supportive care with careful monitoring

**Tips for Board Exam Questions**

* Know the populations at highest risk for severe RSV infections, including premature infants, those with lung/heart disease, and immunocompromised patients.
* Remember that ribavirin has not shown clear efficacy and is not recommended for routine use in RSV.
* Recognize that bronchodilators provide limited benefit and systemic steroids should be avoided in RSV bronchiolitis.
* Palivizumab given to high-risk infants can significantly reduce RSV hospitalizations

**Summary**

Respiratory syncytial virus is a very common respiratory infection in infants and children under 1 year old. It frequently causes bronchiolitis and viral pneumonia leading to hospitalization. Premature infants and those with chronic diseases are at highest risk for severe disease. Supportive care remains the foundation of treatment for most patients. Ribavirin lacks proven efficacy and is not recommended routinely. Bronchodilators provide limited benefit while corticosteroids prolong viral shedding and should be avoided. Palivizumab antibody prophylaxis significantly reduces complications in high-risk infants when given during RSV season. Understanding the guidelines for palivizumab use and recognizing the lack of efficacy for ribavirin and routine bronchodilators/steroids are key for pharmacists caring for pediatric patients.

**References**

1. Ralston SL, Lieberthal AS, Meissner HC, et al. Clinical Practice Guideline: The Diagnosis, Management, and Prevention of Bronchiolitis. Pediatrics. 2014;134(5):e1474-e1502. doi:10.1542/peds.2014-2742
2. American Academy of Pediatrics Committee on Infectious Diseases; American Academy of Pediatrics Bronchiolitis Guidelines Committee. Updated guidance for palivizumab prophylaxis among infants and young children at increased risk of hospitalization for respiratory syncytial virus infection. Pediatrics. 2014;134(2):415-420. doi:10.1542/peds.2014-1665
3. Committee on Infectious Diseases. From the American Academy of Pediatrics: Policy statements--Modified recommendations for use of palivizumab for prevention of respiratory syncytial virus infections. Pediatrics. 2009;124(6):1694-1701. doi:10.1542/peds.2009-2345
4. Hall CB, Weinberg GA, Iwane MK, et al. The burden of respiratory syncytial virus infection in young children. N Engl J Med. 2009;360(6):588-598. doi:10.1056/NEJMoa0804877
5. Meissner HC. Viral Bronchiolitis in Children. N Engl J Med. 2016;374(1):62-72. doi:10.1056/NEJMra1413456
6. Crowe JE Jr. Respiratory syncytial virus. In: Kliegman RM, St Geme JW III, Blum NJ, Shah SS, Tasker RC, Wilson KM, eds. Nelson Textbook of Pediatrics. 21st ed. Philadelphia, PA: Elsevier; 2020:chap 250.