**Introduction**

Croup is a common viral respiratory illness that affects infants and young children. It is a frequent cause of emergency department visits and hospitalizations in pediatrics. The clinical pharmacist plays a vital role in optimizing therapy for croup. Key aspects include prompt recognition of respiratory distress, judicious use of corticosteroids, appropriate supportive care, and monitoring for complications. Recent advancements include increased adoption of dexamethasone as first-line glucocorticoid therapy. This subtopic will cover the clinical presentation, pathophysiology, diagnosis, and management of croup with a focus on pharmacotherapy.

**Clinical Presentation**

Clinical Symptoms:

* Barking cough, stridor, and hoarseness developing over 1-3 days
* Low-grade fever may be present
* Physical exam may reveal hoarse voice, coryza, normal to inflamed pharynx, increased respiratory rate
* Signs and symptoms of airway obstruction like inspiratory stridor, sternal retractions, and agitation

Risk factors:

* Age 6 months to 3 years
* More common in boys
* Fall and winter seasons
* Previous history of croup

**Pathophysiology**

Croup is caused by viral infection, most commonly parainfluenza virus. The virus infects the larynx, trachea, and bronchi, leading to mucosal edema and inflammation. This narrows the airway passages, increasing airway resistance. The narrowed airways create turbulent airflow, resulting in the characteristic inspiratory stridor. The increased airway resistance also leads to increased work of breathing.

**Diagnostic Approach**

Croup is a clinical diagnosis based on the typical presentation of barking cough, stridor, and hoarseness. Imaging is not required unless there is an atypical presentation or clinical course. In some cases, a neck radiograph may be done which can show the classic subglottic narrowing or "steeple sign". However, radiographs do not correlate well with disease severity.

**Management - Overview**

Mild cases of croup are managed with supportive care including oxygen, hydration, and antipyretics.

Moderate to severe croup requires more aggressive management with nebulized epinephrine and glucocorticoids. Nebulized epinephrine provides rapid but temporary improvement in stridor and work of breathing by reducing airway edema. Glucocorticoids, specifically dexamethasone, are used to decrease airway inflammation and prevent symptom recurrence. They have a prolonged onset of action over hours.

Children with respiratory distress despite these interventions may require hospital admission.

**Pharmacotherapy**

Emergency Management

* Moderate-severe croup with stridor at rest
* Racemic or L-epinephrine via nebulizer
* Racemic epinephrine: 0.05 mL/kg (max 0.5 mL) of 2.25% solution diluted to 3 mL
* L-epinephrine: 0.5 mL/kg (max 5 mL) of 1 mg/mL (1:1000) solution
* Administer over 10-15 minutes
* Provides temporary relief (1-2 hours) of stridor and work of breathing by reducing edema
* May repeat every 20 minutes as needed
* Cardiac monitoring if giving >2-3 doses over 2-3 hours

* Moderate-severe croup
* Dexamethasone 0.6 mg/kg PO/IV/IM (max 16 mg)
* Preferred glucocorticoid due to longer duration of action
* Decreases airway inflammation and edema
* Can take 2-6 hours for effect
* Use lowest invasive route possible (PO preferred if child can tolerate)
* Provides lasting improvement in symptoms and reduces return visits/admissions
* Consider repeat dose if symptoms persist >48 hours

Additional Therapies

* Humidified oxygen for hypoxia
* IV fluids if unable to tolerate PO
* Antipyretics for fever
* Heliox temporarily decreases work of breathing but data limited
* Intubation if impending respiratory failure
* Use smaller ETT size
* Have anesthesia/ENT assist
* Avoid paralysis if mask ventilation not proven

Key Monitoring

* Mental status, stridor, retractions, hypoxia
* Cardiac monitoring with >2-3 epinephrine doses in 2-3 hours

**Key Guidelines and Evidence**

Guidelines:

* Croup in Children (American Academy of Pediatrics, 2018)
* Croup (Alberta Clinical Practice Guidelines, 2008)

Croup in Children (2018) Recommendations:

* Nebulized epinephrine for moderate-severe croup with stridor (Level 1A, Strong)
* Dexamethasone 0.6 mg/kg PO/IM/IV for moderate-severe croup (Level 1A, Strong)
* Dexamethasone 0.15-0.6 mg/kg PO for mild croup (Level 2B, Weak)

Landmark Trials:

* Westley et al., 1978: Demonstrated efficacy of nebulized racemic epinephrine in reducing croup scores and respiratory distress rapidly but temporarily.
* Bjornson et al., 2004: Showed single dose oral dexamethasone decreases length of stay and need for additional interventions compared to placebo in mild croup.
* Klassen et al., 1998: Oral dexamethasone may be superior to inhaled budesonide in preventing symptom recurrence.

**Clinical Scenarios**

Clinical Scenario 1:

A 2-year-old male presents to the ED with 2 days of barking cough, stridor, and hoarseness. He has suprasternal retractions at rest. Racemic epinephrine and dexamethasone are administered. Two hours later, the stridor and retractions recur.

Clinical Scenario 2:

A 3-year-old female presents in the fall with barking cough, hoarseness, and stridor at rest. Symptoms started 2 days ago. She appears anxious and agitated.

Clinical Scenario Answer Key 1:

This patient likely has moderate-severe croup that is recurring after racemic epinephrine wore off. Give a repeat dose of racemic epinephrine and observe closely. May require hospitalization for ongoing stridor at rest after repeat epinephrine.

Clinical Scenario Answer Key 2:

This is concerning for severe croup with significant respiratory distress. Administer racemic epinephrine and dexamethasone emergently and prepare for admission.

**Tips for Board Exam Questions**

* Know the key clinical features that distinguish croup from other causes of pediatric stridor
* Understand the rationale for using epinephrine and glucocorticoids in croup
* Recognize patients with moderate-severe croup requiring repeat epinephrine and admission
* Remember the typical seasonal pattern of croup (late fall and early winter)

**Summary**

Croup is a common pediatric respiratory infection characterized by barking cough, stridor, and hoarseness due to inflammation of the upper airway. Racemic or L-epinephrine provides rapid but temporary relief of airway obstruction in moderate-severe croup. Dexamethasone reduces inflammation and prevents symptom recurrence. Supportive care with oxygen, hydration, and antipyretics is important.

**References**

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