

Croup in Children

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Abstract

Croup is one of the most common causes of upper airway obstruction in young children. Upper airway inflammation produced by a viral infection causes a barking cough, hoarse voice, inspiratory stridor, and respiratory discomfort. It causes upper airway blockage and must be distinguished from acute epiglottitis, bacterial tracheitis, or foreign body inhalation. Croup affects roughly 3% of children each year, mostly between the ages of 6 months and 3 years, and the parainfluenza virus is responsible for 75% of cases. Symptoms normally go away after 48 hours, but severe upper airway blockage might cause respiratory failure and arrest in rare cases. The degree of respiratory distress and accompanying findings must be the emphasis of the patient's examination. It is necessary to rule out the likelihood of foreign body aspiration and epiglottitis. The efficacy and safety of corticosteroids (intramuscular and oral dexamethasone), nebulized budesonide, oral prednisolone, heliox, humidification, and nebulized adrenaline are all investigated (racemate and L-adrenaline [epinephrine]). The provision of humidified air is the most crucial part of management. Children with moderate to severe croup benefit from racemic epinephrine and steroids. Children with restless stridor, tiredness, poisoning, or respiratory distress should be admitted. Active airway intervention is unusual, but if a blockage develops, it can save a life.

Keywords: Croup; upper airway obstruction; inspiratory stridor; respiratory failure; Dexamethasone; Racemic epinephrine.

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INTRODUCTION

Laryngitis, laryngotracheitis, laryngotracheobronchitis and bacterial tracheitis, or spasmodic croup are the upper respiratory infections which produce inspiratory stridor, barking cough, and hoarseness in infants.¹ Hoarseness is more common in older children and adults than in newborns and young children, who have a barking cough. The presence of chest wall retractions and stridor at rest are two of the most crucial clinical markers.

EPIDEMIOLOGY

The most common age group is 6 to 36 months. It's more common in three-month-old babies and preschoolers, but it's uncommon in children older than six.² Male: Female ratio of about 1.4:1.³ The majority of occurrences happen in the fall or early winter. Children remain contagious for three days or until the fever goes away, whichever comes first. Croup and recurrent croup are linked to a family history of the illness. In a case-control study, children with croup-prone parents were 3.2 times more likely to have an episode of croup and 4.1 times more likely to have recurring croup than children without croup-prone parents. Parental smoking, which is known to increase the risk of various respiratory tract infections in children, does not appear to increase the risk of croup.⁴

ETIOLOGY

Croup outbreaks can be caused by type 1 parainfluenza virus, which causes a milder sickness than type 1, and type 3 parainfluenza virus (sporadic croup), which is more severe than types 1 and 2. According to Frost HM and Robinson CC, Croup was the most common discharge diagnosis for children with verified parainfluenza 1 (42%), parainfluenza 2 (48%), but only 11% of children with confirmed parainfluenza 3 infections. Type 4 parainfluenza virus infection is less likely to induce stridor and croup in children than types 1-3.^{5,6} RSV, adenoviruses, measles, influenza (longer hospitalization and a higher risk of recurrence of laryngeal symptoms), enteroviruses (Coxsackie types A9, B4, and B5, as well as echovirus types 4, 11, and 21), rhinoviruses, herpes simplex virus, and metapneumoviruses needs longer hospitalization and has higher risk of readmission for relapse of laryngeal symptoms. The 2004 discovery of human coronavirus NL63 (HCoV-NL63) which has been related to croup and other respiratory illnesses.⁷ Croup has been linked to the SARS-CoV-2 virus, however this appears to be a rare presentation of this viral infection in youngsters.⁸

PATHOPHYSIOLOGY

The subglottic constriction of the trachea is the anatomic signature ("fixed" obstruction). When a youngster resists, cries, or becomes agitated, the extrathoracic trachea becomes dynamically obstructed below the cartilaginous ring. Fibrinous exudates and, on rare occasions, pseudo membranes can be found. Bacterial tracheitis-Bacterial tracheitis

which is caused by a superadded bacterial infection that causes thick pus formation within the subglottic trachea lumen. The mucosal surface develops ulcers, pseudo membranes, and forms a micro abscess. In most cases, the supraglottic tissues are normal. Host factors Subglottic stenosis or laryngeal web and hyperactive airways are exacerbated by atopy (spasmodic or recurrent croup).⁹ Airway narrowing caused by respiratory tract papillomas (human papillomavirus) or scarring after intubation.

CLINICAL FEATURES

Laryngotracheitis

Occurs in children three months to three years of age.¹⁰ Gradual onset of nasal irritation, congestion, and coryza, followed by fever, hoarseness, barking cough, and stridor over 12 to 48 hours. Allow three to seven days for the symptoms to subside before returning to normal. Severe upper airway blockage is indicated by suprasternal, subcostal, and intercostal retractions, as well as reduced breath sounds. Hypoxia, cyanosis, respiratory exhaustion, and death are all possible outcomes.

Spasmodic croup

It occurs in children aged three months to three years [10]. It invariably occurs at night; the symptoms are transient; and the onset and termination of symptoms are rapid. Fever is usually not present. Episodes can repeat itself on the same night or for two to four nights in a row. With a family history of allergies, there may be a genetic predisposition. The episodic character of the episodes and the child's relative well-being between them distinguish it from classic croup, which has constant symptoms.

Bacterial tracheitis

It could show up as Primary infection: upper airway obstruction symptoms arise suddenly, with a fever and a poisonous look. Secondary infection: substantial deterioration of viral laryngotracheitis over the clinical course, with high fever, poisonous look, and increased respiratory discomfort due to tracheal blockage from purulent secretions.

RAPID ASSESSMENT AND INITIAL MANAGEMENT

To identify the children with severe respiratory distress and/or impending respiratory failure, a rapid assessment of general appearance of the child which includes the presence of stridor at

rest and vital signs which consists of heart rate, respiratory rate and saturation of the child with airway stability, and mental aptitude is required. Checking on the child's hydration is also a good idea. Dehydration has been associated to moderate to severe croup due to decreased oral intake and increased insensible losses due to fever and tachypnea. Croup can be distinguished from other causes of acute upper airway blockage by the following characteristics: Fever-if child doesn't have fever in between the initiation of symptoms and the presentation of symptoms which suggests spasmodic croup or another noninfectious aetiology (eg, subglottic cyst, subglottic hemangioma). A barking, seal-like cough is the hallmark physical finding in a patient with subglottic constriction. Hoarseness-While hoarseness is a common symptom of croup, especially in older children, it is not a sign of epiglottitis or foreign body aspiration. Difficulties swallowing-Acute epiglottitis can make swallowing difficult. Drooling is a common symptom of peritonsillar or retropharyngeal abscesses, retropharyngeal cellulitis, or epiglottitis in children. Drooling was found in around 80% of children with epiglottitis but just 10% of those with croup in an observational study.¹¹ Throat pain - Dysphagia and sore throat are more common symptoms in children with epiglottitis than in children with croup.

ASSESSMENT OF SEVERITY

[12] Westley croup score: [1] Consciousness level: normal (including sleep) = 0; confused = 5. [2] Cyanosis: None = 0, agitation = 4, repose = 5. [3] Stridor: none = 0, agitation = 1, repose = 2. [4] Normal = 0, lowered = 1, and significantly decreased = 2. [5] None = 0, mild = 1, moderate = 2, and severe = 3.

Mild croup: Westley croup score of ≤ 2 . Moderate croup: Westley croup score of 3 to 7. Severe croup: Westley croup score of ≥ 8 .

Respiratory failure

The following signals foreshadowed it: (1) Tiredness and sluggishness (2) Highlighted retractions (retractions may decrease with increased obstruction and decreased air entry) (3) Breathing sounds that are reduced or non-existent (4) a lack of consciousness (5) Disproportionate tachycardia (7) Cyanosis or pallor.

ASSESSING FOR OTHER CAUSES

Elements of the physical examination can help

distinguish croup from other causes of acute upper airway blockage and respiratory distress. Epiglottitis patients frequently prefer to sit up straight in the "tripod" or "sniffing position" (neck is mildly flexed, and head is mildly extended). Voice quality-Croup patients may have a hoarse voice or a feeble cry. A muffled "hot-potato" voice can be caused by epiglottitis, retropharyngeal abscess, or peritonsillar abscess.

Examination of the oropharynx for the following signs

Excessive salivation, which could be a sign of acute epiglottitis, peritonsillar abscess, parapharyngeal abscess, or retropharyngeal abscess. • Diphtheritic membrane • Tonsillar asymmetry or uvula deviation suggestive of peritonsillar abscess • Midline or unilateral enlargement of the posterior pharyngeal wall suggestive of retropharyngeal abscess.¹¹⁻¹²

DIAGNOSIS

Clinical diagnosis: The occurrence of a barking cough and stridor, particularly during a typical community outbreak of one of the causal viruses.

Direct laryngoscopy: Noninflammatory edema in spasmodic croup. Bacterial tracheitis is characterised by thick pus, ulcerations, pseudomembranes, and mucosal surface microabscesses. Normally, the supraglottic tissues are normal.

IMAGING

Indications: (1) Doubtful diagnosis (2) Atypical course (3) Suspected inhaled or swallowed foreign body (4) Recurrent croup, and Inability to respond to therapeutic interventions. An X-ray of the chest can reveal subglottic constriction, often known as the "steeple sign." During inspiration, the lateral view may indicate hypopharyngeal overdistention and subglottic haziness. The epiglottis should be in good shape.

Greater tracheal constriction on a frontal or lateral plain radiograph was associated with a higher risk of admission and a longer hospital stay, according to Yang WC et al.¹³

Laboratory studies: Rarely indicated, limited diagnostic utility, but may help guide management in more severe cases.

Blood tests: Serum chemistries indicate no apparent changes, but dehydrated children may have low serum bicarbonate and/or increased blood urea nitrogen.

Microbiology: Confirmation of etiologic diagnosis is not necessary for majority.

Differential Diagnosis: (1) Acute epiglottitis (2) Retropharyngeal and peritonsillar abscesses (3) Aspiration or swallowing of foreign bodies (4) Allergic response (5) Angioneurotic edema (acute) (6) Injury to the upper airway (7) Upper airway congenital abnormalities Diphtheria of the larynx.

TREATMENT

There is no cure for the viruses that cause croup. Pharmacologic therapy to reduce airway edema, respiratory assistance, and hydration maintenance. Symptomatic treatment includes humidity (92 percent oxygen saturation in room air), fever lowering, and water. If the condition worsens, use bag mask ventilation and advanced airway procedures. Dexamethasone (0.6 mg/kg, maximum dose of 10 mg), administered using the least intrusive method possible: oral if tolerated, IV if access is accessible, and intramuscular if oral is not tolerated and IV access is not available. Racemic epinephrine in the form of 0.05 mL/kg per dosage (maximum of 0.5 mL) of a 2.25 percent solution mixed to 3 mL total volume with normal saline and administered via nebulizer over 15 minutes. L-epinephrine as 0.5 mL/kg per dose (maximum of 5 mL) of a 1:1000 dilution given via nebulizer over 15 minutes.

Nebulized Budesonide: For children with vomiting or severe respiratory distress, nebulized budesonide (2 mg [2 mL solution] via nebulizer) may be an option to IM or IV dexamethasone. Budesonide may be combined with epinephrine and delivered concurrently to children experiencing acute respiratory distress.

Hospitalization: Children with moderate/severe croup whose condition worsens or does not improve as expected after nebulized epinephrine and corticosteroids treatment. Fewer than 5% of children with croup require hospitalisation, and of those, 1 to 6% require intubation. Mortality is uncommon, occurring in less than 0.5 percent of intubated children.

Heliox: Not more effective than humidified oxygen

or racemic epinephrine in reducing croup scores.

Antibiotics: Use only to treat specific bacterial complications. Antitussives and decongestants: unproven benefit. Sedatives may decrease the work of breathing and improve agitation without actually improving ventilation or hypoxemia.⁸⁻¹²

Monitoring

Pulse oximetry, level of consciousness, stridor, cyanosis, air entry, and retractions. Monitor trends in ventilation with capnography

Criteria for Discharge

No stridor at rest, Normal pulse oximetry, Good air exchange, Normal color, Normal level of consciousness, accepting orally.

Complications: (1) Hypoxemia (oxygen saturation <92 percent in room air) (2) Respiratory failure (3) Pulmonary edema, (4) Pneumothorax, and Pneumomediastinum.

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