How Do You Know It's Croup?

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Croup is usually caused by the virus parainfluenza and is most prevalent in the late fall to early winter months. It occurs most commonly in children between six months and three years of age, but can also occur in children as young as three months and as old as 15. Boys are affected more often than girls.

The symptoms of croup are commonly preceded by non-specific cough, rhinorrhea, and fever.[1-3] The characteristic barking cough, stridor, and respiratory distress usually develops suddenly during the evening or at night, but occasionally, can develop gradually through the course of a day. Stridor typically occurs only during inspiration, but with more severe distress can be biphasic. Fever can occur. Most children who present with acute onset of upper airway obstruction characterized by stridor and chest indrawing have croup. In general, the diagnosis of croup is straightforward, but rare and problematic causes of stridor must first be considered and excluded.

Little John's midnight visit to the hospital

John, an 18 month-old child, has had a two-day history of cough and runny nose. Suddenly after midnight, his coughing became worse and he appeared to have difficulty breathing. He was agitated and turned blue momentarily.

His parents bundled him up and brought him to the emergency department. John is generally healthy; he has never been hospitalized, nor is he currently taking any medication. His temperature is 38.5C, his heart rate is 160 beats/minute, his respiratory rate is 36, and his oxygen saturation is 97% on room air. He has a seal-like barky cough, a crowing noise on inspiration, and his chest wall is visibly "sucking in", yet he is fairly comfortable without significant agitation.

Does John have croup or does he have another cause of acute upper respiratory obstruction?

What is the differential diagnosis?

The most common alternative diagnosis is bacterial tracheitis, which is also the most difficult to distinguish from croup. In fact, bacterial tracheitis is thought to be a superinfection of croup. It can be most readily distinguished by the presence of high fever, toxic appearance, and poor response to epinephrine. Management

of the disease includes intravenous antibiotics, with these patients frequently requiring intubation and respiratory support.

The second most likely alternative diagnosis is epiglottitis. A young child with epiglottitis most commonly presents with a sudden onset of high fever, dysphagia, drooling, toxic appearance, anxiety and sits forward in a "sniffing position". Contrary to croup, these patients do not display a barky cough. Securing the airway is the most crucial aspect of management, and should only be attempted by physicians extremely experienced in airway management. Any child in whom epiglottitis is being considered should be referred by ambulance and accompanied by a physician. Rarely, children can present with acute onset of stridor due to an occult foreign body lodged, most commonly in the upper oesophagus. Very rarely, retropharyngeal abscess and peritonsillar abscess can present with stridor.

What about triage?

Children with croup can be broadly categorized as having four levels of severity (Table 1). Though the major concern of parents and health practitioners is the potential for respiratory compromise, most children can be safely managed at home, with very few requiring artificial airway support.

What is the course of the disease?

Symptoms most commonly become substantially worse at night, and improve during the day. For the most part, obstructive symptoms resolve within 48 hours, with only a small percentage of children remaining symptomatic for up to five or six days. Though the onset of respiratory distress often occurs suddenly, respiratory failure occurring within minutes is rare; failure typically occurs over several hours. Signs of respiratory failure and imminent respiratory arrest include:

- reduction in respiratory effort,
- lethargy,
- pallor, and
- dusky appearance.

Exploring treatment options

Mist

Mist wanes, bedside humidifiers, and mist tents should not be recommended. Mist tents, in particular, should not be used because they frequently make young children agitated due to

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Table 1
Severities of croup

Mild	Occasional barky cough • none to limited stridor at rest • none to mild suprasternal and/or intercostal indrawing (retractions of the skin of the chest wall)
Moderate	Frequent barky cough • easily audible stridor at rest • suprasternal and sternal wall retraction at rest • little to no distress or agitation
Severe	Frequent barky cough • prominent inspiratory and occasional expiratory stridor • marked sternal wall retractions • significant distress and agitation
Impending respiratory failure	Barky cough (often not prominent) • audible stridor at rest (occasionally hard to hear) • sternal wall retractions (may not be marked) • lethargy or decreased level of consciousness • often dusky without supplemental oxygen

the tent's wet, cold, and "caged" environment which separates them from their parents.[4]

Oxygen

The administration of oxygen should be reserved for children with hypoxia and significant respiratory distress. "Blow-by"—administration of oxygen through a plastic hose with the end opening held near the child's nose and mouth—is often the most beneficial way of administering oxygen.

Helium-oxygen mixtures

Administering helium to children with croup has been proposed because lower-density gas can potentially decrease turbulent airflow in a narrowed airway.[5] This treatment modality may have some benefit in children with very severe respiratory distress. However, there is insufficient evidence to advocate its general use.

Analgesics/antipyretics

No controlled trials have been published specifically addressing the use of analgesics or antipyretics in children with croup. However, it is reasonable to suppose they make children more comfortable by reducing fever and pain.

Antitussives and decongestants

No experimental studies have been published regarding the potential benefit of antitussives or decongestants in children with croup. Furthermore, there is no rational basis for their use and, therefore, should not be administered.

Antibiotics

As croup is virtually always due to a viral infection, empiric antibiotic therapy is not rational. Furthermore, superinfection of children with croup is such a rare phenomenon (less than one in 1,000) that the use of antibiotics for prophylaxis is also not rational.

Epinephrine

Based on historic data, the administration of epinephrine in severe croup cases substantially reduces the number of patients requiring an artificial airway.[7] Epinephrine has been shown to substantially reduce respiratory distress within 10 minutes of administration and last for more than an hour (Table 2).

Glucocorticoids

Steroids are the mainstay of therapy for croup. On the basis of more than 20 randomized controlled trials and two meta-analyses, corticosteroids have been shown to reduce the duration and necessity of intubations and hospitalization, as well as the need for reintubation and the rate of return to a health-care practitioner for persistent croup symptoms.[7-11] In a recently completed large, multi-centre Canadian study, involving 720 children with mild croup, it was shown that those treated with dexamethasone, as compared with placebo had;

- half the rate of return to a health-care practictioner (7% vs. 15%),
- had substantially less severe croup symptoms,
- lost less sleep in the 48 hours after treatment,
- their parents experienced less stress in the 24 hours following treatment, and
- both their families and the health-care system incurred slightly fewer costs.[12]

Benefits appeared to be just as great in those children with very mild symptoms and those who had had croup symptoms for several days at the time of assessment. No adverse effects occurred in either treatment group. Therefore, all children diagnosed with croup should be treated with corticosteroids, with the exception of a rare child with known immune deficiencies or recent definite exposure to varicella.

Dexamethasone appears to be equally effective when given orally or parenterally.[13] The traditional dose of dexamethasone is 0.6 mg/kg. However, there is some evidence that lower doses (0.15 mg/kg) are equally as effective.[14] On the other hand, a meta-analysis of controlled trials suggests higher doses of corticosteroids yield a clinically important response in a greater proportion of patients.[7] No controlled studies have been published examining whether or not multiple doses of corticosteroids provide greater benefit than a single dose. However, given the short duration of croup symptoms in most patients, a single dose of corticosteroid is probably sufficient.

Inhaled budesonide has been shown to be equivalent to oral dexamethasone in effectiveness.[15] However, because it is generally more traumatic to administer and substantially more expensive, budesonide should not be routinely used. In patients with severe or near respiratory failure, the simultaneous administration of budesonide and epinephrine is logical and may be more effective than epinephrine alone. In addition, for children who vomit oral medications, inhaled steroids may be a reasonable alternative. CME

Take-home message

- Most children with acute onset of upper airway obstruction, characterized by stridor and indrawing, have croup.
- One of the most common alternative diagnoses, bacterial tracheitis, can be distinguished by the presence of high fever, toxic appearance, and poor response to epinephrine.
- Any child considered to have epiglottitis should be referred by ambulance and accompanied by a physician.
- With very few exceptions, all children with croup should be treated with corticosteroids.

Table 2
Pharmacotherapy

Drug category	Dose and duration	Comments
Adrenergic agonist • Epinephrine	• Racemic epineprhine 0.5mL of 2.25% solution diluted in 3 mL of NS or sterile water via nebulizer • L Epinephrine 1:1,000 solution 5 mL via nebulizer • May be repeated back-to-back in children with severe respiratory distress	• Racemic epinephrine & L epinephrine are equivalent in terms of effect and safety • The duration of effect of epinephrine doses not exceed 2 hours. Patients should not be discharged from medical care for at least 2 hours after receiving a dose of epinephrine.
Corticosteroids • Dexamethasone	• 0.6 mg/kg PO/IM/IV once • May repeat dose in 6 to 24 hours	• Oral dexamethasone is well-absorbed and achieves peak serum concentra tions as rapidly as with intramuscular administration (without the pain!) • Several controlled trials suggest oral and intramuscular administration yield equivalent results • Experience suggests clinical improvement will begin as early as 2 to 3 hours after treatment • No evidence to suggest multiple doses provide additional benefit over a single • Reduces - Rate & duration of intubation - Rate & duration hospitalisation - Rate of return to medical care - Duration of symptoms in children with mild, moderate, & severe symptoms • In most cases, budesonide offers no advantages over dexamethasone and is substantially more expensive
• Budesonide	• 2 mg (2 mL) solution via nebulizer	• May be useful in patients with vomiting, severe respiratory distress; budesonide and epinephrine can be administered simultaneously

NS: Normal saline IM: Intramuscularly
PO: Orally IV: Intravenously

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