

# Clinical Evidence Handbook

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## Croup

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Author disclosure: David Wyatt Johnson is the author of references cited in this review.

Croup leads to signs of upper airway obstruction and must be differentiated from acute epiglottitis, bacterial tracheitis, and an inhaled foreign body.

- Croup affects about 3% of children per year, usually those between the ages of six months and three years, and 75% of infections are caused by parainfluenza virus.
- Symptoms usually resolve within 48 hours, but severe upper airway obstruction can rarely lead to respiratory failure and arrest.
- Oxygen is standard treatment in children with respiratory distress.

A single oral dose of dexamethasone improves symptoms in children with mild croup, compared with placebo.

- Although humidification is often used in children with mild to moderate croup, we found no evidence from randomized controlled trials to support its use in clinical practice.

In children with moderate to severe croup, intramuscular or oral dexamethasone, nebulized adrenaline (epinephrine), and nebulized budesonide reduce symptoms compared with placebo.

- Oral dexamethasone is as effective as nebulized budesonide at reducing symptoms, and is less distressing for the child.
- A dexamethasone dose of 0.15 mg per kg may be as effective as a dose of 0.6 mg per kg. Adding nebulized budesonide to oral dexamethasone does not seem to improve efficacy compared with either drug alone.
- We do not know whether heliox (helium-oxygen mixture) or humidification is beneficial in children with moderate to severe croup.

### Definition

Croup is characterized by the abrupt onset, most commonly at night, of a barking cough,

inspiratory stridor, hoarseness, and respiratory distress due to upper airway obstruction. Croup symptoms are often preceded by symptoms like those of an upper respiratory tract infection. The most important diagnoses to differentiate from croup include bacterial tracheitis, epiglottitis, and the inhalation of a foreign body. Some investigators distinguish subtypes of croup. Those most commonly distinguished are acute laryngotracheitis and spasmodic croup. Children with acute laryngotracheitis have an antecedent upper respiratory tract infection, are usually febrile, and are thought to have more persistent symptoms. Children with spasmodic croup do not have an antecedent upper respiratory tract infection, are afebrile, have recurrent croup, and are thought to have more transient symptoms. However, there is little empirical evidence that spasmodic croup responds differently from acute laryngotracheitis.

We have included children up to 12 years of age with croup; no attempt has been made to exclude spasmodic croup. We could not find definitions of clinical severity that are either widely accepted or rigorously derived. We have elected to use definitions derived by a committee consisting of a range of specialists and subspecialists during the development of a clinical practice guideline from Alberta Medical Association (Canada). The definitions of severity have been correlated with the Westley Croup Score, because it is the most widely used clinical score, and its validity and reliability have been well demonstrated. However, randomized controlled trials included in the review use a variety of croup scores. *Mild croup*: occasional barking cough; no stridor at rest; and no to mild suprasternal and/or intercostal indrawing (retractions of the skin of the chest wall), corresponding to a Westley Croup Score of

0 to 2. *Moderate croup*: frequent barking cough, easily audible stridor at rest, and suprasternal and sternal wall retraction at rest, but no or little distress or agitation, corresponding to a Westley Croup Score of 3 to 5. *Severe croup*: frequent barking cough, prominent inspiratory and occasionally expiratory stridor, marked sternal wall retractions, decreased air entry on auscultation, and significant distress and agitation, corresponding to a Westley Croup Score of 6 to 11. *Impending respiratory failure*: barking cough (often not prominent), audible stridor at rest (can occasionally be hard to hear), sternal wall retractions (may not be marked), usually lethargic or decreased level of consciousness, and often dusky complexion without supplemental oxygen, corresponding to a Westley Croup Score greater than 11. During severe respiratory distress, a young child's compliant chest wall "caves in" during inspiration, causing unsynchronized chest and abdominal wall expansion (paradoxical breathing). By this classification scheme, about 85% of children attending

general emergency departments with croup symptoms have mild croup, and less than 1% have severe croup (unpublished prospective data obtained from 21 Alberta general emergency departments).

**Incidence and Prevalence**

Croup has an average annual incidence of 3% and accounts for 5% of emergency admissions to the hospital in children younger than six years in North America (unpublished population-based data from Calgary Health Region, Alberta, Canada, 1996 to 2000). One retrospective Belgian study found that 16% of children five to eight years of age had croup at least once, and 5% had recurrent croup (more than three episodes). We are not aware of epidemiologic studies establishing the incidence of croup in other parts of the world.

**Etiology and Risk Factors**

One long-term prospective cohort study suggested that croup occurred most commonly in children between six months and three

**Clinical Questions**

**What are the effects of treatments (dexamethasone or humidification) in children with mild croup?**

- Beneficial            Dexamethasone (oral single dose; reduced need for further medical attention for ongoing symptoms compared with placebo)
- Unlikely to be beneficial    Humidification\*

**What are the effects of treatments in children with moderate to severe croup?**

- Beneficial            Budesonide, nebulized (compared with placebo)
- Dexamethasone, intramuscular or oral (compared with placebo)
- Likely to be beneficial    Adrenaline (epinephrine), nebulized (compared with placebo)
- Dexamethasone, intramuscular (improves croup scores compared with nebulized budesonide)
- Dexamethasone, oral (compared with nebulized budesonide)\*
- Unknown effectiveness    Dexamethasone, oral, higher dose vs. lower dose (unclear which dose is most effective)
- Dexamethasone, intramuscular vs. dexamethasone, oral (unclear which route of administration is most effective)
- Dexamethasone, oral (compared with oral prednisolone)
- Heliox (helium-oxygen mixture)
- L-adrenaline (epinephrine) compared with racemic adrenaline
- Unlikely to be beneficial    Dexamethasone, oral, plus budesonide, nebulized, vs. either drug alone
- Humidification

\*—Based on consensus.

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years of age, but it can also occur in children as young as three months and as old as 12 to 15 years. Case-report data suggest that it is extremely rare in adults. Infections occur predominantly in late autumn, but can occur during any season. Croup is caused by a variety of viral agents and occasionally by *Mycoplasma pneumoniae*. Parainfluenza accounts for 75% of all cases, with the most common type being parainfluenza type 1. Prospective cohort studies suggest that the remaining cases are mainly respiratory syncytial virus, metapneumovirus, influenza A and B, adenovirus, coronavirus, and mycoplasma.

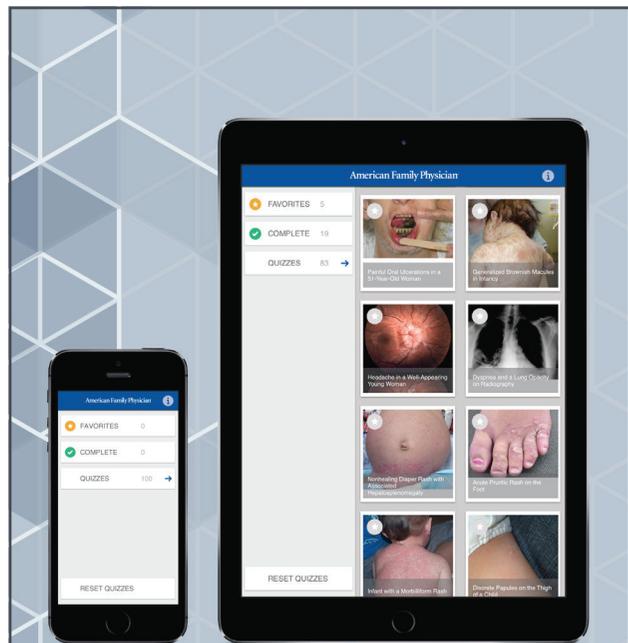
Viral invasion of the laryngeal mucosa leads to inflammation, hyperemia, and edema. This leads to narrowing of the subglottic region. Children compensate for this narrowing by breathing more quickly and deeply. In children with more severe illness, as the narrowing progresses, their increased effort at breathing becomes counterproductive, airflow through the upper airway becomes turbulent (stridor), and their compliant chest wall begins to cave in during inspiration, resulting in paradoxical breathing, and consequently the child becomes fatigued. With these events, if untreated, the child becomes hypoxic and hypercapnic, which eventually result in respiratory failure and arrest.

### Prognosis

Croup symptoms resolve in most children within 48 hours. However, a small percentage of children with croup have symptoms that persist for up to a week. Rates of hospital admission vary significantly between communities, but on average less than 5% of all children with croup are admitted to the hospital. Of those admitted, only 1% to 3% are intubated. Mortality is low; in one 10-year study, less than 0.5% of intubated children died. Uncommon complications of croup include pneumonia, pulmonary edema, and bacterial tracheitis.

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