

# *Acute Laryngitis in Childhood*

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## **Viral croup**

### **Definition**

The term “croup syndrome” characterizes a group of diseases with variable anatomic involvement and etiology, and is clinically manifested with the following symptoms: hoarseness, barking cough, predominantly inspiratory stridor and varying degrees of respiratory discomfort. When the etiology of this syndrome is viral it is named viral croup. Other etiologies for this syndrome include bacterial tracheitis and diphtheria.

The disease can also be classified according to the degree of the airways involvement by the respiratory viruses. Thus, the disease is called laryngitis if restricted to the larynx and is mainly characterized by hoarseness and barking cough. If the inflammation involves the larynx and the trachea the resulting laryngotracheitis has characteristic croup symptoms. If the bronchioles are also involved, the disease is called laryngotracheobronchitis and involves extended expiratory time and wheezing.

### **Etiology and epidemiology**

Laryngotracheobronchitis is the most common cause of upper airway obstruction in children, accounting for 90% of stridor cases. The disease is responsible for 15% of respiratory tract diseases in the childhood.

The viral etiology of croup is trivial, the main agents being parainfluenza virus (type 1, 2 and 3), A and B influenza and Respiratory Syncytial Virus (RSV).

It occurs in children with ages between 1 and 6 years, with a peak incidence at 18 months of age predominantly in boys. This age range is more prone to the development of the disease since the children are generally experiencing their first infection by these agents, favoring viral aggression throughout the airway. In adults, local immunity restricts the disease to the nasopharynx.

Although most cases occur in autumn and winter, viral croup can be found all year round.

### **Pathogenesis**

The viral infection starts in the nasopharynx and spreads through the respiratory epithelium of larynx, trachea and bronchoalveolar tree. The physical exam will reveal different findings, according to the degree of the respiratory epithelium lesion. There is diffuse inflammation, erythema and edema on the walls of trachea

and alteration in the mobility of the vocal chords. The mucosa of the subglottic region is little adherent allowing the formation of significant edema with potential involvement of the airways. In infants, 1 mm of edema in the subglottic region causes a 50% reduction in the diameter of the trachea.

The airflow is significantly decreased by the edema in the subglottic region of the trachea (narrowest portion of the upper airway in children), generating inspiratory stridor.

### Clinical presentation

The disease starts with clear rhinorrhea, pharyngitis, light cough and low fever. Symptoms of upper airway obstruction start after 12 to 48 hours, and are characterized in the croup syndrome by progression of the respiratory failure signs and increase in body temperature.

The symptoms are generally solved in 3 to 7 days. In more severe cases, there is increased heart and respiratory rates; clavicular, sternal and diaphragm retraction; nostril movement; cyanosis; psychomotor agitation and even sleepiness. Children who have undergone previous manipulation of the upper airways (surgery or intubation) or had local disease need a more careful approach.

Most children with laryngotracheitis have light symptoms, which do not progress to progressive airway obstruction. There are several score systems proposed to evaluate the severity of airway obstruction, based on clinical findings as consciousness level, cyanosis, stridor, pulmonary compliance and retractions (**Table 1**). Children younger than 6 months, patients with rest stridor or consciousness level alteration and hypercapnia detection are under potential risk for development of respiratory failure. The pulse oximetry should be performed in all children with stridor. However, it is important to emphasize that the normal oxygen saturation can give a false impression of low risk associated to the disease. Hypoxia is generally indicative of advanced disease and imminent respiratory failure.

**Table 1. Clinical score for stridor approach**

SIGN	0	1	2	3
Stridor	absent	with agitation	mild at rest	severe at rest
Retraction	absent	mild	moderate	severe
Air entrance	normal	normal	reduced	very reduced
Color	normal	normal	cyanotic under agitation	cyanotic at rest
Consciousness level	normal	agitation under stimulus	agitation	lethargic
Total score: < 6 = mild; 7-8 = moderate; > 8 = severe Adapted from Tausig LM, Castro O, Biandry PA, et al. <i>Am J Dis Child</i> 1975;129:790-95				

### Diagnosis

The diagnosis is based on clinical findings. The classical findings on cervical X-ray with narrowing of the subglottic trachea (*pencil point* or *church tower sign*) do not have much value, as they may be present in a healthy child only as an anatomic narrowing of the subglottic region. In addition, 50% of the children with viral croup have normal cervical X-ray. Therefore, the radiological exam is reserved to the diagnostic investigation of other etiology for croup symptoms (aspiration of foreign body) or cases in which the disease outcome is atypical. Isolating the virus by immunologic methods is useful in cases of doubtful etiolo-

gy or in clinical protocols, and should not be included in the initial laboratory assessment.

#### **Treatment**

The purpose of the treatment is to maintain airways patency.

#### **Nebulization**

The use of nebulization with saline or humidified air, although usual, has no proven efficacy. Nebulization must be discouraged if the child becomes more agitated by the procedure, as it causes turbulence in the upper airway airflow. The child should be in a calm environment and on a parent's the lap when the nebulization is administered. Nebulization should be given as a source of oxygen if hypoxemia is detected.

#### **Corticosteroids**

There is a wide evidence of clinical improvement with the use of corticosteroids, reducing the severity of symptoms, the need for hospitalization, reduced hospitalization time or time spent in the emergency service, reduced need for admission in ICU and the need of association with other drugs (epinephrine). Dexamethasone was extensively studied as a potent glucocorticoid and for having a long period of action (more than 48 hours). It can be given by oral or parenteral administration, as a single dose ranging from 0.15mg/kg (light croup) up to 0.6 mg/kg (severe croup). Inhalatory budesonide reduces the severity symptoms of croup when compared to placebo, and is similar to dexamethasone in cases of mild or moderate croup at a 2 mg inhalatory dose.

#### **Epinephrine**

It acts by stimulating the alpha-adrenergic receptors, with subsequent constriction of arteriolar-capillaries. The inhalatory epinephrine has a dramatic effect on croup symptoms, reducing stridor and respiratory failure symptoms. As the drug effect is short (2 hours), the patient might return to respiratory discomfort when the drug activity is over, and should therefore remain in the emergency department for 3 to 4 hours after the use of epinephrine. The discharge criteria include: absence of rest stridor, normal air inflow, normal color, normal consciousness level and previous use of dexamethasone. The epinephrine indications include: moderate to severe croup and children that have undergone previous upper airway manipulation or procedure. The dose for inhalation is 5 ml of 1-isomer of epinephrine (1:1000) mixture.

#### **Intubation**

Most children with laryngotracheitis do not need intubation after using epinephrine and dexamethasone. The manipulation of this airway is difficult because it is a sick airway; there is an anatomical difficulty in this age group; the psychomotor agitation of the child; and the risk of total obstruction of the airways. It is a general consensus, however, that the procedure should be performed in a patient with imminent airway obstruction in a well-controlled environment, with well-controlled protocols, by experienced professionals with an anesthesiologist and otorhinolaryngologist or pediatric surgeon present. The internal diameter of the tracheal cannula that is going to be used should be 0.5 mm less than the ideal calculated for the child's age.

**Hospitalization**

The decision to admit or discharge a child with croup can be a difficult task. In general, admitted children have: 1) toxemia; 2) dehydration or are unable to ingest liquids; 3) significant stridor or retractions at rest; 4) no response to epinephrine or clinical worsening 2-3 hours after its administration; 5) no reliable parents.

**Differential diagnosis**

With the introduction of H.influenza type b vaccine, cases of infectious supraglottitis have been expressively reduced. The supraglottitis is a differential diagnosis for infectious obstruction of upper airways; however, it is not characterized by croup syndrome. The obstruction causes stridor and respiratory discomfort in infectious supraglottitis, but there is not hoarseness nor barking cough which are typical of the vocal chords and trachea involvement, which are spared in this disease. The children with supraglottitis have toxic aspect and circulatory perfusion alteration, which are typical of bacteremia and absent in viral croup. Other differential diagnoses include: angioneurotic edema, foreign body aspiration, bacterial tracheitis, retropharyngeal or peritonsillar abscess, infectious mononucleosis and bacterial tracheitis.

**Spasmodic croup**

Much has been written to differentiate spasmodic croup from viral croup, but this differentiation is useless for the clinical practitioner.

The spasmodic croup is different from the viral croup as it causes a non-inflammatory edema of the subglottic tissues, suggesting that there is no viral involvement of tracheal epithelium. In the endoscopic exam of the larynx, the mucosa is pale in the spasmodic croup and erythematous and inflamed in viral croup. Although there is an association with the same viruses that cause viral croup, the reason for this sudden edema is not known. It has been suggested that the spasmodic croup seems to be much more an allergic reaction to viral antigens than a straight viral infection.

The spasmodic croup occurs in children from 3 months to 3 years of age. The child remains in a good general condition and shows common cold symptoms. At night, the child wakes up with sudden dyspnea, hoarseness, barking cough and inspiratory stridor. There is no fever and the child generally improves after being calmed down and receiving nebulization.

Some children present multiple episodes of croup. This description is more consistent with spasmodic croup recurrence than separate episodes of viral croup. There are reports of more than 3 episodes in 30% of the children, more than 5 episodes in 17%, and more than 9 episodes in 6% of the patients.

If there is no spontaneous resolution of the symptoms, the treatment for viral laryngotracheitis can be used; however, this is only necessary in few cases. There is no indication for the use of anti-histamine, non-hormonal anti-inflammatory drugs or inhalation with nasal vasoconstrictors.

**Recommended reading**

1. Malhorta A, Krilov LR. Viral croup. *Pediatrics in Review* 2001;22:5-11.  
Kaditis AG Wald ER .Viral croup: Current diagnosis and treatment. *Pediatr Infect Dis J* 1998;17:827-834.
2. Klassen TP. Croup: A current perspective. *Pediatr Clin North Am* 1999;46:1167-1178.
3. Milczuk H. Upper airway obstruction in children. *New Horizons* 1999;7:326-334.
4. Marchetti F, Longo G, Ventura A. Oral Dexamethasone for Mild Croup. *N Engl J Med* 2004;351(26):2768-69.