Croup

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ABSTRACT

Children do suffer from different diseases, some are common in small age group and some are common in all age group during pediatric age group. It is true for Nepal too. Among different diseases, croup is one of them.

The viruses infect the nose and throat initially, and then spread along the upper respiratory tract (back of the throat) to the larynx and trachea .As the infection progresses, the top part of the trachea becomes swollen, which narrows the space available for air to enter the lungs. This leads to the symptoms of croup

Most children develop a fever, which may range from mild (100.4ºF or 38ºC) to very high (104ºF or 40.5ºC). The fever itself does not cause them harm, Croup may have symptoms such as rash, eye redness (called conjunctivitis), and swollen lymph nodes may develop, depending upon the virus causing the illness. Baby may present with dehydration if cannot drink well.

Key words: barking cough, croup, child

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INTRODUCTION

Croup is a syndrome that includes spasmodic croup, laryngotracheitis (viral croup), laryngotrachea bronchitis, and laryngotracheo bronchopneumonitis.[1, 2]However, recurrent and viral croup account for most cases[3,4] It is the most common etiology for hoarseness, cough, and onset of acute strider in febrile children. The vast majorities of children with croup recover without consequences or squeal; however, it can be life-threatening in young infants

Croup is more common in boys than in girls, usually occurs between six and 36 months of age, and peaks during the second year of life.[2,5,6] It has been reported occasionally in adolescents and rarely in adults.[7] The incidence of croup often peaks during the fall season, although sporadic cases may occur throughout the year.[8,9]

The most common cause of croup is a viral infection (such as parainfluenza or influenza) that leads to swelling of the larynx and trachea. However, infection with these viruses is common and most children with these infections do not develop croup. The parainfluenza virus is the most common cause of croup. Four strains of the virus are responsible for most cases. These are: parainfluenza I, parainfluenza II, parainfluenza III, parainfluenza IV .Parainfluenza I is responsible for most cases of croup[10.] A number of other viruses can also cause croup. These include:

- Influenza A and B (flu viruses)
- The measles virus, in children who have not been immunized against measels
- The rhinovirus (common cold virus)
- Enteroviruses
- The respiratory syncytial virus (RSV), which can cause severe breathing problems and pneumonia in babies

Other infectious causes of croup include the following:

- Adenovirus
- Human bocavirus
- Coronavirus
- Echovirus
- Reovirus
- Metapneumovirus
- herpes simplex virus, varicella

Influenza A is associated with severe respiratory disease as it has been detected in children with marked respiratory compromise. The bacterial pathogen, *Mycoplasma pneumoniae*, has also been identified in a few cases of croup.[12]Approximately 5% of children experience more than 1 episode.Bacterial infection of the same areas can occur during the viral infection, but this does not happen very often. Bacterial co infection is usually more severe and requires a different treatment than a viral infection.

Viral croup (laryngotracheitis) and recurrent croup (spasmodic) are difficult to distinguish between clinically as both can be associated with viral infections and are similar in appearance. Some researchers argue that spasmodic croup may be linked to allergens such as pollen, a bee sting or allergic reaction to viral antigens, rather than a direct result of a viral infection.

	Spasmodic croup	Laryngotrachietis
Definition	Sudden night time onset Harsh, vibratory sound associated with mild upper respiratory tract infection No inflammation.	Inflammation of the larynx Inflammation of the trachea.
Typical age at occurrence	3 months - 3 years	3 months - 3 years

Table 1: Spasmodic croup vs Laryngotrachietis

Bacterial croup

Bacterial croup is caused by a bacterial infection. This type is significantly less common than viral croup and can be subdivided into laryngotracheobronchitis (LTB), laryngotracheobronchopneumonitis (LTBP) and laryngealdiphtheria.[6,8]

	Laryngotracheobronchitis (LTB) and laryngotracheobronchopneumonitis (LTBP)	Laryngeal diphtheria
Definition	Inflammation of the larynx Inflammation of the trachea Inflammation of the bronchi Inflammation of the lung.	Infection of larynx Infection of other airway areas due to *corynebacterium diphtheriae*, resulting in progressive airway obstruction. *corynebacterium diphtheriae*, resulting in progressive airway obstruction.
Typical age at occurance	3 months - 3 years	All age

Table 2: Difference between LTB/LTBP and Laryngeal diptheria

The important symptoms of croup are a “barking cough” and hoarseness.. Symptoms usually start gradually, beginning with nasal irritation, congestion, and runny nose. Difficulty breathing can develop and become worse during the 12 to 48 hours after congestion and barking cough begin.

Croup is usually mild and lasts less than one week, although it is possible for symptoms to become severe and life threatening. Symptoms are usually worse at night. The more severe cases are due to difficulty breathing caused by swelling in the upper part of the windpipe

As the upper airway narrows, high-pitched, noisy breathing (called stridor) develops and the child may breathe faster; the child may become restless or anxious (agitated) as breathing

becomes more difficult. Agitation can increase the narrowing, which leads to even more difficulty breathing and further agitation. The effort required to breathe faster and harder is tiring, and the child may become exhausted and unable to breathe on his or her own in severe cases.

Low oxygen levels (called hypoxia) and blue-tinged skin (called cyanosis) can develop as airflow to the lungs is restricted. Cyanosis may first be noticed in the fingers and toenails; ear lobes; tip of the nose, lips, tongue; and inside of the cheek.

Contagiousness — Children with croup should be considered contagious for three days after the illness begins or until the fever is gone.

Severity of croup — Croup can be very mild or very severe, depending on how difficult it is for the infant or child to pull air into the lungs. Croup may become more severe when a child becomes agitated or upset.

A child with moderate to severe croup may have to struggle to breathe in ways that can be frightening for both the child and parent (or other caregivers).

Mild croup — A child with mild croup generally is alert and without blue-tinged skin or retractions (sucking in of the skin around the ribs and the top of the sternum. There may be a barking cough. Stridor (high-pitched, noisy breathing) is not present at rest but may be present as the child coughs or cries. A child with mild croup can develop more severe symptoms intermittently throughout the course of the illness, especially during the evening hours.

Moderate croup — A child with moderate croup may have stridor (high-pitched, noisy breathing) and retractions (sucking in of the skin around the ribs and the top of the sternum) at rest, may be slightly disoriented or agitated, and may have moderate difficulty breathing.

Severe croup — A child with severe croup has stridor and retractions at rest. Retractions are a sign of severe croup. These include inward movement (sucking in) of the sternum (breast bone) or skin between the ribs as the child struggles to take a breath. The child may appear anxious, agitated, or fatigued. Cyanosis (blue-tinged skin) is common, initially only when the child is moving or crying, but progressively worsening so that it is present even when the child is resting.]

Scoring systems

Croup scores have been developed to assist the clinician in assessing the degree of respiratory compromise. One of the most commonly cited croup severity assessment score is the Westley score. Although widely used for research purposes and evaluation of treatment protocols, its clinical application has not been extensively studied. The Westley score evaluates the severity of croup by assessing the following 5 factors, with a score range of 0 to 17:

- Inspiratory stridor: None - 0 points, Upon agitation - 1 point, At rest - 2 points
- Retractions: None 0 points, Mild - 1 point, Moderate - 2 points, Severe - 3 points
- Air entry: Normal - 0 points, Mild decrease - 1 point, Marked decrease - 2 points
- Cyanosis: None - 0 points, Upon agitation - 4 points, At rest - 5 points
- Level of consciousness: Normal, including sleep - 0 points, Depressed - 5 points

With the Westley rating system,

a score of less than 3 connotes mild disease;

a score of 3-6 represents moderate disease;

and a score greater than 6 represents severe disease.

Croup is usually diagnosed based upon the child's symptoms and signs, including a barking cough and stridor, especially if these findings occur during the fall and winter months. X-ray and laboratory testing are rarely needed

Diffential diagnosis

Should be differentiate with following diseases

- Bacterial Tracheitis
- Inhalation Injury
- Laryngeal Fractures
- Laryngomalacia
- Measles
- Pediatric Airway Foreign Body
- Pediatric Diphtheria
- Pediatric Epiglottitis
- Pediatric Mononucleosis and Epstein-Barr Virus Infection
- Pediatric Peritonsillar Abscess
- Bacterial Tracheitis
- Laryngomalacia

The treatment of croup depends upon the severity of symptoms and the risk of rapid worsening; children with mild symptoms who have no risk factors for severe croup generally are treated at home, while a child with moderate to severe symptoms or who is at risk for rapid worsening should be treated in an emergency department.

Mild croup — Most children with croup have mild symptoms and can be successfully treated at home. This includes using mist from a humidifier or sitting with the child in a bathroom (not in the shower) filled with steam generated by running hot water from the shower. A parent should stay with the child during mist treatment; a favorite book or lullaby may help to decrease the child's anxiety and prevent crying, which can worsen stridor.

Hot steam humidifiers should be avoided because of the risk of burns. If the child's stridor does not improve during the mist treatment, the parent should contact their child's healthcare provider.

Other suggestions for home treatment of mild croup include:

●Allow the child to breathe cool air during the night by opening a window or door.

●Fever can be treated with an over-the-counter medication such as acetaminophen or ibuprofen.

●Coughing can be treated with warm, clear fluids to loosen mucus on the vocal chords. Warm water, apple juice, or lemonade is safe for children older than four months. Frozen juice popsicles also can be given.

●Smoking in the home should be avoided; smoke can worsen a child's cough.

The treatment used depends upon the type and severity of signs and symptoms, but may include one or more of the following:

●Humidified air or oxygen (if oxygen is necessary).

●Intravenous fluids may be needed if the child is dehydrated as a result of fever or rapid breathing, both of which increase the body's loss of fluids. Difficulty breathing can discourage a child from drinking, which can increase the risk of dehydration.

●Monitoring of oxygen levels, breathing and heart rate, skin color (normal versus blue-tinged), and level of alertness are used to measure the child's status and response to treatment. A child who fails to improve or who improves slowly may need further treatment.

●Placement of a breathing tube in the throat is rarely needed for children with severe croup; less than 1 percent of children seen in the emergency room require intubation.

Dexamethasone — Dexamethasone is the most frequently used medication for the treatment of all types of croup; it is a glucocorticoid that provides long-lasting and effective treatment. It works by decreasing swelling of the larynx, usually within six hours of the first dose. It can reduce the need for a repeat visit to the emergency department or provider's office, decrease the time spent in the emergency department, and decrease the dose of other medications

It can be given as an oral syrup or as an intravenous (IV) or intramuscular (IM) injection (depending upon which treatment is easiest for the child). Most children only require one dose, and serious side effects are rare.

Epinephrine — Epinephrine, commonly referred to as "adrenaline", is given by nebulizer (an inhaled mist) to children with moderate to severe croup. It also reduces swelling in the airway and begins to work faster than dexamethasone. It works for a short time period (two hours or less), and may be given every 15 to 20 minutes for severe symptoms. Retreatment may be needed after two hours if symptoms return after an initial response. When such "rebound" symptoms occur, it is usually within two to four hours after the treatment.

Side effects of epinephrine include rapid heartbeat. Serious side effects are rare. Children who are given epinephrine must be monitored for three to four hours after the last dose to ensure that symptoms of airway blockage do not return.

Other therapies — other therapies, such as antibiotics, cough medicines, decongestants, and sedatives, are not routinely recommended for children with croup. Antibiotics do not treat viruses, which cause most cases of croup. Cough medicines and decongestants have not been proven to be helpful, and sedatives can mask symptoms of low blood oxygen and difficulty breathing.

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Medications — A child with mild croup who is seen in a healthcare provider's office or the emergency department may be given mist treatment in addition to a single dose of a glucocorticoid medication. The most frequently used glucocorticoid is dexamethasone, which can be given as an oral syrup or as an intravenous (IV) or intramuscular (IM) injection (depending upon which treatment is easiest for the child).

Dexamethasone provides long-lasting and effective treatment for mild croup, as well as for moderate and severe croup. It works to decrease swelling of the larynx, usually within six hours of the first dose. For a child with mild croup, dexamethasone can reduce the need for a repeat visit to the emergency department or provider's office and can improve the child's ability to sleep (by easing the work of breathing).

Budesonide is another glucocorticoid medication that is sometimes used. It is administered by inhalation. Other oral glucocorticoids may be prescribed as well.

Moderate to severe croup — moderate to severe croup should be evaluated in an emergency department or clinic capable of handling urgent respiratory illnesses. Severe croup is a life-threatening illness and treatment should not be delayed for any reason.

The treatment used depends upon the type and severity of signs and symptoms, but may include one or more of the following:

●Humidified air or oxygen (if oxygen is necessary

●Intravenous fluids may be needed if the child is dehydrated as a result of fever or rapid breathing, both of which increase the body's loss of fluids. Difficulty breathing can discourage a child from drinking, which can increase the risk of dehydration.

Complications

Complications in croup are rare. In most series, less than 5% of children who were diagnosed with croup required hospitalization and less than 2% of those who were hospitalized were intubated. Death occurred in approximately 0.5% of intubated patients.

A secondary bacterial infection may result in pneumonia or bacterial tracheitis, a life-threatening infection that can arise after the onset of an acute viral respiratory infection.[8, 9, 10, 11] In this scenario, the child usually has a mild to moderate illness for 2-7 days, but then develops severe symptoms. These patients typically have a toxic appearance and do not respond well to nebulized racemic epinephrine.

Treatment in cases of bacterial tracheitis requires close observation, broad-spectrum antibiotics, and, occasionally, endotracheal intubation. Key bacterial pathogens are *Staphylococcus aureus* including methicillin-resistant strains (MRSA), group A streptococcus (*Streptococcus pyogenes*), *Moraxella catarrhalis*,*Streptococcus pneumoniae*, *Haemophilus influenzae,* and anaerobes.

Pulmonary edema, pneumothorax, pneumomediastinum, lymphadenitis, and otitis media have also been reported in croup. Poor ability to maintain adequate oral intake plus increased insensible fluid losses can lead to dehydration; as such, patients may require intravenous fluid hydration to stabilize their fluid volume.

References

1. Cherry JD. Clinical practice. Croup. N Engl J Med 2008; 358:384.
2. Cherry JD. Croup (laryngitis, laryngotracheitis, spasmodic croup, laryngotracheobronchitis, bacterial tracheitis, and laryngotracheobronchopneumonitis) and epiglottitis (supraglottitis). In: Feigin and Cherry's Textbook of Pediatric Infectious Diseases, 7th ed, Cherry JD, Harrison GJ, Kaplan SL, et al (Eds), Elsevier Saunders, Philadelphia 2014. p.241.
3. Cooper T, Kuruvilla G, Persad R, El-Hakim H. Atypical croup: association with airway lesions, atopy, and esophagitis. Otolaryngol Head Neck Surg 2012; 147:209.
4. Peltola V, Heikkinen T, Ruuskanen O. Clinical courses of croup caused by influenza and parainfluenza viruses. Pediatr Infect Dis J 2002; 21:76.
5. Counihan ME, Shay DK, Holman RC, et al. Human parainfluenza virus-associated hospitalizations among children less than five years of age in the United States. Pediatr Infect Dis J 2001; 20:646.
6. Rihkanen H, Rönkkö E, Nieminen T, et al. Respiratory viruses in laryngeal croup of young children. J Pediatr 2008; 152:661.
7. Weinberg GA, Hall CB, Iwane MK, et al. Parainfluenza virus infection of young children: estimates of the population-based burden of hospitalization. J Pediatr 2009; 154:694.
8. Kuypers J, Martin ET, Heugel J, et al. Clinical disease in children associated with newly described coronavirus subtypes. Pediatrics 2007; 119:e70.
9. Sung JY, Lee HJ, Eun BW, et al. Role of human coronavirus NL63 in hospitalized children with croup. Pediatr Infect Dis J 2010; 29:822.
10. van der Hoek L, Sure K, Ihorst G, et al. Croup is associated with the novel coronavirus NL63. PLoS Med 2005; 2:e240.
11. Williams JV, Harris PA, Tollefson SJ, et al. Human metapneumovirus and lower respiratory tract disease in otherwise healthy infants and children. *N Engl J Med*. 2004 Jan 29. 350(5):443-50.
12. Worrall G. Croup. *Can Fam Physician*. 2008 Apr. 54(4):573-4. [M
13. State of the evidence for standard-of-care treatments for croup: are we where we need to be?, Cherry, James D. MD, MSc, Pediatr Infect Dis J, 24(11 Suppl):S198-202, discussion S201, November 2005.
14. The management of croup, Julie C Brown, BMB, doi: 10.1093/bmb/61.1.189, 2002.
15. Croup, James D. Cherry, M.D., M.Sc, NEJM, DOI: 10.1056/NEJMcp072022, 24 January 2008.