

Case Report

MANAGEMENT OF CROUP IN CHILDREN: A CASE REPORT

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ABSTRACT

Background Croup is a viral respiratory disease in children that attacks the larynx and trachea causes obstruction or blockage of the upper respiratory tract which, if severe, can be life-threatening. Diagnosis of respiratory tract infection in children requires keen clinical vigilance to understand the risk of airway obstruction and the possible need for prompt intervention. Clinical symptoms in croup usually fever, runny nose, painful swallowing, and mild cough. This condition can develop into a loud, hoarse and harsh cough. Recognition of signs and symptoms is very important to prevent morbidity and mortality.

Objective To describe diagnosis and management of croup in children.

Case Description A 3-year-old boy, came to the emergency room with complaints of sudden shortness of breath this morning accompanied by fever and a barking cough. These complaints had been felt for 3 days before going to the hospital, but they can reduce on their own and according to the parents there were no danger signs for complaints in their children.

Conclusion Croup is a self-limited disease, but sometimes it tends to be severe and even fatal. Prompt and appropriate management can prevent or reduce the risk of croup morbidity and mortality in children.

Keywords: croup, respiratory tract infection, obstructive

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INTRODUCTION

Croup or laryngotracheobronchitis is a viral respiratory disease in children that attacks the larynx and trachea, can progress to the bronchi, if severe, can be life-threatening. The incidence of croup most often affects children, asthma and allergies are also risk factors.^{1,4} Croup is mostly mild, only <1% of cases develop severe symptoms.⁶

Croup is caused by a viral infection of the respiratory tract, most often by Parainfluenza virus. The infection causes general inflammation of the airways, the subglottic area becomes narrow, causing upper airway obstruction.⁶ Usually the child has symptoms of a mild upper respiratory tract infection. Changes are generally sudden with a fever, loud inspiratory stridor, loud "barking" or "seal-like" cough, and a hoarse voice.^{2,5}

Croup is usually self-limited. In some cases, corticosteroids are useful in reducing the severity and duration of symptoms, and may

significantly reduce relapse, hospitalization, intubation, and use of epinephrine.^{4,11}

CASE DESCRIPTION

3-year-old boy came to the emergency room on June 15, 2023, with complaints of sudden shortness of breath this early morning accompanied by fever barking cough. Three days before going to the hospital, the patient had a cough, runny nose, and fever but they can reduce it on their own. According to the parents there were no danger signs for complaints in their children.

Clinical Findings: On physical examination, the patient had an active cough, with a rapid respiratory rate (35 x/mins), oxygen saturation 92-94% room air, temperature 38°C, pulse 140 x/mins, nostril breathing. There was mild chest retraction and stridor breath sound. The result of laboratory examination was leukocytosis (11500 cell/ul) and increase neutrophil segment

(73%). The SARS-COVID 2 rapid antigen was negative.

The patient immediately received 1.5 cc Ventolin plus 2 cc NaCl 0.9% nebulization, 3 cc adrenaline nebulization (without dilution), and dexamethasone injection 8 mg. During hospitalization, the medications were infusion of KaEN 3B 1000 cc per 24 hours, injections of paracetamol 200 mg, injection of ampicillin 400 mg, injection of dexamethasone, and nebulization of 3 cc adrenaline two hours after first nebulization. After the symptoms were resolved, the patient underwent a chest x-ray examination, and the result was pneumonia in the inferior lobe of the right lung.

DISCUSSION

Croup is a respiratory illness that affect the larynx, trachea and bronchi that leads to inspiratory stridor and barking cough. The incidence of croup most often affects children aged 6 months to 3 years, more often occurs in boys than girls with a ratio of 1.5: 1.6 , asthma and allergies are also risk factors. An estimated 3% to 5% of children have at least one episode of croup during childhood; most often when aged 6 months to 3 years.^{1,4}

Croup is caused by a viral infection of the respiratory tract; most often by Parainfluenza virus types 1 and 3. Other viruses involved are Influenza A and B, Adenovirus, Metapneumovirus, Respiratory Syncytial Virus (RSV), and Measles virus although rare, Mycoplasma pneumonia has also been found.⁶ The infection causes general inflammation of the airways and edema of the upper airway mucosa. The subglottic area becomes narrow, causing upper airway obstruction.⁶

Sensitivity in assessing danger signs as a doctor is required to be honed to act quickly and precisely to free the child's airway immediately. Checking the airway, breathing patterns, and circulation as well as nebulizing with epinephrine and anti-inflammatory drugs can help in this case of children. Follow the algorithm for treating croup in children. Prepare for the worst possibility if you have to intubate a patient who does not respond to previous therapy. The sooner the child's airway is treated and freed, the better the result will be. A proper history and physical examination can

diagnose the Croup. Investigations can help establish the diagnosis.^{4,8}

Evaluation of croup in pediatric patients includes^{4,8}

- Stridor type (inspiratory, expiratory, or biphasic)
- Breathing frequency
- Chest retraction
- Cyanosis
- Oxygen desaturation
- Awareness

Clinical diagnosis can be established based on clinical symptoms. On physical examination you can also find hoarseness, runny nose, pharyngeal inflammation, and slightly increased respiratory rate. The patient's condition varies according to the degree of respiratory distress.^{4,8}

Radiographic examinations in an anteroposterior and lateral position of the upper airway can be used to evaluate croup. In croup, the anteroposterior view characteristically shows a "steeple sign" or "tower sign" in the subglottic area (Fig. 1B). The characteristic radiographic findings may be absent in 50% of patients and are also not pathognomonic for croup.^{3,4}

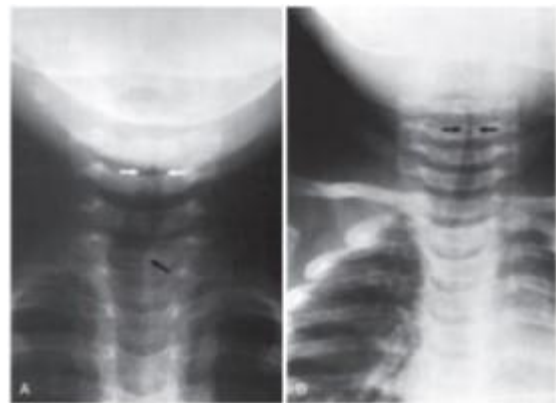


Figure 1(A) Anteroposterior neck radiograph showing normal proximal tracheal contour (white arrow). Some children have features of tracheal angulation that are the normal variation (black arrow). (B) Anteroposterior neck radiograph showed subglottic narrowing in viral croup^{4,8}

Flexible fiberoptic laryngoscopy may aid in the diagnosis of croup, but great care should be taken to avoid acute airway obstruction in children with moderate to severe obstructive symptoms. In children with severe airway obstruction, uncertain diagnosis, or other risk factors for airway pathology, direct laryngoscopy and

bronchoscopy should be performed. Typical endoscopic findings of croup include edema and narrowing of the vocal cords and subglottis, (Fig. 1B). However, endoscopy cannot fully assess anatomic abnormalities if performed during acute infection.^{3,4,9,19} In the acute setting, another important diagnosis to consider is other life-threatening respiratory tract infections such as epiglottitis. Several differential diagnoses of croup are described in Table 1.

A careful history is important for the diagnosis, whether due to a foreign body in the airway, bacterial tracheitis, retropharyngeal abscess, thermal injury, or caustic ingestion.⁴ Croup may recur and occur in about 5% of children; Congenital subglottic stricture and gastroesophageal reflux disease are the most common etiologies of croup recurrence. Asthma and allergies are also risk factors.^{7,13}

Table 1. Differential Diagnosis of Upper Respiratory Tract Infection in Children

Characteristics	Laryngotracheitis (viral croup)	Supraglottitis (epiglottitis)	Bacterial tracheitis	Retropharyngeal abscess
Age	6 months – 3 years	1 – 8 years	6 months – 8 years	1 – 5 years
Onset	Slow	Rapid	Rapid	Slow
Prodromal symptoms	Upper respiratory tract symptoms	Absent or mild upper respiratory symptoms	Upper respiratory tract symptoms	Upper respiratory tract symptoms
Fever	Variation / none	High	High	Usually, high
Barking cough	Yes	No	Yes	No
Dysphagia	No	Yes	Yes	Yes
Radiographic picture	Subglottic constriction	Enlarged epiglottis	Subglottic narrowing, irregular tracheal walls	Widening of the prevertebral space

Croup is usually self-limited and does not require medical intervention. Steps at home include the role of parents, keeping children calm by reducing stimuli that make children cry and worry. Patients presenting for medical evaluation can be managed with several modalities which include systemic glucocorticoids, racemic epinephrine, and a mixture of helium and oxygen (heliox). There are clinical croup algorithms for consistent, safe, and effective management (Figure 2).^{4,11}

Corticosteroids are useful in reducing the severity and duration of symptoms, and may significantly reduce relapse, hospitalization, intubation, and use of epinephrine. Low-dose oral administration (1 to 2 mg/kg/day divided twice daily) is an option for outpatient treatment. Intravenous administration at a dose between 0.15 to 0.6 mg/kg is preferred for severe disease in inpatient treatment.^{4,11}

Nebulized epinephrine is recommended for moderate to severe croup. Administration of epinephrine to children with severe croup has reduced cases of intubation or

tracheotomy. Nebulized epinephrine improves signs of respiratory distress within 10 to 30 minutes of starting medication. The clinical effect is maintained for at least 1 hour, fading after 2 hours.^{4,6,12,16}

Epinephrine - racemic aerosol (L- and D-epinephrine) or L-epinephrine are adrenergic agents that rapidly improve symptoms of obstructed airways by reducing airway edema. Its mechanism of action is through vasoconstriction and decreased vascular permeability. It acts more quickly than glucocorticoids but is considered second-line therapy after steroids because of the risk of side effects (tachycardia, agitation, hypertension) and short duration of action.^{4,17,20} In addition, given the risk of rebounding, children on an outpatient treatment should be observed closely for three to four hours after administration before being discharged. In inpatient treatment, adrenergic agents may be used every 30 minutes, usually every three to four hours. Use in combination with

glucocorticoids can reduce rebound and increase treatment efficacy. Epinephrine - racemic aerosol should be used with extreme

caution in patients with tachycardia or cardiac anomalies such as tetralogy of Fallot or idiopathic subaortic stenosis.^{4,17}

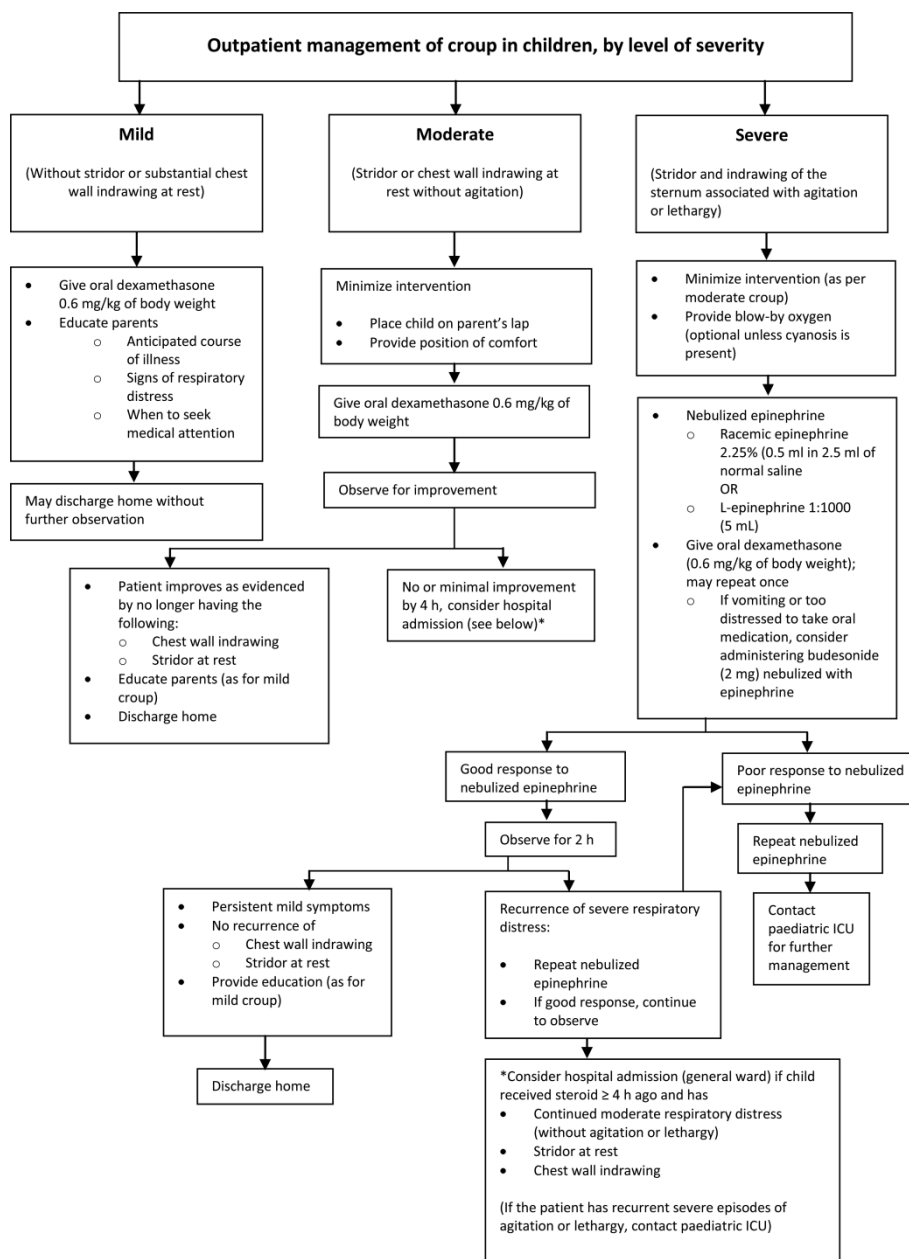


Figure 2. Management of Croup patients based on their degree⁶

One randomized controlled trial demonstrated that nebulization of 1:1000 L-epinephrine in a 5 mL dose was as safe and as effective as a 0.5 mL dose of racemic epinephrine. This standard dose can be used in all patients regardless of age and weight.^{4,17}

Heliox (helium-oxygen) may reduce the severity of symptoms in children with severe croup. The mechanism of action of Heliox is that the lower density of helium gas reduces the turbulence of the airflow in the narrowed passages. Heliox is sometimes used in severe cases to avoid intubation. Heliox has not been shown to improve croup symptoms when compared with standard treatment and is therefore not recommended routinely.^{6,18} Other therapies such as antibiotics and short-acting beta-2 agonist bronchodilators in children with croup are rarely indicated because the incidence of bacterial infection is low.⁶

Tracheal intubation is necessary if the child is unable to breathe independently and CO₂ is elevated or first or second line treatment is inadequate. The recommended endotracheal tube (ETT) size is 0.5-1.0 mm smaller than usual for age. The size of the ETT should be appropriate so that the patient can breathe easily during spontaneous ventilation and facilitate the suctioning of mucus or airway secretions.^{4,13}

CONCLUSION

Croup is a self-limited disease, but sometimes it tends to be severe and even fatal. Prompt and appropriate management can prevent or reduce the risk of croup morbidity and mortality in children. Most croup in children has mild symptoms, gets better on its own. The role of parents is very important to pay attention to signs of difficulty breathing in their children. Early diagnosis and appropriate therapy can reduce the risk of airway obstruction. Investigations to help with the diagnosis include radiography, flexible fiberoptic laryngoscopy, laryngoscope, or direct endoscopy. Treat with corticosteroids, epinephrine – racemic aerosol, heliox, antibiotics, short-acting beta-2 agonist bronchodilators or endotracheal tubes according to clinical condition and child's response.

CONFLICT OF INTEREST AND FUNDING RESOURCES

The authors stated no conflict of interest.

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