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Review Article

**EVALUATION OF CROUP DIAGNOSIS AND MANAGEMENT:  
SIMPLE LITERATURE REVIEW**

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**Abstract:**

**Background:** Croup is a viral infection that effect larynx, trachea and/or bronchi and characterized by an acute onset of barking cough, hoarseness and stridor with or without dyspnea. In most of time it occurs as a result of parainfluenza virus. Over the last years, a lot of literatures have been published resolving important controversies in the diagnosis and treatment of viral croup. As a result reviewing the new literatures done in this field will help in providing a better outcome for the patients.

**Objective:** In this paper, we reviewed the recent published articles regarding Croup symptomology, differential, diagnosis and management.

**Methods:** A comprehensive search was done using biomedical databases; Medline, and PubMed, for studies concerned with assessment of Croup. Keywords used in our search through the databases were as; "Croup Symptomology", "Croup Diagnosis", and "Croup Management".

**Conclusion:** Croup is a viral infection that occur as a result of Parainfluenza virus type 1 in 75% of the cases, it mostly effect children between 6 month up to 3 years during late autumn, but also can effect children up to 15 years during any time of the year. Croup diagnosis is mainly clinically dependent. Croup present with of barking cough, hoarse voice, inspiratory stridor, and often low grade fever. All children with croup should be treated with corticosteroid and in case of severe croup epinephrine should be used due to its fast action in controlling the symptoms.

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**INTRODUCTION:**

Croup is relatively a common condition that effect children below 3 years. In general, it's self-limited viral infections that infect larynx, trachea and/or bronchi and characterized by an acute onset of barking cough, hoarseness and stridor with or without dyspnea. The uses of real-time reverse-transcriptase polymerase chain reaction lid us to find that parainfluenza virus and rhinovirus are the most common etiologic agents [1].

Croup incidences mostly increase in winter and effect males and infants more than females and older children. Approximately about 8% of children below 2 years presented to emergency department with croup symptoms are hospitalized and less than 1% is admitted into Intensive care unit [2].

Conditions called Spasmodic Croup define as recurrent condition with clinical manifestations similar to viral croup, but without prodromal upper respiratory infection symptoms. Spasmodic Croup symptoms are transient and respond differently to the management plan, and patient's condition improved after exposure to cold night air. Epiglottitis is a condition characterized by inflammation of supraglottic area by Haemophilus influenzae. It effect children in pre-school age and associated with sudden onset of fever, difficulty breathing, stridor, and sore throat. Mostly the child appears toxic and ill [3].

Over the last years, a lot of literatures have been published resolving important controversies in the diagnosis and treatment of viral croup. Thus in our study we aims to discuss and evaluate questions and controversies on the diagnosis and management of viral croup and provide a simplified review paper that analyze the recent advances.

**METHODOLOGY:****Sample**

We performed comprehensive search using biomedical databases; Medline, and Pubmed, for studies concerned with assessment of stress ulcer prophylaxis published in English language between 2013 and 2018. Keywords used in our search through the databases were as; "Croup", "Croup Diagnosis", "Croup Evaluation & Management" "Croup Pathogenesis". More relevant articles were recruited from references lists scanning of each included study.

**Analysis**

No software was used, the data were extracted based on specific form that contain (Title of

the study, name of the author, Objective, Summary, Results, and Outcomes). Double revision of each member's outcomes was applied to ensure the validity and minimize the errors.

**DISCUSSION:**

Viral croups (Laryngotracheobronchitis) define as an acute infection of larynx, trachea and bronchi. As mentioned early, Croup mostly effect children below 3 years old and account for about 15% of respiratory tract infection in children<sup>1</sup>. Croup infection can occur during any time of the year, but the incidence increase in late autumn season. In approximately 75% of the cases croups occur as a result of parainfluenza virus type 1. Other cases occur as a result of respiratory syncytial virus, metapneumovirus, influenza A and B, adenovirus, coronavirus, and mycoplasma [2].

As a result of larynx invasion by the virus, inflammatory process starts which cause hyperemia and edema that lead to narrowing of subglottic area. As a result a child with croup will present with abrupt onset of barky cough, hoarse voice, inspiratory stridor, and often fever.

Croup diagnosis depends on history and physical examination alone. In approximately 99% of cases with abrupt onset of stridor in children occur as a result of croup. However, a physician should but in mind other deferential diagnosis in cases of no response to the standard treatment **Table 1**.

Bacterial tracheitis is uncommon complications of croup occur as a result of infection with Staphylococcus aureus, H. influenzae, Streptococcus pneumoniae, or Moraxella catarrhalis. It is a life threatening condition characterized by abrupt onset of severe respiratory distress due to the presence of thick mucosal secretion in trachea. The conditions start with a viral like respiratory symptoms. However, the condition become acutely worse with time and the child doesn't respond to the standard croup treatment and looks very ill with toxic appearance. A physician may consider endotracheal intubation because of the presence of thick secretions in the trachea that may obstruct airway [4].

Epiglottitis is conditions occur as a result of infection with Haemophilus influenzae type B. It present with abrupt onset of dysphagia, drooling, anxiety muffled sound and high fever. Recently it becomes uncommon condition as a result of vaccination programs targeting H. Influenza. However, it should

be considered in every child present with atypical croup symptoms. In epiglottitis a child will appear toxic and prefer to sit in an upright posture to maintain the airway in an optimal “sniffing” position.

A physician should always take in consideration that a child might rapidly develop a sudden airway obstruction. Therefore, a constant monitoring of the child to ensure a secure airway is needed<sup>5,6</sup>.

**Table 1. Differential Diagnosis of Stridor [7]:**

Condition	History	Physical Examination	Workup	Etiologies
Laryngotracheitis (viral croup)	Barking cough, coryza	Low-grade fever, nasal flaring, respiratory retractions, stridor	Not indicated in most of the cases	Parainfluenza virus type 1
Angioedema	Detailed questioning to identify the offending antigen	Swelling of the face and Neck	Epicutaneous skin testing or radioallergosorbent testing may be performed later	Allergic reaction
Bacterial Tracheitis	Mild to moderate presentation, then rapid decomposition in three to seven days	High-grade fever, toxic appearance, copious secretions, productive cough, retractions; no drooling or odynophagia	Lateral neck radiography may be helpful, bacterial culture of tracheal secretions after intubation, WBC count (elevated)	Staphylococcus aureus, Haemophilus influenzae, group A streptococci
Foreign body aspiration	Sudden onset, history of choking	Stridor	X- ray, CT, Bronchoscopy	Foreign Body
Peritonsillar abscess	Dysphagia, throat pain that is more severe on affected side	Inferior and medial displacement of the tonsil, contralateral deviation of the uvula, erythema and exudates on the tonsil	CT with intravenous contrast media	Gram-positive organisms (including $\beta$ -lactamase producing), gramnegative organisms, anaerobes
Retropharyngeal abscess	Fever, odynophagia, dysphagia, neck pain	Drooling, stridor, neck mass, nuchal rigidity	Lateral neck radiography (widening of the retropharyngeal soft tissues); CT with intravenous contrast media is helpful	Gram-positive organisms (including $\beta$ -lactamase producing), gramnegative organisms, anaerobes
Spasmodic croup (recurrent croup)	Usually recurrent, short duration, barking cough	Afebrile, less retractions and nasal flaring	Generally not indicated, but bronchoscopy (especially in children younger than three years) and endoscopy may be considered	Same as viral croup, with possible allergic component or gastroesophageal reflux

As mentioned early the diagnosis of croup mainly depends on history and physical examination. The sudden onsets of barking cough that worse at night, with preceding low grade fever, hoarseness and stridor is highly suggested for croup. During the physical examination the physician should assess the severity of the condition by evaluating respiratory status, chest retraction, and use of accessory muscles, stridor, and heart rate. According to the literatures there was a significant variation in relation to assessment of croup severity between physicians because its observer dependent. The most important and significant factors that can help in croup assessment are presence of stridor, and the severity of retractions. In addition pulse oximetry can be used to assess croup severity **Table 2 [8,9,10]**.

**Table 2. Level of severity of croup and clinical features [11]**

<p>☞ <b>Mild</b></p> <ul style="list-style-type: none"> <li>○ Barky cough: occasional</li> <li>○ Stridor: none to limited at rest</li> <li>○ Indrawing (suprasternal and/or intercostal): none to mild</li> </ul> <p>☞ <b>Moderate</b></p> <ul style="list-style-type: none"> <li>○ Barky cough: frequent</li> <li>○ Stridor: easily audible at rest</li> <li>○ Indrawing (suprasternal and/or intercostal): visible at rest</li> <li>○ Distress or agitation: none to limited</li> </ul> <p>☞ <b>Severe</b></p> <ul style="list-style-type: none"> <li>○ Barky cough: frequent</li> <li>○ Stridor: prominent inspiratory and occasionally expiratory</li> <li>○ Indrawing (suprasternal and/or intercostal): marked or severe</li> <li>○ Distress or agitation: substantial</li> <li>○ Lethargy may be present</li> </ul> <p>☞ <b>Impending respiratory failure</b></p> <ul style="list-style-type: none"> <li>○ Barky cough: often not prominent because of fatigue</li> <li>○ Stridor: audible at rest, but may be quiet or hard to hear</li> <li>○ Indrawing: may not be marked</li> <li>○ Lethargy or decreased level of consciousness</li> <li>○ Dusky or cyanotic without supplemental oxygen</li> </ul>
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According to the guideline developed by the Toward Optimized Practice Program, viral cultures and rapid antigen tests are not needed to confirm croup diagnosis or to direct therapy [12]. In case of doubted croup due to atypical presentation, the use of chest x-ray can help in exclusion of other pulmonary conditions. In addition, lateral neck x-ray can help in detection of other differentials such as epiglottitis (thickened epiglottis\_ Steeple sign), retropharyngeal abscess (widening of the retropharyngeal soft tissues), and bacterial tracheitis (thickened trachea). In case of strong suspicion of diagnosis other than croup (Epiglottitis, Bacterial Tracheitis), a physician should be very cautious during the use of radiological study, because the radiological studies may agitate the child and cause an acute airway obstruction [4,13].

### **Management**

After complete assessment of child condition, the management should be started by keeping the child calm and avoid any situation which might fright the child, because any agitation can worsen the symptoms and cause acute airway obstruction<sup>4</sup>. A child should be in position that is comfortable for him or her, the recent literatures did not specify any position. In addition, in case of the presence of respiratory distress, oxygen should be administered via plastic tube held by the parents [4,14].

### ☞ **CORTICOSTEROIDS**

Corticosteroid plays an important role in the

management of croup and controlling its symptoms. Corticosteroids help by decreasing edema in the laryngeal mucosa, and is usually effective within six hours of treatment. The use of corticosteroids helped the patients by reduction in the use of additional medical care, hospital stays, and intubation rates. In a meta-analysis data of patients with severe croup, found that the use of corticosteroids helped in reduction in intubation rate. In addition to the role of oral administration of corticosteroids in relieving symptoms of respiratory distress directly after one hour from administration, it appears that its effect continues up to 10 hours [15,16].

A lot of literatures have been done to assess different types of corticosteroids and route of administration. Sparrow A et al. compared between the use of oral dexamethasone and prednisolone, they found that the first is better in reduction of the rates of return to the medical care. In addition, Fifoot AA et al. found that there were no differences in clinical croup score after 4h from administration of single oral dose of dexamethasone or prednisolone [17].

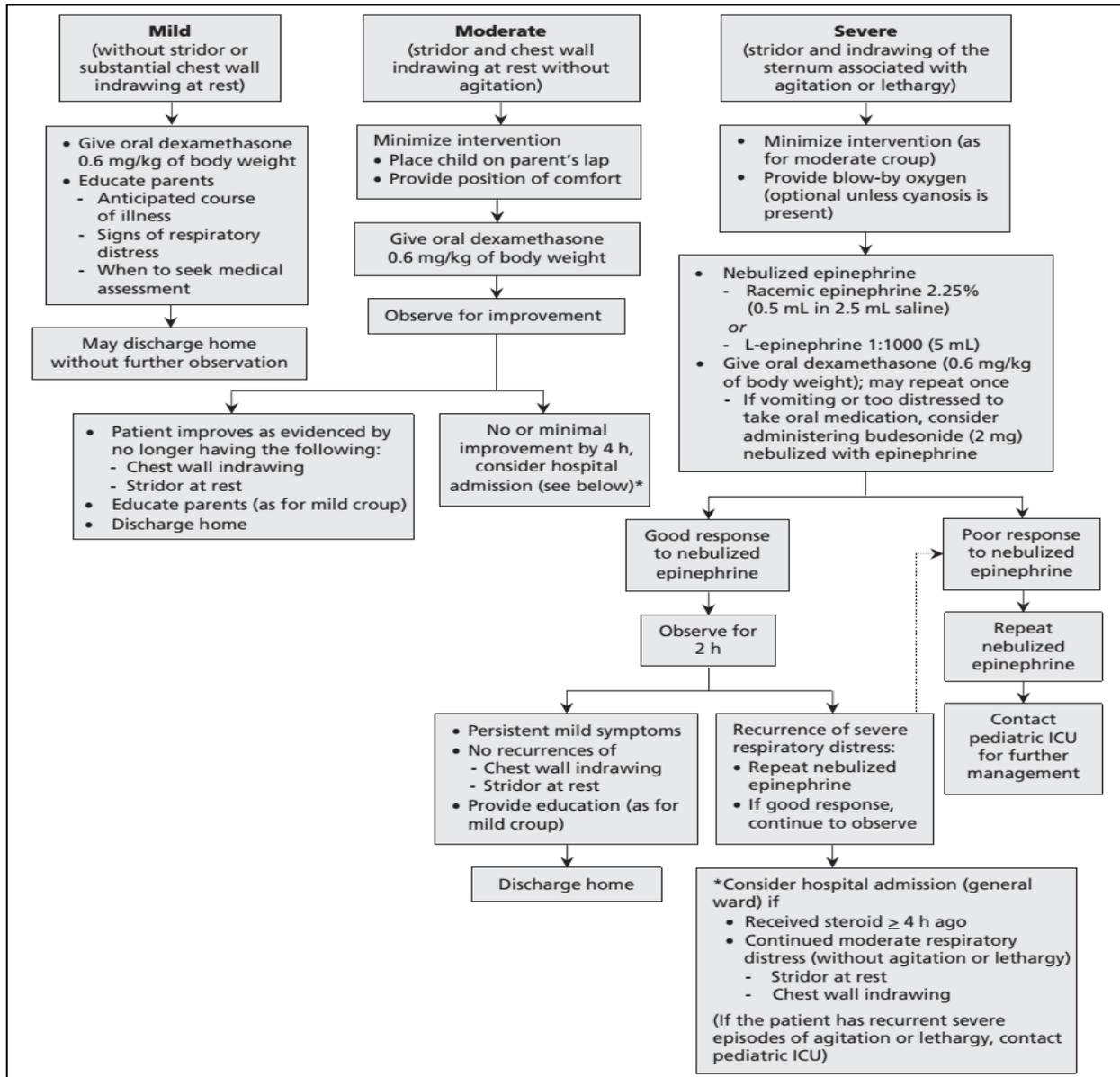
The standard dose of dexamethasone is 0.6 mg/kg. Different studies suggested that administration of a higher dose will be associated with better outcomes. The role of administration of corticosteroid were vigorously evaluated. The literatures found that there were no significant variation between oral/intramuscular/ nebulization administration of dexamethasone in terms of controlling the symptoms or hospital stay [17,18].

### NEBULIZED EPINEPHRINE

Nebulized epinephrine plays an important role in rapid controlling and relieving of the symptoms. A lot of trials found that its effect start within 10 minutes after administration and continue up to 2h. The data showed that its use have helped in reduction of intubations rates and death [19]. In children admitted to hospital with croup, length of stay was shorter in

the group that received nebulized epinephrine as compared with placebo (mean difference  $-32$  h, 95% CI  $-59.1$  to  $-4.9$ ). The standard epinephrine dose is 0.05 ml/kg (maximal dose 5 ml) of racemic epinephrine 2.25% or 0.5 mL per kg (maximal dose: 5 mL) of L-epinephrine 1:1,000 via nebulizer [20].

*Algorithm 1. Outpatient management of croup in children, by level of severity. ICU = intensive care unit. Adapted from Toward Optimized Practice Program<sup>11</sup>*



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