IOSR Journal Of Pharmacy
(e)-ISSN: 2250-3013, (p)-ISSN: 2319-4219
www.iosrphr.org Volume 5, Issue 4 (April 2015), PP. 19-23

Acute Laryngitis and Croup: Diagnosis and Treatment

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ABSTRACT: *Croup is a common respiratory tract infection, among children between 6 months and 5-6 years. Croup is characterized by "barking cough", resembling the call of a seal or sea lion. The stridor is worsened by agitation or crying, and it can be heard at rest, it may indicate critical narrowing of the airways.The virus initially infects the upper respiratory tract and usually produce congestion of the nasal passages and nasopharynx, subsequently, the larynx, the trachea and bronchi are involved. The classic croup- stridor, hoarseness, and cough-arise mostly from the inflammation of larynx and trachea.Parainfluenza virus type 1 is the most frequent cause of croup,with adenoviruses, enteroviruses and Mycoplasma pneumonia.Diagnosis is on clinical manifestations, and the history especially for the younger children.Roentgenographic evaluation is unnecessary, the radiologic picture may be helpful in differential diagnosis. Guidelines for management of croup have been classified as mild,moderate and severe, Westley score of 0 to 2 mild cases, moderately severe score 3 to 7,severe cases with a score of 8 to 11,and high risk score of12 to 17 with imminent respiratory failure.Dexamethosone and budesonide are effective, nebulized epinephrineracemic epinephrine or1-epinephrine may be added to the dexamethasone for severe croup*.

KEY WORDS:*Croup, Barking cough,Viralcroup,Diagnosis and Treatment.*

I. INTRODUCTION

Croup or laryngotracheobronchitis is a respiratory condition that is usually triggered by an acute viral infection of upper airway. The infection leads to swelling inside the throat, which interferes with normal breathing and produces the classical symptoms of a "barking" cough, stridor, and hoarseness [1].Croup affects about 15% of children, and usually presents between the ages of 6 months and 5-6 years[2].It accounts for about 5% of hospital admissions in this population[3].In rare cases, it may occur in children as young as 3 months and as old as 15 years[3].Males are affected 50% more frequently than females, and there is an increased prevalence in autumn[2].In a Seattle prepaid group practice, the annual incidence of croup was 7 per 1000 for all children younger than 6 years, and peak in incidence in the second year of life was 14.9%[4].In North Carolina, much higher rates were observed in all ages with a peak incidence in the second year of life of 47 annual episodes per 1000 children[5].Hospital admissions have significantly declined in recent years and in correlation with use of effective outpatient therapy for croup[6].In Ontario, the estimated annual rates of hospitalization from 1988-2002 also showed a decline among children younger than 5 years, and rates were lower among children 1 to 4 years than among infants[7].Parainfluenza virus type 1 is the most frequent cause of croup. Parainfluenza viruses types 2 and 3 and influenza A also are major agents. Less common causes of croup are respiratory syncytial virus(RSV),influenza B virus, rhinoviruses, adenoviruses,enteroviruses,rubeola virus and *Mycoplasma pneumonia* [5]].Croup is diagnosed on clinical grounds once potentially more severe causes of symptoms have been excluded(i.e.epiglottis or an airway foreign body)[1].Children with croup are generally kept as calm as possible. Steroids are given routinely; with epinephrine used in severe cases [8].Children with oxygen saturations under 92% should receive oxygen [2].Dexamethasone and budesonide are effective in relieving the symptoms of croup as early 6 hours after treatment. [9].The paper reviews the current literature, diagnosis and management of croup in clinical practice.

II. HISTORY AND NOMENCLATURE

Home in 1765 first introduced the word *croup* in his treatise "An Inquiry into the Nature, Causes and Cure of the Croup" in which he described 12 patients with croup[10].The term croup descended from an Anglo *Saxon word kropan* or the old Scottish term roup, which means "to cry in a shrill voice"[11].For the next century, the term croup was applied to numerous probably viral and bacterial diseases, which included diphtheria,"cynache trachealis"which was often called"membranous" or"true" croup as opposed"spasmodic"or" flase"croup. Differentiation awaited Klebs' discovery of *Corynebacterium diphtheria* in 1883.In 1948 Rabe[12],classified the forms of infectious croup according to etiology-bacterial or nonbacterial-and suggested that the latter larger group was viral in origin. He was able to identify the pathogen-*C.diphtheriae* or *Haemophilusinfluenzae* type b-in only 15% 0f 347 patients.

The term croup now generally refers to an acute respiratory illness characterized by a distinctive barking cough,hoarsness, and inspiratory stridor in a young child,usually between six months and three years old. This syndrome results from inflammation of varying levels of the respiratory tract, which sometimes spreads to the lower respiratory tract, producing concomitant lower tract findings.Croup is primarily laryngotracheitis and encompases a spectrum of infections from laryngitis to laryngotrecheobronchitis and sometimes laryngotracheobronchopneumonia[2].Most common among the clinical argot of croup are recurrent, allergic, and spasmodic croup. Most children develop croup only once or twice despite multiple infections with viruses that are prime etiologic agents. Some children have recurrent episodes of croup however, which is often referred to as "spasmodic croup". Spasmodic croup and "allergic croup" also have been applied to cases that tend to be sudden in onset, often at night, with minimal coryza and fever, and that occur among children with a family history of croup or atopic. Spasmodic croup generally cannot be differentiated from a single episode of the usual type of croup, however, in its clinical manifestations or in its etiology, which is usually viral [2].

III. ETIOLOGIC AGENT

Croup is usually deemed to be due to a viral infection[13].Among children evaluated for croup in emergency department one or more viral agents were identified in 80% of specimens by reverse transcriptase polymerase chain reaction(RT-PCR);the parainfluenza viruses were detected more frequently[14].No matter what means of detection were used, studies over decades have consistently shown that the parainfluenza viruses especially type 1 are the most frequent cause of croup[2].Only the parainfluenza viruses are associated with the major peaks of occurrence of croup cases Parainfluenza type 1 has been identified in approximately one fourth to one third of cases. Parainfluenza type 3 generally is the second most commonly associated virus, accounting for about 6% to 10% of cases depending on the year and circulating strain .Similarly, although respiratory syncytial virus(RSV) infections are particularly prevalent among this group, relatively few(about 5% of RSV infections) manifest as croup.

More recent studies using RT-PCR methods have detected rhinoviruses,enteroviruses,and bocaviruses in 9% to 13% of specimens from children with croup. In many cases, another viral agent was concurrently identified. Confections with rhinoviruses are particularly frequently[14].Among children presenting with croup in an emergency department, two thirds of specimens with rhinovirus had another agent concurrently by RT-PCR.Adenoviruses and human metapneumovirus were identified in 1% to 2% of these children with croup *Mycoplasma pneumonia* was detected rarely among the croup cases(0% to 0.7%)[14].Limited information exists suggesting that coronaviruses cause a small proportion(about 2%) of croup cases.A study of more recently discovered human coronaviruses NL63 suggests, however, that this agent is highly associated with croup when detected in high titer and as a single agent[15].Outbreaks in the United States and elsewhere serve as a reminder that rubeola in the prevaccine era often resulted in severe and complicated croup. During the 1989-1999 upsurge of measles cases in the United States, laryngotracheobronchitis complicated approximately 20% of the cases of measles among hospitalized patients in Los Angeles and Houston[16].Children with croup as a complication of measles tended to be, the younger, they had a more severe course, and 17% to 22% required intubation. In some children, the outcome was fatal.

IV. PATHOPHYSIOLOGY

The viral infection that cause croup leads to swelling of the larynx,trachea, and large bronchi due to infiltration of white cells(especially histiocytic, lymphocytes, plasma cells, and neutrophils).Swelling produces airway obstruction which, when significant, leads to the dramatically increased work of breathing and the characteristic turbulent, noisy airflow known as stridor[8,3].The virus initially infects the upper respiratory tract and usually produces congestion of the nasal passages and nasopharynx.Subsequently especially during the primary infection, the larynx, the trachea, and sometimes bronchi become involved.The classic signs of croup-stridor, hoarseness, and cough-arise mostly from the inflammation of the larynx and trachea.The resulting is greatest at the subglottic level because this is the least distensible part of the airway as it is enriched by the cartilage, with narrow anterior ring and the largest posterior quadrangular lamina forming a "single ring. "The impeded flow of air through this narrow area produces the classic high pitched vibrator sounds or stridor. This is most apparent on inspiration because the negative intraluminal pressure tends to narrow the extra thoracic airway further, much as sucking on partially occluded paper straw causes it to collapse inwardly. This effect is enhanced in young children because of increased compliance of their airway walls [17].

Even with minimal inflammation of the membrane lining the narrow passage of the larynx and glottis in a young child results in an appreciable degree of obstruction because resistance to airflow is inversely related to the fourth power of the radius of the airway. The mucous membrane is also looser and more vascular, and the cricoid cartilage is less rigid. Nasal obstruction and crying can aggravate the dynamic narrowing of the child's airway further [18].With the subglottic obstruction child's tidal volume initially declines. This is compensated by an increase in the respiratory rate to maintain adequate alveolar ventilation. If the degree of obstruction worsens, the work of breathing may increase such that child tries and can no longer maintain the necessary

compensation respiratory effect.The tidal volume may decrease further, and as the respiratory rate declines, hypercarbia and secondary hypoxemia ensues [18].

V. CLINICAL PRESENTATIONS

Croup is characterized by a "barking" cough, stridor, hoarsness, and difficult breathing which usually worsen at night[13].The "barking" cough is often described as resembling the call of a seal or sea lion[2].The stridor is worsened by agitation or crying, and it can be heard at rest, it may indicate critical narrowing of the airways. As croup worsens stridor may decrease considerably[13].Most children have a prodrome and mild respiratory tract signs of rhinorrhea, cough, and sometimes fever,12 to 48 hours before the onset of the distinctive "rough and stridulous" cough of croup.The deepening cough and hoarseness herald the onset of the respiratory stridor. The cough is not productive, but has the striking deep brassy tone of "seal's bark". The respiratory stridor may be accompanied by retractions of the chest wall, usually most marked in the supraclavicular and suprasternal areas.progress. Some children may progress to have inspiratory and expiratory stridor. The respiration rate may be highly elevated, but rates greater than 50 per minute are unusual in children with croup, in contrast to the marked tachypnea that is often evident with bronchiolitis [18].

The onset of stridor commonly occurs at night, and in milder cases may improve in the morning, only to worsen again at night. Children whose croup is characterized by abrupt nighttime onset with little prodrome of respiratory tract infection, followed by daytime improvement, are often designated as "spasmodic croup". These children have repeated similar episodes over several days or separated by months. Generally an episode of recurrent croup cannot be differentiated from the actual case of viral croup clinically or by viral etiology. Compared with children with a recurrent episode of croup, children with single episode of croup have been shown to be not significantly different in their demographic features, history of atopy, family history of atopy, or clinical features [19].A etiology viral was identified by RT-PCR in 68% of children, and the proportion with an identified viral infection was not significantly different between children with single and recurrent episode of croup. For most children, the course of croup is less than 3 to 4 days. Although the cough may persist longer,the characteristics barking quality resolves within 2 days in most children [20].

VI. DIAGNOSIS

Croup is a clinical diagnosis. The first step is to exclude other obstructive conditions of upper airway, especially epiglottitis, an airway foreign body, subglottic stenosis, angioedema, retropharyngeal abscess, and bacterial tracheitis [8,2].Diagnosis can always be made on the basis of the characteristic epidemiologic features, the clinical manifestations, and the history, especially in children 6 months through 3 years of age. Diagnostic procedures that upset the child may worsen the respiratory distress and should be avoided [21].Laboratory analysis generally should be limited to tests necessary for management of a more severely ill child,such tests used to assess dehydration and oxygenation.White blood cell count and differential are rarely helpful or distinctive in diagnosing croup. Identification of the specific viral agent also is usually unnecessary, and obtaining respiratory tract swabs and secretions is likely to augment the child's respiratory distress [18].Viral identification may be warranted when specific antiviral therapy is being considered, such as for severely ill or high- risk children with influenza. In most instances, a rapid antigen assay, such as immunofluorscent and enzyme immunoassays, is used. RT-PCR assays are the most sensitive, but the results often unavailable within the time required for decision on the management of croup[22].

Roentgenographicevaluation is usually unnecessary for the diagnosis of croup and, should be undertaken with caution and careful monitoring of the child.Among atypical cases, however, the radiologic picture may be helpful in the differential diagnosis [18].The characteristic manifestation of viral croup noted on an anteroposterior neck film is a 5-to 10 mm narrowed shadow of the trachea in the subglottic area. This is often described as the "hourglass" or "steeple" sign. The lateral view of the neck may show an increased width of the airspace in the hypo pharyngeal area. Dilation of the pharyngeal airway develops from child's increased respiratory effort as a result of the tracheal obstruction [18}.The diagnostic value of these roentgenographic findings is nevertheless questionable. They are not consistently observed in all cases of the viral croup, and some studies have shown them to be of low specificity and sensitivity for confirming or ruling out viral croup [18].

Differential diagnosis. Children presenting with atypical features or history, a broad range of diagnosis should be considered [23].A case should be considered atypical if the child does not have the most characteristic features of croup Especially the seal's bark cough and hoarsnessThe history of a rapidly progressive course, high fever, a toxic appearance, and drooling suggest a bacterial infection, primarily epiglottis and bacterial tracheitis.Cases of bacterial epiglottis are rare since the widespread use of *H.influenzae* type b vaccination[23].The differentiation features of epiglottis include the striking rapid onset and progression of the

illness, marked by a high fever and toxic appearance. The child is often sitting, leaning forward, and anxious.The history of an upper respiratory tract infection with rhinorrhea and laryngitis usually is not present. Instead the child may have a muffled voice, marked dysphagia and drooling. Bacterialtrachetis has an acute onset and presentation similar to that epiglottis[22].Its rapid and dramatic onset is characterized by high fever stridor, and dyspnea copious amounts of purulent sputum. The child may progress rapidly to complete airway obstruction. The course is unresponsive to therapy with nebulized epinephrine, and suspected cases should be managed as medical emergency.Bacterial cellulitis and abscesses of the deep neck spaces, including peritonsillar and retropharyngeal abscesses, may also manifest with similar findings of high fever, dysphagia, and drooling[24].The characteristic upper respiratory signs,hoarseness and barking cough, are usually are not present. A major cause of stridor in the past *C.diphtheriae,* although now rarely seen in the United States and other developed countries, should still be considered in countries with low rates of immunization [25].

Noninfectious causes of obstruction that mimic croup include aspiration of foreign body, which is common in the same age group as that of viral croup; trauma to the upper airway, such as from toxic ingestions, and angioneurotic edema [24].Anatomic abnormalities such as vocal cord paralysis and anomalies that impinge on the laryngotrachea area may cause stridor, especially when a respiratory infection augments the obstruction to airflow. These include traheolaryngomalacia, laryngeal webs, and papillomas. In most cases, the history and lack of acute signs of respiratory infection allow differentiation. Occasionally, recurrent episodes of stridor, may be related to gastrointestinal reflux [26].

VII. TREATMENT

Appropriate therapy for croup is determined by the severity of the child's illness. Accurate assessment of the child's clinical status is essential. The natural fluctuation in the course of croup often confounds this evaluation, however, as well as judging the success of therapy. Most children with mild croup may be cared for at home. Keeping a child comfortable and avoiding disturbing procedures are particularly important because anxiety and crying may enhance respiratory distress. The child should be given adequate liquids and antipyretic if necessary [18].Despite a plethora of home therapies for croup, none has proved consistently effective. Vaporizersand other means of producing mist in the home have long been advised. In the past century, steaming tea kettles were an integral and often primary mode of therapy. Nevertheless, the beneficial effects of mist have not been proven [27].

Multiple scoring systems have been used to assess the severity of croup. The scoring system most frequently used is the **Westley clinical score** [[28].The major findings on physical examination used for this score are the degree of *stridor,chest wall retractions, air entry, level of consciousness or fatigue, and presence of cyanosis. Guidelines*for the management of croup generally have classified croup *as mild, moderate, and severe,with mild cases having corresponding Westley score of 0 to 2,moderately severe cases having scores of 3 to 7,severe cases having scores of 8 to 11,and cases at imminent respiratory failure having scores of 12 to 17*[2].

Therapies recommended vary according to the assessment level of severity, but mainstay of therapy beyond supportive care is dexamethasone.One dose of dexamethasone orally or, if necessary intramuscularly administered to outpatients and in emergency department has been shown to be effective in reducing the need for hospitalization [29].Nebulized epinephrine, racemic epinephrine,or1-ephinephrine may be added to the dexamethasone for children with severe croup. Because improvement after nebulized epinephrine is transient, the child should be observed for at least 2 hours.The administration of a mixture of helium and oxygen has long been used to improve gas exchange in various obstructive disorders of the upper and lower respiratory tract. Little evidence exists, however, that administering heliox to children with croup is beneficial [30].

Prognosis. Croup remains a common illness among young children, but with the currently available modalities for management, most children may be cared at home, and the illness usually resolves within 3-4 days[20].Most have mild symptoms, and only 5% of children discharged from the emergency department after corticosteroids therapy need to return because of worsening symptoms[31].If the child's symptoms are minimal at discharge, return within 24 hours is unlikely. In Canada of all children with croup, about 4% have been estimated to require hospitalization, and intubation was required for 1 in 170 hospitalized children or 1 in 4500 of all children with croup[32].Rajapaksa and associates reported that viral croup is usually self-limiting disease with half of cases going away in a day and 80% of cases in two days[13,32].It can very rarely result in death from respiratory failure and/or cardiac arrest [13].Other uncommon complication include bacterial trachetitis pneumonia, and pulmonary edema[3].

VIII. CONCLUSION

Croup is a common disease worldwide among young children. Currently available modalities for management, most children with mild symptoms may be cared at home. Research is required to examine the most beneficial method for disseminating croup practice guidelines and to increase the uptake of evidence.

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