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COMPARISON TYPES OF CROUP: DIPHTERIC AND VIRAL CROUP

Akramov Abdullo Ahmad o'g'li
3rd year of the faculty Pediatrics of Samarkand State Medical University
abdullohakramov313@gmail.com

Davranova Malika Alisher qizi
3rd year of the faculty Pediatrics of Samarkand State Medical University
davranovamalika886@gmail.com

Orifov Jonibek Erkinjon o'g'li
3rd year of the faculty Pediatrics of Samarkand State Medical University
jonibekorifov@gmail.com

Murodova Mexribonu Asrorovna
3nd year of the faculty Pediatrics of Samarkand State Medical University

Elboboyeva Mohinur Muzaffar qizi
2nd year of the faculty Pediatrics of Samarkand State Medical University

Qarshiyeva Jayrona Utkirovna
2nd year of the faculty Pediatrics of Samarkand State Medical University

Abstract: This article explores the multifaceted aspects of croup, a respiratory condition impacting young children. Distinguishing between viral and diphtheric croup is vital for accurate diagnosis and targeted medical intervention. Understanding the historical context and epidemiology aids in comprehensive insights. Diagnostic approaches for both types involve clinical evaluation, laboratory tests, and imaging. Reflecting on historical and current perspectives, this article emphasizes preventive measures, including vaccination, to mitigate the impact of these respiratory conditions on children.

Keywords: Croup, Viral Croup, Diphtheric Croup, Respiratory Infections, Corynebacterium diphtheriae, Parainfluenza, Clinical Evaluation, Diagnostic Methods, Historical Insights, Epidemiology, Airway Obstruction, Treatment Approaches, Antitoxin.

Research objective: Study and comparison of diphtheric and viral croup through analysis of various methods and materials.

Introduction: Croup, a common respiratory condition primarily affecting young children, is characterized by the inflammation of the upper airways, leading to a distinctive barking cough, hoarseness, and difficulty breathing. This ailment encompasses various forms, each presenting unique characteristics and triggers. Two prominent types of group include viral croup and diphtheria croup. Understanding the distinctions between these variants is crucial for accurate diagnosis and tailored medical intervention.

Diphtheric croup, also known as membranous croup, is a severe and potentially life-threatening form of croup caused by the bacterium Corynebacterium diphtheriae. This bacterial infection produces a pseudomembrane, composed of dead tissue, mucus, and bacterial debris, which forms

over the mucous membranes of the upper respiratory tract, particularly in the larynx and trachea. As the infection progresses, the exotoxin causes inflammation, edema, and the formation of a grayish-white pseudomembrane on the mucosal surfaces of the larynx. This membrane adheres tightly to the underlying tissue, impeding normal respiratory function. The presence of this pseudomembrane can lead to airway obstruction, resulting in the hallmark symptoms of diphtheric croup, such as stridor and respiratory distress.

Viral croup, also known as laryngotracheitis, is a common respiratory condition primarily affecting children, characterized by inflammation of the larynx, trachea, and bronchi. The condition is typically caused by viral infections, with parainfluenza viruses, influenza viruses, and respiratory syncytial virus (RSV) being common culprits. Viral croup often presents with distinctive symptoms, including a barking cough, hoarseness, and respiratory distress. The pathogenesis of viral croup involves the invasion of the respiratory epithelium by the causative virus, leading to inflammation and swelling of the affected airways. Viral replication and the host immune response contribute to mucosal injury and increased mucus production. Parainfluenza viruses, in particular, have an affinity for the laryngeal tissues, causing a more pronounced effect on the upper airways. The inflammatory response triggers the release of various cytokines and chemokines, recruiting immune cells to the site of infection. Edema and increased mucus secretion contribute to airway narrowing, leading to the characteristic symptoms of croup, such as stridor and respiratory distress. While viral croup is typically a self-limiting illness, severe cases may require medical intervention to alleviate symptoms and ensure adequate oxygenation.

Methods and Materials: In this section, we analyzed materials and methods from different literature. Our analysis included the study history, epidemiology, and diagnosis of diphtheric and viral croup from various literatures.

History

The clinical manifestations of diphtheria, including the membranous croup, have been recognized since ancient times. However, the specific causative agent and its role in respiratory infections were not identified until the late 19th century. In 1884, German physician Edwin Klebs first described the bacterium that he believed was responsible for diphtheria. Subsequently, in 1888, the Swiss-French bacteriologist Albert Loeffler, along with Friedrich Frosch, successfully isolated and cultured this bacterium. They named it Corynebacterium diphtheriae, highlighting its characteristic appearance with club-shaped formations. In 1890, Emil von Behring and Kitasato Shibasaburo, working independently, discovered that the clinical symptoms of diphtheria were not caused directly by the bacteria but by a toxin produced by Corynebacterium diphtheriae. This groundbreaking discovery paved the way for the development of antitoxin therapies and marked the beginning of specific treatments for diphtheria.

Viral croup-like symptoms, characterized by a distinctive barking cough and respiratory distress, have been documented in historical medical literature for centuries. However, the specific viral etiology of croup was not recognized until the development of virology in the 20th century. The early 20th century witnessed significant progress in virology, with researchers isolating and identifying various respiratory viruses. This period marked the discovery of viruses such as

parainfluenza viruses, influenza viruses, and respiratory syncytial virus (RSV), which are now known to be common causes of viral croup.

Epidemiology

Diphtheria is an infectious disease caused by the bacterium Corynebacterium diphtheriae. Historically, diphtheria was a major global health concern, particularly affecting children. However, due to widespread vaccination efforts, the incidence of diphtheria has significantly declined in many parts of the world. The introduction of diphtheria vaccination, often administered as a part of the diphtheria-tetanus-pertussis (DTP) vaccine, has played a crucial role in reducing the prevalence of diphtheria. Childhood immunization programs have been successful in preventing severe cases and outbreaks. Diphtheria remains endemic in certain regions where vaccination coverage is insufficient or where healthcare infrastructure is compromised. Developing countries with limited access to vaccines may still experience sporadic outbreaks.

The incidence of viral croup can vary, and it is most commonly observed in children, especially those between the ages of 6 months and 3 years. Croup is a relatively common respiratory condition, and many children experience at least one episode of croup during their early years. The reason for this is the weakness of the mucous membrane in children and the narrowness of the airways. Several viruses can cause croup, with parainfluenza viruses being the most frequent culprits.

Diagnosis

The diagnosis of diphtheric croup, also known as membranous croup, involves a combination of clinical evaluation, laboratory testing, and imaging studies:

1.Clinical Evaluation

Symptoms: Diphtheric croup is characterized by a barking cough, hoarseness, and respiratory distress. Patients may also present with a low-grade fever. Pseudomembrane Formation: The hallmark feature is the formation of a grayish-white pseudomembrane on the mucous membranes of the larynx, trachea, and other upper respiratory structures.

2.Laboratory

Corynebacterium diphtheriae Culture: A definitive diagnosis is established by isolating Corynebacterium diphtheriae from clinical specimens, such as throat swabs or pseudomembrane samples.

Polymerase Chain Reaction (PCR): Molecular methods, such as PCR, can provide a rapid and sensitive means of detecting the presence of Corynebacterium diphtheriae DNA in clinical specimens.

Toxin Gene Detection: PCR assays targeting the diphtheria toxin gene can also be used for rapid identification of toxigenic strains.

Serology: Blood tests to detect antibodies against diphtheria toxin may be performed, but these are generally supportive rather than definitive for acute diagnosis.

3.Instrumental diagnosis

Radiography: Imaging studies, such as neck X-rays, may be performed to assess the extent of airway involvement and pseudomembrane formation. X-rays may show a characteristic "thumbprint sign," indicating narrowing of the airway.

4.Epidemiological context

Epidemiological status: Knowledge of recent travel to areas where diphtheria is endemic or exposure to individuals with confirmed or suspected diphtheria is important for considering the diagnosis.

Vaccination Status: Information about the individual's diphtheria vaccination status can be relevant. Diphtheria is preventable through vaccination, and the absence of recent immunization may increase the risk of infection.

The diagnosis of viral croup is primarily clinical, based on the characteristic symptoms and physical examination findings. The following steps are typically involved in diagnosing viral croup:

1.Clinical Evaluation

Characteristic Cough: The distinctive barking cough often indicates involvement of the larynx and upper airways.

Stridor: The presence of stridor, especially during inhalation, suggests airway narrowing and is a key clinical feature of croup.

Hoarseness: Hoarseness or changes in the quality of the voice are common in croup due to inflammation of the vocal cords.

Substernal and Suprasternal Retractions: These retractions, where the skin is pulled inward during inspiration, may be observed in more severe cases.

Fever: While some cases of croup may be associated with a mild fever, it is not always present.

2.Laboratory

Viral Testing: In some cases, especially if the clinical presentation is atypical or severe, viral testing may be considered. Polymerase chain reaction (PCR) or rapid antigen tests can help identify the specific respiratory virus responsible for the croup.

3.Instrumental diagnosis

Neck X-ray: While not routinely recommended, a neck X-ray may be performed in cases where the diagnosis is uncertain or to assess the degree of airway narrowing. It may reveal characteristic findings such as a "steeple sign," indicating subglottic narrowing.

4. Epidemilogical context

Seasonal status: Viral croup often has a seasonal pattern, with increased incidence in the fall and early winter. This coincides with the peak activity of certain respiratory viruses.Epidemiological

status: Inquiring about recent exposure to individuals with respiratory infections, especially other children, can provide important epidemiological context.

Results: We obtained the necessary results from the analyzed materials and methods. These results are the differences between diphtheric and viral croup, and we presented these results in the form of a table.

Comparison diphteric and viral croup

Materials		Diphtheric Croup	Viral Croup
Age Distribution		Can affect individuals of all ages, but historically, it has been more common in children.	Only affects young children, particularly those between 6 months and 3 years of age.
Ethiology		Exotoxin of Corynebacterium diphtheriae	Parainfluenza virus accounts for more than 75% of croup infections and other viruses measles, adenovirus and respiratory syncytial virus (RSV), Human Metapneumovirus (HMPV)
PATHOLOGY	Pathological process	Diphtheric fibrinous inflammation	Serous or catarrhal inflammation
	Macroscopical patho morphology	Grayish-white pseudomembrane and narrowing of the respiratory tract	The airway narrowing is a result of edema
	Microscopical patho morphology	Pseudomembrane composed of fibrin, dead epithelial cells, and bacterial colonies	Inflammatory infiltrates, tissue destruction

DIAGNOSIS	Specific cough	especific cough is not observed	Barking cough
	Respiratory disorders	Hoarseness,Stridor	
	Specific other symptoms	Myocarditis and nerve damage	Fever, weakness, and malaise
	Blood analysis	Neutrophilia Exotoxin	Acute phase proteins increased, lymphocytosis, increased rate of etrocyte deposition

Discussion: The materials and results we see above are closely related to the pathogenesis of croup. An important role in diphtheric croup pathogenesis is played by the exotoxin produced by diphtheria corinabacteria. This toxin circulates in the blood and damages the heart, muscles, mucous membranes, nerves. His most damaging area is hissing trachea. In exotoxin exposure, mucous membrane cells are altered. Also exotoxin increases the permeability of the vascular wall. As a result, fibrinous diphtheritic inflammation begins on the mucous membrane. And a false mucous membrane is formed, consisting of necrossed tissue and fibrin threads. The result is a narrowing of the airway-the diphtheric croup we have mentioned. The pathogenesis of viral croup differs from that of diphtheric croup.In the first, the trigger is the counting of viruses.In children, inflammation occurs in acute respiratory viral diseases caused by weakness of the mucous membrane of the hiccups.Inflammation can be catarrhal or serous. The important thing is that during the inflammatory process, the inflammatory exudate accumulates under the mucous membrane and edema is acquired. Edema, in turn, narrows the airway and causes viral croup.

Now we will discuss the treatment of croup. The treatment of diphtheric croup involves a multi-faceted approach aimed at addressing the bacterial infection and managing airway obstruction caused by the diphtheria toxin. Key components of treatment include: Diphtheria antitoxin, derived from horse serum, is a critical component of treatment. It neutralizes the effects of the diphtheria toxin circulating in the bloodstream. Early administration is crucial to prevent systemic complications. Prompt initiation of appropriate antibiotics, such as penicillin or erythromycin, is essential to eliminate the bacteria (Corynebacterium diphtheriae) causing the infection. Antibiotics

also help prevent the spread of the bacteria to others.In severe cases with significant airway obstruction, medical professionals may need to intervene to maintain a patent airway. This can involve measures such as intubation or, in extreme cases, a surgical procedure known as tracheostomy. Supportive measures include providing humidified air to ease breathing, monitoring oxygen levels, and addressing symptoms such as fever or respiratory distress. Infected individuals should be isolated to prevent the spread of the bacteria. Additionally, vaccination against diphtheria is recommended for close contacts and as a preventive measure for the general population.

Viral Croup Treatment: Corticosteroids, such as dexamethasone, facilitate faster symptom resolution and reduce the need for medical care and hospital stays. Dexamethasone is more effective than budesonide for symptom improvement, with no significant difference in readmission rates. Nebulized racemic epinephrine is beneficial for moderate to severe cases, improving symptom scores at 30 minutes. However, its effects may diminish after 2 hours. Extended observation is recommended; discharge with close follow-up is considered if symptoms stabilize after 4 hours. L-epinephrine 1:1000 (0.5 mL/kg via nebulizer) is preferred over racemic epinephrine for its prolonged effects. Administer oxygen through "blow-by" for reduced agitation compared to mask or nasal cannula use. Approximately 0.2% of children may require endotracheal intubation for respiratory support. Use a tube one-half size smaller than usual to accommodate airway narrowing.

Conclusion: In conclusion, croup, a common respiratory condition predominantly affecting young children, manifests in various forms, with viral croup and diphtheric croup being prominent types. Diphtheric croup, caused by Corynebacterium diphtheriae, presents a severe threat, forming a pseudomembrane in the upper respiratory tract, leading to airway obstruction. On the other hand, viral croup, often caused by parainfluenza viruses, displays characteristic symptoms such as a barking cough and respiratory distress. Understanding the historical context of these conditions, their epidemiology, and diagnostic approaches is crucial for effective management. Diphtheria, once a global health concern, has significantly declined due to vaccination efforts. Viral croup, common among children, may necessitate clinical evaluation, viral testing, and sometimes imaging studies for accurate diagnosis. The pathogenesis of diphtheric croup involves the damaging exotoxin produced by Corynebacterium diphtheriae, while viral croup results from viral invasion and subsequent inflammation, often affecting the laryngeal tissues. Recognizing these distinct mechanisms guides tailored treatment strategies. While advancements in diagnostics, treatment, and vaccination have transformed the landscape of croup management, continued vigilance and adherence to preventive measures, such as vaccination, remain essential to safeguarding the health of children and preventing the resurgence of these respiratory conditions.

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