**CAHIERS MAGELLANES-NS**
Volume 07 Issue 1
2025

*ISSN:1624-1940*
http://magellanes.com/

# ACUTE SUBGLOTTIC LARYNGITIS. ETIOLOGY, EPIDEMIOLOGY, PATHOGENESIS AND CLINICAL PICTURE, LITERATURE REVIEW

**Ramadan Issa[1]*, Abeer Fahad Almutairi[2], Waad Mohammed Almutiri[3], Raneem Salem Fihrah[4], Yazeed Saeed Nasser Amer[4], Aroub Abdullah Aseery[4], Jawaher Mohammed Al-Harbi[5], Lujain Abdulaziz Aljohani[6], Hisham Ahmed Alshehri[7], Fatima Alhassan Hamidaddin[8], Maarib Babiker Mansour Mohamed[9], Rogiah Mahdi Aldali[10], Mohammed Atef Siyam[11], Hatoon Abdullah Alharbi[12]**

1 Faculty of Pediatrics, Ain Shams University, Al Qahera, Egypt
[2]MBBS, general practitioner Ibn Sina PHC, AlJubail, Saudi Arabia
[3]MBBS, University of Jeddah, Jeddah, Saudi Arabia
[4]MBBS, King Khalid University, Abha, Saudi Arabia
[5]MBBS, General practitioner MOH, Qassim, Saudi Arabia
[6]MBBS, taibah university, Almadinah Almunawarah, Saudi Arabia
[7]Respiratory Therapist, King Saud bin Abdulaziz University, Riyadh, Saudi Arabia
[8]MBBS, King Saud bin Abdulaziz University, Riyadh, Saudi Arabia
[9]MBBS, Gezeira university, Albaha, Saudi Arabia
[10]Respiratory Therapist, University of Toledo, Qatif, Saudi Arabia
[11]MBBS, Sulaiman Al Rajhi University, Qassim, Saudi Arabia
[12]general practitioner, Makkah Health Culster, Makkah, Saudi Arabia
*Corresponding author*: drmsiyam@gmail.com

## Abstract

Acute subglottic laryngitis, commonly known as croup, is a viral respiratory illness predominantly affecting children aged 6 months to 3 years. It is characterized by a distinctive barking cough, stridor, and varying degrees of respiratory distress. The etiology is primarily viral, with the parainfluenza virus being the most common cause, although other viruses such as respiratory syncytial virus, influenza, and adenovirus can also contribute. This article provides an overview of the etiology, epidemiology, pathogenesis, clinical presentation, diagnosis, and management of croup. The pathogenesis involves inflammation of the subglottic area, leading to airway narrowing and subsequent respiratory symptoms. Diagnosis is mainly clinical, supported by tools like neck X-rays and pulse oximetry to assess severity. Management ranges from supportive care for mild cases to more intensive interventions, including nebulized epinephrine, corticosteroids, and oxygen therapy for moderate to severe cases. In extreme cases, intubation may be necessary. Complications, such as secondary bacterial infections and respiratory failure, are rare but require immediate intervention. The prognosis for most children is excellent, with most recovering fully, though recurrence is common, particularly during viral seasons. Early recognition and prompt management are essential to minimize morbidity and improve outcomes in children with croup. Further research is required to refine treatment protocols and better understand the long-term implications of recurrent episodes.

**Keywords:** Acute subglottic laryngitis, croup, viral infections, pediatric respiratory distress, parainfluenza virus, corticosteroids, nebulized epinephrine, diagnosis, management.

*ISSN:1624-1940*
http://magellanes.com/

## Introduction

Acute subglottic laryngitis, commonly known as croup, is a respiratory condition primarily affecting young children. It is characterized by inflammation and swelling of the larynx and subglottic area (Mazurek et al., 2019) leading to airway narrowing and difficulty breathing. Croup is most often viral in origin and is associated with a distinctive barking cough, hoarseness, and inspiratory stridor. The disease can range from mild to severe, with more critical cases leading to significant respiratory distress and potential life-threatening complications (Pham, Bourayou, Maghraoui-Slim, & Koné-Paut, 2016).

Understanding the etiology, epidemiology, pathogenesis, and clinical presentation of croup is essential for healthcare professionals to provide accurate diagnosis and effective management. A clear grasp of the disease's underlying causes and how it progresses allows clinicians to tailor treatment strategies based on the severity of the symptoms, reduce the risk of complications, and ensure a better prognosis for affected children. Given the high prevalence of croup in pediatric populations, early recognition and intervention can significantly improve outcomes and reduce hospital admissions.

## Etiology of Acute Subglottic Laryngitis (Croup)

The etiology of acute subglottic laryngitis, or croup, is primarily viral, with several viruses known to be responsible for its onset. The most common causative agent is the parainfluenza virus, particularly types 1 and 3, which are most prevalent during the fall and early winter months (Kivekäs & Rautiainen, 2018). Other viruses, such as respiratory syncytial virus (RSV), influenza virus, and adenovirus, have also been identified as contributors to croup, though they are less frequently implicated (Proença-Módena et al., 2011) Bacterial infections are less common but may occur as secondary infections following viral illness. Bacterial pathogens, such as *Streptococcus pneumoniae*, *Staphylococcus aureus*, and *Haemophilus influenzae*, can lead to complications and more severe forms of croup, often necessitating more aggressive treatment, including antibiotics.

Several risk factors contribute to the development of croup. The condition is most commonly seen in children aged 6 months to 3 years due to the smaller size of their airways, making them more susceptible to obstruction (Hogg, Paré, & Hackett, 2017). Environmental factors, such as exposure to cold, dry air, or respiratory irritants (e.g., smoke), can exacerbate symptoms or increase the likelihood of developing croup. Additionally, Children with pre-existing comorbidities, such as asthma or immune system disorders, may be at a higher risk for developing more severe forms of croup (Di Cicco, Tozzi, Ragazzo, Peroni, & Kantar, 2021).

## Epidemiology of Croup

Acute subglottic laryngitis, commonly known as croup, predominantly affects young children and exhibits specific epidemiological patterns (Tristram, 2019).

**Age Distribution:** Croup is most commonly seen in children aged 6 months to 3 years. This age group is particularly vulnerable due to the smaller diameter of their airways, which makes them more susceptible to inflammation and airway obstruction caused by viral infections. Although children up to 5 years may still develop croup, the incidence decreases significantly after the age of 3.

**Seasonal Patterns:** Croup tends to have a seasonal pattern, with the incidence peaking during the fall and winter months. This correlates with the prevalence of viral respiratory infections, which are more common during colder months. The cold, dry air combined with

*ISSN:1624-1940*
http://magellanes.com/

increased indoor crowding during these seasons provides favorable conditions for the spread of viruses that cause croup.

**Global Prevalence and Regional Variations:** The global prevalence of croup is high, particularly in temperate climates where respiratory viral infections are more common during specific seasons. While croup occurs worldwide, the incidence can vary depending on regional factors such as healthcare access, vaccination coverage, and climate (Baker et al., 2022). For example, regions with higher rates of influenza and parainfluenza infections tend to report more cases of croup. Additionally, the widespread use of vaccines for some respiratory viruses, like influenza, may reduce the incidence of croup in certain populations.

**Table 2: Epidemiology of Acute Subglottic Laryngitis (Croup)**

| Characteristic | Details |
|---|---|
| **Age Group Most Affected** | Typically affects children between 6 months and 3 years |
| **Peak Incidence** | Fall and winter months |
| **Global Prevalence** | Varies by region, but commonly seen in both developed and developing countries |
| **Gender Distribution** | Slightly higher incidence in males than females |
| **Comorbidities** | Children with underlying respiratory conditions or weakened immune systems are at higher risk |

**Pathogenesis of Acute Subglottic Laryngitis (Croup)**

The pathogenesis of acute subglottic laryngitis, or croup, involves a combination of viral infection, inflammatory response, and airway narrowing. The condition typically begins with viral invasion of the upper respiratory tract and progresses to inflammation and swelling of the subglottic region, leading to respiratory symptoms.

**Mechanism of Inflammation**The inflammation in croup occurs primarily in the subglottic region of the larynx, which is the area just below the vocal cords (Kivekäs & Rautiainen, 2018). This area is particularly susceptible to swelling due to its narrow diameter, which can become significantly obstructed when inflamed. When the body responds to viral infection, immune cells, such as lymphocytes and macrophages, are activated and release inflammatory mediators like cytokines. These molecules cause the blood vessels in the affected area to dilate and become more permeable, allowing fluid to leak into the tissues and cause swelling (edema) (Breslin, 2023). The swelling leads to narrowing of the airway, resulting in the hallmark symptoms of croup, such as a "barking" cough, stridor (a high-pitched wheezing sound), and respiratory distress.

**Role of Immune Response and Viral Replication:** The immune response plays a crucial role in the development of symptoms and disease progression. When a virus like parainfluenza or respiratory syncytial virus (RSV) infects the respiratory epithelium, the body's immune system recognizes the pathogen and mounts a defense (Domachowske & Rosenberg, 1999). Viral replication leads to further damage of the mucosal lining and stimulates an inflammatory cascade. The release of inflammatory mediators, including prostaglandins, histamines, and cytokines,

*ISSN:1624-1940*
http://magellanes.com/

exacerbates the swelling and leads to airway constriction. The virus itself may not cause direct damage to the lower respiratory tract, but the body's immune response to the viral infection is the primary cause of the airway obstruction.

**Progression of Disease from Mild to Severe Obstruction:** In mild cases of croup, the swelling is limited, and the child may experience a mild cough and some hoarseness, with minimal airway obstruction (Pfleger & Eber, 2013). However, in more severe cases, inflammation progresses and causes significant narrowing of the airway. This leads to increased difficulty breathing, with stridor and retractions of the chest as the child works harder to get air. Severe cases may involve complete airway obstruction, where immediate intervention with medications such as corticosteroids or nebulized epinephrine is necessary to reduce inflammation and alleviate the obstruction. If untreated or poorly managed, severe croup can lead to respiratory failure and may require intubation or other advanced airway management techniques.

**Table 1: Pathogenesis of Acute Subglottic Laryngitis (Croup)**

| Step | Description | Clinical Outcome |
|---|---|---|
| **Viral Infection** | Invasion of respiratory viruses (e.g., parainfluenza virus) | Inflammation of the subglottic region |
| **Inflammatory Response** | Immune system activation, release of cytokines | Edema, mucosal swelling, and narrowing of the airway |
| **Airway Obstruction** | Progressive swelling, reduced airflow | Symptoms of respiratory distress (stridor, barking cough) |
| **Resolution or Progression** | Treatment or worsening of the inflammatory process | Recovery or severe obstruction requiring intervention |

**Clinical Picture and Symptoms of Acute Subglottic Laryngitis (Croup)**

The clinical presentation of acute subglottic laryngitis, or croup, is characterized by a combination of respiratory symptoms, which are often distinguishable from other upper respiratory infections (Kivekäs & Rautiainen, 2018; Mustafa et al., 2015). The severity and duration of symptoms can vary, and it is important to recognize signs early to manage the condition effectively (Behlau, 2015; Kwong, Hoa, & Coticchia, 2007).

**Common Symptoms:**

The hallmark symptoms of croup include:

- **Barking Cough:** Often described as a "seal-like" or "barking" cough, this is one of the first signs of croup. It results from inflammation in the subglottic area, which irritates the airway and causes a distinctive, harsh sound (Kivekäs & Rautiainen, 2018).

*ISSN:1624-1940*
http://magellanes.com/

- **Stridor:** A high-pitched wheezing sound heard during inspiration. It occurs due to narrowing of the upper airway, particularly in the subglottic region, and is a key indicator of respiratory distress (Kivekäs & Rautiainen, 2018).
- **Hoarseness:** Swelling and inflammation of the vocal cords may cause hoarseness or loss of voice, especially in the early stages of the infection (Kwong et al., 2007).

**Duration and Severity of Symptoms:**

Symptoms of croup typically begin suddenly, often at night, and can worsen over the course of several hours. The severity of symptoms can vary based on the degree of airway obstruction:

- **Mild cases:** In mild cases, the child may have a barking cough and mild stridor, but they are generally not in significant respiratory distress. These symptoms may improve with home care, such as humidified air or a soothing environment (Behlau, 2015).
- **Moderate to severe cases:** In more severe cases, symptoms can progress to significant respiratory distress, characterized by labored breathing, use of accessory muscles (retractions), and persistent stridor even at rest. These children may appear agitated, anxious, or fatigued due to the difficulty in breathing (Mustafa et al., 2015; Kivekäs & Rautiainen, 2018).

**Identification of Moderate to Severe Cases:**

Moderate to severe cases of croup require urgent attention and possible hospitalization. Indicators of more severe disease include:

- **Respiratory Distress:** Increased effort in breathing, such as flaring of the nostrils, use of accessory muscles, and visible retractions (when the skin sinks in around the ribs or collarbone during breathing) (Kwong et al., 2007).
- **Retractions:** The skin over the chest or abdomen may visibly sink with each breath, a sign that the body is working harder to get air (Kivekäs & Rautiainen, 2018).
- **Hypoxia:** A decrease in oxygen levels in the blood, which may present as cyanosis (bluish discoloration of the lips or face), tachypnea (increased respiratory rate), or lethargy. This requires immediate intervention, as hypoxia can lead to respiratory failure if not managed promptly (Mustafa et al., 2015).

**Importance of Recognizing Clinical Signs Early:** Early recognition of the clinical signs of croup is essential for effective management. By identifying the severity of the disease early on, clinicians can decide on the appropriate course of treatment, whether that be supportive care, corticosteroids, or nebulized epinephrine. In cases where the child's breathing becomes more difficult or hypoxia develops, early intervention can prevent the need for more invasive procedures, such as intubation or ventilation. Additionally, parents and caregivers should be educated to seek medical care if symptoms worsen or if they notice signs of significant distress in their child, such as persistent stridor or difficulty in speaking.

Bower & McBride, 2014). While a detailed medical history and physical exam are typically sufficient for diagnosis, certain diagnostic tools may be used to confirm the condition and assess its severity. Additionally, differential diagnosis is important to rule out other conditions that may present with similar symptoms of upper airway obstruction (Skolnik, 1993; O'Brien, 2015).

**Clinical Diagnosis:**

- **History:** The diagnosis often begins with a detailed history, which may include symptoms such as the sudden onset of a "barking" cough, stridor, and hoarseness, especially in children aged 6 months to 3 years. Symptoms frequently worsen at night and may be preceded by a viral upper respiratory infection (Pham et al., 2016).

*ISSN:1624-1940*
http://magellanes.com/

- **Physical Examination:** During the physical examination, physicians will listen for characteristic findings, such as a harsh, seal-like cough and audible stridor, which are key indicators of croup. The presence of retractions and respiratory distress can help determine the severity of the disease (Petrocheilou et al., 2014).

**Use of Diagnostic Tools:** Although the diagnosis of croup is typically made based on clinical presentation, several diagnostic tools may be employed to confirm the diagnosis and assess the extent of airway obstruction:

- **Neck X-ray:** A lateral neck X-ray may be ordered if the diagnosis is unclear or if complications are suspected. In typical croup cases, a "steeple sign" may be seen on the X-ray, which refers to a narrowing of the subglottic airway resembling the shape of a church steeple. This is a classic finding in croup but is not required for diagnosis (Bower & McBride, 2014).
- **Pulse Oximetry:** Pulse oximetry is a non-invasive method to measure the oxygen saturation levels in the blood. It is particularly useful for assessing the severity of respiratory distress and determining the need for supplemental oxygen. In severe cases of croup, low oxygen saturation levels (hypoxia) may be detected, signaling the need for more aggressive treatment (Petrocheilou et al., 2014).
- **Differential Diagnosis:** While croup is the most common cause of a barking cough and stridor in young children, other conditions may present with similar symptoms and must be ruled out through a differential diagnosis. These include:
- **Epiglottitis:** Epiglottitis, caused by bacterial infections such as *Haemophilus influenzae*, can cause similar symptoms, including stridor, drooling, and difficulty breathing. However, unlike croup, epiglottitis often presents with a more rapid onset of severe symptoms and is associated with fever and a toxic appearance. Epiglottitis is a medical emergency and requires immediate attention.
- **Foreign Body Aspiration:** In cases where a child suddenly develops stridor or wheezing, foreign body aspiration must be considered. This can present similarly to croup but usually has a more abrupt onset and is often associated with a specific event, such as eating or playing with small objects.
- **Bacterial Tracheitis:** This is a bacterial infection of the trachea that may present with a cough, stridor, and fever. It can be differentiated from croup based on the rapid onset of high fever, purulent secretions, and the patient’s general condition, which is often worse than in viral croup.
- **Allergic Reactions or Anaphylaxis:** Severe allergic reactions can also cause airway swelling and stridor. This condition should be considered if there is a history of known allergies, exposure to allergens, or sudden onset of symptoms following a trigger.
- **Laryngomalacia:** This congenital condition involves softening of the laryngeal tissues and is typically associated with inspiratory stridor that is present from birth. Unlike croup, the stridor in laryngomalacia tends to worsen when the child is lying down or feeding and improves with age.

By differentiating croup from these other potential causes of airway obstruction, clinicians can ensure appropriate treatment is provided promptly and avoid unnecessary interventions.

## Management of Acute Subglottic Laryngitis

The management of acute subglottic laryngitis (croup) largely depends on the severity of the

*ISSN:1624-1940*
http://magellanes.com/

symptoms. Most cases are self-limiting and can be managed with supportive care, while more severe cases may require medical intervention to prevent complications and ensure proper recovery.

**Mild Cases:** In mild cases of croup, supportive care is typically sufficient. This includes:

- **Hydration:** Ensuring adequate fluid intake is essential for maintaining hydration and thinning secretions, which can help alleviate some symptoms.
- **Monitoring:** Close monitoring of the child's condition at home is crucial. Parents should be aware of warning signs that may suggest the condition is worsening, such as increasing stridor, respiratory distress, or lethargy.

**Moderate to Severe Cases:** For children with moderate to severe croup, medical intervention is often required:

- **Nebulized Epinephrine:** In cases of significant respiratory distress, nebulized epinephrine is administered to reduce airway swelling and improve airflow. It has a rapid onset of action and can significantly reduce stridor and retractions.
- **Corticosteroids:** Dexamethasone or other corticosteroids are frequently used to reduce inflammation and swelling in the subglottic region. These medications help improve symptoms and shorten the duration of the illness.
- **Oxygen Therapy:** If the child is experiencing hypoxia or significant difficulty breathing, supplemental oxygen may be administered to ensure adequate oxygen levels in the blood.

**Intubation and Emergency Procedures:** In severe cases where respiratory failure occurs, endotracheal intubation may be necessary. This is typically reserved for life-threatening situations where other treatments have failed, and the child's airway is at risk of complete obstruction. Emergency procedures and close monitoring in an intensive care unit (ICU) may be required in these cases.

**Role of Parents and Caregivers:** In cases of mild croup, parents and caregivers can play a crucial role in managing symptoms at home. This includes:

- Keeping the child calm to avoid further airway narrowing caused by agitation.
- Using a humidifier or vaporizer in the child's room to keep the air moist, which can help soothe the throat and reduce coughing.
- Monitoring for any worsening of symptoms and seeking medical attention if necessary.

**Follow-Up Care:** After treatment, follow-up care is essential to monitor the child's recovery and ensure there are no complications. Additionally, parents should be educated on recognizing early signs of recurrence, especially during seasonal peaks of croup.

## Complications and Prognosis

**Possible Complications:** While most cases of croup resolve without major complications, some children may develop issues that require further medical attention:

- **Secondary Bacterial Infections:** Bacterial superinfection of the upper airway may occur, especially if the child has been treated with corticosteroids. Signs of secondary bacterial infections include high fever, worsening cough, and purulent secretions.
- **Respiratory Failure:** Severe airway obstruction, particularly in young children with underlying conditions, may lead to respiratory failure. This is a serious complication that requires immediate intervention, such as intubation or ventilation.

**Long-Term Prognosis:** Most children with croup recover completely with no long-term effects. The prognosis is generally good, especially if appropriate treatment is provided early in the disease course. The majority of children who experience croup will not develop significant

*ISSN:1624-1940*
http://magellanes.com/

complications or persistent respiratory issues.

**Recurrence Rates and Preventive Measures:** Croup can recur in some children, particularly during viral season (fall and winter). The recurrence rate is higher in children who have a history of respiratory illnesses or a family history of asthma. Preventive measures, such as avoiding exposure to viral infections, using humidified air, and ensuring appropriate hydration, can help reduce the risk of recurrence. In some cases, parents may be advised to seek early medical attention if symptoms recur.

## Conclusion

Acute subglottic laryngitis, or croup, is a common condition in young children, typically characterized by a barking cough, stridor, and respiratory distress. The condition is primarily viral in origin, with parainfluenza virus being the most common causative agent. Early recognition of symptoms and appropriate management are key to reducing morbidity. Most cases of croup are self-limiting and can be managed with supportive care, while more severe cases require medical interventions such as nebulized epinephrine, corticosteroids, and, in extreme cases, intubation.

By emphasizing early diagnosis and intervention, healthcare providers can effectively manage croup, reducing the need for emergency procedures and improving outcomes. Awareness of the potential complications, as well as the role of parents and caregivers in managing mild cases at home, is vital for a successful recovery and prevention of recurrence. Further research is needed to refine treatment protocols and better understand the long-term effects of recurrent croup.

## References

1. Baker, R. E., Mahmud, A. S., Miller, I. F., Rajeev, M., Rasambainarivo, F., Rice, B. L., ... & Metcalf, C. J. E. (2022). Infectious disease in an era of global change. Nature Reviews Microbiology, 20(4), 193-205.
2. Behlau, I. (2015). Croup, supraglottitis, and laryngitis. *Clinical Infectious Disease, 199*.
3. *Bower,* J., & McBride, J. T. (2014). Croup in children (acute laryngotracheobronchitis). In *Mandell, Douglas, and Bennett's Principles and Practice of Infectious Diseases* (pp. 762).
4. Breslin, J. W. (2023). Edema and lymphatic clearance: molecular mechanisms and ongoing challenges. Clinical Science, 137(18), 1451-1476.
5. Di Cicco, M., Tozzi, M. G., Ragazzo, V., Peroni, D., & Kantar, A. (2021). Chronic respiratory diseases other than asthma in children: the COVID-19 tsunami. Italian Journal of Pediatrics, 47, 1-11.
6. Domachowske, J. B., & Rosenberg, H. F. (1999). Respiratory syncytial virus infection: immune response, immunopathogenesis, and treatment. Clinical Microbiology Reviews, 12(2), 298-309.
7. Hogg, J. C., Paré, P. D., & Hackett, T. L. (2017). The contribution of small airway obstruction to the pathogenesis of chronic obstructive pulmonary disease. Physiological reviews, 97(2), 529-552.
8. Key, O. (2004). Croup (Laryngitis, Laryngotracheitis, Spasmodic Croup, Laryngotracheobronchitis, Bacterial Tracheitis and Laryngotracheobronchopneumonitis) and Epiglottitis (Supraglottitis).
9. Kivekäs, I., & Rautiainen, M. (2018). Epiglottitis, acute laryngitis, and croup. In *Infections of the ears, nose, throat, and sinuses* (pp. 247-255).
10. Kivekäs, I., & Rautiainen, M. (2018). Epiglottitis, acute laryngitis, and croup. In Infections of the ears, nose, throat, and sinuses (pp. 247-255).

*ISSN:1624-1940*
http://magellanes.com/

11. Kivekäs, I., & Rautiainen, M. (2018). Epiglottitis, acute laryngitis, and croup. Infections of the ears, nose, throat, and sinuses, 247-255.
12. Kivekäs, I., & Rautiainen, M. (2018). Epiglottitis, acute laryngitis, and croup. Infections of the ears, nose, throat, and sinuses, 247-255.
13. Kwong, K., Hoa, M., & Coticchia, J. M. (2007). Recurrent croup: Presentation, diagnosis, and management. American Journal of Otolaryngology, 28(6), 401-407.
14. *Mazurek, H., Bręborowicz, A., Doniec, Z., Emeryk, A., Krenke, K., Kulus, M., & Zielnik-Jurkiewicz, B. (2019). Acute subglottic laryngitis. Etiology, epidemiology, pathogenesis and clinical picture. Advances in Respiratory Medicine, 87(5), 308-316.*
15. Mazurek, H., Bręborowicz, A., Doniec, Z., Emeryk, A., Krenke, K., Kulus, M., & Zielnik-Jurkiewicz, B. (2019). Acute subglottic laryngitis. Etiology, epidemiology, pathogenesis and clinical picture. Advances in Respiratory Medicine, 87(5), 308-316.
16. Mustafa, M., Patawari, P., Muniandy, R. K., Sien, M. M., Parash, M. T. H., & Sieman, J. (2015). Acute laryngitis and croup: Diagnosis and treatment. IOSR Journal of Pharmacy (e)-ISSN, 2250-3013.
17. O'Brien, T. I. M. O. T. H. Y. (2015). Laryngitis, epiglottitis, and tracheitis. *Head, Neck and Orofacial Infections: An Interdisciplinary Approach E-Book*, 282.
18. Petrocheilou, A., Tanou, K., Kalampouka, E., Malakasioti, G., Giannios, C., & Kaditis, A. G. (2014). Viral croup: diagnosis and a treatment algorithm. *Pediatric Pulmonology, 49*(5), 421-429.
19. Pfleger, A., & Eber, E. (2013). Management of acute severe upper airway obstruction in children. Paediatric Respiratory Reviews, 14(2), 70-77.
20. Pham, L. L., Bourayou, R., Maghraoui-Slim, V., & Koné-Paut, I. (2016). Laryngitis, epiglottitis and pharyngitis. *Infectious Diseases, 229*.
21. Pham, L. L., Bourayou, R., Maghraoui-Slim, V., & Koné-Paut, I. (2016). Laryngitis, epiglottitis and pharyngitis. Infectious Diseases, 229.
22. Proença-Módena, J. L., Acrani, G. O., Snider, G. L., Arruda, E., Gerrant, R. L., Walker, D. H., & Weller, P. F. (2011).
23. Skolnik, N. (1993). Croup. *Journal of Family Practice, 37*(2), 165-171.

Tristram, D. (2019). Laryngitis, Tracheitis, Epiglottitis, and Bronchiolitis: Sore Throat, Change in Voice, Feverora Wheezing Infant in Respiratory Distress. Introduction to Clinical Infectious Diseases: A Problem-Based Approach, 75-.