

BACTERIAL TRACHEITIS IN A 9-MONTH-OLD CHILD

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The most common cause of stridor in children presenting to emergency departments during the fall and winter is viral laryngotracheobronchitis, or croup.¹ However, bacterial tracheitis, a rare upper airway infectious disease, has recently emerged as the most common life-threatening upper airway infection in children.² In their article on the re-emergence of bacterial tracheitis, Hopkins et al² announced that “the epidemiology of potentially life-threatening upper airway infections is changing.” This change is partially due to the introduction of the *Haemophilus influenzae* type b (Hib) vaccine, which has contributed to a decreased incidence of epiglottitis.³ The results of a 9-year retrospective study of pediatric patients (n = 107) with potentially life-threatening upper airway infections by Hopkins et al² demonstrated that bacterial tracheitis was 3 times more likely to have caused respiratory failure than both viral croup and epiglottitis combined.

Pediatric Airways: What Makes Them Unique

Emergency nurses are often the frontline staff assessing children who present with fever and stridor. Several anatomic and physiologic differences place infants and children at an increased risk of respiratory distress and failure. The size of an infant's trachea is approximately the diameter of the infant's little finger.⁴ The pediatric respiratory system continues to grow until about the age of 7 or 8 years, when it is similar to that of an adult.⁴ Younger pediatric patients have smaller airways that are more susceptible to obstruction from any insult: secretions, edema, inflammation, trauma, and foreign bodies. In addition, infants and young children have immature accessory

muscles, cartilaginous ribs, higher metabolic rates, increased oxygen demands, and lower residual capacities.^{4,5}

Croup: The Most Common Cause of Stridor

The “bark” of viral croup, the most common upper airway infection, is typically worse than the “bite”; it can sound quite scary but rarely requires hospital admission or active airway intervention.¹ Viral croup remains a very common upper airway infection in children, but the widespread use of systemic corticosteroids for viral croup has had a major impact on the morbidity of the disease.² Croup typically occurs during the fall and winter months, and only about 2% of patients with the condition are admitted to the hospital each year.⁵ The stridor produced from croup is a result of partial obstruction of the upper airway, in contrast to the wheezing common to asthma, which is a result of partial obstruction of the lower airway. The harsh intermittent cough and stridor of croup tends to worsen at night and can be very frightening to parents who have never heard its unique seal-like sound. By the time the parents rush a child with croup to the emergency department, the “attack” and any associated stridor is often resolved, likely because the child has been outdoors breathing in cooler, more humid air, which is known to help alleviate the symptoms of croup. Treatment of croup is symptom- and severity-dependent and typically includes oral steroids such as dexamethasone, as well as nebulized epinephrine and humidified oxygen.⁵ Evidence now exists to support the administration of corticosteroids even in children with mild croup.³

Bacterial Tracheitis: A Life-Threatening Cause of Stridor

Unlike croup, bacterial tracheitis is rare, with an incidence of 4 to 8 per 1,000,000 children.⁶ Bacterial tracheitis can occur in patients with intact (natural) airways and in those with artificial airways such as a tracheostomy. It typically occurs after the patient experiences an insult (such as trauma or intubation) or an antecedent upper respiratory infection. Bacterial tracheitis occurs almost exclusively in children.⁶ Patients with bacterial tracheitis present with a combination of symptoms that mimic both croup and epiglottitis. However, clinical deterioration in patients with bacterial

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TABLE

A comparison of croup, bacterial tracheitis, and epiglottitis

Variable	Croup	Epiglottitis	Bacterial tracheitis
Causative organisms	Parainfluenza viruses, influenza A and B, respiratory syncytial virus, and rhinovirus ⁴	<i>Haemophilus influenzae</i> type B, streptococcus, staphylococcus, and pneumococci ⁴	<i>Staphylococcus aureus</i> , <i>Haemophilus influenzae</i> type B, streptococcus, <i>Moraxella catarrhalis</i> , and <i>Pseudomonas</i> and <i>Neisseria</i> organisms ⁵
Peak incidence	6 mo–3 y ⁴	2–6 y ⁴	3–8 y ¹
Typical clinical presentation	Barking cough that is worse at night, low-grade fever, hoarse voice, stridor in more severe cases	High fever, sore throat, dysphagia, muffled voice, stridor, drooling	High fever, respiratory distress, cough, hoarse voice, sore throat, prominent stridor (inspiratory or biphasic)
Onset	Gradual; 2–3 d after onset of upper respiratory symptoms	Acute	Acute, several days after onset of upper respiratory symptoms; rapid worsening of symptoms within 2–10 h
Treatments	Systemic corticosteroids, nebulized epinephrine, humidified respiratory gases, oxygen	Intubation, IV antibiotics	Intubation to secure the airway, suctioning, bronchoscopic debridement, IV antibiotics

tracheitis can be rapid, typically occurring within 2 to 10 hours. Bacterial tracheitis therefore should be considered in the stridulous child who does not respond to traditional treatment such as nebulized epinephrine and systemic corticosteroids.

In a child with bacterial tracheitis, as with croup, the thickening of the trachea can result in a “steeple sign” that is present on an anteroposterior neck radiograph (ie, a tapering of the trachea that looks similar to an inverted “V”).³ However, the diagnosis of bacterial tracheitis is confirmed by direct visualization¹ with bronchoscopy or intubation. Endoscopic findings of bacterial tracheitis include edema and erythema of the subglottis, mucopurulent tracheal secretions, pseudomembrane formation along the tracheal wall mucosa, and sloughing of the tracheal mucosa that can lead to complete airway obstruction.⁶

Comparing Croup, Bacterial Tracheitis, and Epiglottitis

Although viral croup is typically benign and is responsible for about 80% of acute stridor in children,⁴ epiglottitis and bacterial tracheitis must still be considered in the differential diagnosis. Left unchecked, both epiglottitis and bacterial tracheitis can rapidly become life threatening. These 3 infections and their most common presenting symptoms are compared in the [Table](#).

Case: A 9-Month-Old Child with Bacterial Tracheitis

A 9-month-old girl presented to the pediatric emergency department of a major medical center in southeastern North Carolina with a 2-day history of fever, nasal congestion, and a barking cough. The child’s mother reported that the infant was drinking well and that her immunizations were up to date. Upon examination the child had a temperature of 99.6°F, a heart rate of 146, and a respiratory rate of 38 with a pulse oximetry reading of 98% on room air. The respiratory examination revealed no retractions, stridor, or nasal flaring and no use of accessory muscles. The lungs were clear to auscultation bilaterally. The infant was diagnosed with mild croup, given oral dexamethasone, and discharged home with instructions to follow up with her primary care physician in 2 to 3 days or to return to the emergency department if her condition worsened.

Three days later the patient returned to the pediatric emergency department with a temperature of 103°F, a heart rate of 205, a respiratory rate of 60, and oxygen saturations of 90% on room air. The mother reported that during the past 3 days her daughter continued to have fever, cough, and difficulty breathing. The family did follow up with their pediatrician as instructed but returned to the pediatric emergency room a day later because of the infant’s increased work of breathing. Upon repeat triage examination, she was

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