

# Bacterial Tracheitis: A case report

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## Abstract

Bacterial tracheitis is an infectious cause of acute upper airway obstruction in children. Although tracheitis presents similar to croup with respiratory distress and stridor, this disease entity must be differentiated from the latter early, as the therapy for each disease is different. We present a case of bacterial tracheitis describing the clinical course, pertinent laboratory and radiological examinations and treatment.

## Introduction

Bacterial tracheitis is a rare, life-threatening form of upper airway obstruction usually seen in children. It is often confused with other forms of upper airway obstruction and must be distinguished from viral croup and epiglottitis [1]. The incidence of bacterial tracheitis is much lower than that of viral croup and higher than that of epiglottitis. Cases occur most frequently in preschool children and boys are more commonly affected than girls. Most patients present with acute onset of respiratory distress, fever, toxicity, and stridor after a prodrome of upper respiratory tract infection lasting a few days [2]. This condition may rapidly progress and the standard croup treatment is ineffective. Tracheitis requires hospitalization and almost always, endotracheal intubation. The diagnosis is based on endoscopic findings of tracheal inflammation and should be suspected if a child with croup-like symptoms does not respond to conventional therapy.

## Case report

A 10-month-old previously healthy white male presents to the Emergency Department (ED) in acute respiratory distress and stridor. He had a one-day history of moderately high-grade fever, cough with hoarseness. The patient already been seen earlier in the day at his doctor's office and had been diagnosed to have croup. There was no associated drooling. He was suspected to have a penicillin allergy and a maternal aunt was known to have bronchial asthma. Immunizations were up to date, including Prevnar®. His elder siblings exhibited similar symptoms of croup. The patient had no history of exposure to any daycare environment.

At the ED, the patient was highly febrile (39°C/103°F), tachycardic (180 beats per minute) but normotensive and breathing at a rate of 40/min. SpO<sub>2</sub> in room air was 88-90%. Significant on physical examination was the moderate respiratory distress with appreciable inspiratory stridor. He had normal breath sound intensity and clear breath sounds, without wheezing or crackles on auscultation.

He was administered one nebulization of racemic epinephrine and intramuscular Dexamethasone at night with improvement as recorded by less stridor and SpO<sub>2</sub> of 94% in room air. He was then admitted for further observation with a diagnosis of croup. Increased progression of stridor and associated desaturation to 86% in room air was noted the next morning and another nebulization with racemic epinephrine was given. Despite the treatment however, he required oxygen supplement with 1-liter per minute with nasal cannula to maintain SpO<sub>2</sub> at 90%. Capillary blood gas pH was 7.35 with pCO<sub>2</sub> of 41. His CBC showed significant bandemia (44%). His chest radiograph showed normal findings. There was subglottic narrowing evident on a lateral neck x-ray. He was then transferred to the pediatric intensive care unit (PICU) for elective intubation and the Otorhinolaryngology (ENT) and Infectious Disease (ID) Services were consulted

During intubation, purulent secretions were immediately evident. The specimen on Gram stain showed 4+ Gram positive cocci and 3+ polymorphonuclears (PMNs) while culture isolated 4+ Streptococcus pneumoniae, 3+ Hemophilus influenza and 3+ Moraxella catarrhalis. While awaiting sensitivity studies, treatment with intravenous (IV) Vancomycin, Clindamycin and gentamicin was empirically given. S. pneumoniae showed sensitivity to penicillin and clindamycin while H. influenza was identified as beta lactamase negative. The patient was extubated within 72 hours and did well with no residual stridor. SpO2 in room air was 96%. He became afebrile without any neurological or pulmonary sequelae. Resolution of fever He completed a 7-day IV course of Vancomycin and Clindamycin. He was discharged from the hospital after 8 days to complete another 3 days of oral Clindamycin.

## **Discussion**

Bacterial tracheitis term was first coined by Jones in 1979 [3] although it was Bland, a French doctor, who gave the first accurate description of laryngotracheo-bronchitis (LTB) in 1823 [4]. Previously, this disease entity was known as membranous croup or membranous laryngotracheobronchitis. Bacterial tracheitis is a condition characterized by stridor, cough, fever, toxic appearance and failure to respond to the usual croup therapy (nebulized racemic epinephrine and systemic steroids). There is usually a history of an upper respiratory tract infection. Fever is usually present with bacterial tracheitis, but is not a universal finding. Jones and Donnelly described eight patients in different series and 1 out of 8 in each series did not have a documented fever [3,5]. Failure or a poor response to nebulized racemic epinephrine is a hallmark of bacterial tracheitis. Sofer reported that three out of seven patients with bacterial tracheitis did not respond to nebulized epinephrine compared to 12/12 croup patients who responded to nebulized epinephrine [6]. Our patient responded to racemic epinephrine transiently.

The differential diagnosis of bacterial tracheitis includes any cause of stridor and upper airway obstruction in a child. Croup or acute laryngotracheobronchitis is a relatively benign cause of stridor in children. Croup is caused by many viruses, most commonly parainfluenza resulting in subglottic edema. The highest incidence is at 2 years of age, but is commonly seen in children 1-6 years of age [5]. About 4% of croup patients need hospitalization. Usual treatment for these patients includes cool mist, nebulized epinephrine, and systemic steroids.

Another cause of acute upper airway obstruction is acute epiglottitis. This is now a rare infection classically caused by H. influenza, but other bacterial and viral etiologies have been documented.

Acute epiglottitis is an airway emergency. The patient is usually febrile and appears toxic. He has a tripod posture with extended neck. Management includes airway control and systemic antibiotics. The incidence of this disease has decreased since the introduction H. influenza type B vaccine.

The epidemiology of bacterial tracheitis has changed since first reported by Jones in 1979 [3]. The disease is still more prevalent in the winter months, but the mean age of the patients has increased<sup>6</sup>. Bacterial tracheitis has been reported from 3 weeks to 16 years of age [1,5]. Jones' patients ranged between 3 weeks to 6 years of age with seven out of eight patients being younger than 3 years of age [3]. Bernstein in 1998 had 20 nonintubated patients with a mean age of 98.9 months and 26 intubated patients with a mean age of 46.9 months. The mean age for all patients in this study was 69.3 months [7].

The diagnosis of bacterial tracheitis is based on the presence of upper airway obstruction and one of the following three criteria: (i) Radiographic evidence of intratracheal membranes, (ii) laryngotracheal inflammation or purulent secretions on bronchoscopy, and (iii) tracheal aspirate positive for leukocytes on gram stain or positive culture [8]. Laboratory studies other than tracheal culture are of limited value in the diagnosis of bacterial tracheitis. The white blood cell count can vary between 1200- 34600/mm with a shift to left [7,8]. An elevated absolute band neutrophil count has been documented by Jones, Donnelly, and Sofer [3,5,6]. The patient we presented had a normal white blood cell count, but did exhibit an elevated band cell count. Blood cultures also of limited value in the diagnosis of bacterial tracheitis. Blood cultures were all negative in some studies [1,6]. There are reports of positive blood cultures especially when the causative organism is H. influenza.

It is unlikely that H. influenza would cause invasive disease today, unless the patient is unvaccinated or immunocompromised. Tracheal gram stain and cultures are useful in the diagnosis and management of bacterial tracheitis. Tracheal cultures can be obtained via bronchoscopy or after endotracheal intubation. Tracheal cultures and gram stain are frequently positive. Jones reported all 8 of his patient's with a positive tracheal culture [3]. Bernstein reported 84% positive cultures in 45 patients and Sofer reported 6/7 patients with a positive tracheal culture [7,6]. The advent of viral culture and direct immunofluorescence has shown that concomitant viral and bacterial infection is common.

Radiological imaging may aid in the diagnosis of bacterial tracheitis. A lateral neck x-ray looking for intratracheal membranes or tracheal irregularities is indicated in the diagnostic evaluation of bacterial tracheitis. Reports of positive intratracheal membranes or tracheal irregularities have varied from approximately 20% to 82% in the latest series from Bernstein.[7]. The available data show that a positive lateral neck radiograph is diagnostic, but a negative finding is nonspecific. Chest radiographs may be helpful in the diagnosis of bacterial tracheitis. Chest radiograph normalities have been reported in several studies. Jones et al reported seven to eight patients had abnormalities including focal infiltrates, atelectasis, and air trapping. Others have reported between 50-60% of patients with a focal infiltrate on presentation [3,4]. In Bernstein's series, 61% of 46 patients had a chest x-ray and seven had pulmonary infiltrates, seven had atelectasis, two had hyperinflation, and two had pulmonary edema [7]. The chest radiograph is a poor test for bacterial tracheitis, but the clinician should be alerted when a patient with stridor or symptoms of croup has one of the above findings.

The etiology of bacterial tracheitis has changed since 1979 when Jones first described this entity. Staphylococcus aureus and H. influenza are the usual causative agents of bacterial tracheitis [3].

M. catarrhalis and viral pathogens also cause tracheitis. Jones speculated as early as 1979 that bacterial tracheitis could have a viral component [3], and indeed more recent studies have tended to confirm his early speculation. Donnelly showed that five out of eight patients in his study had parainfluenza or influenza viruses. Bernstein showed that with 46 patients: 27% had M. catarrhalis, 22% had S. aureus, 18% had H. influenza, 9% had group a streptococcus, 16% had no organism [7]. Approximately half of her patients had viral cultures, 72% had influenza A and 72% had both a positive bacterial culture and influenza A culture. Experiments have shown that viral respiratory infections and influenza A facilitate the adherence of S. aureus, H. influenza and S. pneumonia to pharyngeal cells of human volunteers. Treatment of bacterial tracheitis includes initial attention to the airway, breathing, and circulation.

Endotracheal intubation is needed in some patients. Earlier studies cite a need to intubate up to 80% of patients. The more recent study by Bernstein showed a 57% intubation rate [7]. The earlier literature advocated early tracheostomy, but more recent data no longer advocates this practice. Humidification of the inspired air and frequent suctioning of the endotracheal tube is needed to prevent mucous plugging. Initial antibiotic therapy should target the most common respiratory pathogens and S. aureus. Cefuroxime or ceftriaxone are reasonable first line therapy. A positive gram stain or culture of the trachea facilitates antibiotic management. We chose ceftriaxone as first line therapy in our patient. Vancomycin was added considering resistant pathogens when the gram stain results showed gram-positive cocci.

The complications of bacterial tracheitis include acute upper airway obstruction, respiratory arrest, pulmonary edema and pneumonia [8,9]. Seizures and anoxic brain injury have been reported secondary to hypoxia [8] Toxic shock syndrome and ARDS have been documented secondary to staphylococcal tracheitis [9]. These complications are uncommon, but have been reported in the literature. The mortality from bacterial tracheitis has been reported to be 0-20%. The higher mortality is reported from the earlier literature. The latest series by Bernstein however reported no mortality [7].

## **Conclusion**

A child with cough, stridor, fever and a toxic appearance should raise suspicion for bacterial tracheitis. Increased oxygen requirement and failure to respond to nebulized epinephrine and systemic steroids should further alert the clinician towards diagnosis of bacterial tracheitis. If a chest radiograph shows a focal infiltrate and a complete blood count shows bacteremia, then the possibility of bacterial tracheitis is more likely.

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