**Bacterial tracheitis in children: Clinical features and diagnosis**

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**INTRODUCTION**The clinical features and diagnosis of bacterial tracheitis in children will be reviewed here. The treatment of bacterial tracheitis and tracheal infections associated with tracheostomy tubes and endotracheal intubation in children are discussed separately. (See ["Bacterial tracheitis in children: Treatment and prevention"](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-treatment-and-prevention?search=acute+airway+obstruction&topicRef=6034&source=see_link) and ["Tracheobronchitis associated with tracheostomy tubes and endotracheal intubation in children"](https://www-uptodate-com.uchile.idm.oclc.org/contents/tracheobronchitis-associated-with-tracheostomy-tubes-and-endotracheal-intubation-in-children?search=acute+airway+obstruction&topicRef=6034&source=see_link).)

**TERMINOLOGY**Bacterial tracheitis is an invasive exudative bacterial infection of the soft tissues of the trachea ([picture 1](https://www-uptodate-com.uchile.idm.oclc.org/contents/image?imageKey=PEDS%2F55364&topicKey=PEDS%2F6034&search=acute+airway+obstruction&source=see_link)) [[1](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/1)]. In some cases, there is involvement of the subglottic laryngeal structures, extension into the upper bronchial tree, or associated pneumonia [[2-5](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/2-5)]. Thus, "acute bacterial laryngotracheobronchitis" may be a more accurate clinical and anatomic description of this entity, but "bacterial tracheitis" is the preferred terminology in most publications. (See ['Pathogenesis and pathology'](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis?search=acute%20airway%20obstruction&topicRef=6455&source=see_link#H3) below.)

Other terms that have been used to describe bacterial tracheitis include "exudative tracheitis," "bacterial croup," "membranous croup," "pseudomembranous croup," "acute laryngotracheobronchitis," and "membranous laryngotracheobronchitis" [[6](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/6)].

The discussion below addresses bacterial tracheitis in children without an artificial airway in place. Tracheal infections associated with tracheostomy and endotracheal tubes are discussed separately. (See ["Tracheobronchitis associated with tracheostomy tubes and endotracheal intubation in children"](https://www-uptodate-com.uchile.idm.oclc.org/contents/tracheobronchitis-associated-with-tracheostomy-tubes-and-endotracheal-intubation-in-children?search=acute+airway+obstruction&topicRef=6034&source=see_link).)

**PATHOGENESIS AND PATHOLOGY**The larynx of healthy individuals is often colonized with bacterial species common to the upper respiratory tract, some of which are potential pathogens (eg, *Staphylococcus aureus*, *Streptococcus pneumoniae*, gram-negative enteric bacteria, *Pseudomonas aeruginosa*). Such colonization can extend, at least transiently, into the trachea [[7](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/7)]. Bacterial colonization of the trachea may be present within 24 hours after birth, even in infants born at <31 weeks gestation [[8](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/8)].

Bacterial tracheitis almost always occurs in the setting of prior airway mucosal damage, as occurs with antecedent viral infection [[9,10](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/9,10)] (see ['Predisposing viruses'](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis?search=acute%20airway%20obstruction&topicRef=6455&source=see_link#H7) below). Aspiration of bacteria-laden secretions into the trachea during bacterial infection of the upper respiratory tract (eg, acute bacterial sinusitis, streptococcal pharyngitis) or after tonsillectomy also may lead to bacterial tracheitis [[9,11](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/9,11)].

Extension of tracheal infection into the bloodstream is uncommon, as blood cultures are rarely positive [[6,9,12-14](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/6,9,12-14)].

Pathologic findings vary depending upon the combination of specific predisposing virus and bacterial etiology [[15,16](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/15,16)]. Autopsy examinations have noted severe subglottic obstruction caused by edema, necrotic debris, and purulent secretions. The tracheal mucosa is edematous and hyperemic. Patches of mucosa may be necrotic or sloughed. Cellular infiltrates of mononuclear and polymorphonuclear cells are present in the mucosa and submucosa. Microabscesses may be present [[17](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/17)].

**EPIDEMIOLOGY**The true incidence of bacterial tracheitis is not known, but it appears to be rare [[18](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/18)]. The estimated incidence was 0.1 cases per 100,000 children per year in a multicenter review that identified 34 cases between 1993 and 2007 [[19](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/19)]. Nonetheless, bacterial tracheitis is among the most frequent pediatric airway emergencies requiring admission to an intensive care unit [[5,20](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/5,20)].

Bacterial tracheitis generally occurs during the first six years of life (mean age in a systematic review of 300 cases ranged from 10 to 75 months) [[21](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/21)]. However, it has been reported in infants as young as one month, adolescents, and adults [[22](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/22)]. There is a slight male predominance (male-to-female ratio of 1.3:1) [[21](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/21)].

The majority of cases of bacterial tracheitis occur in previously healthy children in the setting of a viral respiratory tract infection [[6](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/6)]. Bacterial tracheitis occurred as a complication in 21 (0.3 percent) of 6769 children <18 years old who were hospitalized with influenza infection from 2003 to 2010 in the United States [[23](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/23)].

The majority of cases occur in the fall and winter, coinciding with the typical seasonal epidemics of parainfluenza, respiratory syncytial virus, and seasonal influenza [[1,4,9,19](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/1,4,9,19)]. (See ["Respiratory syncytial virus infection: Clinical features and diagnosis", section on 'Epidemiology'](https://www-uptodate-com.uchile.idm.oclc.org/contents/respiratory-syncytial-virus-infection-clinical-features-and-diagnosis?sectionName=EPIDEMIOLOGY&search=acute+airway+obstruction&topicRef=6034&anchor=H2&source=see_link#H2) and ["Epidemiology of influenza", section on 'Seasonality'](https://www-uptodate-com.uchile.idm.oclc.org/contents/epidemiology-of-influenza?sectionName=Seasonality&search=acute+airway+obstruction&topicRef=6034&anchor=H8&source=see_link#H8) and ["Parainfluenza viruses in children", section on 'Epidemiology'](https://www-uptodate-com.uchile.idm.oclc.org/contents/parainfluenza-viruses-in-children?sectionName=EPIDEMIOLOGY&search=acute+airway+obstruction&topicRef=6034&anchor=H6&source=see_link#H6).)

**MICROBIOLOGY**

**Bacterial isolates** — *S. aureus* is the most common bacterial isolate in nearly all case series; there are isolated reports of bacterial tracheitis caused by methicillin-resistant *S. aureus* [[18,19,21,24,25](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/18,19,21,24,25)]. Other commonly isolated bacteria include *S. pneumoniae*, group A S*treptococcus* (*Streptococcus pyogenes*), alpha-hemolytic streptococci, and *Moraxella catarrhalis* (which is more common among younger children [[4](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/4)]). *Haemophilus influenzae*strains, including type b (Hib) and nontypeable strains, also can be etiologies of bacterial tracheitis [[5,19,24](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/5,19,24)].

Rarely reported isolates include *P. aeruginosa*, *Haemophilus parainfluenzae* [[6,17](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/6,17)], *Klebsiella pneumoniae* [[6](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/6)], *Escherichia coli*, *Corynebacterium* spp (including *Corynebacterium* *diphtheriae*), *Neisseria* spp, *Serratia marcescens*, and anaerobes, including *Prevotella* spp [[6,9,17,21,22,24](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/6,9,17,21,22,24)]. Bacterial tracheitis is often polymicrobial [[2,4,5,24,26](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/2,4,5,24,26)].

There are reports of cases with cultures yielding only normal oropharyngeal flora and negative cultures in patients without prior antibiotic therapy [[2,4,22](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/2,4,22)]. Isolated viral infection, uncultured fastidious or anaerobic microbes, and improper specimen processing are possible explanations for such cases.

**Predisposing viruses** — Viruses that have been isolated in children with bacterial tracheitis include parainfluenza, influenza A and B, respiratory syncytial virus, rhinovirus, measles, and enterovirus [[3,4,10,16,25](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/3,4,10,16,25)]. Parainfluenza and influenza A appear to be the most commonly associated viruses [[4,25](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/4,25)]. Herpes simplex virus may predispose to and cause tracheitis, particularly in individuals who are immune compromised [[27-29](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/27-29)].

**PRESENTATION**

**No artificial airway** — Two primary presentations of bacterial tracheitis have been described in children without artificial airways [[6,17,30](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/6,17,30)]:

●In most children, prodromal symptoms and signs suggestive of viral respiratory tract infection are present for one to three days before more severe signs of illness, such as stridor and dyspnea, develop (secondary bacterial tracheitis) [[1,3,4](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/1,3,4)].

●In a minority of children, onset is fulminant, with progression to acute respiratory distress less than 24 hours after the onset of initially minor symptoms (primary bacterial tracheitis). Most children with fulminant onset are toxic appearing, with fever and leukocytosis at the time of presentation.

**Artificial airway** — Tracheal infections associated with tracheostomy tubes and endotracheal intubation in children are discussed separately. (See ["Tracheobronchitis associated with tracheostomy tubes and endotracheal intubation in children"](https://www-uptodate-com.uchile.idm.oclc.org/contents/tracheobronchitis-associated-with-tracheostomy-tubes-and-endotracheal-intubation-in-children?search=acute+airway+obstruction&topicRef=6034&source=see_link).)

**CLINICAL FEATURES**

**Airway obstruction** — The predominant clinical features of bacterial tracheitis are those of airway obstruction: stridor, cough, and respiratory distress. In children with signs of severe airway obstruction or impending respiratory failure (ie, marked retractions, poor air entry, fatigue, listlessness, or depressed level of consciousness), airway control precedes diagnostic evaluation. Children younger than two to three years of age may be at increased risk for severe disease because of their relatively narrow airway diameter [[4](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/4)]. (See ["Emergency evaluation of acute upper airway obstruction in children"](https://www-uptodate-com.uchile.idm.oclc.org/contents/emergency-evaluation-of-acute-upper-airway-obstruction-in-children?search=acute+airway+obstruction&topicRef=6034&source=see_link) and ["Emergency endotracheal intubation in children"](https://www-uptodate-com.uchile.idm.oclc.org/contents/emergency-endotracheal-intubation-in-children?search=acute+airway+obstruction&topicRef=6034&source=see_link).)

**Symptoms and signs** — Common clinical features include [[25](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/25)]:

●Fever (common but not universal)

●Stridor (inspiratory or biphasic)

●Cough (membranous exudates may be expectorated)

●Respiratory distress

●Odynophagia or dysphagia

●Drooling is uncommon but may be present

●Hoarseness or voice changes

The reported frequencies of symptoms and signs vary in different case series ([table 1](https://www-uptodate-com.uchile.idm.oclc.org/contents/image?imageKey=PEDS%2F70282&topicKey=PEDS%2F6034&search=acute+airway+obstruction&source=see_link)) [[2,4-6,9,22,31](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/2,4-6,9,22,31)]. The variation of findings among these reports likely reflects different combinations of antecedent viral infections and bacterial pathogens, and differences in case severity (some series included only patients admitted to the intensive care unit).

Other uncommon but reported symptoms and signs include neck pain, orthopnea, choking, dysphagia, dysphonia, and syncope [[6,14](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/6,14)]. Patients with significant obstruction may have cyanosis, somnolence, or combative behaviors (related to hypoxemia and/or hypercarbia) [[32](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/32)].

Hoarseness and wheezing, when present, usually reflect the underlying viral infection (eg, parainfluenza and respiratory syncytial virus, respectively), but occasionally may be due to bacterial infection of the laryngeal structures or extending from the trachea into the bronchial tree. Rhinorrhea, exanthems, pharyngitis, poor perfusion, erythroderma, lethargy, and other findings that represent manifestations of the associated viral infection or bacterial sepsis or toxin production also may be present.

Toxic shock syndrome and scarlet fever have been reported in association with *S. aureus* and group A *Streptococcus* bacterial tracheitis, respectively [[26,33,34](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/26,33,34)].

**Radiographic features** — In patients with signs of severe airway obstruction or impending respiratory failure (ie, marked retractions, poor air entry, fatigue, listlessness, or depressed level of consciousness), radiographic evaluation should be deferred until after the airway has been controlled.

Findings on lateral neck or anteroposterior radiographs in a patient without an artificial airway in place typically show subglottic tracheal narrowing (steeple sign) ([image 1](https://www-uptodate-com.uchile.idm.oclc.org/contents/image?imageKey=PEDS%2F52418&topicKey=PEDS%2F6034&search=acute+airway+obstruction&source=see_link)). However, this finding is nonspecific and may also be seen in viral croup and in healthy children during inspiration. Irregularity of the margins of the tracheal mucosa below the subglottis and/or presence of irregular or linear shadows (membranes) in the tracheal lumen are common but not universal ([image 2](https://www-uptodate-com.uchile.idm.oclc.org/contents/image?imageKey=PEDS%2F80331&topicKey=PEDS%2F6034&search=acute+airway+obstruction&source=see_link)) [[35](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/35)]. Serial radiographs are generally not necessary, but if obtained they may demonstrate change in position or disappearance of such shadows as the exudates or pseudomembranes shift position or are expectorated [[12,35](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/12,35)]. Exudates or pseudomembranes can mimic the appearance of foreign bodies in the airway [[12,35,36](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/12,35,36)].

Other findings may include pulmonary infiltrates, atelectasis, hyperinflation, and/or pulmonary edema [[1,3,14,26](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/1,3,14,26)].

**Laboratory features** — Neither a complete blood count with differential nor inflammatory markers are helpful in confirming or excluding the diagnosis of bacterial tracheitis. The white blood cell (WBC) count is highly variable. Mild leukopenia is as common as leukocytosis. Increased proportion of bands and/or absolute band counts are common [[1,5,26](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/1,5,26)]. WBC count does not correlate with severity of illness or ultimate length of hospitalization [[4,22](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/4,22)]. In the only series that evaluated inflammatory markers, erythrocyte sedimentation rate or C-reactive protein were elevated in 26 of 38 patients (68 percent) [[22](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/22)], but these markers are nonspecific.

Gram stain of exudates typically shows neutrophils and may show one or more bacterial morphologies [[1,3,14,26](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/1,3,14,26)]. Blood cultures are rarely positive [[6,9,12-14](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/6,9,12-14)]. (See ['Etiologic diagnosis'](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis?search=acute%20airway%20obstruction&topicRef=6455&source=see_link#H21) below.)

**DIAGNOSIS**

**Presumptive diagnosis** — A presumptive diagnosis of bacterial tracheitis can be made on the basis of acute onset of airway obstruction with consistent clinical and radiographic features ([table 1](https://www-uptodate-com.uchile.idm.oclc.org/contents/image?imageKey=PEDS%2F70282&topicKey=PEDS%2F6034&search=acute+airway+obstruction&source=see_link) and [image 2](https://www-uptodate-com.uchile.idm.oclc.org/contents/image?imageKey=PEDS%2F80331&topicKey=PEDS%2F6034&search=acute+airway+obstruction&source=see_link)) in the setting of a preceding viral upper respiratory infection (URI) [[4,5,36,37](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/4,5,36,37)]. High fevers, toxic appearance, and poor response to treatment with nebulized [epinephrine](https://www-uptodate-com.uchile.idm.oclc.org/contents/epinephrine-adrenaline-pediatric-drug-information?search=acute+airway+obstruction&topicRef=6034&source=see_link) are particularly suggestive findings but may be absent in some patients [[38](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/38)]. (See ['Clinical features'](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis?search=acute%20airway%20obstruction&topicRef=6455&source=see_link#H11) above.)

Laboratory features (eg, white blood cell count, inflammatory markers) are not helpful in making or excluding the diagnosis. (See ['Laboratory features'](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis?search=acute%20airway%20obstruction&topicRef=6455&source=see_link#H15) above.)

**Bronchoscopic diagnosis** — Definitive diagnosis of bacterial tracheitis requires direct visualization of the airway via laryngoscopy and tracheobronchoscopy ([picture 1](https://www-uptodate-com.uchile.idm.oclc.org/contents/image?imageKey=PEDS%2F55364&topicKey=PEDS%2F6034&search=acute+airway+obstruction&source=see_link)). However, not all affected children require bronchoscopy. The decision depends in large part upon the severity of the presentation.

**Approach** — Our approach to determining the need for bronchoscopy is as follows [[6,25](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/6,25)]:

●Impending respiratory failure – For children presenting with signs of severe airway obstruction and impending respiratory failure (ie, marked retractions, poor air entry, fatigue, listlessness, depressed level of consciousness) airway control precedes diagnostic evaluation. If time allows, the patient should be transported to the operating room where an artificial airway can be established. Operative bronchoscopy is performed once the child is stabilized. Additional details of airway management are discussed separately. (See ["Bacterial tracheitis in children: Treatment and prevention", section on 'Intubation'](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-treatment-and-prevention?sectionName=Intubation&search=acute+airway+obstruction&topicRef=6034&anchor=H2762482385&source=see_link#H2762482385) and ["Emergency evaluation of acute upper airway obstruction in children"](https://www-uptodate-com.uchile.idm.oclc.org/contents/emergency-evaluation-of-acute-upper-airway-obstruction-in-children?search=acute+airway+obstruction&topicRef=6034&source=see_link).)

●High clinical suspicion – For children without respiratory failure but with a high level of clinical suspicion for bacterial tracheitis (eg, a child with acute onset of airway obstruction [stridor and dyspnea] in the setting of preceding viral URI, with poor response to inhaled [epinephrine](https://www-uptodate-com.uchile.idm.oclc.org/contents/epinephrine-adrenaline-pediatric-drug-information?search=acute+airway+obstruction&topicRef=6034&source=see_link), and with tracheal irregularity on airway radiograph), we proceed with bronchoscopy in the operating room setting. Debridement of tracheal exudates via rigid bronchoscopy may produce sufficient improvement to permit further management without intubation [[4,6](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/4,6)]. (See ["Bacterial tracheitis in children: Treatment and prevention", section on 'Bronchoscopy'](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-treatment-and-prevention?sectionName=Bronchoscopy&search=acute+airway+obstruction&topicRef=6034&anchor=H436258663&source=see_link#H436258663).)

●Less severe presentation – For children with a less severe presentation (eg, stridor, cough, odynophagia, and fever without significant respiratory distress), we perform bedside flexible laryngoscopy as the initial evaluation. We proceed to operative bronchoscopy only if flexible laryngoscopy reveals purulent secretions that persist despite suctioning or if the child subsequently develops more severe airway obstruction. (See ["Bacterial tracheitis in children: Treatment and prevention", section on 'Ongoing assessment of the airway'](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-treatment-and-prevention?sectionName=Ongoing+assessment+of+the+airway&search=acute+airway+obstruction&topicRef=6034&anchor=H178086558&source=see_link#H178086558).)

**Findings** — Characteristic findings on bronchoscopy include subglottic narrowing (edema, erythema) and thick, purulent secretions in the trachea ([picture 1](https://www-uptodate-com.uchile.idm.oclc.org/contents/image?imageKey=PEDS%2F55364&topicKey=PEDS%2F6034&search=acute+airway+obstruction&source=see_link)) [[9,17](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/9,17)]. Pseudomembranes may be seen and exudate may extend into the bronchi [[13](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/13)]. If indicated, purulent secretions and pseudomembranes can be removed during endoscopy [[38](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/38)]. The adjacent laryngeal structures may or may not be involved. The epiglottis typically appears normal but may be slightly erythematous. The remainder of the larynx may be covered by purulent exudates, although this occurs in a minority of cases. Involvement of the mainstem bronchi is common, and exudates may extend further down into the bronchial tree [[12,16](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/12,16)].

The hallmark exudates vary in amount and character. In mild cases, exudates may be minimal or absent. In more severe cases, exudates are extensive and sometimes so tenacious that they cannot be expectorated [[16](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/16)]. The exudates may take the form of pseudomembranes that remain adherent to the tracheal lumen or become detached [[4,12,35](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/4,12,35)]. Thick, inspissated mucus casts adherent to the tracheal wall also have been reported [[39](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/39)].

Early in the disease course, the tracheal mucosa may appear simply red and swollen, but with untreated progression, the surfaces become covered by an exudate with a dry, glazed, gray surface that can narrow the tracheal lumen [[15](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/15)]. Marked destruction of the mucosa and deeper layers of the trachea may occur. Perforation and pneumomediastinum have been described [[16](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/16)].

**Etiologic diagnosis** — The microbiologic evaluation for children with suspected bacterial tracheitis includes:

●Respiratory specimens for Gram stain and cultures (aerobic and anaerobic) – These should be obtained during bronchoscopy or immediately following endotracheal intubation for patients requiring ventilatory support. Patients who do not require these procedures may be able to provide a suitable expectorated sputum specimen, though young children are usually not able to.

●Respiratory specimens for viral testing – Tracheal or upper respiratory specimens should be sent for rapid viral antigen or polymerase chain reaction-based tests for specific agents or panels of agents.

●Blood cultures – Blood cultures should be obtained in all patients, though positive cultures are not common in children with bacterial tracheitis [[6,9,12-14](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/6,9,12-14)].

**DIFFERENTIAL DIAGNOSIS**The differential diagnosis of bacterial tracheitis is that of acute respiratory distress, especially severe obstructive dyspnea, with fever ([table 2](https://www-uptodate-com.uchile.idm.oclc.org/contents/image?imageKey=PEDS%2F81102&topicKey=PEDS%2F6034&search=acute+airway+obstruction&source=see_link)) [[13](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/13)]. (See ["Emergency evaluation of acute upper airway obstruction in children"](https://www-uptodate-com.uchile.idm.oclc.org/contents/emergency-evaluation-of-acute-upper-airway-obstruction-in-children?search=acute+airway+obstruction&topicRef=6034&source=see_link).)

Important considerations include epiglottitis, croup, peritonsillar or retropharyngeal abscess or cellulitis, severe bacterial pneumonia (especially with complicating parapneumonic effusion or empyema), foreign body aspiration, and diphtheria, each of which is discussed briefly below.

●**Epiglottitis** – Epiglottitis may present with acute onset of upper airway obstruction, fever, and toxic appearance, similar to primary bacterial tracheitis. Children with epiglottitis classically present with dysphagia, drooling, and distress ([picture 2](https://www-uptodate-com.uchile.idm.oclc.org/contents/image?imageKey=PEDS%2F76538&topicKey=PEDS%2F6034&search=acute+airway+obstruction&source=see_link)); they prefer the tripod posture ([picture 3](https://www-uptodate-com.uchile.idm.oclc.org/contents/image?imageKey=PEDS%2F79826&topicKey=PEDS%2F6034&search=acute+airway+obstruction&source=see_link)). The presentation of bacterial tracheitis often is less acute, and drooling is uncommon, although it has been described ([table 1](https://www-uptodate-com.uchile.idm.oclc.org/contents/image?imageKey=PEDS%2F70282&topicKey=PEDS%2F6034&search=acute+airway+obstruction&source=see_link)). The radiographic features of epiglottitis (enlarged epiglottis or "thumb sign") ([image 3](https://www-uptodate-com.uchile.idm.oclc.org/contents/image?imageKey=PEDS%2F67312&topicKey=PEDS%2F6034&search=acute+airway+obstruction&source=see_link)) and bacterial tracheitis (normal epiglottis and intraluminal membranes) ([image 2](https://www-uptodate-com.uchile.idm.oclc.org/contents/image?imageKey=PEDS%2F80331&topicKey=PEDS%2F6034&search=acute+airway+obstruction&source=see_link)) also differ. However, tracheoscopy may be necessary for diagnosis ([picture 1](https://www-uptodate-com.uchile.idm.oclc.org/contents/image?imageKey=PEDS%2F55364&topicKey=PEDS%2F6034&search=acute+airway+obstruction&source=see_link)). (See ["Epiglottitis (supraglottitis): Clinical features and diagnosis"](https://www-uptodate-com.uchile.idm.oclc.org/contents/epiglottitis-supraglottitis-clinical-features-and-diagnosis?search=acute+airway+obstruction&topicRef=6034&source=see_link) and ['Diagnosis'](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis?search=acute%20airway%20obstruction&topicRef=6455&source=see_link#H16) above.)

●**Croup** – Bacterial tracheitis may share clinical and radiographic features with croup (viral laryngotracheitis), particularly if croup is the underlying predisposing illness. Bacterial tracheitis should be suspected as a complication of croup if there is marked worsening during the clinical course of croup (eg, high fever, toxic appearance, and increase in respiratory distress) and in children who have a poor response to nebulized [epinephrine](https://www-uptodate-com.uchile.idm.oclc.org/contents/epinephrine-adrenaline-pediatric-drug-information?search=acute+airway+obstruction&topicRef=6034&source=see_link) or glucocorticoids [[38](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/38)]. (See ["Croup: Clinical features, evaluation, and diagnosis"](https://www-uptodate-com.uchile.idm.oclc.org/contents/croup-clinical-features-evaluation-and-diagnosis?search=acute+airway+obstruction&topicRef=6034&source=see_link).)

●**Peritonsillar or retropharyngeal abscess or cellulitis** – Children with peritonsillar or retropharyngeal cellulitis/abscess or other painful infections of the oropharynx may present with drooling, change in voice quality, and unwillingness to move the neck, features that are usually (but not always) absent in children with bacterial tracheitis. (See ["Peritonsillar cellulitis and abscess"](https://www-uptodate-com.uchile.idm.oclc.org/contents/peritonsillar-cellulitis-and-abscess?search=acute+airway+obstruction&topicRef=6034&source=see_link) and ["Retropharyngeal infections in children"](https://www-uptodate-com.uchile.idm.oclc.org/contents/retropharyngeal-infections-in-children?search=acute+airway+obstruction&topicRef=6034&source=see_link).)

●**Severe bacterial pneumonia**– Severe bacterial pneumonia, especially with complicating parapneumonic effusion or empyema, may be difficult to differentiate from bacterial tracheitis (which may extend into the lung parenchyma). Bacterial tracheitis should be suspected in children with pulmonary infiltrates who have 1) irregular tracheal markings or intratracheal opacities on plain radiographs, or 2) stridor or other signs of respiratory distress out of proportion to the lung disease apparent on plain radiographs. (See ["Epidemiology, clinical presentation, and evaluation of parapneumonic effusion and empyema in children"](https://www-uptodate-com.uchile.idm.oclc.org/contents/epidemiology-clinical-presentation-and-evaluation-of-parapneumonic-effusion-and-empyema-in-children?search=acute+airway+obstruction&topicRef=6034&source=see_link) and ['Diagnosis'](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis?search=acute%20airway%20obstruction&topicRef=6455&source=see_link#H16) above.)

●**Foreign body aspiration** – Foreign bodies in the larynx or trachea can cause complete or partial airway obstruction that requires immediate treatment. Foreign bodies lodged in the esophagus in the area of the cricoid cartilage or the tracheal bifurcation can compress the airway, causing partial airway obstruction. Symptoms are likely to have an abrupt onset, but in contrast to bacterial tracheitis, fever usually is absent. Tracheal foreign body and tracheal exudates or pseudomembranes may have similar appearance on radiographs [[36,39](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/36,39)]. Endoscopy may be necessary to distinguish between tracheal foreign body and bacterial tracheitis. (See ["Airway foreign bodies in children"](https://www-uptodate-com.uchile.idm.oclc.org/contents/airway-foreign-bodies-in-children?search=acute+airway+obstruction&topicRef=6034&source=see_link) and ["Foreign bodies of the esophagus and gastrointestinal tract in children"](https://www-uptodate-com.uchile.idm.oclc.org/contents/foreign-bodies-of-the-esophagus-and-gastrointestinal-tract-in-children?search=acute+airway+obstruction&topicRef=6034&source=see_link).)

●**Diphtheria** – The clinical presentation of diphtheria can be similar to that of bacterial tracheitis. The onset of symptoms is typically gradual. Sore throat, malaise, and low-grade fever are the most common presenting symptoms. A diphtheritic membrane (gray and sharply demarcated) ([picture 4](https://www-uptodate-com.uchile.idm.oclc.org/contents/image?imageKey=ID%2F52701&topicKey=PEDS%2F6034&search=acute+airway+obstruction&source=see_link)) may be present. Diphtheria is exceedingly rare in countries with high rates of immunization for diphtheria, tetanus, and pertussis. (See ["Epidemiology and pathophysiology of diphtheria"](https://www-uptodate-com.uchile.idm.oclc.org/contents/epidemiology-and-pathophysiology-of-diphtheria?search=acute+airway+obstruction&topicRef=6034&source=see_link).)

●**Inflammatory bowel disease** – Bacterial tracheitis rarely may mimic tracheal inflammation associated with inflammatory bowel disease (IBD). The presentation of IBD tends to be subacute or chronic. Nodular mucosal edema, small erythematous lesions, and whitish granular lesions may be seen on bronchoscopy. Infiltrations of lymphocytes and plasma cells may be seen on biopsy [[40,41](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis/abstract/40,41)]. (See ["Clinical presentation and diagnosis of inflammatory bowel disease in children", section on 'Extraintestinal manifestations'](https://www-uptodate-com.uchile.idm.oclc.org/contents/clinical-presentation-and-diagnosis-of-inflammatory-bowel-disease-in-children?sectionName=Extraintestinal+manifestations&search=acute+airway+obstruction&topicRef=6034&anchor=H1351752&source=see_link#H1351752).)

**SUMMARY AND RECOMMENDATIONS**

●Bacterial tracheitis is an invasive exudative bacterial infection of the soft tissues of the trachea ([picture 1](https://www-uptodate-com.uchile.idm.oclc.org/contents/image?imageKey=PEDS%2F55364&topicKey=PEDS%2F6034&search=acute+airway+obstruction&source=see_link)). In some cases, there is extension to the subglottic laryngeal structures or the upper bronchial tree. (See ['Terminology'](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis?search=acute%20airway%20obstruction&topicRef=6455&source=see_link#H2) above.)

●Bacterial tracheitis generally occurs during the first six years of life. The majority of cases occur in previously healthy children in the setting of a viral respiratory tract infection. (See ['Epidemiology'](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis?search=acute%20airway%20obstruction&topicRef=6455&source=see_link#H4) above.)

●*Staphylococcus aureus* is the most common cause of bacterial tracheitis. Other commonly isolated bacteria include *Streptococcus pneumoniae*, group A *Streptococcus* (*Streptococcus pyogenes*), alpha-hemolytic streptococci, and *Moraxella catarrhalis*. (See ['Microbiology'](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis?search=acute%20airway%20obstruction&topicRef=6455&source=see_link#H5) above.)

●In children with signs of severe airway obstruction or pending respiratory failure, airway control precedes diagnostic evaluation. (See ['Airway obstruction'](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis?search=acute%20airway%20obstruction&topicRef=6455&source=see_link#H12) above and ["Emergency evaluation of acute upper airway obstruction in children"](https://www-uptodate-com.uchile.idm.oclc.org/contents/emergency-evaluation-of-acute-upper-airway-obstruction-in-children?search=acute+airway+obstruction&topicRef=6034&source=see_link) and ["Emergency endotracheal intubation in children"](https://www-uptodate-com.uchile.idm.oclc.org/contents/emergency-endotracheal-intubation-in-children?search=acute+airway+obstruction&topicRef=6034&source=see_link).)

●Common clinical features include fever, stridor, cough, and respiratory distress. Drooling is uncommon but may be present. The reported frequencies of symptoms and signs vary in different case reports of bacterial tracheitis ([table 1](https://www-uptodate-com.uchile.idm.oclc.org/contents/image?imageKey=PEDS%2F70282&topicKey=PEDS%2F6034&search=acute+airway+obstruction&source=see_link)). (See ['Symptoms and signs'](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis?search=acute%20airway%20obstruction&topicRef=6455&source=see_link#H13) above.)

●Radiographic features of bacterial tracheitis may include narrowing of the subglottic trachea ([image 1](https://www-uptodate-com.uchile.idm.oclc.org/contents/image?imageKey=PEDS%2F52418&topicKey=PEDS%2F6034&search=acute+airway+obstruction&source=see_link)), irregularity of the margins of the tracheal mucosa, and/or presence of irregular or linear shadows (membranes) in the tracheal lumen ([image 2](https://www-uptodate-com.uchile.idm.oclc.org/contents/image?imageKey=PEDS%2F80331&topicKey=PEDS%2F6034&search=acute+airway+obstruction&source=see_link)). These findings are not universal. (See ['Radiographic features'](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis?search=acute%20airway%20obstruction&topicRef=6455&source=see_link#H14) above.)

●A presumptive diagnosis of bacterial tracheitis can be made on the basis of acute onset of airway obstruction with consistent clinical and radiographic features ([table 1](https://www-uptodate-com.uchile.idm.oclc.org/contents/image?imageKey=PEDS%2F70282&topicKey=PEDS%2F6034&search=acute+airway+obstruction&source=see_link) and [image 2](https://www-uptodate-com.uchile.idm.oclc.org/contents/image?imageKey=PEDS%2F80331&topicKey=PEDS%2F6034&search=acute+airway+obstruction&source=see_link)) in the setting of a preceding viral upper respiratory infection. Definitive diagnosis of bacterial tracheitis requires direct visualization of an inflamed, exudate-covered trachea ([picture 1](https://www-uptodate-com.uchile.idm.oclc.org/contents/image?imageKey=PEDS%2F55364&topicKey=PEDS%2F6034&search=acute+airway+obstruction&source=see_link)). Microbiologic testing is necessary to guide antimicrobial therapy. (See ['Diagnosis'](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis?search=acute%20airway%20obstruction&topicRef=6455&source=see_link#H16) above.)

●The differential diagnosis of bacterial tracheitis is that of acute airway obstruction with fever. Important considerations include epiglottitis, croup, peritonsillar or retropharyngeal abscess or cellulitis, severe bacterial pneumonia, foreign body aspiration, and diphtheria ([table 2](https://www-uptodate-com.uchile.idm.oclc.org/contents/image?imageKey=PEDS%2F81102&topicKey=PEDS%2F6034&search=acute+airway+obstruction&source=see_link)). (See ['Differential diagnosis'](https://www-uptodate-com.uchile.idm.oclc.org/contents/bacterial-tracheitis-in-children-clinical-features-and-diagnosis?search=acute%20airway%20obstruction&topicRef=6455&source=see_link#H22) above and ["Emergency evaluation of acute upper airway obstruction in children"](https://www-uptodate-com.uchile.idm.oclc.org/contents/emergency-evaluation-of-acute-upper-airway-obstruction-in-children?search=acute+airway+obstruction&topicRef=6034&source=see_link).)

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