

*Jerrold H. Levy, M.D., F.A.H.A., F.C.C.M., Editor*

## Epiglottitis

### *It Hasn't Gone Away*

J. Lance Lichtor, M.D., Maricarmen Roche Rodriguez, M.D., Nicole L. Aaronson, M.D., Todd Spock, M.D., T. Rob Goodman, M.B.B.Chir., Eric D. Baum, M.D.

**G**EORGE Washington, the United States' first president, 2 yr after leaving office on December 13, 1799, was reported to have "a cold" and mild hoarseness. The next morning, around 2:00 AM, he had difficulty breathing. By 6:00 AM, he was febrile, had throat pain, and experienced respiratory distress. Three physicians were called to his side and tried various remedies, all without success.<sup>1</sup> Washington died at 10:20 PM, likely due to bacterial epiglottitis. If he had lived and received care 200 yr later, the outcome might have been different.

#### Case Description

Recently, the authors cared for a 24-month-old patient who presented with drooling and refusal to take food or liquid orally. The patient had been well until the morning, when she choked on a "tater tot." The patient took a nap shortly after the child's mother removed part of the foreign body, but awoke unable to control her secretions and refusing to eat. The parents brought their daughter to the emergency department, and a lateral neck radiograph suggested an aspirated foreign body. She was brought urgently to the operating room, anesthesia was induced with sevoflurane followed by a propofol infusion, and direct laryngoscopy was performed. The epiglottis was diffusely edematous and moderately erythematous, but not quite as deep red and severely swollen as the "classic" description (fig. 1). There was frankly purulent drainage from the mucosa of the epiglottis. The fact that the patient choked on a "tater tot" was a diversion that did not fit with a severe, recent abrasion. She was transferred to the intensive care unit for antibiotic therapy (vancomycin and ceftriaxone, followed by cefdinir for a 7-day course of antibiotics) and steroid therapy (Decadron). On the third postoperative day, direct visualization of the epiglottis by the otolaryngologist while the patient was still intubated

revealed resolving epiglottitis. The patient's trachea was extubated on the fourth postoperative day after physicians noted an appropriate cuff leak. Lower respiratory tract culture grew *Staphylococcus aureus*, which indicated appropriate antibiotic therapy. After 7 days, the patient was discharged home from the hospital. Epiglottitis should have been the suspected diagnosis rather than pharyngolaryngeal foreign body, and the differential diagnosis of epiglottitis is explained later in the Background section of this article.

While bacterial epiglottitis used to be a common disease, usually seen by pediatric anesthesiologists, it is now much less common. Here, we will discuss the pathophysiology and the infectious nature of the disease in both adults and children and will summarize anesthesia management.

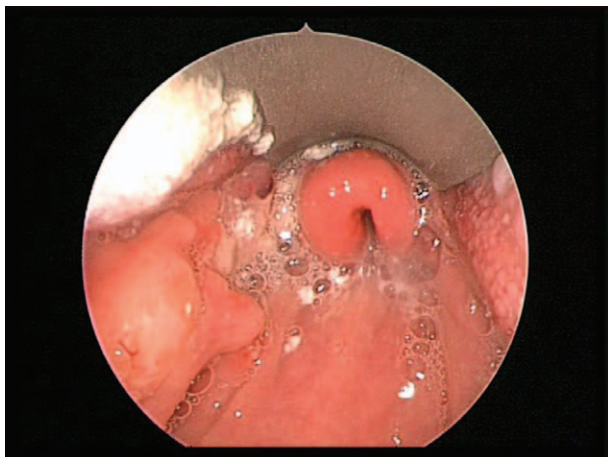
#### Background

Before the *Haemophilus influenzae* vaccination, epiglottitis was most commonly seen in children between 3 and 5 yr of age. Now, epiglottitis is more common in adults. Before the introduction of the *Haemophilus* vaccine, *Haemophilus influenzae* type b (*Hib*) was the most common cause of epiglottitis; now group A  $\beta$ -hemolytic *Streptococci* is more commonly responsible for such infections. Noninfectious causes of epiglottitis may include trauma from foreign objects, inhalation, and chemical burns. Epiglottitis is also associated with systemic disease or negative reactions to chemotherapy. In 1985, the first polysaccharide *Hib* vaccine was licensed for use in children aged 18 months and older, and by the year 2000, the annual incidence of invasive *Hib* in children younger than 5 yr decreased 99%, to less than one case per 100,000.<sup>2</sup> Yet, the mean annual incidence of acute epiglottitis per 100,000 adults has increased from 0.88 (from 1986 to 1990) to 2.1 (from 1991 to 1995), then to 3.1 (from 1996 to 2000).<sup>3</sup>

This article is featured in "This Month in Anesthesiology," page 1A.

Submitted for publication October 20, 2015. Accepted for publication February 4, 2016. From the Departments of Anesthesiology (J.L.L., M.R.R.), Otolaryngology (N.L.A., T.S., E.D.B.), and Radiology and Biomedical Imaging (T.R.G.), Yale University School of Medicine, New Haven, Connecticut.

Copyright © 2016, the American Society of Anesthesiologists, Inc. Wolters Kluwer Health, Inc. All Rights Reserved. Anesthesiology 2016; 124:1404-7



**Fig. 1.** Image from a patient with epiglottitis.

Epiglottitis presents differently in children and adults. Children tend to be healthy before the onset of symptoms, the disease tends to be confined to the epiglottis and aryepiglottic folds, and children experience stridor and difficulty breathing.<sup>4</sup> The common bacterial cause is *Haemophilus influenzae* type b. The epiglottis is “cherry-red,” and children have a high risk of airway closure. Adults tend to have underlying medical conditions and may not show signs of airway obstruction. For adults, supraglottitis may be a more appropriate term, and the inflammation tends to affect the structures surrounding the supraglottis, including the pharynx, uvula, base of the tongue, aryepiglottic folds, and false vocal cords. Common pathogens include *Streptococcus pneumoniae*, *Staphylococcus aureus*, and *Klebsiella pneumoniae*.

### Clinical Presentation

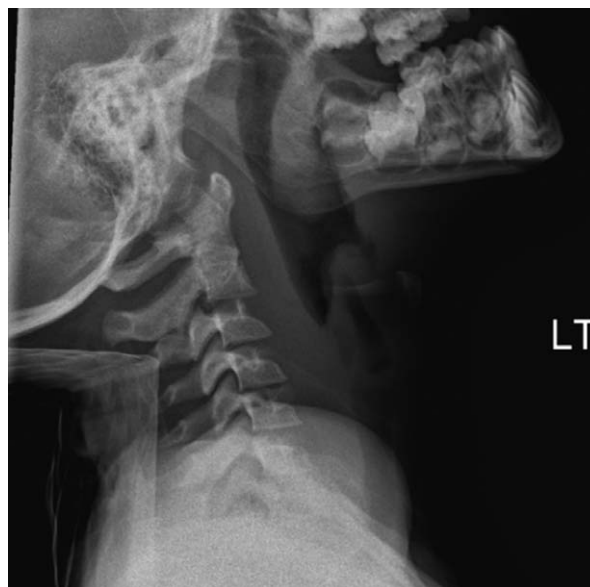
**Children.** Cases of epiglottitis in children continue to occur because of other infectious agents or vaccine failure.<sup>5</sup> Epiglottitis can cause a life-threatening airway emergency, and therefore it is important for physicians to promptly recognize and treat the condition. Croup can also present with fever, stridor, and shortness of breath. Patients with epiglottitis usually present with a generalized toxemia, including high fevers, severe sore throat, and difficulty swallowing. Stridor, if present, is usually inspiratory. The patient may be sitting up and leaning forward in the sniffing position, breathing with an open mouth and a protruding tongue. The patient frequently drools because of difficulty and pain on swallowing. This “tripod position” may not be present in the older child/adult presenting with epiglottitis. Findings may only include subtle signs of respiratory difficulties, such as the inability to lie flat, voice changes, and dysphagia. Unlike croup, where onset is insidious over a period of 2 to 3 days, epiglottitis patients tend to experience acute onset of symptoms. In one series, while both croup and epiglottitis were associated with acute stridor, croup was also associated with coughing and no drooling, while epiglottitis was associated with drooling and the lack of coughing.<sup>6</sup>

**Adults.** Supraglottitis, or inflammation of the supraglottic larynx, seen in adults, has a different presentation than epiglottitis in children. Adults with supraglottitis have predominant symptoms of odynophagia, dysphagia, and voice changes out of proportion to pharyngeal inflammation. Childhood epiglottitis—muffled voice, drooling, dyspnea, stridor, and cough—occurs in less than 50% of adults.<sup>4</sup> Adults may also experience fever, toxic appearance, cervical lymphadenopathy, and anterior neck and chest cellulitis. Guardiani *et al.*,<sup>7</sup> based on a 10-yr study of 60 adults and 1 child, described odynophagia (100% of patients) as the most common symptom, followed by difficulty swallowing (85%) and voice changes (74%). The presentation of adult supraglottitis peaks at 42 to 48 yr of age, with a male predilection of 2.5:1.<sup>8</sup> This “tripod position” may not be present in the older child/adult presenting with epiglottitis.

### Diagnosis

**Children.** In children, physicians must be highly vigilant for epiglottitis to avoid performing procedures that might further aggravate an already tenuous airway. Problems may arise if the person performing the neck radiograph on a child has not been specifically trained in airway management. Airway assessment is best suited to an operating room with an anesthesiologist and otolaryngologist present. Typical radiographic findings include an enlarged, “thumbprint-like” epiglottis with edematous epiglottic folds (fig. 2).

**Adults.** In adults with supraglottitis, physicians can perform a more extensive workup, including lateral neck radiographs to achieve a diagnosis. Lateral neck radiograph findings can include the “thumbprint sign” of supraglottitis, a grossly swollen epiglottic shadow, and obliteration of the vallecula known as the “vallecula sign.” Soft-tissue lateral neck radiographs have an approximately 12% false-negative rate, so clinical



**Fig. 2.** Radiograph of a patient with classic epiglottitis.

signs and symptoms of supraglottitis are also important.<sup>10</sup> The ratio of epiglottitis to C4 vertebral body width may be a more sensitive test than lateral neck radiographs: a ratio greater than 0.33 is suggestive of epiglottitis.<sup>11</sup> Indirect, direct, and flexible laryngoscopies are more accurate and have not been found to precipitate airway obstruction in adults. Ultrasonography instead of plain films might also help diagnose epiglottitis.<sup>12</sup>

### Management/Anesthetic Considerations

**Children.** Tracheostomy was originally used to treat epiglottitis until 1968, when one of the first reports of nasotracheal tube use was published.<sup>13</sup> Nowadays, endotracheal tubes and the use of general anesthesia are the norm. When epiglottitis is suspected, while in the emergency department, the patient should be placed in the sitting position and then an intravenous line should be placed. Radiographs of neck soft tissue can be obtained only if an experienced physician remains with the child. If radiographs are diagnostic, the child should immediately go to the operating room. If laryngitis instead of epiglottitis is apparent, therapy for laryngitis should be instituted. Although for a child's elective surgery it is common to first start the anesthetic by performing mask induction, then obtain venous access, and then intubate the trachea, whether that combination is advisable for a child with epiglottitis is unclear. It should be emphasized that safety is largely dependent upon the skill and judgment of the care provider rather than upon the specific technique they select. Before the start of induction, children should be allowed to remain sitting upright, even on their parents' laps, particularly given that these children arrive often in a very stressful situation. Forcing the child to remain supine during induction can precipitate airway obstruction. Video laryngoscopy, a difficult airway cart, a needle cricothyroidotomy kit (percutaneous transtracheal ventilation or trans-laryngeal ventilation), and a setup for tracheostomy should be available. The presence of an otolaryngologist at the time of anesthesia induction is mandatory, and bronchoscopy is much more helpful than a cricothyroidotomy. Drugs that produce paralysis of skeletal muscle should only be administered after adequacy of ventilation is checked and probably are not needed, given that a child's trachea can usually be intubated while anesthetized deeply with sevoflurane. Intubation is not usually the issue although airway obstruction during induction frequently is an issue. In severe cases, these children are acidotic, hypoxic, and hypercapnic, all conditions that are propitious for arrhythmia and hemodynamic instability. Nasotracheal intubation is the common method of intubation since accidental extubation could be disastrous and is less likely when a nasal endotracheal tube is used. The choice of the endotracheal tube should be adapted to the patient's age and to the use of a cuffed or uncuffed tube. It is mandatory to ensure an air leak at 20 cm H<sub>2</sub>O to reduce the risk of possible laryngeal complications, such as subglottic stenosis. Once the airway is secured, the patient should be taken to an intensive care setting where the patient receives

intravenous antibiotics. The patient may be ready for extubation within 24 to 48 h, once toxemia has resolved. The majority of pediatric intensivists check for air leak when assessing any child for extubation readiness<sup>14</sup> and the same should apply to determine extubation readiness for a patient with epiglottitis. In some cases, direct laryngoscopy with deep sedation or general anesthesia is needed to evaluate the extent of edema and appropriateness for extubation.

**Adults.** In adults with supraglottitis, patient management should be tailored to the disease presentation. More mild cases without symptoms of respiratory distress, tachypnea, or stridor that do not require prophylactic intubation can be monitored in a high-vigilance area, and patients should be monitored with continuous pulse oximetry. A review of 308 supraglottitis cases showed that only 15% of patients required airway intervention with intubation or tracheotomy, and most of these patients were medically managed with intravenous antibiotics with or without steroids.<sup>15</sup> Antibiotics should be active against *H. influenzae*, *S. pyogenes*, and *S. pneumoniae*; third-generation cephalosporins (ceftriaxone or ampicillin/sulbactam) are typically employed. Levofloxacin or moxifloxacin can be used in patients who are allergic to penicillin. Although systemic steroids have been used to manage these patients, there is no study that shows a clear benefit in terms of length of intensive care unit stay or duration of ventilation. Stridor, respiratory distress, tachycardia, and tachypnea; rapid onset of symptoms; and shortness of breath are associated with the need for airway intervention. Voice change, difficulty handling secretions, odynophagia, dysphagia, fever at presentation, age, sex, and major medical comorbidities are not associated with the need for airway intervention.<sup>7</sup> In adults, when severe airway obstruction is observed, intubation may be quite difficult because of significant inflammation of the surrounding soft tissues, and patients should be considered as if they have a difficult airway. As with a child, an otolaryngologist should be present and backup equipment as described for the child should be immediately available. Flexible fiberoptic nasendoscopy can help facilitate diagnosis and assess the degree of obstruction. Unlike for children, the preferred intubation technique would be to provide topical anesthesia while using light sedation and intubate the patient while awake.<sup>16</sup> Although the sitting position during anesthesia induction is emphasized for children, the position is not as critical for adults. If there is severe airway obstruction, cricothyroidotomy instead of tracheal intubation may be considered part of the management. High-flow nasal oxygenation or noninvasive ventilation should be considered for oxygenation/respiratory support in dyspneic adults without severe signs of upper airway obstruction, although intubation rates may not be changed.<sup>17</sup>

### Complications

Epiglottitis can lead to airway loss and death. Epiglottic abscess has been found to occur in up to 24% of patients.<sup>18</sup> The abscesses can often be detected using a computed tomography scan, while a magnetic resonance imaging shows obliteration



of the surrounding fat planes. These scans require the patient to be in a supine position, and with this condition, respiratory distress can be greater when the patient is supine. If computed tomography or magnetic resonance imaging is felt to be necessary in a complicated patient, consideration should be given to securing the airway before placing these patients in the supine position in an imaging department. Likewise, naso-fiberoptic exam can also assess edema and abscesses even when performed on an intubated patient. Patients with epiglottic abscess often require drainage of the abscess in addition to intravenous antibiotics. Descending necrotizing mediastinitis has also been reported in cases of epiglottitis.<sup>19</sup> These patients often require drainage of the mediastinum in addition to drainage of the primary abscess and airway management *via* tracheotomy. Immunocompromised patients are at a higher risk of these complications, and physicians must therefore use broad-spectrum antibiotics as well as debridement, as needed.

### Conclusion

The clinician should have a firm understanding of the presentation, workup, and management of a patient with epiglottitis. With the widespread use of *Hib* vaccine, epiglottitis incidence has decreased dramatically among children. The typical presentation of epiglottitis in a child includes acute onset of fever, stridor, and drooling. Adults, however, may present with supraglottitis— inflammation of the supraglottic larynx and surrounding pharyngeal structures—with predominant symptoms of odynophagia, dysphagia, and voice changes out of proportion to pharyngeal inflammation. If the patient's airway is stable, lateral neck radiographs with the thumbprint or vallecule sign can assist in corroborating the diagnosis. Importantly, in a child with epiglottitis and airway compromise, physicians should defer laryngoscopy until the airway is secured in the operating suite. Adults are more likely to tolerate invasive diagnostic procedures, such as flexible fiberoptic laryngoscopy without airway compromise. All scenarios require clinicians to have a high index of suspicion and promptly institute treatment to appropriately manage children and adults who present with epiglottitis or supraglottitis.

### Acknowledgments

The authors thank Yale New Haven Hospital, New Haven, Connecticut, and the computed tomography staff who helped with the management of the index patient.

Support was provided solely from institutional and/or departmental sources.

### Competing Interests

The authors declare no competing interests.

### Correspondence

Address correspondence to Dr. Lichtor: Department of Anesthesiology, Yale University School of Medicine, 333 Cedar Street, TMP3, New Haven, Connecticut 06520. lance.lichtor@yale.edu. Information on purchasing reprints may

be found at [www.anesthesiology.org](http://www.anesthesiology.org) or on the masthead page at the beginning of this issue. ANESTHESIOLOGY's articles are made freely accessible to all readers, for personal use only, 6 months from the cover date of the issue.

### References

1. Morens DM: Death of a president. *N Engl J Med* 1999; 341:1845–9
2. Briere EC, Rubin L, Moro PL, Cohn A, Clark T, Messonnier N; Division of Bacterial Diseases, National Center for Immunization and Respiratory Diseases, CDC: Prevention and control of *Haemophilus influenzae* type b disease: Recommendations of the advisory committee on immunization practices (ACIP). *MMWR Recomm Rep* 2014; 63:1–14
3. Berger G, Landau T, Berger S, Finkelstein Y, Bernheim J, Ophir D: The rising incidence of adult acute epiglottitis and epiglottic abscess. *Am J Otolaryngol* 2003; 24:374–83
4. Mayo-Smith MF, Spinale JW, Donskey CJ, Yukawa M, Li RH, Schiffman FJ: Acute epiglottitis. An 18-year experience in Rhode Island. *Chest* 1995; 108:1640–7
5. McEwan J, Giridharan W, Clarke RW, Shears P: Paediatric acute epiglottitis: Not a disappearing entity. *Int J Pediatr Otorhinolaryngol* 2003; 67:317–21
6. Tibballs J, Watson T: Symptoms and signs differentiating croup and epiglottitis. *J Paediatr Child Health* 2011; 47:77–82
7. Guardiani E, Bliss M, Harley E: Supraglottitis in the era following widespread immunization against *Haemophilus influenzae* type B: Evolving principles in diagnosis and management. *Laryngoscope* 2010; 120:2183–8
8. Al-Qudah M, Shetty S, Alomari M, Alqadah M: Acute adult supraglottitis: Current management and treatment. *South Med J* 2010; 103:800–4
9. Chung CH: Adult acute epiglottitis and foreign body in the throat—Chicken or egg? *Eur J Emerg Med* 2002; 9:167–9
10. Solomon P, Weisbrod M, Irish JC, Gullane PJ: Adult epiglottitis: The Toronto Hospital experience. *J Otolaryngol* 1998; 27:332–6
11. Nemzek WR, Katzberg RW, Van Slyke MA, Bickley LS: A reappraisal of the radiologic findings of acute inflammation of the epiglottis and supraglottic structures in adults. *AJNR Am J Neuroradiol* 1995; 16:495–502
12. Hung TY, Li S, Chen PS, Wu LT, Yang YJ, Tseng LM, Chen KC, Wang TL, Hung TY: Bedside ultrasonography as a safe and effective tool to diagnose acute epiglottitis. *Am J Emerg Med* 2011; 29:359.e1–3
13. Geraci RP: Acute epiglottitis—Management with prolonged nasotracheal intubation. *Pediatrics* 1968; 41:143–5
14. Mhanna MJ, Anderson IM, Iyer NP, Baumann A: The use of extubation readiness parameters: A survey of pediatric critical care physicians. *Respir Care* 2014; 59:334–9
15. Bizaki AJ, Numminen J, Vasama JP, Laranne J, Rautiainen M: Acute supraglottitis in adults in Finland: Review and analysis of 308 cases. *Laryngoscope* 2011; 121:2107–13
16. Mathoera RB, Wever PC, van Dorsten FR, Balter SG, de Jager CP: Epiglottitis in the adult patient. *Neth J Med* 2008; 66:373–7
17. Frat JP, Thille AW, Mercat A, Girault C, Ragot S, Perbet S, Prat G, Boulain T, Morawiec E, Cottereau A, Devaquet J, Nseir S, Razazi K, Mira JP, Argaud L, Chakarian JC, Ricard JD, Wittebole X, Chevalier S, Herblant A, Fartoukh M, Constantin JM, Tonnelier JM, Pierrot M, Mathonnet A, Béduneau G, Delétage-Métreau C, Richard JC, Brochard L, Robert R; FLORALI Study Group; REVA Network: High-flow oxygen through nasal cannula in acute hypoxemic respiratory failure. *N Engl J Med* 2015; 372:2185–96
18. Ozanne A, Marsot-Dupuch K, Ducreux D, Meyer B, Lasjaunias P: Acute epiglottitis: MRI. *Neuroradiology* 2004; 46:153–5
19. Huopio M, Kokkonen J, Heino S, Valtonen M, Hakala T: [Epiglottitis and necrotizing mediastinitis in a middle-aged man]. *Duodecim* 2014; 130:503–6