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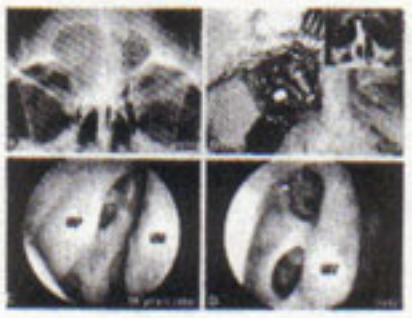

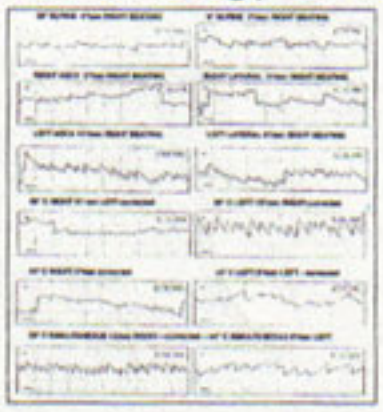

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Need for tracheotomy is rare in patients with acute supraglottitis: Findings of a retrospective study

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Abstract

We retrospectively reviewed the cases of 23 adults and six children who had been given a presumed diagnosis of acute supraglottitis between 1987 and 1997. The most common symptoms in these patients were odynophagia, dysphagia, hoarseness, and fever. Stridor and drooling were also observed, primarily in the children. Fiberoptic laryngoscopy confirmed the presence of edema and erythema of the supraglottic structures in all patients. Blood cultures were positive for Hemophilus influenzae *type b in three children and for* Serratia marcescens *in one adult. All other blood cultures were negative. All patients were treated with intravenous broad-spectrum antibiotics and humidified oxygen, and two-thirds received intravenous corticosteroids. Patients were monitored with pulse oximetry and serial fiberoptic laryngoscopy. Two patients required intubation; one had an epiglottic abscess, and the other had laryngeal edema so severe that vocal fold mobility could not be assessed. The length of stay in the intensive care unit ranged from 1 to 7 days (mean: 1.9). All patients recovered and were discharged free of symptoms after 2 to 11 days of overall hospitalization (mean: 4.4).*

Introduction

Supraglottitis is an acute infection of the supraglottic larynx. Because airway obstruction in acute supraglottitis can quickly become fatal, the infection must be diagnosed promptly and treated aggressively.

Supraglottitis was first reported in 1900 by Theisen, who called it *angina epiglottidea*.[1] Woo and van Hasselt[2] and Shapiro et al[3] favor the term *acute supraglottitis* because the inflammatory process involves multiple supraglottic structures rather than the epiglottis alone.

A noticeable change in the epidemiologic pattern of supraglottitis has occurred since the introduction of *Hemophilus influenzae* b vaccines. The incidence of *H influenzae* in children has declined while the incidence of non-*H influenzae*-related cases in adults has increased.[4] Supraglottitis is often more acute in children than in adults, and systemic toxicity and the risk of airway obstruction are more common in children.[5] Therefore, it is of prime importance to quickly initiate airway management in pediatric cases.

Yet there is controversy over the best way to manage airway obstruction in these patients. One issue being debated is whether it is better to prophylactically intubate a patient or to observe the airway in a monitored setting. Some authors report that many patients do not generally progress to obstruction that requires airway intervention, and they therefore advocate vigilant observation, antibiotic therapy, and humidification.[6,7] Others believe that immediate airway intervention is the safest course.[8]

The purpose of this article is to report our own findings and to review the clinical presentation of acute supraglottitis, microbiology, airway management, and treatment.

Materials and methods

We retrospectively identified 40 patients with a diagnosis of supraglottitis who had been admitted to Lenox Hill Hospital in New York City between 1987 and 1997. We excluded from this study 11 patients whose hospital records had been misclassified. The remaining 29 patients included 18 males and 11 females, aged 3 to 76 years (mean: 37); six were arbitrarily classified as children based on their being younger than 18 years of age (figure).

Data sheets were created to record demographic infor-

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mation, symptoms, physical examination findings, laboratory results, types of treatment, lengths of stay in the intensive care unit (ICU) and on the otolaryngology floor, and outcomes. Relevant medical history regarding upper respiratory infection, asthma, diabetes, recurrent tonsillitis, and immunosuppression were recorded (table 1). There were two immunosuppressed patients; one had chronic lymphocytic leukemia and the other had pemphigoid.

Acute supraglottitis had been diagnosed by the attending otolaryngologist by visualizing the inflamed supraglottic structures with a flexible fiberoptic laryngoscope. Radiographic studies—soft tissue lateral neck films and computed tomography (CT) of the neck—had been performed on some patients. CT had been ordered when the otolaryngologist suspected a deep neck infection. However, neither the neck films nor CT had been used to make the diagnosis of supraglottitis. Aerobic and anaerobic blood and throat cultures were performed on most patients before antibiotic treatment was started.

All patients had been admitted to the ICU and treated with intravenous broad-spectrum antibiotics (cefuroxime, ampicillin/sulbactam, ampicillin/chloramphenicol, or clindamycin), humidification, and elevation of the head of the bed; 19 of the 29 patients (66%; all adults) had also been infused with an intravenous corticosteroid. The choice of antibiotic had been based on the sensitivity of pathogens at our institution; we currently use cefuroxime for patients who have no drug allergy and clindamycin for patients who are allergic to penicillin. Steroids had been administered to those patients whose laryngeal edema was more severe.

Patients were monitored by pulse oximetry and serial fiberoptic laryngoscopy. Those who required airway intervention underwent orotracheal intubation. A tracheotomy and intubation tray was routinely ordered at the bedside in the ICU and on the otolaryngology floor, but no patient required a tracheotomy. After discharge from the ICU, patients were transferred to the otolaryngology floor. Those who were able to tolerate a liquid diet were continued on an oral broad-spectrum antibiotic for a minimum of 1 week. The criteria for hospital discharge included a stable airway, absence of fever for 24 hours, tolerance of a soft diet, and controlled pain with oral analgesics.

Results

Clinical presentation. All patients had been seen initially by the emergency room physician and then by the otolaryngology staff. The most common initial symptoms in the group as a whole were odynophagia (97%), dysphagia (72%), and fever greater than 100° F (66%) (table 2). Hoarseness (72%) was seen primarily in adults,

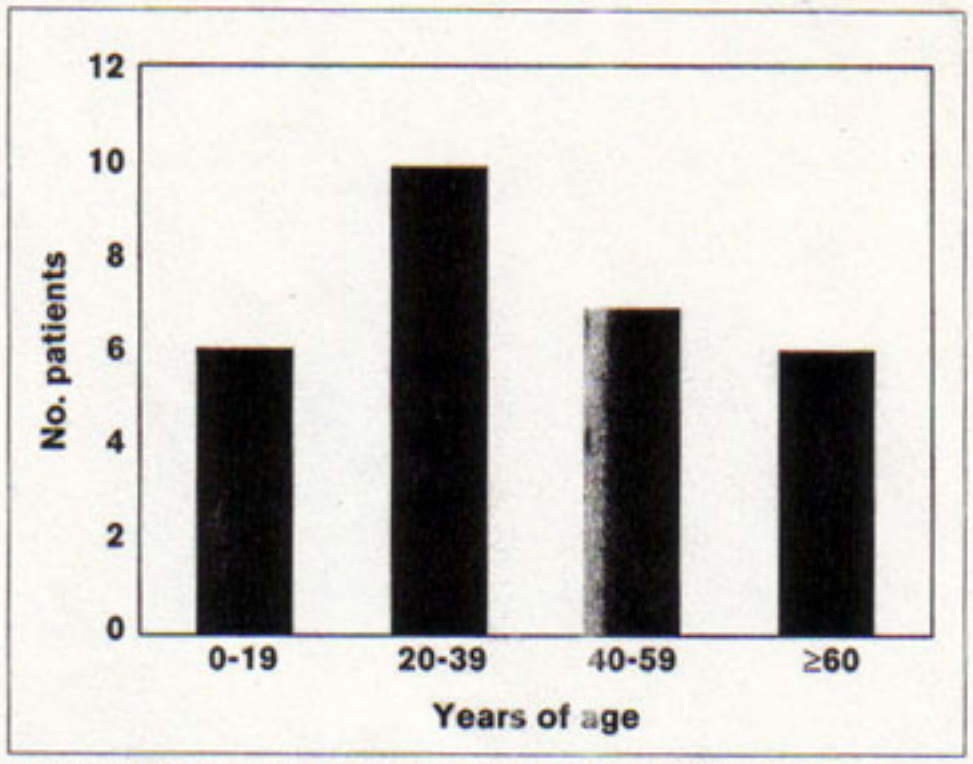

Figure. The number of patients in each of four age groups.

while suprasternal retractions (14%) and drooling (10%) were seen exclusively in children. For the purpose of this study, we defined stridor (17%) as noisy inspiration and dyspnea (38%) as difficulty breathing. Three of the five patients with stridor were children, and they were managed conservatively; the two adults required intubation. These two adults also came to the emergency room with an upright posture and restlessness. None of the patients with dyspnea (all adults) required airway intervention. The length of time between the onset of symptoms and hospital arrival ranged from 5 hours to 6 days (mean: 2 days); it was less than 24 hours for both of the intubated adults.

Physical examination. Vital signs recorded on emergency room admission included temperature, pulse, and respiratory rate. Temperatures ranged from 98 to 104° F (mean: 100.8), pulse rates ranged from 70 to 140 beats per minute (mean: 99), and respiratory rates from 18 to 40 breaths per minute (mean: 22). Both of the intubated patients had pulse rates higher than 135 and respiratory rates greater than 30. Nearly one-third of all patients had tender neck adenopathy and pharyngitis.

On fiberoptic laryngeal examination, all patients had exhibited edema and erythema of various supraglottic structures; one patient had an epiglottic abscess, and one

Table 1. Relevant medical history in 29 patients with acute supraglottitis

Condition	n (%)
Upper respiratory infection	7 (24)
Asthma	3 (10)
Diabetes	3 (10)
Recurrent tonsillitis	2 (7)
Immunosuppression	2 (7)

Table 2. Symptoms of acute supraglottitis in 29 patients

Symptom	n (%)
Odynophagia	28 (97)
Dysphagia	21 (72)
Hoarseness	21 (72)
Fever (>100° F)	19 (66)
Dyspnea	11 (38)
Stridor	5 (17)
Suprasternal retractions	4 (14)
Upright posture	4 (14)
Otalgia	4 (14)
Drooling	3 (10)
Restlessness	2 (7)

Table 3. Findings on physical examination in 29 patients with supraglottitis

Finding	n (%)
Edema and erythema	
Epiglottis	29 (100)
Aryepiglottic folds	22 (76)
False vocal folds	15 (52)
Arytenoids	11 (38)
True vocal folds	3 (10)
Cervical adenopathy	9 (31)
Pharyngitis	9 (31)

patient had laryngeal edema so severe that vocal fold mobility could not be assessed. The epiglottis was edematous and erythematous in all patients (table 3). Edema and erythema were also common in the aryepiglottic folds (76%), false vocal folds (52%), and arytenoids (38%). Additionally, three patients (10%) had edema and erythema of the true vocal folds. The patient who had an epiglottic abscess required intubation, incision, and drainage in the operating room, and this patient remained intubated for 72 hours. The other patient who required intubation in the emergency room because of laryngeal edema remained intubated for 48 hours. Both patients recovered fully.

Laboratory and radiographic evaluation. The laboratory workup had included initial and serial measurements of white blood cell (WBC) counts with differentials for all patients and blood and throat cultures for all but one patient. The initial WBC counts ranged from 3.7 to 26 × $10^3/\mu l$ (mean: 13 × 10^3), and there was a left shift (granulocytes >80%) in 15 patients. Blood cultures were positive in only four patients; three children had *H influenzae* type b and one adult had *Serratia marcescens*. Throat cultures were positive in three patients; two adults grew group A beta-hemolytic streptococci, and one grew *Hemophilus parainfluenzae*.

Radiographic evaluation had included lateral soft tissue neck films in 12 patients, which were positive in eight and later found to be falsely negative in four. CT of the neck with intravenous contrast had been performed on four other patients who were suspected of having a neck abscess. These scans were positive for supraglottitis in all four patients, but they revealed no other concomitant neck space infections or abscesses.

Treatment. All patients had been admitted to the ICU and treated with various intravenous antibiotic regimens to cover the most common pathogens, *H influenzae* and *Streptococcus pneumoniae*. These antibiotics included cefuroxime, ampicillin/sulbactam, ampicillin/chloramphenicol, and clindamycin. They were generally administered for a minimum of 48 hours. Afterward, patients were continued on oral broad-spectrum antibiotic coverage for a minimum of 1 week. The 19 adults who were administered corticosteroid therapy had been given either dexamethasone or methylprednisolone for the first 24 to 48 hours; at that point, either the corticosteroid was discontinued or the patient was switched to a tapering dose of prednisone. While they were receiving corticosteroid therapy, these patients had also been placed on intravenous ulcer prophylaxis (cimetidine or ranitidine).

In addition, all patients, except the two who were intubated, received 30% humidified oxygen delivered through a facemask and parenteral fluid therapy, and the head of the bed was elevated so that patients were positioned in a semi-sitting posture. Pulse oximetry was used to monitor patients in the ICU.

The length of ICU stay ranged from 1 to 7 days (mean: 1.9), and the length of the overall hospital stay ranged from 2 to 11 days (mean: 4.4). The average hospital stay for the two intubated adults was significantly longer at 9 days. There were no deaths and only one complication; the epiglottic abscess. The patient in whom vocal fold motion could not be assessed subsequently experienced a complete recovery of motion. All patients experienced a complete resolution of symptoms and were discharged from the hospital.

Discussion

Our study supports the idea that conservative medical therapy can be administered without instituting prophylactic airway intervention in most patients with acute supraglottitis. The most common symptoms in our series were odynophagia and dysphagia, a finding that is similar to those reported by other investigators.[9,10] Other common symptoms were hoarseness and fever. There was no correlation between WBC counts or positive blood cul-

tures and the need for airway intervention. Only two of our 29 patients (7%) required airway control with intubation, and both had been identified early by the severity of their symptoms. Both of these patients had a severe degree of stridor, tachypnea, tachycardia, and upright posture, and both had come to the emergency room within 24 hours of the onset of these symptoms.

Many investigators have attempted to examine clinical predictors that correlate with the need for airway intervention (table 4). Mayo-Smith et al conducted a large retrospective study in Rhode Island during an 18-year period (1975 to 1992) and found that stridor, drooling, a shorter duration of symptoms, the presence of *H influenzae* bacteremia, and a higher WBC count were associated with the need for airway intervention.[4] In their review of 407 patients, the 12 patients who had died (2.9%) had experienced respiratory obstruction within 12 hours of presentation. Barrow et al[5] and Deeb et al[11] found a strong association between the need for airway intervention and the presence of stridor, drooling, and a short duration of symptoms.

Nevertheless, controversy still prevails in the literature over which criteria best predict the need for airway intervention. Wolf et al treated 30 patients who had an abrupt onset of symptoms (including stridor and dyspnea) who were not given an artificial airway, and all 30 patients fared well.[7] In a retrospective review, Dort et al found no initial sign or symptom that reliably predicted the need for intubation.[12] In our study, we treated three children with stridor and 11 adults with moderate dyspnea without the need for airway intervention.

It appears that most cases of adult supraglottitis follow a less severe course than the classic fulminant cases associated with *H influenzae* bacteremia in children. Therefore, many patients can be managed with conservative medical therapy in a monitored setting.[6] The low incidence of positive blood cultures in adult supraglottitis in other studies[4-6] as well as in ours (4%) further underscores the different nature of this disease in adults compared with children and suggests a possible viral etiology. However, adults and children can have a fulminant course, so vigilant observation in a monitored setting is the safest strategy. Even so, in some cases, patients have experienced a fatal obstruction while being observed in the emergency room, in the general medical ward, and even in the ICU.[13] But overall, the clinical threshold for airway intervention should remain low.

Epiglottic abscess is regarded as a very rare condition, but one that carries a high mortality (30%).[14] The one patient in our study who had an abscess had been diagnosed promptly by fiberoptic laryngoscopy in the emergency room and was immediately transferred to the operating room for airway control followed by incision and drainage. The other patient who was in acute respiratory distress had been promptly diagnosed with supraglottitis; this patient's vocal fold mobility could not be assessed by fiberoptic laryngoscopy, and so the patient was intubated immediately in the emergency room.

Table 4. Comparison of results in selected studies of supraglottitis

Author	No. of patients	Airway intervention (%)	Mortality (%)
Deeb et al, 1985[11]	80	30	0
Wolf et al, 1990[7]	30	0	0
Barrow et al, 1993[5]	46	15	0
Dort et al, 1994[12]	43	33	2.0
Frantz et al, 1994[6]	129	15	0
Mayo-Smith et al, 1995[4]	407	36	2.9
Rizk et al, 2000*	29	7	0

** Present study.*

The results of our review indicate that fiberoptic laryngoscopy is a safe, accurate, and expedient means of diagnosing acute supraglottitis. Soft tissue radiographs had been performed on 12 of our patients, and four were false negatives; these four patients were later confirmed to have supraglottitis by fiberoptic examination. Supraglottitis can occur with only minimal swelling of the epiglottis that might not be evident on lateral soft tissue radiography.[4] Therefore, direct visualization is the most accurate method of confirming the diagnosis. In our study, CT had been performed only when there was a suspicion of a concomitant neck space infection, and all four of these scans were positive for supraglottitis.

Combination ampicillin/chloramphenicol had been used during the earlier years covered in our study, but in more recent years, patients were given ampicillin/sulbactam or cefuroxime, as well as clindamycin for penicillin-allergic patients. Cephalosporins provide good coverage for the common pathogens and appear to be safer than chloramphenicol.[15]

Although 66% of our patients had received intravenous corticosteroids at various doses, there are no controlled studies to document their efficacy in this setting. Mayo-Smith et al observed no difference in airway intervention, the duration of ICU stay, or the overall duration of hospitalization in 61% of their patients who received corticosteroids.[4]

Based on our findings, we recommend (1) observation of all patients in the ICU, with intubation and tracheotomy sets ready at the bedside, (2) flexible fiberoptic laryngos-

copy every 12 hours to monitor disease progression, (3) early intervention in rapidly progressing cases, (4) the use of antibiotics based on the institution's sensitivity, and (5) the use of steroids in more severe cases.

In conclusion, most patients with acute supraglottitis can be managed conservatively with careful monitoring in the ICU. serial fiberoptic laryngoscopy, intravenous broad-spectrum antibiotics, elevation of the head of the bed, and humidified oxygen. Fiberoptic laryngoscopy appears to be the best method of diagnosis. Some patients will require airway intervention, and the decision to intervene thusly should be made on a case-by-case basis rather than as part of a generalized protocol. The presence of stridor, tachypnea, tachycardia, and an upright posture and a short duration of symptoms are strong predictors of the need for airway intervention. There should be a low threshold for initiating airway intervention for patients who show signs and symptoms of a deteriorating airway. A tracheotomy and intubation set should be available at the bedside at all times, but airway intervention is better performed in the operating room under more controlled conditions.

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