

Acute epiglottitis: analysis of factors associated with airway intervention

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Abstract

We reviewed acute epiglottitis (AE) and identified factors associated with airway intervention. This report was a retrospective review of patients with AE and compared with factors associated with airway intervention. We reviewed 96 patients who were diagnosed with AE in our hospitals in Japan. Ninety-two (96 per cent) patients were adults, and no seasonal variation in the incidence of AE was encountered. Eight (8 per cent) patients had tracheostomy and endotracheal intubation had not been done. We found that symptoms of stridor and muffled voice, a rapid clinical course, and diabetes mellitus were the factors associated with airway intervention. Extremely severe swelling of the epiglottis such that only less than half of the posterior vocal fold (scope classification (SC): III) could be seen, and extension of the swelling to the arytenoids (SC: B) were the two factors that were strongly associated with airway intervention.

Key words: Epiglottitis; Larynx; Tracheostomy; Endoscopy

Introduction

Acute epiglottitis (AE) was previously commonly thought of as a disease of the paediatric population. Recently, however, increasing attention has been given to the adult presentations of this disease.^{1–4} Most reports of AE have come from Western countries, and this epidemiology has been well studied. However, there are very few reports of AE from Asian countries, and the epidemiology of AE in Asian countries is still largely unknown.

Several authors believe that airway obstruction can occur suddenly without warning, and therefore they advocated airway protection in all cases.^{5,6} Others believe the disease in adults to be different from the paediatric condition and feel the larger larynx in adults allows for a more conservative approach to airway management.^{7,8}

We reviewed cases of AE in our hospitals in Japan over a 12-year period from 1992 to 2003, and looked especially at clinical diagnostic and therapeutic parameters and outcomes, and identified factors associated with airway intervention.

Method

This study was a retrospective review at the Department of Otolaryngology – Head and Neck Surgery of the Yokohama City University Medical Center and the Yokohama City University School of Medicine Hospital. The time period of the review

was January 1992 to December 2003, in which there were 96 cases of AE. Data for all patients with a diagnosis of epiglottitis (ICD Code 464D) were identified.

Data were collected from hospital records, including patients' demographics and clinical presentations, sex, age, laboratory findings, annual and seasonal occurrence, diagnostic procedures, treatment, airway management, and complications of AE. A diagnosis of all patients with AE was made using the flexible nasopharyngolaryngoscope.

Medical doctors in the Department of Otolaryngology - Head and Neck Surgery made the diagnosis using flexible nasopharyngolaryngoscopy and determined whether the airway was patent or compromised. The decision to secure the airway depended on patients' symptoms and airway appearance. In patients with objective respiratory difficulties (e.g. with cyanosis, sitting erect, or with oxygen desaturation), tracheostomy was immediately addressed; it could also be addressed in those who lacked symptoms and signs of airway obstruction but who had a compromised airway (i.e. with a laryngeal inlet, observed by flexible nasopharyngolaryngoscope, to be appreciably narrowed by at least 50 per cent).

In addition to a tracheostomy, endotracheal intubation was conducted for the airway management in previous reports.^{7,9–11} In our patients, only tracheotomies were conducted as artificial

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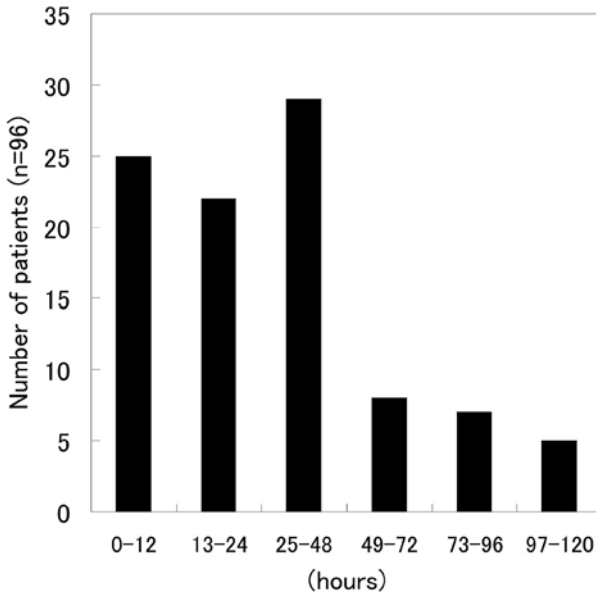


FIG. 1

Duration of symptom before hospital admission. In 76 patients (79 per cent), the duration was less than 48 hr.

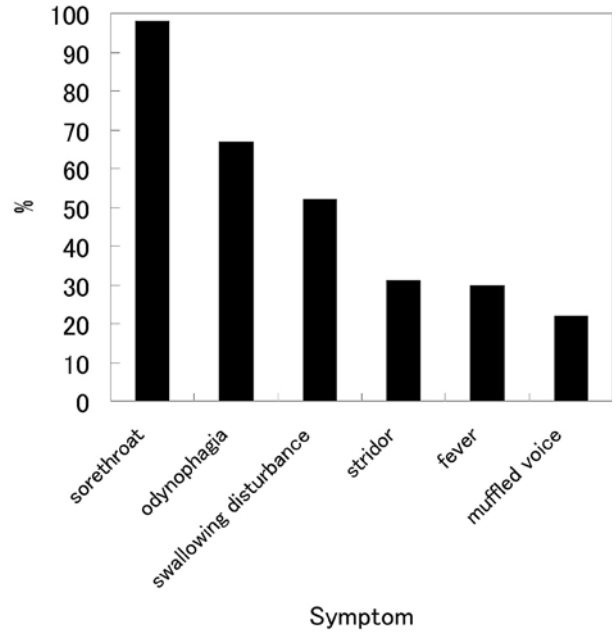


FIG. 2

Symptom on admission to hospital.

airways. Because a failure of endotracheal intubation would enhance the swelling of the epiglottis, a tracheostomy was preferred to endotracheal intubation.

After the airway was secured, patients were transferred to the intensive care unit. All other patients, whose laryngeal aperture appeared patent, were admitted to the department and closely supervised. Conservative treatment included intravenous antibiotics and steroids to treat the infection, supplemented with fluids to increase hydration and 30 per cent humidified oxygen administered via a face mask to ease laboured breathing. Arterial oxygen saturation was continuously monitored by finger pulse oxymetry.

The two-tailed t-test was used to analyse independent groups and the chi-square test was used for associations. A finding was considered significant if $p < 0.05$. To establish risk factors for airway intervention, demographics, clinical presentation, and diagnostic tests of patients requiring emergency intervention and of those managed conservatively were compared.

Results

There were 63 (66 per cent) males and 33 (34 per cent) females in the study group, resulting in a male to female ratio of 1.9:1. The patient ages ranged from 3 to 85 years, with an average age of 51.1 years. Forty of the 96 patients (42 per cent) were smokers. There was no seasonal variation in the incidence of the disease.

The duration of symptoms prior to admission ranged from 2 hr to five days, with an average of 24.2 hr (Figure 1). In 25 patients (26 per cent), the duration was less than 12 hr, in 22 patients (23 per cent), the duration was 13 to 24 hr. Ninety-four patients (98 per cent) complained of a sore throat, 64 (67 per cent) complained of odynophagia and 50 (52 per cent) complained of a swallowing disturbance (Figure 2).

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Scope classification (SC)

All patients had a grossly swollen erythematous epiglottis. Using a flexible nasopharyngolaryngoscope, we used SC and classified the patients with AE, according to epiglottis swelling, as follows:

- I (slight swelling): patient’s epiglottis swelled slightly and the entire length of the vocal folds could be seen with the scope.
- II (moderate swelling): patient’s epiglottis swelled moderately and more than half of the posterior vocal folds could be seen with the scope.
- III (severe swelling): patient’s epiglottis swelled severely and only less than half of the posterior vocal folds could be seen with the scope (Figure 3a).

In addition to the SC, we also divided them into two groups, according to the swelling of their arytenoids: A: without extension of the swelling to the arytenoids and the aryepiglottic folds. B: with extension of the swelling to the arytenoids and the aryepiglottic folds (Figure 3b).

Table I shows each patient’s SC number of AE as well as the number of patients requiring tracheostomy.

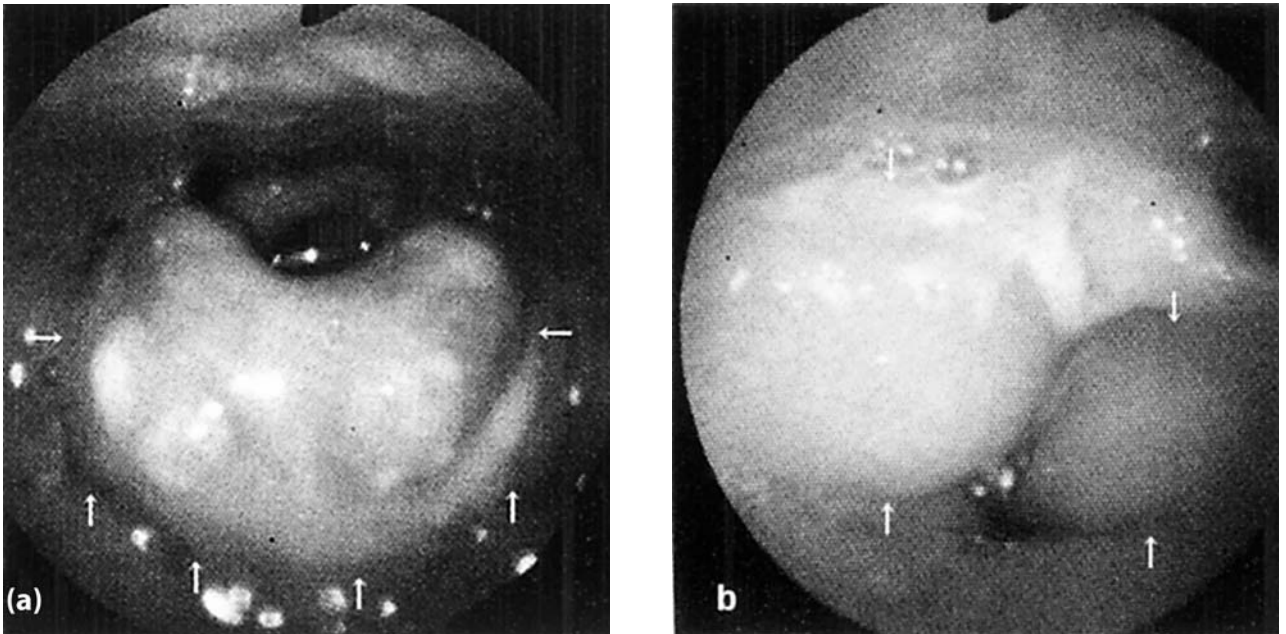


FIG. 3

Scope classification (SC). (a) III (severe swelling): epiglottis swelled severely and cases where only less than half of the posterior vocal fold could be seen with the scope. (b) B: with extension of the swelling to the arytenoids and the aryepiglottic folds.

Laboratory findings

The mean white blood cell count was 16.60×10^3 cells/mm³ (range 3.92–26.30 $\times 10^3$ cells/mm³) and the mean serum C reactive protein (CRP) value was 9.8 mg/dl (range 0.1–24.1 mg/dl) and above normal in 89/96 cases (93 per cent). Cultures from the epiglottis were performed in 42 of 96 (44 per cent) patients for aerobic and anaerobic culture and sensitivity tests. Twenty-five patients grew possible pathogenic organisms, of which 12 cultures were positive for *Streptococcus pneumoniae*, seven for *S. aureus* and four for *Haemophilus influenzae*. Blood cultures were performed in 10 of 96 patients (10 per cent): the results showed positive growth in only two patients (2 per cent), with all growing *S. pneumoniae*.

Airway management

Airway intervention was necessary in eight of the 96 patients (8 per cent). Eight patients required tracheostomy and the remaining 88 patients were managed with close observation in a monitored setting. No patient who was initially observed required emergency airway intervention and none of these patients had endotracheal intubation.

Patients, who had symptoms of stridor, appeared to have a high incidence of airway intervention. In the 30 patients with symptoms of stridor, six (20 per

cent) required airway intervention. Patients who presented within less than 12 hr of the onset of symptoms appeared to have a high incidence of airway intervention. In the 25 patients who presented within 12 hr of the onset of symptoms, four (16 per cent) required airway intervention.

The diagnosis of all patients with AE was made using the flexible nasopharyngolaryngoscope. In 25 patients whose epiglottis swelled severely and of whom only less than half of the posterior end (SC: III) of their vocal folds could be seen, six (24 per cent) required airway intervention (Table I). In 31 patients with extension of the swelling to the arytenoids and the aryepiglottic folds (SC: B), six (19 per cent) required airway intervention.

Medical therapy and outcome

In this study, 91 patients (95 per cent) received intravenous antibiotics. Fifty-seven patients (59 per cent) received cephalosporines. Eighteen (19 per cent) patients received a second-generation cephalosporin (seven received flomoxef sodium [FMOX], six received cefmetazole sodium [CMZ] and five received cefotiam hydrochloride [CTM]); 17 patients (18 per cent) received a third-generation cephalosporin (nine received ceftriaxone sodium [CTRX] and eight received ceftazidime [CAZ]); and

TABLE I
SCOPE CLASSIFICATION (SC)

	Epiglottis swelling			Total
	I: slight	II: moderate	III: severe	
Arythenoid swelling				
A: swelling (-)	18	35	12 (2)	65 (2)
B: swelling (+)	3	15 (2)	13 (4)	31 (6)
	21	50 (2)	25 (6)	96 (8)

Figure within brackets shows number of patients requiring tracheostomy.

TABLE II
COMPARISON OF PATIENTS' CHARACTERISTICS BASED ON AIRWAY INTUBATION

	Patients with airway intervention (<i>n</i> = 8)	Patients without airway intervention (<i>n</i> = 88)	P
Mean age	43.4	51.8	0.42
Male:Female	5:3	58:30	0.43
Symptom			
Sore throat	100% (8)	97% (86)	0.84
Odynophagia	75% (6)	66% (58)	0.45
Swallowing disturbance	75% (6)	50% (44)	0.11
Stridor	75% (6)	27% (24)	<0.01
Fever	38% (3)	30% (26)	0.35
Muffled voice	38% (3)	20% (18)	<0.05
Pharyngitis	38% (3)	44% (39)	0.45
Scope classification			
III (epiglottis swelling severely)	75% (6)	22% (19)	<0.01
B (with arythenoid swelling)	75% (6)	28% (25)	<0.01
Rapid clinical course (<12 hr)	50% (4)	24% (21)	<0.05
Mean leukocyte count (x10 ³ cells/mm ³)	18.2	16.5	0.50
C reactive protein (mg/dl)	11.5	9.6	0.41
Mean number of days hospitalized	18.3	8.8	<0.05
Smoking	63% (5)	40% (35)	0.08
Diabetes mellitus	25% (2)	11% (10)	<0.05

Figure within brackets shows number of patients.

22 patients (23 per cent) received a fourth-generation cephalosporin (eight received cefpirome sulfate [CPR], seven received cefepime dihydrochloride [CFPM] and seven received ceftazidime hydrochloride [CZOP]). Twenty-seven patients (28 per cent) received carbapenem antibiotics (10 received imipenem/cilastatin [IPM/CS], nine received panipenem/betamipron [PAPM/BP] and eight received meropenem trihydrate [MEPM]). Seven patients (7 per cent) received piperacillin sodium [PIPC]. In addition, 21 patients (22 per cent) were also receiving two antibiotics, in combination with clindamycin [CLDM].

Eighty patients (83 per cent) were also treated with steroids (19 hydrocortisone sodium succinate, 19 methylprednisolone sodium succinate, 17 dexamethasone, 15 betamethasone and 10 prednisolone). Seventy-six patients (79 per cent) received humidified oxygen.

All patients recovered completely. No patient had any secondary infection such as meningitis or pneumonia. There were no deaths in this study group. The mean length of hospital stay for all patients was 9.6 days. The patients who required tracheostomy stayed for a mean of 18.3 days. The patients who required airway intervention were hospitalized significantly longer than those who did not require airway intervention (18.3 days compared with 8.8 days, $p < 0.05$).

Discussion

Historically, AE has been predominantly a paediatric disease. Wurtele *et al.* reviewed 12 other reports of AE from North America and Europe from 1946 to 1983, and estimated the paediatric to adult ratio was

3:1.4. Recently, however, in Western countries, 65–78 per cent of patients with AE were adults.^{9–11}

In this study, 96 patients with AE were treated over a period of 12 years; however, only four of these were younger than 20 years of age. In Japan, *Haemophilus influenzae* type B (Hib) vaccine is not routinely prescribed to children. However, paediatricians and otolaryngologists tend to prescribe antibiotics almost routinely to paediatric patients suffering from acute upper respiratory infections. This preventative administration of antibiotics may reduce the occurrence rate of the severe *H. influenzae* infection which causes AE in children.

The sex distribution of our patients was not different from those in previous reports of Western countries, which revealed a male predominance for this disease.^{9,10} There were 63 males and 23 females, resulting in a male to female ratio of 1.9:1. Some reports have emphasized a seasonal occurrence for this disease.^{2,4,10} But, in this study, no seasonal variation in the incidence of the disease was encountered.

The mean length of hospital stay for all patients was 9.6 days. The patients who required tracheostomy stayed for a mean of 18.3 days. This period was clearly longer than those detailed in the American⁹ and European¹⁰ reports. The patients who underwent tracheostomy were kept in our hospital until the tracheostoma was completely closed. These therapeutic strategies extended the hospitalization period.

We reviewed our experience to assess presentation, diagnosis, and treatment options. We also looked closely to distinguish the subgroup of patients who required airway intervention. Wolf *et al.* included patients with a very abrupt onset of symptoms, stridor, dyspnoea, and sepsis, in whom conservative

management was recommended uniformly.¹² Mayo-Smith *et al.* used various clinical data to identify predictors of clinical course, and only the level of respiratory difficulty and degree of positive blood culture were found to be significantly different between the group requiring airway intervention and the group treated conservatively.⁶

The utilization of a flexible nasopharyngolaryngoscope appears to be well tolerated and is likely to be the gold standard for diagnosis. The nasopharyngolaryngoscope provided accurate visualization of the extent of epiglottic swelling, the existence of laryngeal narrowing, and the involvement of neighbouring supraglottic structures such as the aryepiglottic folds, the arytenoids, and the false vocal folds.

Using the flexible nasopharyngolaryngoscope, we are able to use the SC and classified the patients with AE, as shown in Table I. In 25 patients whose epiglottis swelled severely (SC: III), six (24 per cent) required airway intervention. In 31 patients with extension of the swelling to the arytenoids and the aryepiglottic folds (SC: B), six (19 per cent) required airway intervention.

We used this SC and clinical data to identify predictors of clinical course (Table II). We found that symptoms of stridor and muffled voice, severe swelling of epiglottis (SC: III), extension of the swelling to the arytenoids (SC: B), rapid clinical course and diabetes mellitus were the factors significantly associated with airway intervention. Among these factors, diagnosis using the nasopharyngolaryngoscope such as extremely severe swelling of the epiglottis such that only less than half of the posterior vocal fold (SC: III) could be seen and extension of the swelling to the arytenoids (SC: B) were strongly associated with airway intervention.

Controversy also exists regarding the method of airway control. Proponents of tracheostomy believe that it is the best means of airway control.⁹ Others find routine use of tracheostomy to be inappropriate and consider that intubation should be utilized when necessary as a means of airway control.⁸

In this study, only tracheostomy was conducted to provide an artificial airway, and endotracheal intubation was not performed. Because a failure of endotracheal intubation would enhance the swelling of the epiglottis, tracheostomy was preferred. Following this strategy, there was no fatality in our patients. From a survey of the Japanese literature from 1989 to 1998 we find that in Japan 5.5 per cent of AE required tracheostomy and only 1.3 per cent of AE were performed using endotracheal intubation.¹³

The role of steroids in the management of AE is still empirical. They were used in this study with 80 patients (83 per cent), which is consistent with the range in other studies of 24 to 95 per cent.^{6,7,11} The use of steroids did not shorten the duration of hospitalization in this or the other studies.

We believe a selective approach to airway management is safe and effective. The decision to monitor a patient or to proceed with a more aggressive airway intervention is a clinical one based

on the patient's status and the monitoring facilities available. In our hospitals, we have a head and neck surgical step-down unit, with constant care provided by nurses who are familiar with head and neck surgical patients. This set-up allows us to safely institute a selective approach to airway management, as is indicated by our low morbidity and mortality rates in this review.

Conclusions

We used SC and clinical data to identify predictors of clinical course. We found that symptoms of stridor and muffled voice, rapid clinical course and diabetes mellitus were the factors associated with airway intervention. Diagnosis using the nasopharyngolaryngoscope such as extremely severe swelling of the epiglottis such that only less than half of the posterior vocal fold (SC: III) could be seen and extension of the swelling to the arytenoids (SC: B) were strongly associated with airway intervention. Although selective tracheostomy is recommended as the result of conservative management with close monitoring, medical doctors must readily pursue airway intervention if it is warranted by these factors.

- **This paper reviews 96 patients with adult epiglottitis**
- **Stridor, muffled voice, rapid clinical course and diabetes mellitus were factors associated with the need for active airway intervention**
- **A method is presented for assessing severity based on endoscopic appearance**

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Dr H Katori takes responsibility for the integrity of the
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