The Laryngoscope
Lippincott–Raven Publishers, Philadelphia

Adult Epiglottitis in a Canadian Setting

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The objective of this study was to determine stable estimates of the incidence, case fatality, and epidemiologic features of adult epiglottitis, and risk factors for intubation. The authors designed a retrospective cohort combined with a nested case-control study, followed by detailed analysis of cases from two tertiary care institutions. Among 813 cases, the incidence was 2.02 cases/10^5 population per year. Ten recorded deaths constituted a case fatality rate of 1.2% (95% confidence interval [CI]: 0.5% to 1.9%). The eight fully documented deaths indicated no sudden episodes of catastrophic upper airway obstructions without previous dyspnea. A detailed review of 51 cases revealed that 18% of patients underwent expeditious intubation. Patients managed without initially requiring intubation did not need emergency airway interventions. Only the presence of dyspnea (noted in 29% of patients) at the time of admission ($P < 0.001$) predicted the need for intubation. A low case fatality rate in a conservatively managed cohort and the absence of sudden upper airway catastrophes in patients without dyspnea suggest that prophylactic intubation and intensive care unit monitoring is not warranted in all patients. An early complaint of dyspnea may safely discriminate between patients requiring invasive airway management and close observation.

***Laryngoscope,* 108:64–69, 1998**

INTRODUCTION

Epiglottitis is a rare but potentially life-threatening infectious inflammation of the epiglottis and surrounding upper airway. As early as 1941[1] it had become a well-recognized pediatric emergency receiving a great deal of attention in the literature. In contrast, the occurrence of epiglottitis in adults was largely ignored until the 1980s.[2]

In 1986, a study by MayoSmith et al.[2] describing 56 cases of adult epiglottitis in Rhode Island observed an annual incidence of 0.97 cases per 10^5 adults and a case fatality rate of 7.1%. The high case fatality rate was in part explained by four reported deaths caused by "sudden" upper airway obstruction and resulted in the authors recommending prophylactic intubation in all patients diagnosed with adult epiglottitis. While some other studies have also supported an aggressive approach to airway management,[3,4] others advocate a more selective approach.[5–11]

All studies to date have described small and, often, selected groups of patients with epiglottitis. As a result, even the basic features of the illness such as the incidence, the case fatality rate, and gender and seasonal distribution, as well as features of the clinical presentation, have varied dramatically from study to study.[2,5,12] Specifically, published estimates[5,7,13,14] of case fatality rates range from 0.6% to 50%, while annual incidence rates range from 0.97 to 1.8 cases per 10^5 population.[2,5,12,15] In addition, most studies were not able to uniformly apply a gold-standard diagnostic test to confirm epiglottitis. Therefore we sought to determine the incidence, case fatality rate, and other epidemiologic features of adult epiglottitis.

MATERIALS AND METHODS

Study Design

Patients with epiglottitis were identified using the health records from the Canadian Institute for Health Information (CIHI) over a 5-year period. The large number of cases was used to establish stable estimates of the case fatality rates, age-specific and overall incidence rates, and gender and seasonal distributions. Deaths from epiglottitis during this period were also identified.

A detailed review of cases from two tertiary care hospitals in Ottawa, Ontario, Canada, was undertaken to determine clinical and laboratory features of epiglottitis. Therapeutic information and outcomes were documented to further characterize this condition. In addition, cases from one Ottawa community hospital were examined to determine whether the cases in the large cohort were correctly labeled with the diagnosis of epiglottitis and, empirically, whether findings at a community hospital were similar to those in the tertiary centers. Risk factors for intubation were identified using a nested case-control design.

Patient Selection

The ICD-9 code for epiglottitis was used to identify epiglottitis in persons aged 16 years and older in the CIHI registry. All Ontario hospitals are required to submit information from every

Presented in part at the Annual Meeting of the American College of Chest Physicians, 1994; the Annual Meeting of the Canadian Society of Otolaryngology—Head and Neck Surgery, 1994; and the Annual Meeting of the American Thoracic Society, 1995.

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Editor's Note: This Manuscript was accepted for publication May 7, 1997.

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admission to this government-sponsored health registry; hence all hospitalized patients labeled with the diagnosis of epiglottitis were included in the administrative database.

In the two hospitals, patients were identified through a computerized search of hospital records using the same ICD-9 code. The diagnosis of epiglottitis required written documentation of edema and erythema of the epiglottis determined through direct visualization. A radiographic diagnosis of epiglottitis alone was insufficient to confirm the diagnosis.

Data Collection

The CIHI registry provided data on patient demographics including age, gender, secondary diagnoses, dates of admission and discharge, and patient outcomes, as well as survival and the development of complications. Information extracted from the two tertiary care hospitals included patient demographics, reported symptoms, complications, laboratory results, and therapeutic and diagnostic procedures, as well as information on morbidity and outcomes including survival and lengths of hospital and intensive care unit (ICU) stay. The information available from the community hospital included patient demographics, the presence or absence of dyspnea, airway management, and survival status. Any respiratory complaint whatsoever noted in the medical record was sufficient to label a patient with "dyspnea" as having a potential risk factor for intubation.

Statistical Analysis

Descriptive statistics were used to characterize the distribution of all key variables. The number of cases per year, overall or in specific age-groups, was averaged over 5 years. These values were then used as the numerator in the calculation of respective incidence rates. In the denominator, data from the 1991 Canadian census for the province of Ontario were used. Thus the population at risk for the overall incidence was 10.8 million, and the population in given age strata was used in the calculation of age-adjusted rates. Case fatality rates were computed using the total number of deaths from epiglottitis divided by the total number of cases of the disease. Ninety-five percent confidence intervals (95% CIs) were calculated for incidence and case fatality rates. To establish the risk factors for endotracheal intubation, patient demographics, clinical presentation and diagnostic test results were compared between intubated and nonintubated patients. Comparisons were performed using Fisher's Exact Test or chi-squared procedures for categorical data, Wilcoxon's rank Sum statistics for ordinal data, and independent Student's *t*-tests for continuous data. All comparisons were considered statistically significant using a two-sided alpha of 0.05. No adjustments were made for multiple comparisons. However, absolute *P* values and CIs are reported.

TABLE I.
Demographic and Outcome Data From Both the 813-Patient Cohort and the 51 Confirmed Cases From Two Tertiary Care Hospitals.

	Observations	
Variable	(n = 813)	(n = 51)
Demographics		
Age (y)	42 (±20.5)	44 (±20.5)
Sex (% male)	58%	60%
Outcomes		
Mortality rate (%)	10 (1.2%)	0 (0%)
Length of ICU stay (d)	NA	2.2 (±1.54)
Length of hospital stay (d)	4.7 (±4.27)	5.6 (±2.54)

Variables reported as means ± standard deviation.
ICU = intensive care unit.
NA = values for ICU length of stay were not available in the larger cohort.

RESULTS

Demographics, Incidence, and Diagnosis

Eight hundred thirteen cases of adult epiglottitis were identified between January 1989 and March 1994. Patients presented to one of 126 hospitals throughout the province. The number of admissions per hospital ranged from 1 to 29 patients. The average age of adults diagnosed with epiglottitis was 42 (±18.5) years, and significantly more cases were noted in men (58% with 95% CI: 55% to 62%; Table 1). The overall incidence rate of epiglottitis in adults was 2.02 cases/10^5 population per year. Yearly incidence rates over 5 years ranged from 1.34 to 2.17 cases/10^5 population. Age-adjusted incidence rates for adults were between 1.8 to 2.8 cases/10^5 population per year (Fig. 1). There was no significant seasonal variation present (range, 22.4% to 28%; $P = 0.25$) (Fig. 2).

The diagnosis of epiglottitis was documented in the records of all 51 patients from the two tertiary care hospitals using direct visualization as a gold standard. Seventeen additional cases from a community hospital and all deaths in which diagnostic information was available (n = 8) were also correctly labeled with the diagnosis of epiglottitis. All cases reviewed were appropriately classified in the CIHI registry. In addition, patient demographics were similar in both the larger cohort and in the 51 patients with detailed information available (Table I).

Presentation and Management

In the subset of 51 patients from the two hospitals the duration of symptoms before presentation averaged 1.9 (±1.05) days (Table II). All but one patient (98%) presented with moderate to severe odynophagia. The one ex-

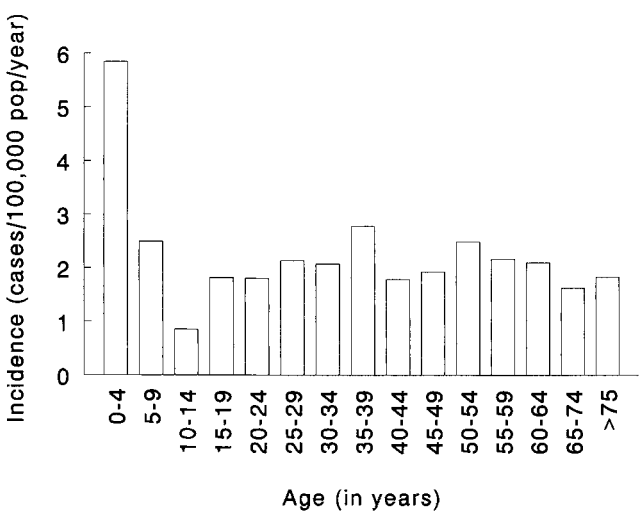

Fig. 1. Age-adjusted incidence rates for epiglottitis. A total of 1137 patients (813 adults and 324 children) were diagnosed with epiglottitis in the province of Ontario, Canada, over a 5-year period, which has a population approximating 10.5 million persons. The overall incidence was 2.02 cases/10^5 population. The age-adjusted rates ranged from 0.9 to 5.8 cases/10^5 population overall and from 1.8 to 2.8 cases/10^5 population in adults.

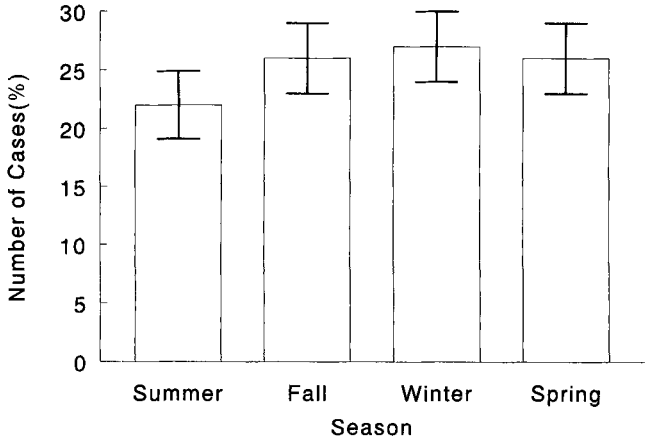

Fig. 2. Seasonal variation in the presentation of epiglottitis. The 813 cases of adult epiglottitis were equally distributed among all four seasons ($P = 0.25$). The proportion of patients presenting in a given season ranged from 22% for the summer months to 27% during winter. Error bars represent 95% CIs, which all include 25%, suggesting no statistically significant seasonal variation.

ception was unable to voice his complaints as a result of severe mental retardation. Twenty-nine percent of patients (n = 16) were dyspneic or had some form of respiratory complaint at the time of initial evaluation in the emergency department. Respiratory complaints ranged from mild dyspnea on exertion or lying flat to severe respiratory distress at rest. A history of current smoking was recorded in 51% of patients for whom a smoking history was requested, while an upper respiratory tract infection was noted in only 20% (n = 10) of patients.

Many other features were documented in the detailed review. An elevated leukocyte count ($\geq 12.0 \times 10^9$ cells/L) and a temperature elevation (≥37.5°C) were present in only 71% and 63% of patients, respectively. Soft tissue x-rays of the neck were performed in 28 patients. The true positive rate of official radiology reports in these patients with confirmed epiglottitis was 75% (95% CI: 59% to 91%). The percentage of bacteriologic specimens yielding significant growth on microbiologic analysis ranged from 11% (95% CI: 0.5% to 22%) for blood cultures to 75% (95% CI: 33% to 100%) for direct epiglottic cultures. When cultures did yield significant growth, the most common organism cultured was *Haemophilus influenzae* type B.

A selective approach to mechanical ventilation and ICU monitoring was practiced in the two tertiary care hospitals. The intubation rate in the emergency department was 20% (n = 10) overall. Significantly, none of the 41 remaining patients managed conservatively deteriorated and required urgent airway interventions. Of all intubation risk factors examined in the teaching hospitals (n = 51), only the presence of dyspnea at the time of admission ($P < 0.001$) predicted the need for aggressive airway management (Table III). Dyspnea was always present in patients before intubation. The positive predictive value of dyspnea as a symptom suggesting the need for intubation was 62%, while the negative predictive value was 100%.

TABLE II.
Clinical Features, Laboratory Results, Therapeutic Interventions, and Complications of the 51 Patients With Confirmed Epiglottitis.

Variable	Observations (n = 51)
Clinical features	
Duration of symptoms (d)	1.9 (±1.05)
Fever (%)	63
Odynophagia (%)	98
Dysphagia (%)	92
Dyspnea (%)	29
Laboratory results	
Reported soft tissue radiograph (%)	57
True positives (%)	75
Normal leukocyte count ($<12 \times 10^9$/L)	29
Microbiology (% positive)	
Blood (n = 34)	11
Throat (n = 18)	22
Sputum (n = 7)	43
Epiglottis (n = 4)	75
Therapeutic interventions	
Intubation in emergency department (%)	20
Monitoring in intensive care unit (%)	86
Antibiotics (%)	100
Glucocorticoids (%)	24
Complications	
Overall (%)	22
Complications following admission (%)	18
Infectious complications (%)	12
Intubation once admitted (%)	0
Tracheostomy rate (%)	0
Long-term sequelae (%)	0

Duration of symptoms reported as mean days ± standard deviation unless otherwise specified.

Eighty-six percent of the patients were monitored in a critical care setting. No tracheotomies or cricothyrotomies were performed in the 51 patients. Antibiotics, predominantly cefuroxime, were administered to all patients; glucocorticoids were given to 24% (n = 12) of patients. The use of glucocorticoids did not appear to significantly shorten hospital length of stay (5.16 ± 1.7 days in the steroid group vs. 5.7 ± 2.7 days in patients not given steroids, $P = 0.52$).

Outcomes and Complications

In the larger retrospective cohort the case fatality rate was 1.2% (95% CI: 0.5% to 1.9%). In reviewing the hospital records of 8 of the 10 patients who died as a result of epiglottitis, the diagnosis was confirmed through direct visualization (n = 7) and by soft tissue x-ray of the neck (n = 1). In one of the 10 identified deaths the hospital medical record could not be found, and in the other the hospital would not release information from the record because of ongoing legal proceedings. The available documentation suggested the presence of severe respiratory symptoms at least 4 hours before death in seven of eight patients. Interestingly, only five of the nine deaths were

TABLE III.
Comparison of Various Characteristics of Intubated and Nonintubated Patients With Confirmed Epiglottitis

Variable	Intubated (n = 10)	Nonintubated (n = 41)	*P* value
Demographics			
Age (in years)	43 (±20.0)	44 (±21.5)	0.91
Sex (% male)	70	41	0.72
Clinical features			
Fever	70	63	0.74
Odynophagia	100	98	1.00
Dysphagia	90	93	1.00
Respiratory complaints	100	15	0.0001
Laboratory features			
Soft tissue radiograph (% positive)	83	73	0.99
Leukocyte count	16.2 (±4.83)	14.1 (±5.2)	0.23

Variables reported as means ± standard deviation unless otherwise specified.

directly related to acute airway obstruction alone. These five patients all presented late; three patients failed immediate airway management, and two had unrecognized respiratory complaints that resulted in progression of upper airway obstruction within hours of arrival in the emergency department.

In the subset of 51 cases there were no deaths or long-term sequelae noted. However, there were three patients diagnosed with infectious complications at the time of admission: one patient with a peritonsillar abscess; a second with a cervical cellulitis, and a third with right-side, lower-lobe pneumonia. Once admitted, an additional eight patients developed complications; five of the complications were infectious, including five patients with peritonsillar abscesses or cellulitis and two with lobar pneumonia. The three remaining noninfectious complications included one case each of adult respiratory distress syndrome, an allergic reaction to cefuroxime, and a duodenal ulcer.

DISCUSSION

In this study we documented a case fatality rate of 1.2% with 95% CIs ranging from 0.5% to 1.9% in patients diagnosed with adult epiglottitis. The mortality rate was much lower and the estimate more precise than the 7.1% (95% CI: 0.4% to 13.8%) reported by MayoSmith et al.[2] In 51 confirmed cases we documented a very significant association between the presence of dyspnea and the need for intubation. In fact, the absence of any degree of dyspnea had a negative predictive value of 100%. The low case fatality rate, coupled with this ability to predict a benign course, suggests that a more selective approach to aggressive airway management is, indeed, safe and should be advocated in adult patients diagnosed with epiglottitis.

One of the most important observations in this study was the association between patients reporting dyspnea and the need for intubation to secure the airway. Among all demographic, clinical, and laboratory characteristics examined, dyspnea was the only predictor of intubation. Specifically, none of the 34 patients who did not report dyspnea as a presenting symptom deteriorated or required emergency airway management. All patients requiring intubation reported at least some dyspnea before intubation. Dyspnea was also reported in the eight epiglottitis-related deaths examined, suggesting that sudden upper airway catastrophes did not occur in adults without some prodromal dyspnea. An association between respiratory symptoms was also reported by MayoSmith et al.[2]; however, these authors recommended that all patients with epiglottitis should be intubated. In contrast to this very aggressive approach, Frantz et al.[9] recently reported that patients managed conservatively with obvious signs of respiratory distress did not have an increased mortality rates. This present study suggests that even the presence of mild dyspnea indicates that patients should be closely monitored and should be considered for "elective" intubation and mechanical ventilation. Thus it features prominently as one of the initial steps in Figure 3.

The case fatality rate of 1.2% in this study was considerably less than some published reports[2,14] but comparable to others.[5,6,13] Interestingly, less than half of the eight deaths were directly related to acute airway obstruction alone; the remaining deaths were complicated by major secondary diagnoses such as malignancies, end-stage heart failure, and cirrhosis. The available documentation suggested that all patients who died presented late; three patients failed immediate airway management, and two patients had unrecognized respiratory complaints that resulted in acute upper airway obstruction within hours after arrival. Therefore only 0.2% of deaths from epiglottitis in 813 patients might have been prevented had respiratory symptoms been recognized in a more timely fashion.

The overall incidence of 2.02 cases/10^5 documented in this study was more than 100% greater than the first North American population-based study[2] and 12% greater than a more recent study.[15] This increase may be directly related to heightened awareness and perhaps also to improved ease of visualization of the upper airway using fiberoptic laryngoscopy. We believe that both of these factors resulted in the detection of larger numbers of mild cases with a lower case fatality rate. Indeed, the Rhode Island study appeared to identify sicker patients given that a greater proportion reported respiratory complaints (46% vs 31%) compared with cases reviewed in this study. We do not believe that incidence rates increased over time given stable rates in Ontario during a 5-year period.

The large number of cases in this study also permitted reliable and stable estimates of age-adjusted incidence rates as well as gender and seasonal distributions. The total number of cases noted in the adult population (n = 813) was almost two and a half times the number noted in the pediatric age-group (n = 324). However, age-adjusted incidence rates of epiglottitis in children 4 years of age or less were 5.8 cases/10^5 population as compared with 2.02 cases/10^5 across all adult age-groups. The incidence ranged from 1.6 to 2.8 cases/10^5 population in adults, peaking between the ages of 35 to 39 years. Therefore the risk of epiglottitis appears evenly distributed among all adult age-groups but occurs significantly less frequently than in young infants (Fig. 1).

In the small cohort, we reviewed the symptoms, signs, and laboratory features of adult epiglottitis. The disease evolved rapidly with less than 2 days between the onset of symptoms, predominantly odynophagia and dysphagia, and the need for hospitalization. Indeed, the only consistent historical, clinical, or laboratory features on presentation associated with adult epiglottitis were the rapid development of progressive odynophagia and dysphagia.

One of the interesting findings on review of the social histories was the large number of smokers among patients with the disease. A history of current smoking was noted among 51% of all adults with epiglottitis, which dramatically exceeded the 23% age-adjusted incidence of smoking in the general population of the Ottawa region. This result raises the possibility of a biologically credible association between smoking and the development of epiglottitis.

Interestingly, only 20% of patients in this study received steroids in addition to antibiotics (100%), orotracheal intubation (20%), and ICU monitoring (86%). The role of corticosteroids in epiglottitis has been well described in published case series[6,13,16–18] but remains controversial. Several authors have suggested that steroids may decrease airway inflammation resulting in improved airway patency, possibly decreasing lengths of ICU and hospital stay as well as the need for intubation. This rationale has also been increasingly advocated in the treatment of many other upper airway diseases. For example, their efficacy in croup has recently been documented in a randomized clinical trial.[19] In epiglottitis the evidence supporting the use of steroids remains limited.[3] In this subset of patients there was no definite trend identified toward shortening the length of hospitalization in patients receiving steroids. However, a significant benefit from corticosteroids may have been missed, given the small number of patients in the study. A prospective randomized trial evaluating the benefits of steroids in this disease would certainly help elucidate the role of this pharmacologic intervention. However, it will take years to recruit enough subjects for such a study. In the absence of specific contraindications, a short course of corticosteroids may result in shortening the overall hospitalization period in adults with epiglottitis. Indeed, there are no randomized trials evaluating any therapy or management strategy used in the treatment of epiglottitis. Despite the lack of prospective studies, the information from this study and the published literature were used in formulat-

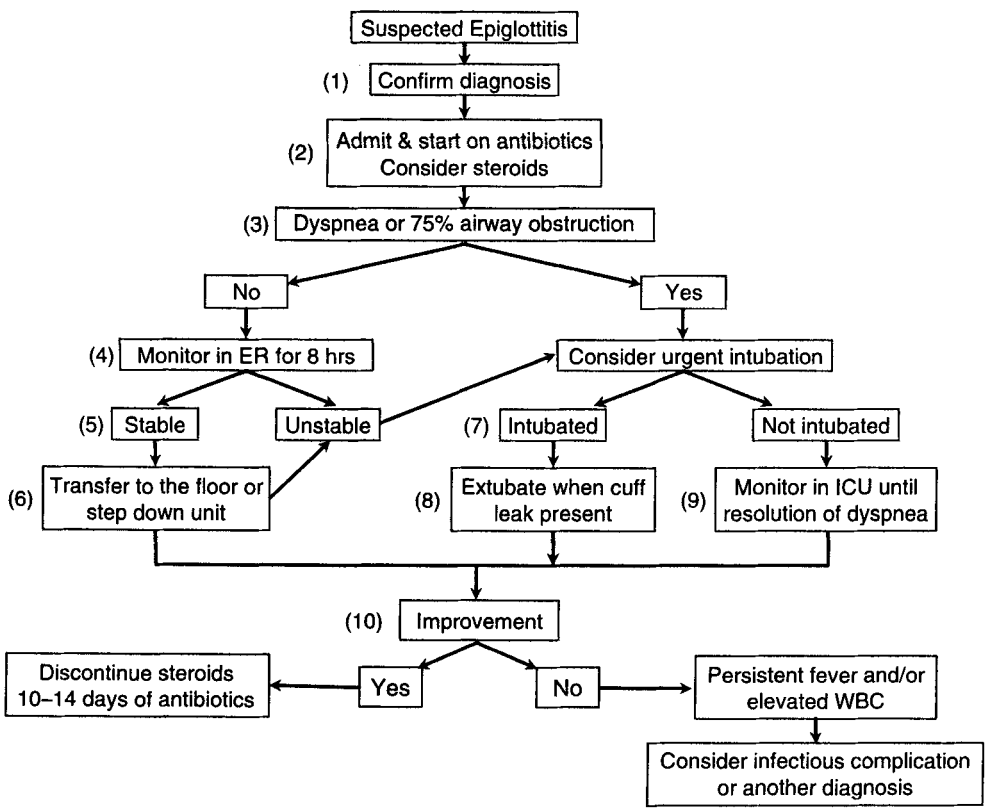

Fig. 3. Algorithm describing a proposed decision tree for the treatment of epiglottitis: *1.* Based on our experience, we suggest that all patients should undergo an examination of the upper airway using nasopharyngolaryngoscopy or other techniques to directly visualize the epiglottis and, more important, the degree of tracheal narrowing. *2.* Broad-spectrum antibiotics that cover gram positive organisms and *Haemophilus influenzae* must be administered to all patients. In addition, patients may be given corticosteroids such as methylprednisolone to modulate the inflammatory response. *3.* Should visualization reveal evidence of more than 75% obstruction of the upper airway, we recommend considering immediate intubation or close observation in a critical care setting. Patients should also be questioned about respiratory symptoms. If any degree of dyspnea is described, again, we recommend considering immediate intubation. *4.* If patients have no respiratory symptoms or a patent airway, they should be monitored in a critical care setting for approximately 8 to 12 hours and *5.* subsequently sent to the floor or a step-down unit if in stable condition and still free of respiratory symptoms. *6.* The patient should still have frequent measurement of vital signs and oximetry (hypoxia is a late finding but the monitoring process increases patient contact) and be repeatedly asked about dyspnea. *7.* If, at any time, the patient becomes short of breath, reevaluate the upper airway for a possible intubation and transfer to a critical care setting. *8.* Extubation may be performed once a cuff leak develops upon deflation of the endotracheal tube cuff and direct visualization of the epiglottitis demonstrates resolution of epiglottic swelling. Extubations should be performed by experienced personnel in a controlled setting. *9.* Patients who are monitored in the intensive care unit (ICU) for 24 hours may be discharged once dyspnea resolves. 10. If symptoms, fever, or an elevated leukocyte count persists beyond 36 hours, an infectious complication such as a pneumonia or retropharyngeal or peritonsillar abscess should be considered. Corticosteroids should be discontinued once dyspnea resolves, and antibiotics continued for a minimum of 7 days.

ing a management strategy for patients diagnosed with this life-threatening infection (Fig. 3).

The use of a cohort design complemented by an in-depth review of a series of cases has proven to be a very powerful strategy in describing the clinical presentation, outcomes, and epidemiologic features of this relatively rare and potentially life-threatening condition. However, misclassification (incorrectly labeling a patient with the diagnosis) is a potential concern in this study. If misclassifications did occur, we believe that the proportion of incorrectly diagnosed cases was small. In fact, all 51 cases in the two tertiary care hospitals, the 17 cases from a community hospital, and the eight deaths for which diagnostic information was available appeared appropriately categorized through direct visualization. Therefore we believe that the widespread use of easy and safe techniques to visualize upper airway structures resulted in the accurate diagnosis of mild to severe cases of epiglottitis in the remaining cohort. In addition, by examining all identified deaths, we ensured that all lethal consequences from epiglottitis were scrutinized.

CONCLUSION

Adult epiglottitis may be more common than previously appreciated and may occur at any age, in both sexes, and at any time of the year. We believe that an increased awareness of this condition accompanied by the widespread use of nasopharyngolaryngoscopy resulted in the identification of more cases with a wide spectrum of disease severity. Consequently, the case fatality rate was noted to be low at 1.2%. The presence of dyspnea predicting the need for acute airway interventions, coupled with the low case fatality rate, suggests that physicians should selectively use an aggressive airway management strategy in patients diagnosed with adult epiglottitis.

ACKNOWLEDGMENT

The authors wish to thank Laura Maclachlan, BSc, and Karen Sullivan for their assistance in the execution of this study. We also appreciated the assistance of Christine Proiette from the Canadian Institute for Health Information for organizing the health records registry search. Ian Stiell, MD, FRCPC, MSc, and Bryan Garber, MD, FRCSC, provided invaluable advice and helpful comments on the manuscript.

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