

Acute epiglottitis: epidemiology, clinical presentation, management and outcome

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Abstract

Aims: To describe the incidence trends, clinical presentation, management and outcome of acute epiglottitis in a Danish population after the introduction of *Haemophilus influenzae* type b vaccine.

Methods: Retrospective review of the health records of all patients discharged with a diagnosis of acute epiglottitis from the otolaryngology department, Roskilde County Hospital, Denmark, from 1996 to 2005.

Results: One infant and 34 adults were identified. The incidence of acute epiglottitis in children was 0.02 cases/100 000/year. Before introduction of the *H influenzae* type b vaccination (1983–1992), the mean national incidence of acute epiglottitis was 4.9 cases/100 000/year. The incidence of acute epiglottitis in adults was constant, with a mean value of 1.9 cases/100 000/year. Twenty-nine per cent of the patients required an artificial airway, and respiratory distress was found to be associated with airway intervention ($p = 0.010$). All patients recovered completely.

Conclusions: In the *H influenzae* type b vaccine era, acute epiglottitis in children has almost disappeared. The incidence in the adult population has been constant. A discriminate approach to airway management seems safe in adults.

Key words: *Haemophilus Influenzae* Vaccines; Epiglottitis; Child; Immunisation; Denmark

Introduction

Acute epiglottitis is a potentially life-threatening infection of the supraglottic structures, which can lead to sudden, fatal airway obstruction. Historically, acute epiglottitis was initially described as a disease of adults, but from the 1960s onwards it has been considered to be mainly a paediatric disease.¹ The introduction of the conjugate vaccines against *Haemophilus influenzae* type b in western countries led to a dramatic decline in the incidence of acute epiglottitis in children.^{2–5} Subsequently, the focus shifted again towards acute epiglottitis in adults, in whom the disease was now more common than in children. There have been several reports of an increasing incidence of acute epiglottitis in adults.^{2,6,7} Over the last six to seven years, the incidence of acute epiglottitis in children in the UK has started to rise again,⁸ suggesting that acute epiglottitis may be on the uprise in the paediatric population.

In Denmark, the *H influenzae* type b vaccine was introduced into the infant immunisation schedule in June 1993, to be given at three, five and 12 months of age without a booster dose. Based on preliminary clinical observations, this has had a great impact on the incidence of acute epiglottitis, which has fallen dramatically. The purpose of this study was to describe

the trends of acute epiglottitis incidence, both in the paediatric and adult Danish population, on the basis of acute epiglottitis cases admitted to our institution over the last 10 years. We also aimed to assess the presenting symptoms, clinical course, management and outcome of acute epiglottitis.

Methods

A retrospective review of health records was performed for all patients discharged with a diagnosis of acute epiglottitis from the department of otolaryngology–head and neck surgery, Roskilde County Hospital, Denmark, over a 10-year period between January 1996 and December 2005. Our hospital is a regional referral centre, and all paediatric and adult patients in Roskilde county suspected of having acute epiglottitis would be referred to our department. A search of paediatric department health records confirmed that no patients with acute epiglottitis were treated in that department over the study period.

Data collection was performed using a form designed for the purpose of this study. Information recorded included: patient demographics; vaccination status; treatment prior to admission; referring

instance; symptoms and findings; epiglottitis appearance; treatment; airway management; laboratory findings; complications; and outcome. The diagnosis of acute epiglottitis was established by transnasal flexible fibre-optic laryngoscopy.

Data analysis was performed using the Statistical Package for the Social Sciences and the Systat 10 statistical software programmes. Where the sample distribution was approximately normal, the mean and standard deviation (SD) were used as descriptive statistics; otherwise, the median and range were given for descriptive purposes. To establish risk factors for airway intervention, different patient characteristics were compared between patients who had received airway intervention and those who had not. Categorical dichotomous variables were compared using Fisher's exact test, whereas comparisons of continuous variables were performed using the two-tailed *t*-test. We did not make adjustments for multiple comparisons, but the absolute *p* values are presented. Hypothesis testing for seasonal variation was performed using Kolmogorov–Smirnov statistics.⁹

Results and analysis

Demographic and epidemiologic findings

Thirty-five patients with acute epiglottitis were identified, 34 adults and one infant. The average population at risk in the reviewed period was 232 107. The median age of the adults was 56.8 years (range 28–92 years) and of the infant was 1.8 years; the distribution of the cases by age is shown in Figure 1. Sixty-three per cent of the patients were male, giving a male-to-female ratio of 1.7:1. None of the patients had been vaccinated against *H influenzae* type b. Thirteen patients (37 per cent) had been

referred from their general practitioner, 12 patients (34 per cent) from the emergency department or other departments, and the remaining 10 patients (29 per cent) from an otolaryngologist.

The incidence of patients with acute epiglottitis admitted to our hospital over time, illustrated in Figure 2, showed no time trend. The mean incidence in children in our study population was 0.02 cases/100 000 children/year. The mean incidence in adults was 1.9 cases/100 000 adults/year. To put this in a national perspective, we also calculated average incidences for children (0–15 years) and adults (over 15 years), based on figures from the Danish National Board of Health. Before the introduction of *H influenzae* type b vaccination, during the period 1983–1992, there were 486 acute epiglottitis cases in children nationwide, and the incidence was 4.9 cases/100 000 children/year. The corresponding numbers for adults were 1040 cases of acute epiglottitis and an incidence of 2.5 cases/100 000 adults/year. After the introduction of *H influenzae* type b vaccination, between 1995 and 2004, the total number of acute epiglottitis cases in children fell to 40 and the incidence to 0.78 cases/100 000 children/year. In the adult population, the cumulative frequency of acute epiglottitis in the same period was 1000 cases and the incidence was 2.1 cases/100 000 adults/year.

Figure 3 depicts the seasonal incidence of acute epiglottitis cases in our study population. The exact admission date was used to calculate the cumulative relative frequency, which is illustrated together with the cumulative relative frequency expected if there were no seasonal variation (i.e. a straight line). There was a slight tendency to departure from the uniform seasonal variation during the winter and early spring months, but this was not significant ($0.15 < p < 0.20$).

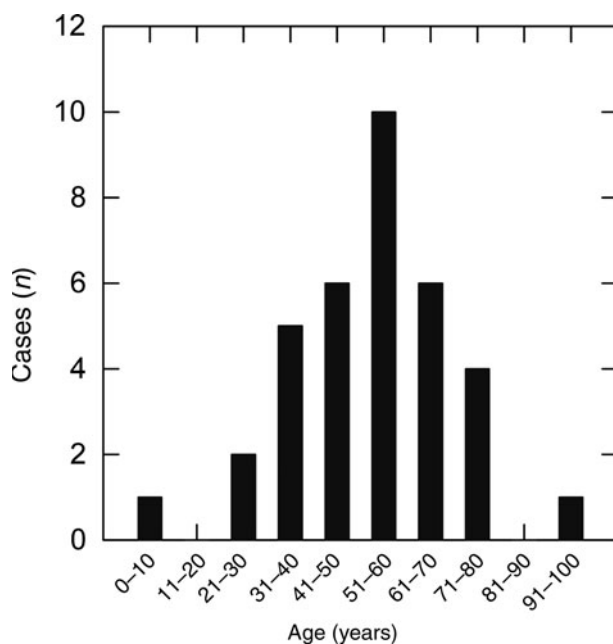


FIG. 1

Distribution of acute epiglottitis cases over the 10-year study period, by age. The average population at risk was 232 107.

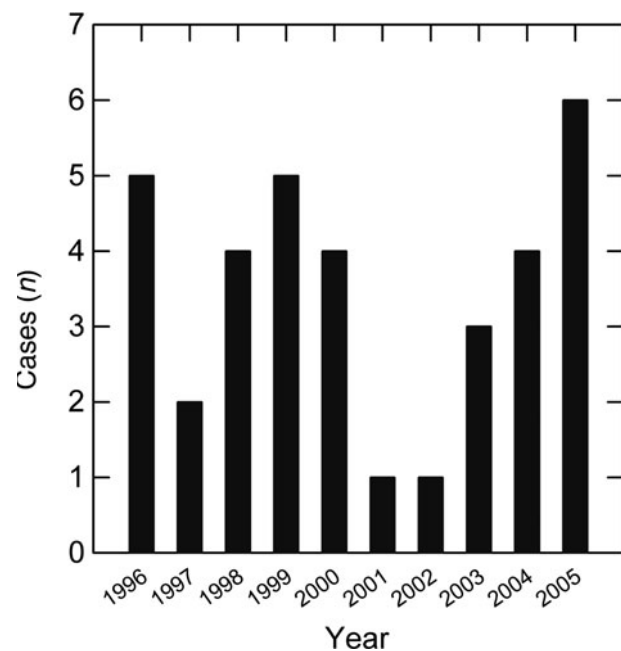


FIG. 2

Incidence of acute epiglottitis over the 10-year study period. The average population at risk was 232 107.

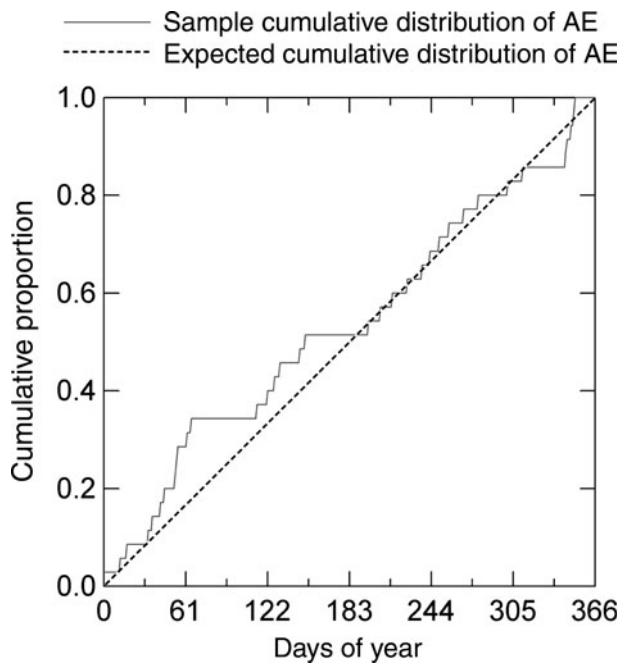


FIG. 3

Seasonal distribution of acute epiglottitis (AE) cases over the 10-year study period.

Clinical and paraclinical findings

The main symptoms, clinical and paraclinical findings are presented in Table I. The dominant symptom (occurring in 94 per cent of patients) was odynophagia, while only approximately half the patients had drooling or a history of fever or respiratory difficulty. One-third of the patients had muffled voice.

Examination of the larynx showed a swollen, erythematous epiglottis in 24 patients (69 per cent), while 10 patients (28 per cent) had severe swelling of the epiglottis, the aryepiglottic folds and false folds, with more than 50 per cent narrowing of the

TABLE I

MAIN SYMPTOMS, SIGNS AND LABORATORY RESULTS

| Clinical findings | Results |
|--|------------------|
| <i>Symptoms</i> | |
| Odynophagia (<i>n</i> (%)) | 33 (94.3) |
| Drooling (<i>n</i> (%)) | 21 (60.0) |
| History of fever (<i>n</i> (%)) | 20 (57.1) |
| Respiratory difficulty (<i>n</i> (%)) | 19 (54.3) |
| Muffled voice (<i>n</i> (%)) | 10 (28.6) |
| <i>Clinical & paraclinical signs</i> | |
| Hoarseness (<i>n</i> (%)) | 14 (40) |
| Stridor (<i>n</i> (%)) | 4 (11.4) |
| Severely swollen epiglottis (<i>n</i> (%)) | 10 (28.6) |
| Swollen, erythematous epiglottis (<i>n</i> (%)) | 24 (68.6) |
| Slightly swollen epiglottis (<i>n</i> (%)) | 1 (2.9) |
| Temperature (mean (SD); °C) | 38.1 (0.82) |
| <i>Investigations</i> | |
| White blood cell count (mean (SD); $\times 10^3$ cells/mm ³) | 17.64 (4.99) |
| C-reactive protein (median (range); mg/dl) | 11.95 (0.9–29.0) |

SD = standard deviation

supraglottic airway. Only one patient (3 per cent) had slight swelling whereby the entire length of the vocal folds could be seen with the fibrescope. Hoarseness was found in 40 per cent and stridor in 11 per cent of the patients. The mean body temperature on admission was 38.1°C (SD 0.82).

The median C-reactive protein concentration was 11.95 mg/dl (range 0.9–29.0 mg/dl). The mean white blood cell count was 17.64×10^3 cells/mm³ (SD 4.99×10^3).

Throat swabs were obtained from 10 patients. Growth of pathogens was present in only one patient (beta haemolytic streptococci). Twelve patients had blood cultures: 10 showed no growth, one had a positive culture for *H influenzae* type b and one had a positive culture for *Streptococcus pneumoniae*.

Medical therapy

Thirteen patients (37 per cent) had been treated with antibiotics before hospitalisation. Nine patients had received penicillin, one patient ampicillin and metronidazole, and three a macrolid antibiotic. The antibiotic regimen in the hospital consisted of either cefuroxime (34 per cent) or ampicillin (66 per cent) given intravenously. Only two patients received metronidazole in combination with one of the other antibiotics. Twenty-six patients (74 per cent) were treated with intravenous corticosteroids and 10 patients (29 per cent) received adrenaline inhalation. The mean hospital stay for the patients who received steroids (6.3 days (SD 6.7)) was significantly different ($p = 0.005$) from that of patients who did not receive steroids (3.9 days (SD 1.2)).

Airway management

Nine patients (26 per cent) had successful endotracheal intubation as part of their initial treatment. Of these patients, the intubation was described as difficult in three and easy in the remaining six. One patient underwent acute tracheotomy after failed attempts at accessing the airway by endotracheal intubation. A further 20 patients (57 per cent) were transferred to the intensive care unit after the diagnosis was established for close monitoring. The remaining five patients were admitted directly to the ENT department for close monitoring. None of these patients experienced deterioration, which demanded airway intervention or later transfer to the intensive care unit. The mean intubation time was 2.8 days (SD 0.8), while the median intensive care unit stay was 2.0 days (range 0.5–5.0 days). The median hospital stay was 5.0 days (range 2.0–21.0 days). There was a significant difference ($p = 0.038$) between the hospital stay of patients who received airway intervention (mean 8.9 days, SD 5.1) and that of those who did not (mean 4.6 days, SD 1.5). The use of glucocorticoids was significantly different, comparing intubated (10/10) and unintubated (16/25) patients ($p = 0.036$). Of the parameters presented in Table II, only the occurrence of respiratory distress differed significantly between patients who received airway intervention and those who did not.

TABLE II
FACTORS ASSOCIATED WITH AIRWAY INTERVENTION

| Variable | Airway intervention* | No airway intervention† | <i>p</i> |
|---|----------------------|-------------------------|----------|
| Age (mean; yrs) | 57.7 | 50.8 | 0.425 |
| M:F ratio | 8:2 | 14:11 | 0.259 |
| <i>Symptoms</i> | | | |
| Odynophagia (<i>n</i>) | 8 | 25 | 0.076 |
| Drooling (<i>n</i>) | 7 | 14 | 0.445 |
| History of fever (<i>n</i>) | 3 | 17 | 0.062 |
| Respiratory difficulty (<i>n</i>) | 9 | 10 | 0.010 |
| Muffled voice (<i>n</i>) | 3 | 7 | 1.000 |
| History of antibiotics before admission (<i>n</i>) | 4 | 9 | 0.825 |
| <i>Clinical & paraclinical signs</i> | | | |
| Hoarseness (<i>n</i>) | 3 | 11 | 0.704 |
| Stridor (<i>n</i>) | 3 | 1 | 0.061 |
| Temperature (mean; °C) | 38.5 | 38.0 | 0.087 |
| <i>Investigations</i> | | | |
| White blood cell count (mean; × 10 ³ cells/mm ³) | 17.8 | 17.5 | 0.889 |
| C-reactive protein (mean; mg/dl) | 15.2 | 13.3 | 0.700 |

**n* = 10; †*n* = 25.

Complications and outcome

At admission, two patients had pneumonia and acute epiglottitis simultaneously, one patient had a peritonsillar abscess, and another patient had an infected cyst on the neck. During the hospital stay, one patient developed a pneumothorax, treated with pleural drainage. Another patient developed an epiglottic abscess, treated by incision and drainage. After extubation, a 38-year-old man appeared psychologically unwell and had a psychiatric consultation. The changes were temporary and were ascribed to steroid treatment. After discharge, two patients had persistent voice changes and were referred for logopaedic treatment. There were no deaths, and all patients made a full recovery.

Discussion

During the past few decades, the epidemiology of acute epiglottitis has changed, both in the paediatric and the adult populations. There is generally agreement that the introduction of *H influenzae* type b vaccination has led to a dramatic decline in the incidence of acute epiglottitis in children.^{2–4,8,10–13} However, for several reasons, paediatric acute epiglottitis has not disappeared. Firstly, vaccination rates are not 100 per cent, and even if there is some evidence of herd immunity,¹⁴ there are several reports of *H influenzae* type b acute epiglottitis in unvaccinated children.^{11,15} Secondly, vaccination failures do occur, even if rare (the overall vaccine effectiveness in a prospective study in the UK was 98 per cent¹⁶).^{8,11,15,17} Finally, acute epiglottitis in children can also be caused by pathogens other than *H influenzae* type b.^{3,5,11} More worryingly, not only has acute epiglottitis in children not vanished, but there is also evidence of increasing incidence in the UK.⁸ The findings of our study are in accord with previous reports of a decreased incidence of acute epiglottitis in children following introduction of the *H influenzae* type b vaccination. However, we have not observed any recent rise in the incidence of acute epiglottitis similar to that reported in the UK.

In contrast to the situation in children, there is contradiction in the literature regarding the epidemiology of acute epiglottitis in adults. Some studies have found an increasing incidence,^{2,7,13} while other authors reported a stable incidence.¹⁸ Our data show a stable incidence of the acute epiglottitis in adults. This concurs with the findings of Garpenholt *et al.* in Sweden, who found a decreased incidence, albeit statistically insignificant.¹²

Two hypotheses have been formulated to explain the rising incidence of adult acute epiglottitis found elsewhere. Mayo-Smith *et al.*² have hypothesised the existence of two forms of acute epiglottitis in adults: the classic form caused by *H influenzae* type b, and a 'supraglottitis' form, unrelated to *H influenzae* type b, with a slower onset and less localisation to the epiglottis but more oropharyngeal inflammation. An increase in occurrence of the latter form would explain the rising incidence of acute epiglottitis in adults. The second hypothesis ascribes the increasing incidence of adult acute epiglottitis to the indiscriminate use of antibiotics, leading to the emergence and spread of antimicrobial resistance.⁷ If this holds true, it would explain the constancy of acute epiglottitis incidence in Denmark, where the use of antibiotics is very restricted.

We observed no seasonal variation in the incidence of acute epiglottitis. Kass *et al.* have reported a summer seasonal predominance in the incidence of acute epiglottitis, based on analysis of 17 cases.¹⁹ However, other studies with larger samples have not confirmed this.^{2,7,20,21}

The male-to-female ratio (1.7:1) in our study confirms the preponderance of male patients found in other studies, which have reported ratios of between 1.2:1 to 4:1.^{1,7}

Airway management and corticosteroid usage are two controversial issues in the treatment of acute epiglottitis. The airway management recommendations in the literature encompass a broad spectrum. At one extreme, some authors have advocated the automatic establishment of an artificial airway in all paediatric patients presenting with acute epiglottitis.²²

This approach has also been recommended for adult patients in earlier studies.²³ At the other extreme, conservative management of adults has been suggested, in contrast to the interventionist approach advocated in children.²⁴ However, most authors fall somewhere between these two extremes and recommend a selective approach in adults, based on comprehensive evaluation of the patient.^{2,18,20} Some of the factors found to be associated with airway intervention are: respiratory discomfort; stridor and drooling;² drooling alone; history of diabetes mellitus; rapid onset of symptoms and abscess formation;⁷ stridor and sitting erect;¹⁸ and dyspnoea.²⁰

- **This study investigated the incidence trends, clinical presentation, management and outcome of acute epiglottitis in a Danish population after the introduction of the *Haemophilus influenzae* type b vaccine**
- **In the *H influenzae* type b vaccine era, acute epiglottitis in children has almost disappeared. In Denmark, a recent rise in the incidence of *H influenzae* type b epiglottitis in children, similar to that reported in the UK, has not been observed**
- **The incidence of acute epiglottitis in the adult population has remained constant**
- **A discriminate approach to airway management, based on careful clinical evaluation, seems safe in adults**

In our study, only respiratory distress was found to be significantly associated with airway intervention. The proportion of patients with airway intervention (28 per cent) falls midway within the range reported in the literature (i.e. Frantz *et al.*,¹⁸ 15 per cent; Hebert *et al.*,²⁰ 20 per cent; Mayo-Smith *et al.*,² 21 per cent; and Dort *et al.*,²⁵ 32 per cent). The outcome observed in our study, with full recovery and no deaths, in the context of a selective approach, supports the discriminate airway management of acute epiglottitis in adults.

The proportion of patients with acute epiglottitis reported to receive glucocorticoids varies from 20²⁰ to 83²¹ per cent. Most authors have not found steroids to have a beneficial effect on the length of hospital stay, period of intubation or duration of intensive care unit stay.^{2,7,20,21} However, no conclusion can be drawn from this, as all the reported studies of acute epiglottitis management have been retrospective. There is good reason to believe that these results are biased by clinical selection of the more severe cases to receive glucocorticoids. In our study, all patients who received airway intervention also received steroids, while only 64 per cent of the remaining patients received steroids. This difference was significant. However, the patients who received steroids stayed in hospital significantly longer than those managed without steroids. The

most plausible explanation is that the former patients were more severely affected and that this prompted the institution of steroid treatment. It is conceivable that without the steroid treatment the hospital stay would have been longer. Until the effects of corticosteroids in acute epiglottitis have been investigated in prospective, randomised trials, a potentially beneficial effect of steroids cannot be rejected.

Conclusion

The introduction of *H influenzae* type b vaccination into the Danish infant immunisation programme has had the same profound impact on the incidence of paediatric acute epiglottitis as seen in other countries which have introduced this vaccine. We have not observed a recent rise in the incidence of *H influenzae* type b acute epiglottitis in children similar to that reported in the UK. However, there is every reason to bear in mind the possibility of such an increased incidence. The incidence of acute epiglottitis in the adult population was found to be constant, in contrast to the rising trends reported in other countries. A selective approach to airway management in adult acute epiglottitis, based on careful clinical evaluation, seems safe and recommendable.

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