

Paediatric airway emergencies in Northern Ireland, 1990–2003

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Abstract

The management of paediatric airway emergencies is part of ENT practice. The most common conditions are acute viral laryngotracheobronchitis (croup), acute epiglottitis and bacterial tracheitis. Management of these conditions is significantly different and accurate diagnosis is crucial. We performed a retrospective analysis of all acute airway admissions to the paediatric intensive care unit (PICU) at the Royal Belfast Hospital for Sick Children from 1990 to 2003. The results showed a gradual decrease in the number of admissions due to croup. Acute epiglottitis admissions decreased markedly after 1992 but rose again in 2000, with a peak in 2002. Bacterial tracheitis is now the most common paediatric airway emergency requiring PICU admission and its incidence has been steadily increasing since 1990, peaking in 2003. The total number of admissions showed little change over the 14-year period audited. The significant shift in the nature of these conditions and these findings confirm the ongoing requirement for caution in dealing with a suspected airway emergency.

Key words: Airway Obstruction; Tracheitis; Epiglottitis; Croup; Vaccination; Haemophilus; Laryngotracheobronchitis

Introduction

Paediatric airway emergencies are a common reason for admission to the intensive care unit and are usually seen by a senior otolaryngologist on presentation. Significant changes have taken place in both vaccination and treatments in the last 15 years, which should have led to a significant decline in the number of acute airway admissions to paediatric intensive care units (PICUs). The general perception in both paediatric and otolaryngology circles is that acute infective airway problems are largely the subject of anecdotal and historical interest. This perception may be premature. We decided to assess the number of acute airway admissions to the PICU of the Royal Belfast Hospital for Sick Children from the start of 1990 until the end of 2003. We hoped to find some identifiable patterns in the incidence and nature of these conditions.

Materials and methods

The Royal Belfast Hospital for Sick Children is the tertiary referral centre for all paediatric emergencies requiring intensive care treatment in Northern Ireland, a region with a population of 1.685 million.

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The PICU of this hospital records all admissions with International Classification of Disease codes (ICD), and these records are relatively easy to access through the department. Computer records were available from 1990 to 2003 inclusive which were highly accurate and contained detailed diagnostic information.

We also performed a Medline literature search for articles relating to the three main infective conditions prompting admission. Department of Health (DoH) resources were also analysed; this gave an overview of how the DoH dealt with the epidemiology of these conditions (statistics were also available on related topics for the same period in England and Wales). The DoH resources accessed included DOH Online and immunization documents as well as parental information distributed during the relevant period.

We also looked at the aetiology of the conditions. The data gleaned from the PICU was cross-referenced with the DoH information in an attempt to identify causal factors in the changing pattern of paediatric airway emergencies.

Results and analysis

A total of 197 airway emergencies were admitted to Royal Belfast Hospital for Sick Children PICU

from 1990 to 2003: 82 children with viral laryngotracheobronchitis (croup), 26 with acute epiglottitis and 89 with bacterial tracheitis. The peak year for total airway emergency admissions was 2003 (28 admissions) and the year with the lowest number was 1997 (only four admissions). Data on total airway admissions to PICU are shown in Table I, represented graphically in Figure 1.

These data show that there was a relatively high number of admissions between 1990 and 1994. There followed a sharp drop-off over the next two to three years, with a nadir of only four cases in 1997. From 1998 to 2001, the figures were steady, but there was a large increase, to 19 cases, in 2002 and again in 2003, to 28 cases (the highest annual total in the series). This increase is worrying when seen in isolation but can be better explained by looking at each condition separately.

Acute viral laryngotracheobronchitis (croup) is an acute viral infection which is usually seen in the three

to five month age group and is characterized by a barking cough, hoarseness, inspiratory stridor and a varying degree of respiratory distress. The symptoms range from mild and self-limiting to severe (in which case respiratory failure and death secondary to airway obstruction may result). The infection primarily involves the larynx but may extend into the trachea and bronchi. It is the most common cause of acute stridor in the febrile child.

In 1990, there were 16 cases of croup admitted, the highest annual total in our series. This fell steadily until 1997, when there were no cases. Since 1998, the number of cases requiring admission to PICU remained steady, with two to four per year (see Table II and Figure 2). This decrease is thought to be due to increased treatment of the condition with the nebulized corticosteroid budesonide, but it may have been due to a natural decrease in disease activity. Recent studies have shown that the use of glucocorticoids reduces both the admission rate and the length

TABLE I

PICU TOTAL AIRWAY EMERGENCY ADMISSIONS 1990–2003

Year	Admissions
1990	23
1991	18
1992	11
1993	22
1994	15
1995	9
1996	7
1997	4
1998	8
1999	13
2000	11
2001	9
2002	19
2003	28
Total	197

PICU = paediatric intensive care unit

TABLE II

PICU CROUP ADMISSIONS 1990–2003

Year	Admissions
1990	16
1991	13
1992	6
1993	9
1994	10
1995	4
1996	5
1997	0
1998	4
1999	3
2000	4
2001	3
2002	3
2003	2
Total	82

PICU = paediatric intensive care unit

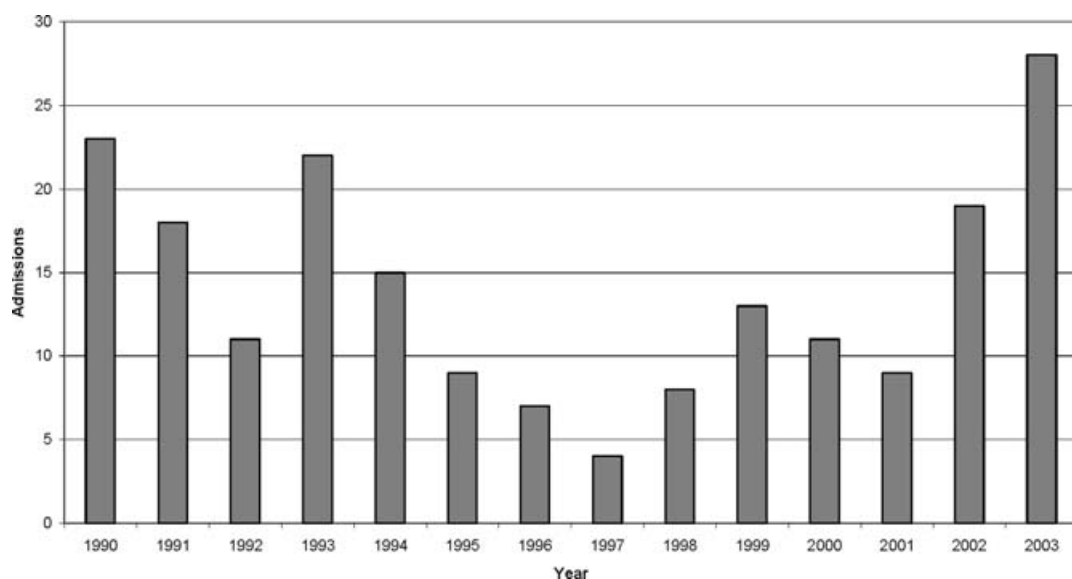


FIG. 1

Paediatric intensive care unit total airway emergency admissions, 1990–2003.

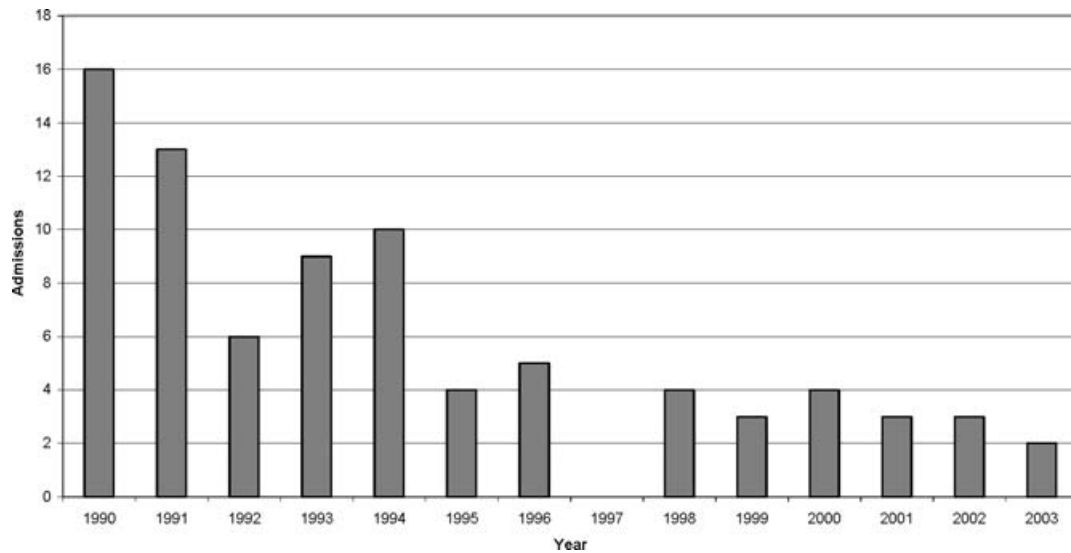


FIG. 2

Paediatric intensive care unit group admissions, 1990–2003.

of hospital in-patient stay.^{1–3} In conjunction with adrenaline, corticosteroids have been shown to reduce the intubation rate in patients with impending respiratory failure.⁴

Acute epiglottitis is characterized by inflammation of the structures above the insertion point of the glottis, including the epiglottis, aryepiglottic folds, arytenoid soft tissue and occasionally the uvula. The condition is caused by bacterial infection, most commonly *Haemophilus influenzae* type B (Hib), and has significant morbidity, occasionally causing respiratory arrest and death. Our data for acute epiglottitis are very interesting (see Table III and Figure 3). In 1990, there were six cases, but this fell sharply after the introduction of the Hib vaccine in 1992. There were no cases at all from 1995 to 1999 inclusive, which led some to believe that the condition had been eradicated. Cases started to re-appear in 2000, and in 2002 there were five cases. Microbiology revealed the causative pathogen to be *H. influenzae* type B in five of the seven cases seen

between 1999 and 2002. No microbiological analysis was available for the other two. These data paralleled haemophilus disease data from England and Wales in the same period and led to the implementation of a re-immunization campaign.⁵ In 2003, there was a drop back to only one case.

The third infectious cause of paediatric upper airway obstruction we surveyed was bacterial tracheitis. This term describes a diffuse inflammatory process involving the larynx, trachea and bronchi, with adherent or semi-adherent mucopurulent membranes within the trachea. Patients present with similar symptoms to croup such as stridor, barking cough and fever. They do not respond to standard therapy for croup and can experience acute respiratory decompensation. Bacterial tracheitis was a relatively uncommon condition compared with croup and acute epiglottitis in the early to mid-1990s but numbers increased markedly in 2002 and 2003 (see Table IV and Figure 4). Between September and November 2003, 14 children were admitted to PICU with bacterial tracheitis.⁶ Bacteriological analysis showed a variation in causative organisms. Virological analysis revealed two cases of parainfluenza type 2, a strain which had not been isolated in Northern Ireland in the previous 10 years.

TABLE III

PICU ACUTE EPIGLOTTITIS ADMISSIONS 1990–2003

Year	Admissions
1990	6
1991	3
1992	4
1993	4
1994	1
1995	0
1996	0
1997	0
1998	0
1999	0
2000	1
2001	1
2002	5
2003	1
Total	26

PICU = paediatric intensive care unit

Discussion

These data show significant trends in all three conditions over the 14-year period assessed.

Croup admissions decreased; initially the most common condition requiring admission, it became much rarer following the introduction of nebulized budesonide.

Acute epiglottitis admissions decreased rapidly after the introduction of the Hib vaccine in 1992. The rapid decline at that time was thought to be due to a number of factors, including a herd immunity effect and the ‘Catch Up’ campaign in 1992, during which all children under the age of 48 months were

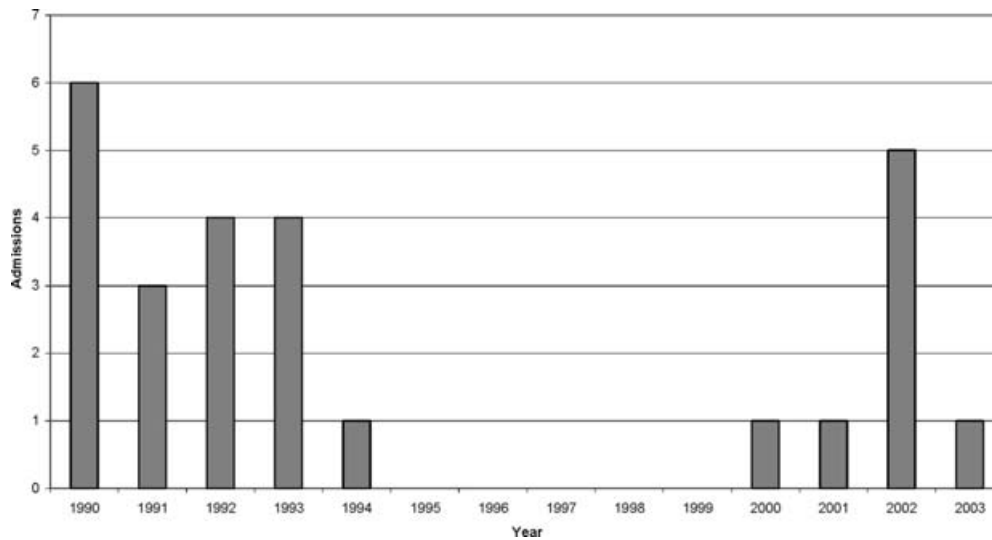


FIG. 3

Paediatric intensive care unit acute epiglottitis admissions, 1990–2003.

immunized. It was thought that this had almost eradicated Hib disease in general, including acute epiglottitis. Cases started to re-appear in 2000, with a marked increase in 2002. All cases were in previously vaccinated children, and our figures closely followed a similar pattern in total haemophilus disease figures for England and Wales over the same period.

There may have been a number of reasons for this rise in acute epiglottitis admissions. A natural, short term rise in the disease may have occurred. A rise in cases may have been because of the UK vaccination schedule, which involved only three doses at two, three and four months of age (whereas other countries gave a booster dose at up to 48 months). The resultant immunological memory may not have been as good with this approach; the effect of the Catch Up campaign may also have diminished. As in Northern Ireland, most new cases of acute epiglottitis in England and Wales occurred in immunized children, so it was not thought that the rise was due to a decrease in the herd immune effect.⁷ In 2001 and 2002, there was a shortage of the Diphtheria toxoid,

Tetanus toxoid, Whole Cell Pertussis vaccine (DTwP) Hib vaccine normally used so the Diphtheria toxoid, Tetanus toxoid, Acellular Pertussis vaccine (DTaP) Hib vaccine was used instead. This latter vaccine produced lower antibody levels and this may have contributed to the rise in Hib infection. In March 2003, parents were contacted by the Health Promotion Agency about a new Hib vaccine campaign. All children who were aged between six and 48 months on 1 April 2003 were offered a booster. Data from 2003 show only one case from early in this year, but it is too early to determine whether this has been due to the revaccination campaign. Recent reports have also shown an increase in non-haemophilus epiglottitis and this may have contributed to the rise, but closer inspection of our series revealed that five of the seven cases admitted between 2000 and 2002 had *H. influenzae* type B as the causative organism. This data mirrors that from other centres,⁸ which have seen an increase in acute epiglottitis cases caused by Hib, especially since 1999.

Bacterial tracheitis showed a more worrying trend. Having been a rare condition for most of the 1990s, it later became the most common paediatric airway emergency admitted to PICU in our series. This is cause for concern. Bacterial tracheitis is a rapidly progressing and hazardous condition that mimics croup in its early stages. Deterioration is rapid and endotracheal intubation is usually required. Studies have shown a marked increase in the last quarter of 2003, which may be attributed to a global increase in general viral activity noted at this time. This has prompted closer monitoring of the disease.

Conclusion

Paediatric airway emergencies were thought to be decreasing in incidence; however, recent studies in England and Wales have shown worrying trends, with resurgence of the two most dangerous conditions, acute epiglottitis⁹ and bacterial tracheitis. Data from Northern Ireland closely follow these

TABLE IV

PICU BACTERIAL TRACHEITIS ADMISSIONS 1990–2003

Year	Admissions
1990	1
1991	2
1992	1
1993	9
1994	4
1995	5
1996	2
1997	4
1998	4
1999	10
2000	6
2001	5
2002	11
2003	25
Total	89

PICU = paediatric intensive care unit

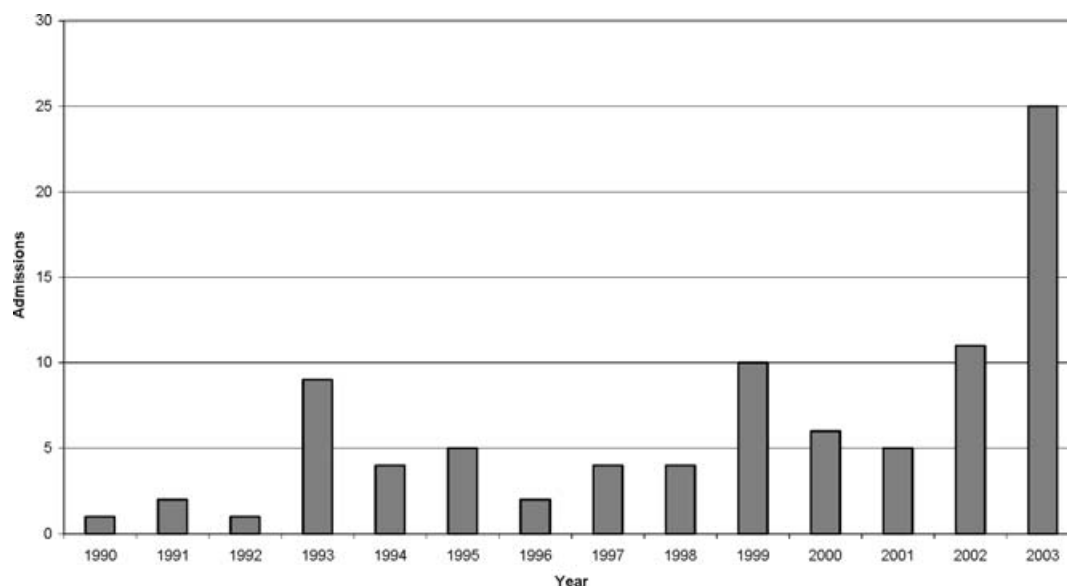


FIG. 4

Paediatric intensive care unit bacterial tracheitis admissions, 1990–2003.

patterns and have led to a new immunization campaign for *H. influenzae* type B in 2003 and closer monitoring of children presenting to paediatric accident and emergency departments with croup symptoms. Otorhinolaryngology trainees should make themselves fully aware of these conditions, including their investigation and treatment.

Overall, these trends constitute a valuable lesson that we should not become complacent about diseases thought to be eradicated, as a resurgence in their incidence can occur at any time.

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- **This paper reviews all acute airway admissions to the paediatric intensive care unit at a tertiary referral centre in Northern Ireland from 1990 to 2003**
- **Acute viral laryngotracheobronchitis (croup) was the commonest diagnosis**
- **Although the incidence of acute epiglottitis initially fell, there was a subsequent resurgence in the condition, prompting a new immunization campaign for *H. influenzae* type B**

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