

Increased need for tracheal intubation for croup in relation to bacterial tracheitis

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Croup is an old disease that is again demanding our attention. Although mortality rates remain low, more of the children with croup are now found to be in urgent need of artificial airways. The rate of endotracheal intubation is not yet high¹ but has changed enough in recent years to be of concern.

Until the end of the 1930s non-diphtheritic croup was regarded as laryngotracheobronchitis, and most publications of the period described it as a bacterial disease with signs and symptoms that were similar to what we today would call bacterial tracheitis.^{2,3} The mortality rate ran between 9% and 42%, and physicians used artificial airways with a tracheostomy in up to 80% of cases.⁴⁻¹⁰ At that time, however, the diagnosis of croup was also applied to epiglottitis. In the 1940s viral croup was recognized as a disease distinct from epiglottitis.¹¹

Over the next two decades, when antibiotics had come into use, the mortality rate dropped to 2.7% and artificial airways were used in only 7% to 29% of cases.¹¹⁻¹⁵ Between 1960 and 1980, deaths were reported in less than 1% of most case series,^{14,16-22} and artificial airways were used in less than 1% of the cases.^{17,18,23}

Some authors have related the sharp decreases in mortality and need for airway support to the introduction of racemic epinephrine, which is given by intermittent positive pressure ventilation.^{17,18} Improvements in intensive care for children may also have had an effect.²⁴

Although the mortality rate for croup remained low during the 1970s, the proportion of patients

who were managed with artificial airways increased in the last years of the decade. In Salt Lake City, Utah the rate of intubation for this disease rose from 0% between 1964 and 1970 to 13% in 1977.^{2,17} Most of the patients so treated were considered to have bacterial tracheitis.² In some series as many as 18% of the children with croup were being intubated.²⁰ The situation is clear in the statistics from the Toronto area: the rate of use of artificial airways fell steadily from 15% in the period 1926 to 1944^{14,25} to between 1.1% and 2.1% in the years 1976 through 1978, but in 1979 an artificial airway was used in 5.9% of croup cases.¹⁹ Our experience in Winnipeg has been much the same.

We believe the increased use of artificial airways in cases of croup actually reflects a reappearance of bacterial tracheitis. We report our recent experience with the need for intubation in children with croup.

Methods

In the 4 years from 1978 to 1981, 436 young children with croup were admitted to the Children's Hospital in Winnipeg. This group did not include patients with epiglottitis, as diagnosed by lateral roentgenography of the neck and direct laryngoscopy. Forty-six had such severe respiratory difficulty that they were

transferred to the intensive care unit, where all patients who require an artificial airway are treated. We reviewed the charts of these 46 patients retrospectively. We based the diagnosis of croup on the presence of stridor and the observation of subglottic narrowing on the roentgenogram.

Results

During the study period the numbers of children admitted to the hospital for croup varied little. The frequency of admissions to the intensive care unit and of nasotracheal intubation, however, increased (Table I), from 6% to 27% and from 1% to 11% respectively. Of the 436 children with croup 20 (5%) required an artificial airway. Ten of these children were treated in 1981, and in 9 of the 10 the ultimate diagnosis was bacterial tracheitis.

Our review of the charts showed that there were two distinct groups of patients with symptoms and signs suggestive of croup who were being treated in the intensive care unit (Table II). Most (32 of the 46) apparently had viral croup. The other 14, who had instead bacterial tracheitis, were more ill, with high temperatures and leukocyte counts.

Cultures of the tracheal secretions of almost all of the patients with bacterial tracheitis yielded either

Table I—Use of artificial airways in 436 patients admitted to hospital with croup*

Year and total no. of patients	No. with artificial airways among patients admitted to intensive care unit	
	With bacterial tracheitis (n = 14)	With viral croup (n = 32)
1978, n = 108	1/1	0/5
1979, n = 115	1/1	1/6
1980, n = 123	2/2	5/7
1981, n = 90	9/10	1/14

*Croup was further identified only in patients admitted to the intensive care unit.

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Staphylococcus aureus or *Haemophilus influenzae*. The one exception involved a patient who had been treated with antibiotics before admission to hospital; gram-negative rods were seen in a smear, but no organisms could be cultured. In all 14 patients the results of virologic studies were negative.

In 2 of the 14 patients with bacterial tracheitis accumulations of pus in the trachea led to cardiorespiratory arrest. This complication also occurred in a patient with thick plugs in the trachea. Such plugs were removed by aspiration from another two patients, thus relieving their respiratory distress. A sixth patient had had an artificial airway established before being transferred to our hospital and was in severe respiratory difficulty when admitted because the endotracheal tube had become plugged with secretions. All of these patients survived the primary disease.

Discussion

During the 4-year study period the number of children admitted to our hospital with a diagnosis of croup changed little, but the numbers of endotracheal intubations increased considerably. This observation is consistent with recent reports from other regions.^{2,17,19,26} The increase has been attributed to the opening of more pediatric intensive care units with highly trained personnel, in which the early use of invasive procedures is encouraged

because the indications for intubation have been expanded. Another explanation is that bacterial tracheitis is becoming more prevalent.

Most of our patients (70%) who required intubation for croup in fact had bacterial tracheitis. In this disease upper airway obstruction is the result of an accumulation of pus in the trachea. Only rarely can this obstruction be managed without an artificial airway.

When a child appears cyanotic or fatigued, the need for this procedure is urgent. Frequent aspiration of the trachea to remove thick purulent material will prevent acute obstruction from occurring.

Although we have suggested using epinephrine early, it has been our experience that this drug relieves respiratory difficulty only temporarily and does not alter the course of the disease. When pus continues to accumulate or the trachea becomes obstructed by plugs of secretions the patient will no longer respond to epinephrine and the disease progresses. We have observed failure of the drug and increasing respiratory difficulty, as have others,^{2,27} in seven children.

Our overall experience with croup and our review of the literature suggest to us that the very recent marked increase in numbers of endotracheal intubations is related to the reappearance of bacterial tracheitis as a cause of severe upper airway obstruction. To keep the mortality rate from rising too, physicians must become aware of this

disorder and the need for the management of such children in intensive care units.

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Table II—Clinical and laboratory features of children with bacterial tracheitis and viral croup

Feature	Bacterial tracheitis (n = 14)	Viral croup (n = 32)
	Mean	
Age (mo)	30.4	32.7
Peripheral-blood leukocytes		
Total count ($\times 10^9/l$)	12.8	10.6
Band forms (%)	28.4	9.7
At time of admission		
Temperature ($^{\circ}C$)	39.3	37.7
	No. of patients	
Pulmonary infiltrate on chest roentgenogram	11/14	4/28
Pathogen cultured from tracheal secretions	13/14	0/13
Results of viral study positive	0/11	4/12
Artificial airway established	13	7
Cardiorespiratory arrest	3	0