THE USE OF STEROID THERAPY AND ITS IMPACT ON CHILDREN HOSPITALISED WITH VIRAL CROUP

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ABSTRACT: The use of steroid therapy and its treatment impact on children hospitalised with viral croup between 1994 - 1998 were reviewed by comparing 30 patients who received steroid therapy with 65 patients who did not. There was no difference in the socio-demographic and clinical profile between the two groups. The hospital stay (2.8 ± 1.3 vs 3.5 ± 1.2 days, $p = 0.02$) and duration of documented stridor (1.3 ± 0.5 vs 2.8 ± 1.0 days, $p = 0.001$) were shorter for patients who received steroid therapy although they appeared to have more severe respiratory distress. There were no complications associated with steroid therapy use. Despite reluctance in administering steroid therapy for viral croup, patients who received the treatment had a shorter hospital stay and duration of stridor. *(JUMMEC 2000; 1: 28-32)*

KEYWORDS: Croup, steroid therapy, hospital stay.

Introduction

Viral croup usually occurs in the second year of life and presents with respiratory symptoms over a few days followed by bark-like coughing, stridor and respiratory distress of varying severity. Although viral croup is essentially a benign self-limiting illness, the stridor associated with respiratory distress and feeding difficulties is uncomfortable for the child and worry most parents prompting them to seek medical attention.

Viral croup does not appear to be a major problem in the tropical region where it accounts for less than 5% of all childhood respiratory tract infections (1, 2). Although this observation markedly contrasts that found in the temperate region (3), it does not underscore the need for an effective treatment for viral croup in children in this region. Steroid therapy has in the last few years been shown to be effective in reducing the severity of symptoms and shortening the duration of illness in viral croup. As steroid therapy favourably alters the course of illness with very little side-effects encountered, its use is now recommended as routine treatment for viral croup (4, 5).

Steroid therapy has been used in our unit for children with viral croup since late 1997. We therefore set out to evaluate the impact of steroid therapy on the outcome of viral croup by comparing patients admitted for viral croup who received steroid therapy and those who did not receive steroid therapy.

Materials and methods

Patient population

We reviewed the medical records of all children admitted with a diagnosis of viral croup according to Court's criteria (6) to the Department of Paediatrics, University Malaya Medical Centre between 1st January 1994 and 31st December 1998.

Patient characteristics

Demographic and clinical data was extracted from the medical records. The severity of illness at admission was divided into mild (stridor when agitated only with no subcostal/intercostal recession), moderate (stridor at rest with subcostal/intercostal recession) and severe (stridor with severe respiratory distress and cyanosis or altered level of consciousness). In addition, the croup score (Table I) was calculated for each patient to reflect the degree of respiratory distress (7). The degree of respiratory distress was proportional to the croup score.

Treatment and outcome

The attending physician that managed the individual patient determined the treatment strategy including the

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use of steroid therapy. Steroid therapy for the treatment of viral croup was only routinely used in our unit since November 1997. Patients were then divided into Group I (patients who received steroid therapy) and Group II (patients who did not receive steroid therapy). Patients in Group I either received dexamethasone or nebulised budesonide (Figure 1). Information concerning additional treatment given to both groups such as nebulised adrenaline, oxygen therapy and intravenous fluids were also reviewed.

Statistical analysis

The students' t test was done to compare quantitative data and dichotomous variables were compared using the Fishers exact test. A p value of less than 0.05 was considered as significant.

Results

A total of 95 patients with a diagnosis of viral croup were admitted during the study period of which 30 patients (32%) received steroid therapy (22 patients received dexamethasone, 4 patient received necbulised budesonide and 4 patients received both). The majority of patients (70%) who received steroid therapy were admitted in 1998 (Figure II). There was no difference in the socio-demographic and clinical profile of both groups except that patients in Group I appeared to have more severe respiratory distress as they had a higher croup score and respiratory rate (Table II).

There were no deaths encountered during the study period but 5 patients developed pneumonia, 2 patients had bacterial tracheitis and 2 patient required mechanical ventilation for severe upper airway obstruction. However, there was no difference in the development of these complications between the two groups (10% vs 9%, p = 0.38).

The duration of hospital stay of patients in Group I was significantly shorter (2.8 ± 1.3 vs 3.5 ± 1.2 days, p value = 0.02) and these patients also recovered faster as the period of stridor documented in the ward was shorter (1.3 ± 0.5 vs 2.8 ± 1.0 days, p value = 0.001). As expected, patients in Group I were more likely to require O_2 supplement as they had more severe respiratory distress. The use of nebulised adrenaline was low in this study population as only 7 patients (7%) received it. There was no significant difference in the additional treatment strategy provided between the two groups (Table II). No patient in Group I developed side effects from the use of steroids. None of the patients returned with stridor after discharge.

Discussion

The management strategy adopted for viral croup in view of its benign self-limiting nature has essentially been

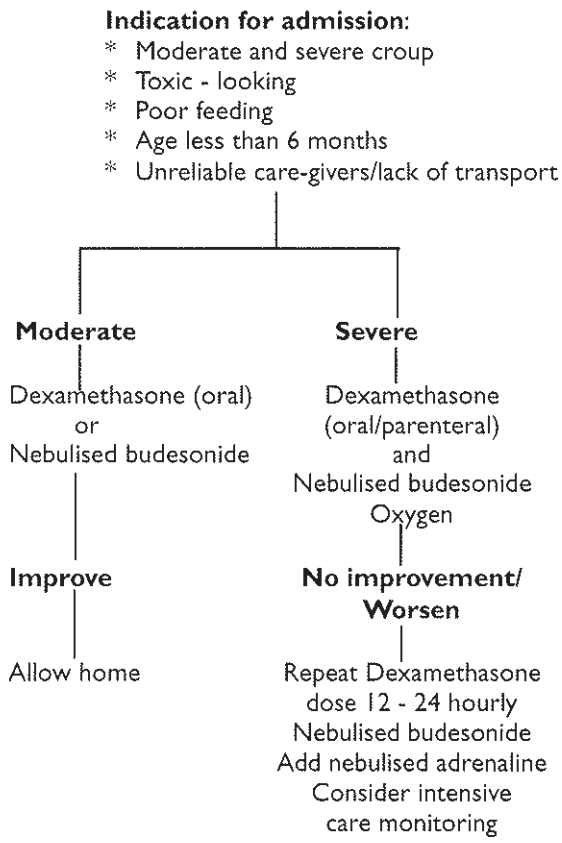

Figure 1. Treatment protocol algorithm for patients hospitalised with viral croup.

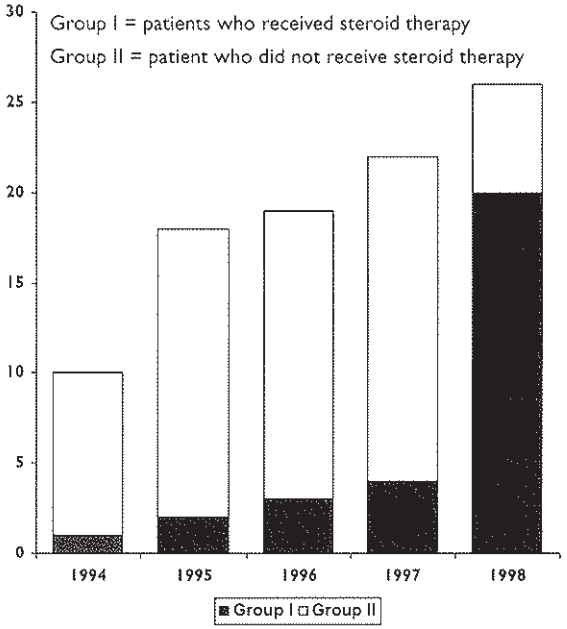

Figure 2. The use of steroid therapy between 1994-1998 (n=95)

of clinical vigilance and symptom relief with the use of mist tents, oxygen supplementation and nebulised adrenaline. Nonetheless this view has changed over the years with the recognition of the efficacy of steroid therapy in viral croup as illustrated by the trend of its use in our unit. In addition, a hospitalisation rate of up to 20% and intubation rate of up to 3% documented in two large case series of viral croup warrants a more aggressive approach in its treatment (8, 9).

There has been ample debate and scepticism over the use of steroid therapy in viral croup since it was first advocated in the 1950s and evidence for its use has been convincing only since the 1990s. Several studies have demonstrated that steroid therapy when compared to a placebo resulted in a faster clinical improvement, shorter hospital stay and a reduced need for intubation (10, 11, 12, 13). Although our observational study was not specifically meant to evaluate the efficacy of steroid therapy, its results re-affirm these findings and provide additional evidence for its routine use. Nonetheless the actual mechanism of action of steroids in viral croup is largely unknown, but believed to be the reduction of subglottic oedema by decreasing local blood flow and vascular permeability.

The concern that the use of steroid therapy may render the patient vulnerable to systemic bacteria or viral infection has instilled reluctance for its wide routine use. Our study population was no exception as despite the introduction of a clinical practice guideline (CPG) for the use of steroid therapy in viral croup, CPG non-adherence of 23% was still encountered in 1998. Practically all studies done to evaluate the use of steroid therapy in viral croup demonstrated an excellent safety profile (14). One patient in each group of our study population developed bacterial tracheitis (*Eschericia coli and Staphylococcus aureus* respectively) that was evident at admission and not likely associated with steroid therapy. There has been only three reported cases of bacterial tracheitis associated with the use of steroid therapy of whom two of the cases had an occult neutropenia (15, 16).

There is still difficulty in recommending the best steroid regiment as the trials that evaluated the efficacy of steroid therapy in viral croup used different routes of administration and doses. Smaller doses of dexamethasone have been shown to be just as effective as larger doses and there is no difference in the efficacy between nebulised budesonide and systemic steroids (10, 17). Interestingly, the onset of action with the use of nebulised budesonide is associated with more rapid onset of action of within 2 - 4 hours compared with systemic steroids (18). A combination of nebulised budesonide and dexamethasone has been shown to be even more effective (19) and is perhaps the ideal combination for the more severe cases. In our unit,

Table I. Croup Severity Scoring System (7).

Symptom	Score	Total Cumulative score
Stridor		2
None	0	
When agitated	1	
At rest	2	
Retraction		5
None	0	
Mild	1	
Moderate	2	
Severe	3	
Air entry		7
Normal	0	
Decreased	1	
Markedly decreased	2	
Cyanosis in room air		12
None	0	
With agitation	4	
At rest	5	
Level of consciousness		17
Normal	0	
Disorientated	5	

dexamethasone is the preferred steroid therapy of choice as it is cheaper, easy to administer and well tolerated by the patient (Figure 1). Nebulisation therapy may be quite distressing for the patient and can worsen the upper airway obstruction in an already uncomfortable anxious child.

It is apparent that steroid therapy should be advocated in patients hospitalised with viral croup in view of the strong clinical evidence to support its use. However, it is more difficult to advocate its routine use in mild cases that are not distressed, feeding well and are expected to recover spontaneously. Recent studies have shown that when steroids given to patients with mild croup in the emergency department, its use was associated with a reduced need for hospitalisation and a shorter duration of illness (20, 21). This dilemma usually faced in the out-patient and emergency unit can perhaps be best addressed by prescribing steroid therapy to a selected group of patients who upon discharge may not seek medical attention should the respiratory distress worsen. This selected group of patients may include those with a lack of transport, stay in homes with difficult access to a health-provider facility, poor socio-economic circumstances and unreliable caretakers.

Nebulised racemic adrenaline has been to shown to offer effective relief in patients with moderate to severe croup as it reduces laryngeal mucosal oedema by causing constriction of the mucosal capillaries (22, 23). However, very few patients received nebulised adrenaline in our

Table 2. Demographic, clinical profile and severity of illness between Group and Group II (n=95)

	Group I (n =30)	Group II (n=65)	p value
Socio-demograhic Profile			
Mean age (months)	14.3 ± 8.4	12.7 ± 6.4	0.24
Sex distribution (M:F)	2.1 : 1	3.6 : 1	0.28
Ethnic distribution			
Malay	43%	37%	
Chinese	40%	49%	0.90
Indian	14%	14%	
Social class IV and V **	17%	15%	0.92
Family monthly income (RM)	1691 ± 752	1889 ± 689	0.54
Weight less than 3rd centile	7%	10%	0.13
Clinical Profile			
Duration of symptoms (days)	2.5 ± 1.6	2.2 ± 1.3	0.27
Fever	87%	86%	0.57
Cough	93%	95%	0.61
Feeding difficulty	73%	57%	0.08
SpO_2	94 ± 8	97 ± 3	0.09
Heart rate (per minute)	154 ± 21	153 ± 16	0.49
Respiratory rate (per minute)	52 ± 10	49 ± 9	0.02*
Severity of illness			
Severe illness	10%	6%	0.07
Croup Score	4.7 ± 2.0	3.9 ± 1.5	0.04*
PICU admission	20%	12%	0.57
Treatment required			
O_2 supplement	25%	12%	0.03*
Intravenous fluid	27%	21%	0.46
Nebulised adrenaline	5%	9%	0.21

* significant p value

**Social class was determined according to the UK General Registrars occupational classification based on the father's occupation.

unit as the racemic from of adrenaline is not available here and concern of worsening of the initial clinical picture described as the "rebound phenomenon". Nebulised adrenaline may be nonetheless very useful in conjunction with steroid therapy as it can provide temporary relief for a distressed patient and provide the time necessary for the steroids to take effect.

There is little doubt that the benefit of steroid therapy use has had a great impact in developed nations where treatment of viral croup cost up to USD 60 million a year (24), the majority attributable to in-patient care. In tropical nations like Malaysia, viral croup appears less prevalent as it accounts for only 2% of all patient admitted with lower respiratory tract infection (25); an observation that possibly reduces the cost benefit impact of steroid therapy compared to our more developed counterparts. Nonetheless, the benefit and safety evident from its use should not be denied to patients admitted with viral croup in this region and despite concerns about the best route and optimal dose of steroid therapy, there is little reason not to advocate its routine use.

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