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Risk Factors Associated with Severe Viral Croup in Hospitalised Malaysian Children

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ABSTRACT

Objective: To determine the risk factors associated with severe viral croup in hospitalised Malaysian children.

Methodology: The medical records of children aged less than five years admitted with a diagnosis of viral croup between 1994 and 1999 were reviewed. Severe viral croup was diagnosed in children who had stridor at rest with marked recession associated with central cyanosis or altered level of consciousness. Multivariate logistic regression analysis was performed to identify risk factors associated with severe viral croup.

Results: Eighteen (14.7%) of 122 children with viral croup were severe. These children were older (mean age 16.8 ± 7.2 vs 12.6 ± 6.6 months, p=0.01) and had a shorter duration of illness prior to admission (1.7 ± 0.7 days vs 2.3 ± 1.4 days, p=0.03). Age between 12 and 24 months (OR 3.8 95% CI 1.3, 12.7, p=0.02) and fever (OR 5.7 95% CI 2.9, 15.6, p=0.02) were the only risk factors associated with severe viral croup after multivariate logistic regression analysis. Only three children or 2.5 per 100 children admitted with viral croup required ventilation.

Conclusion: Only a small number of children admitted particularly those between 12 to 24 months with fever developed severe viral croup. Recognition of these risk factors provides a guide in selecting children who will most likely benefit from steroid therapy. The overall outcome was nonetheless favourable.

Keywords: severe, viral croup, risk factors

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INTRODUCTION

Viral croup is a common childhood respiratory illness that usually presents with a respiratory prodrome lasting a few days followed by respiratory distress, a barking cough and stridor. It usually occurs in the first two years of life and results in varying degrees of upper airway obstruction and respiratory distress[1]. The majority of children with viral croup have a mild and self-limiting illness. However, severe viral croup resulting in life threatening upper airway obstruction although uncommon can be potentially fatal particularly if recognition and intervention strategies provided are late.

We therefore set out to determine the risk factors associated with severe respiratory distress in children hospitalised with viral croup.

METHODS

Patient population

The medical records of all consecutive admissions for viral croup to the Department of Paediatrics, University Malaya Medical Centre between 1 January 1994 to 31 December 1999 were reviewed. The study was retrospective in nature and part prospective for the year 1999. The retrospective component of the study was performed by retrieving all medical records from the Medical Records Administration Unit using the ICD-10 code label for viral croup (J05.0)[2]. Socio-demographic and clinical information were extracted from the medical records and reviewed to determine risk factors associated with severe viral croup.

Definition

Viral croup was diagnosed in children older than three months with a clinical syndrome of a preceding respiratory prodrome followed by stridor, a barking cough and respiratory distress. The severity of respiratory distress was divided into three categories which were Grade I (stridor with excitement or at rest with no accessory muscle use), Grade II (stridor at rest with subcostal, intercostal and sternal recession) and Grade III (stridor at rest with marked recession, central cyanosis or altered level of consciousness)[3]. Children who were admitted with clinical features of Grade III respiratory distress were categorised as severe viral croup. A validated croup score[4] was also calculated based on clinical parameters at admission

for each child. A higher croup score indicated more severe respiratory distress.

Failure to thrive was defined as a weight at admission less than the 3rd centile according to the age and sex of the child using locally available child health anthropometric charts. Social class was determined according to the United Kingdom General Registrar's occupational classification based on the father's occupation.

Statistical analysis

Data collected were analysed with SPSS statistical package version 7.0 for the Windows 95 operating system. The students' t test, chi-square test and Fishers exact test were used for univariate analysis. Multivariate logistic regression analysis with backward stepwise process (likelihood ratio) was used to identify independent risk factors that were associated with severe viral croup. A p value of less than 0.05 was considered as significant.

RESULTS

A total of 122 children were admitted with viral croup during the study period of whom 18 (14.7%) had severe viral croup. All these 18 children required paediatric intensive care. Children with severe viral croup appeared to be older and had shorter illness duration before admission. As expected, these children were more ill on admission and had a significantly longer hospital stay (Table I).

Children who were between 12 and 24 months, with a presence of a hoarse voice or cry and fever (documented temperature of 38.5ºC or more at admission) were identified as risk factors associated with severe viral croup (Table II). However, an age group between 12 and 24 months (OR 3.8 95% CI 1.3, 12.7, p = 0.02) and fever (OR 5.7 95% CI 2.9, 15.6, p = 0.02) were the only risk factors associated with severe viral croup after multivariate logistic regression analysis.

Three patients or 2.5 per 100 children admitted with viral croup required intubation and mechanical ventilation. There was no mortality encountered and all children were discharged well.

Table I. Clinical features of 122 children admitted with viral croup.

Clinical features	Severe viral croup (n=18)	Viral croup (n=104)	p value
Mean age (months)	16.8 (7.2)	12.6 (6.6)	0.01*
Illness duration prior to admission (days)	1.7 (0.7)	2.3 (1.4)	0.03*
Poor feeding	13 [72%]	67 [64%]	0.14
Croup score	7.8 (1.8)	3.5 (0.8)	<0.01*
Heart rate (per minute)	170.7 (20.2)	148.5 (20.5)	<0.01*
Respiratory rate (per minute)	58.4 (14.8)	48.7 (7.6)	<0.01*
Saturation in room air (SpO_2)	90.8 (5.9)	96.7 (4.5)	<0.01*
Hospital stay (days)	3.8 (1.2)	3.0 (1.4)	0.03*

* significant p value

Values in parenthesis ( ) denotes standard deviation (SD).

DISCUSSION

Lower respiratory tract infections namely pneumonia, bronchiolitis and croup are the most important causes of morbidity and hospital admissions for children in the developing nations of the tropical region including Malaysia. Nonetheless, viral croup appears to be less important in Malaysian children as its incidence is far lower than that of bronchiolitis or pneumonia[5,6]. This observation markedly contrasts with the experience reported in temperate developed nations[7,8] where viral croup accounts for up to 20% of all cases of lower respiratory tract infections. Nonetheless, this observation mirrors closely with that of other developing nations in the tropics[9,10]. Differences in the climate, socio-demography and environment although speculative and undetermined may perhaps account for this observation.

Viral croup is generally considered a benign self-limiting illness as the majority of cases resolve without treatment or hospital care. Nonetheless, hospitalisation rates of one to 30 percent[11] have been reported and can present a significant burden of cost to both the family and the health system. The clinical spectrum of viral croup has not been extensively documented in this part of the world, especially the tropics. The clinical spectrum in the severity of viral croup is broad but severe illness is uncommon, an observation that is also reflected in our study population. A young age particularly below 12 months old, boys, an underlying illness, ex-prematurity and failure to thrive are risk factors associated with severe bronchiolitis and pneumonia[12,13]. These risk factors do not however appear to be associated with severe viral croup in Malaysian children. Interestingly an older age group namely between 12 to 24 months appears to be associated with severe viral croup in our study population. It is not likely that this observation is a reflection of the peak incidence of viral croup in the 12 to 24 month age group[14] as our hospital-based sample had a similar proportion of children aged below 12 months and those between 12 to 24 months. In addition, all the various possible risk factors were also taken into account with multivariate logistic regression analysis; further supporting our findings. The very small number of children who developed severe upper airway obstruction requiring intubation

Table II. Univariate analysis of risk factors associated with severe viral croup (N = 122).

Risk factors	Severe viral croup (n=18)	Viral croup (n=104)	OR (95% CI)	p value
Socio-demography				
Age				
less than 12 months	5 (28%)	58 (56%)	0.3 (0.1, 1.0)	0.06
between 12-24 months	12 (67%)	41 (39%)	3.1 (1.1, 9.6)	0.01*
more than 24 months	1 (5%)	5 (6%)	1.4 (0.2, 13.0)	0.56
Sex				
Boys	12 (67%)	76 (73%)	0.7 (0.2, 2.4)	0.61
Girls	6 (33%)	28 (27%)	1.4 (0.4, 4.3)	0.60
Ethnic group				
Malay	8 (44%)	45 (43%)	1.5 (0.5, 4.4)	0.47
Chinese	7 (39%)	45 (43%)	0.9 (0.3, 2.6)	0.52
Indian	3 (17%)	14 (14%)	0.5 (0.1, 3.8)	0.69
Social class IV and V	4 (22%)	17 (16%)	1.7 (0.5, 6.3)	0.64
Clinical profile				
Failure to thrive	2 (9%)	14 (14%)	0.5 (0.1, 3.7)	0.69
Ex-prematurity (less than 37 weeks)	2 (11%)	8 (8%)	1.9 (0.9, 9.7)	0.61
Family history of asthma	2 (11%)	5 (5%)	3.1 (0.5, 17.3)	0.21
Presence of fever (temperature >38.5°C)	5 (27%)	9 (9%)	3.8 (1.1, 14.6)	0.03*
Hoarse voice or cry	16 (89%)	60 (57%)	4.8 (1.0, 12.2)	0.02*
Bacterial pneumonia	3 (16%)	9 (8%)	4.1 (0.9, 18.8)	0.09
Underlying illness	2 (11%)	8 (8%)	1.1 (0.8, 1.5)	0.61
Elevated white count (more than 15 x 10^9/L)	10 (55%)	61 (58%)	1.1 (0.3, 4.0)	0.89
Steroid therapy	8 (45%)	38 (37%)	1.0 (0.9, 1.2)	0.41

* significant p value

and ventilation is similar to the reported intubation rate of between 1.6% and 3.2% of hospitalised patients with viral croup[15,16].

As the majority of children with viral croup do not require hospitalisation, our study population may not represent the overall disease pattern as it samples the more severe spectrum of viral croup. Nonetheless, it does provide an understanding and useful information to clinicians in identifying the group of children most likely to develop severe viral croup and potential life threatening upper airway obstruction. Although the overall outcome of viral croup is excellent, it is nonetheless important to recognise these children who will most likely benefit from early intervention. The traditional treatment strategy for viral croup has essentially been of clinical vigilance and symptom relief with the use of mist tents, oxygen supplementation and nebulised racemic adrenaline. Steroid therapy has, however dramatically changed the management strategy of viral croup as numerous studies have proven the efficacy, safety and benefit of its use[17,18]. Although steroid therapy is now advocated for children hospitalised with viral croup[19], only 46 (38%) children admitted with viral croup in our unit received it. The majority of these children were admitted after 1998 when routine steroid therapy was introduced in our unit for children with viral croup.

CONCLUSION

Only a small proportion of Malaysian children, particularly those between 12 to 24 months and with a fever of 38.5ºC or more who are hospitalised with viral croup developed severe respiratory distress. Recognition of these children at risk of severe viral croup provides the cornerstone of selecting the children that will most likely require clinical vigilance and benefit from the early use of steroid therapy. Nonetheless, the most important clinical aspect that determines hospital admission and intervention for this group of children is the severity of respiratory distress at presentation.

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