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Research Article

Treatment of Acute Bronchiolitis in a Resource-Limited Setting in Port Sudan City. A Simple Effective Regimen

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Abstract

Background: Bronchiolitis is an acute lower respiratory viral infection, caused by the Respiratory Syncytial Virus (RSV in 60 - 85% of cases), and other respiratory viruses. it is the leading cause of hospitalization for infants and toddlers during the winter and early spring months. Till the moment, no consensus on treatment worldwide. The prevalence is increasing in port Sudan eastern Sudan, while we have no admission policy or a unified management protocol.

Aims and Objectives:

1. To formulate admission policy, and a new simple management protocol,
2. To determine the factor(s) that increased the prevalence in port Sudan as a secondary objective,
3. To compare the outcome in the study group (119 infants) and the historical group (135 infants) concerning the hospitalisation length and death rate as a primary objectives.

Method: This is a hospital- based, controlled clinical trial (CCT) study, demographic data collected by a questionnaire, severity criteria for acute bronchiolitis defined. A management guideline is defined and applied to bronchiolitis cases (119 case) with intention to treat, from October to April each year (2013 - 2015). All infants between 1 - 23 month with only acute bronchiolitis were included, while cases with bronchiolitis and associated dysmorphic features, heart disease, tracheo-oesophageal fistula, other respiratory diseases, other morbidities, infants below one month or above two years, were excluded from this study. The outcome compared to a group of matched infants with bronchiolitis (135 cases) who received antibiotics, B2 agonist, and steroids, in the period October to April of the years 2011 - 2012.

Results: Many new life style factors increased the prevalence, the new guidelines decreased the admission rate, (9.6 vs 5.7/mo), the new guideline is simple, less expensive, and effective, and the duration of hospitalization reduced (p = 0.04).

Keywords: *Acute Bronchiolitis; Resource-Limited Settings; Advanced Respiratory Intervention; Simple Effective Intervention;*

Introduction

Bronchiolitis is the leading cause of hospital visits and admission among infants and toddlers during the winter and early spring months [1], causing small airways obstruction and air trapping [2-4], especially among urban peoples living in flats or apartments, due to

limited space, closer contact, and decreased house ventilation, rather than those living in large houses with compounds/villas. Some cultural factors also play roles in the prevalence and severity of the disease, like avoidance of bathing infants in the winter afraid from getting cold, and unawareness of importance of hand washing. Many viruses like Metapneumovirus, Adenovirus, Influenza and Para influenza, Rhinovirus and human bocavirus are accused, but the commonest is the Respiratory Syncytial Virus (RSV) [1,2]. The age peak is 3 - 6 mo with severe disease occurs in infants less than 4 mo, who may need advanced respiratory support with CPAP and mechanical ventilation [2-6], which is not always attainable in the developing countries and form an obstacle to manage such cases. Severity is variable from a mild disease that needs simple intervention and follow up (happy wheezers), to a severe one that necessitate intensive care. Mercifully, in Sudan, severe cases are less common and most of the cases are mild to moderate. This is attributed to the wide, good ventilated houses, and the abundant sun. There is no specific treatment. Antibiotics, bronchodilators, and corticosteroids are controversial [2,4]. Though there is no consensus between different institutes and even between consultants in the same hospital, concentrated saline (≥ 3%) nebulisation gained the consensus [5-12].

Most units use O_2, short β2-agonists (salbutamol), antibiotics, and hydrocortisone, resulting in prolonged hospitalization, morbidity, staff work burden and parents unsatisfaction.

In a resource - constrained settings where intensive care facilities are limited, ways to save lives of infants with sever bronchiolitis should be obtained and implemented.

Methods

To unify severity and admission criteria and classification of cases, the following definitions are made (See table 1 below).

Criterion	Severe	Moderate	Mild
General condition	Lethargic/irritable	Unwell	Well
RR (bpm)	≥ 60	50 -< 60	< 50
Retractions	Severe	Present	Mild/No
SPO_2 % in room air	≤ 90	90 - 94	≥ 96
Cyanosis	++	+ /-	-
Blood gases	Type 11 RF	Type 1 RF	Normal
Ability to feed	Unable	Decreased	Normal

Table 1: *Definition of the severity phenotype.*

Severe case defined as an infant who is sick with spasmodic cough, tachypnoeic (RR 60 bpm or more), sever retractions of the sub costal area and tracheal tug, nasal flaring, lethargic or irritable, unable to feed and has type two respiratory failure on blood gases or clinical cyanosis while breathing room air or hypoxic (SPO_2 ≤ 90 in room air), with inspiratory and expiratory rhonchi on lung auscultation.

Moderate case defined as an infant who is unwell, has a spasmodic cough, tachypnoeic (RR 50 - < 60 bpm), with retractions, decreased feeding and type 1 respiratory failure on blood gases or hypoxia (SPO_2 90 - 94% while breathing room air), with inspiratory and expiratory rhonchi on lung auscultation.

Mild case defined as an infant who is well with spasmodic cough but no tachypnoea (RR ≤ 50 bpm), has mild or no retractions, pink (SPO_2 ≥ 96%) while breathing room air and feeding well with rhonchi on lung auscultation.

A new simple, supportive regimen is defined and implemented by the author, and applied to all admitted cases (total = 119 case) with intension to treat. No consents or ethical approval were needed for this study, as there is no new drug is used and all the components of the regimen were already in use but in different ways and combinations with other drugs like steroids and antibiotics.

The new regimen

Reg-1 (for severe cases) composed of:

1. Provide vital signs assessment 2 hrly or as needed,
2. Provide nebulized 3% saline or N/S through a high flow O_2 ≥ 8 L/min, continuously, or every hr till stabilization,
3. Provide L. epinephrine nebulizer 2.5 ml diluted in 5 ml N/S, 2 - 4 hrly,
4. Provide Oxygen as needed to maintain SPO_2 ≥ 96%,
5. Provide I.V. fluids, 2/3rd of the maintenance, and keep NPO,
6. Provide NGT mucolytic syrup 1.5 - 2.5 ml 8 hrly, depending on age,
7. Provide nasal care (congestion/obstruction relievers like Sea water nasal spray ± nasal drops containing ephedrine, plus nasal suctioning when needed),
8. No antibiotics,
9. No steroids,
10. No β2 agonist.

Reg-2 (moderate cases) composed of:

1. Provide vital signs assessment 2 hrly,
2. Provide 10 ml nebulized 3% saline or N/S through a nebulizer, 2 to 4 hrly,
3. Provide epinephrine nebulizer 2.5 ml diluted in 5 ml N/S, 4 to 6 hrly if needed,
4. Provide oxygen as needed to maintain SPO_2 ≥ 96%,
5. Provide NGT feeds or I.V. fluids if needed or allow direct sucking if possible,
6. Provide oral mucolytic syrup 1.5 - 2.5 ml 8 hrly, depending on age,
7. Provide nasal care (congestion/obstruction relievers (sea water sprays) ± nasal drops containing ephedrine, plus nasal suctioning when needed),
8. No antibiotics,
9. No steroids,
10. No β2 agonist.

This is an observational, longitudinal study, comparing the outcome in the cases of moderate and severe bronchiolitis, aged 1 to 23 mo, admitted to Sea Ports Corporation hospital (SPCH) in Port Sudan/Sudan, during the winter months (October to April) of the years 2013 - 2015, (total of 119 infant, 9 severe cases, 110 moderate cases). Hospital records of all admitted bronchiolitis cases in the years 2011 - 2012 were revised, 137 cases were found, 2 were excluded due to associated bacterial pneumonia in one and dysmorphic features in the other. The remaining 135 infants (7severe, 128 moderate) in the same age range, were compared to the study group. All latest group (control) were received salbutamol nebulizer, O_2, antibiotics, steroids, and fluids or NGT feeds plus saline nasal drops. The first group (study group) received Reg-1 regimen (severe cases), and Reg-2 regimen (moderate cases).

1st group (study group)

All admitted patients (1 - 23 months old) to paediatric words at Sea Ports Corporation Hospital (SPCH) in Port Sudan/Sudan with bronchiolitis in the winter months (October to April) of the years 2013 - 2015 received the new regimen without antibiotics, steroids, or salbutamol nebulizer. Exclusion criteria were any congenital abnormalities including heart, syndromic infants, and other associated medical problems or evidence of respiratory bacterial infection. Mild bronchiolitis cases were followed at the out patient clinic.

Severe cases were admitted directly to ICU and received continuous, either 3% saline or N/S (if 3% is not available) nebulization, that is we put 20 cc NS or 3% saline in the nebulizer cub and attach it to a humidifier (bubbler) that attached to an oxygen cylinder, set at 8L O_2 or more/min, and the amount of saline replaced immediately whenever finished. Adrenaline (L. Epinephrine) 2.5 cc (two and half ampoules of 1 mg/1 ml) diluted in 5 ml N/S, given as nebulizer every 2 hrs, through a face mask, with continuous monitoring of vital signs. All infants kept nothing per mouth (NPO), given 2/3rd of their maintenance fluid, plus nasal care with sea water spray(hypertonic saline) as needed, ephedrine containing nasal drops for children 8 hrly, plus nasal suctioning as needed (Reg-1. Infants from this group who improved to moderate state, shifted to paediatric word to continue their treatment on the Reg-2).

Moderate cases were admitted to the paediatric word and received intermittent N/S or 3% saline (1 - 2 hourly) nebulization, plus diluted adrenaline nebulization same dose as above but at 3 - 4 hourly interval, plus I.V fluid or NGT feeds, plus same nasal care and monitored as same. Those who improved and reclassified as mild, discharged home with follow up.

2nd group (historical control group)

Composed of 135 patients (7 severe, 128 moderate cases), all of them received same treatment regimen of: antibiotic ceftriaxone plus β2 agonist nebulization 4 - 6 hrly plus injectable steroid (hydrocortisone) and other supportive care (I.V fluids or NGT feeds, O_2/nasal cannula, and NS nasal drops ± nasal suctioning).

Results

Results with application of the new Regimen, the admission rate decreased significantly (39.7 per a season versus 67.5 per a season, $P < 0.5$).

In the study group (1st group) 119 infants with bronchiolitis, 9 cases (7.6%) were severe, 110 (92.4%) were moderate (See table 2), and no deaths were encountered (Table 3).

In the historical control group 135 infants, 7 severe, 128 moderate (Table 4).

Total No of cases	119
Severe cases	09 (7.6%)
Moderate cases	110 (92.4%)

Table 2: *Severity of bronchiolitis in the study group.*

Type	Discharged	Died	Total
Severe	09 (100%)	0	9
Moderate	110 (100%)	0	110
Total	119	0	119

Table 3: *Outcome in the study group.*

Total no	135
Severe cases	07 (5.2%)
Moderate cases	128 (94.8%)

Table 4: *Severity phenotype of bronchiolitis in the control group.*

Deaths were 3.7% (Table 5) with statistically significant difference from the study group ($p < .04$).

Type	Discharged (%)	Died (%)	Total
Severe	03 (42.9)	0 4 (57.1)	07
Moderate	125 (97.7)	01 (0.8)	128
Total	128 (94.8)	05 (3.7)	135

Table 5*: Outcome in 2nd group - control group.*

The mean hospitalization time in the study group was 6.4 days in severe cases and 4.7 days in the moderate group, while it was 11.1 days (severe cases) and 8 days (moderate cases) in the control group, which is again, is statistically significant ($p < 0.5$) (See table 6).

M H S* (days)	Study (1st) group	Control (2nd) group	P value
Severe cases	6.4	11.1	< 0.5
Moderate cases	4.7	8	< 0.5

Table 6: *The mean hospital stay.*

Table 7 summarizes the major differences between the two groups.

Observation	Study group	Control group
Total No of cases	119	135
Severe cases	09 (7.6%)	07 (5.2%)
Moderate cases	110 (92.4%)	128 (94.8%)
Discharged	119 (100%)	128 (94.8%)
Deaths	0 (0%)	5 (3.7%)

Table 7: *Comparison between outcome in the two groups.*

Many factors are found to contribute to the increasing prevalence of bronchiolitis in Sudan (Table 8). 100% of the carers were believing that path in the winter will subject/increase the flu illness, while more than 98% were not aware of the importance of hand washing. 71% of the cases were residing in flats, or unventilated houses, while 90% were unaware of the importance of opening widows to allow sun and air exchange. In 88% of the cases, the families were large and 73% of the mothers were not or received low grade education, while in 53% there was a smoking person in the house (See table 8).

Contributory factor	%
avoidance of bathing infants during the winter time	100%
Unawareness of hand washing importance	98.55
Contact with a household common cold/Flu case	97%
Residence in flats/apartment or a small house	71%
Unawareness of room sunning and air exchange (opening the widows)	90%
large families and overcrowding	88%
Illiterate/low grade- educated mothers/parents	73%
A smoking person inside the house	53%

Table 8: *Contributory factors to bronchiolitis.*

The application of the stated definitions for the disease severity decreased the admission rate (39.7 per a season versus 67.5 per a season, $P < 0.5$) and hence decreased the burden on the staff and doctors.

The protocol is found to be simple, satisfying, easily kept by the resident doctors as a treatment package for bronchiolitis, and easily carried out by the nursing staff.

The treatment expenses found to be much less when antibiotics, β2 agonist and steroids are omitted.

Discussion

Prevalence of acute bronchiolitis is increasing in our city due to the changing life style and living in flats with decreased ventilation, and many other contributory factors, the most prominent is avoidance of bathing infants during the winter, due to the widely spread believe

that bathing increases respiratory diseases, in addition to the unawareness of the mothers and carers, by the importance of hand washing. Luckily, the prevalence of severe cases is much less compared to other countries. The new protocol showed simplicity and acceptance and effectiveness. No encountered complications nor death, and expenses including length of hospital stay, were significantly less, that is because bronchiolitis is a viral disease, and the use of antibiotics and steroids will decrease the immunity (killing the normal commensals and suppressing the immune system respectively) subjecting the recipient to more spread of the virus and hence more prolonged, and severe disease. The use of β2 agonist is controversial, as there is no element of bronchospasm in the pathogenesis of bronchiolitis, but it may help thinning the mucus to ease its excretion.

Conclusion

Acute bronchiolitis prevalence is increasing in our city, the Reg- 1 and 2 regimens should be adopted as a hospital policy in treating bronchiolitis.

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