



Research Article

A Comparative Study to Assess the Effectiveness of Nebulised 3% Hypertonic Saline, 0.9% Normal Saline and Salbutamol in Management of Acute Bronchiolitis

Authors

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Abstract

Aims And Objectives: Bronchiolitis is the most common lower respiratory tract infection among infants in both developed and developing countries. Study aim is to compare the effects of nebulized 3% hypertonic saline, 0.9% saline and Salbutamol in acute bronchiolitis.

Material and Methods: 60 Children of age 1 month to 24 months with clinical diagnosis of acute bronchiolitis were included in the study. Cases were divided into 3 groups randomly – 3% hypertonic saline (HS) as Group A, 0.9% normal saline as Group B and Salbutamol as Group C. Four doses of nebulization at an interval of six hours were given daily to patient of each group till discharge.

Results: Baseline Clinical Severity (CS) scores in 3%HS, 0.9% Normal Saline and Salbutamol groups were 6 ± 1 , 5.8 ± 1.5 and 5.5 ± 2.5 respectively ($p=0.14$), which after treatment dropped to 1.0 ± 0.2 , 3.19 ± 0.8 and 1.65 ± 0.7 respectively on the 4th day of treatment ($p<0.01$). Length of hospital stay in 3% HS, 0.9% Normal Saline and Salbutamol groups was 3.0 ± 1.5 , 5.0 ± 1.2 and 3.5 ± 1.7 days respectively, which was found to be statistically significant ($p= 0.001$).

Conclusion: 3% Hypertonic Saline nebulization (without additional bronchodilator) significantly reduces the CS scores and length of hospital stay as compared to 0.9% Normal Saline and Salbutamol nebulization.

Keywords: Bronchiolitis, management, 3 % hypertonic saline nebulization.

INTRODUCTION

Bronchiolitis is the most common lower respiratory tract infection in children in both developed and developing countries^[1]. The incidence is 11.6 per 100 children in the 1st year and 6 per 100 children in the 2nd year of life^[2]. The mortality rate is as high as 0.5–1.5% in hospitalized patients, increasing to 3–4% for

patients with underlying cardiac or pulmonary disease^[3]. It manifests as coryza, cough or fever^[4], after then moderate to severe respiratory distress develops. The physical examination is characterized most prominently by wheezing with prolonged expiration, hyper inflated chest, pushed down liver and spleen and cyanosis^[5]. Respiratory distress is out of proportion to the extent of

physical sign in lung. Most infants show improvement within 4-6 days. It is caused by Respiratory syncytial virus (RSV) in 50–90% of cases^[6], Para-influenza virus, adenovirus, influenza A and B, rhinovirus, Mycoplasma pneumoniae. The diagnosis is usually made on clinical basis and investigations are not generally needed to confirm it. However, confirmation of RSV infection can be made by ELISA test. A rapid test using monoclonal antibodies against RSV on nasopharyngeal aspirates can identify RSV by the bedside^[3].

Management of bronchiolitis is often frustrating for physicians and care-givers because “nothing seems to wo Management of bronchiolitis is often frustrating for physicians and care-givers because “nothing seems to wo Management of bronchiolitis is often frustrating for physicians and care-givers because “nothing seems to wo Management of bronchiolitis is often frustrating for physicians and care-givers because “nothing seems to wo Management is very confusing as it lacks the strong evidence for all the interventions that are used including inhaled epinephrine, bronchodilators, steroids, anticholinergics or antibiotics. Some experts have questioned whether bronchiolitis can be treated at all. It has been suggested that hypertonic saline (H.S) nebulization may be useful in making secretions less viscous and promoting their excretion, thereby resulting in clinical improvement but it lacks the sufficient data, Against such a background, we carried out this study with the objective to find out the “effectiveness of nebulization with 3% H.S in acute bronchiolitis”.

MATERIALS AND METHODS

This prospective study was conducted on 60 children, aged 1 month - 24 months with clinical diagnosis of acute bronchiolitis with a Clinical Severity (CS) score of more than 3, admitted in the Department of Pediatrics, Indira Gandhi Institute of Medical Sciences, Patna from August 2015 to February 2016. Children with cardiopulmonary disease like congenital heart disease, cystic lung disease etc, or history of mechanical ventilation in the neonatal period,

family history of asthma were excluded. A written and informed consent was taken from the parents. The severity of the illness was assessed by using Clinical Severity score described by Wang et al^[7]. The study group children were classified randomly into three groups as A, B, and C.

- A. Group A was nebulized with 5ml of 3% Hypertonic Saline (HS) with oxygen @ 7L/min.
- B. Group B was nebulized with 5ml of 0.9% Normal Saline (NS) with oxygen @ 7L/min.
- C. Group C was nebulized with Salbutamol (0.15mg/kg) using oxygen @ 7L/min.

Four doses at interval of 6 hours were given to each patient daily till discharge. CS scores were recorded before and 30 min after first nebulization at the time of admission and after then once every morning before and 30 min after first nebulization of every day till 4th day of admission. The criteria for discharge was when the Child was feeding well and C.S score of <3.

STATISTICS

Two major outcomes were noted –

- A. Change in the CS score after nebulization with 3% HS, 0.9% NS and Salbutamol every day &
- B. Total Length of hospital stay for each patient.

One way ANOVA technique was used to compare the average CS score before and after giving the specific treatment and length of hospital stay among the three groups. Post Hoc analysis was performed to test the pair wise significance of the average scores under study. Significance of difference between males and females was analyzed using Chi-square test and p value was obtained.

RESULTS

The study groups were similar in baseline characteristics (Table 1) with respect to age, sex and CS score. Patients demographic and illness status at the baseline:

TABLE 1: Shows baseline clinical characteristics

Clinical Characteristics	Group A (3% N.S)	Group B (0.9% N.S)	Group C (Salbutamol)
Age (months)	6.5±3.2	4.2 ± 2.4	6.2 ± 2.5
% Male	60	70	65
Baseline CS * Score	6.0 ±1	5.8 ±1.5	5.5 ±2.5
Duration of illness before study entry(days)	3 ± 1	2.5 ±1.5	2.4 ±1.4

(*clinical severity)

TABLE 2 Comparison of Clinical Severity Scores, Before and 4 Days after Treatment

TREATMENT	no. of patient	BEFORE TREATMENT		P	AFTER TREATMENT		P
		MEAN	Std Dev*		Mean	std Dev*	
Group (A) 3% N.S	20	6.0	1.0	0.14	1.0	0.2	<0.01 SIGNIFICANT
Group(B) (0.9% Saline)	20	5.8	1.5		3.19	0.8	
Group (C) (Salbutamol)	20	5.5	2.5		1.65	0.7	

*standard deviation.

3% HS nebulization causes a significant reduction in the CS scores, as compared to 0.9% Saline nebulization and Salbutamol nebulization. The baseline CS scores in 3%HS, 0.9% Saline and Salbutamol groups were 6.0 ±1 , 5.8 ±1.5 and 5.5±2.5 respectively (p=0.14), which after giving

treatment, dropped to 1.0±0.2, 3.19±0.8 and 1.65±0.7 respectively on the 4th day of treatment (p<0.01). Further Statistical analysis revealed that the fall was maximum in 3% HS group followed by Salbutamol group (Table 2).

TABLE -3 -showing Length of hospital stay (in days) in each treatment group

Treatment	patient no.	Length of hospital stay (days)		P value
		Mean	Std. deviation	
Group (A) 3% N.S	20	3.0	1.5	0.001 (significant)
Group (B) 0.9% N.S	20	5.0	1.2	
Group (C) SALBUTOMOL	20	3.5	1.7	

Length of hospital stay in 3% HS, 0.9% Saline and Salbutamol groups was 3.0±1.5, 5.0±1.2 and 3.5±1.7 days respectively, which was found to be statistically significant (p= 0.001). 3% HS reduced the length of stay by as much as 40% when compared with Normal Saline group. The reduction in length of stay with Salbutamol nebulization was also by 30% (Table 3).

DISCUSSION

Nebulized 3% hypertonic saline (HS) is a new treatment modality for acute bronchiolitis. It helps in reversing the pathophysiology of acute

bronchiolitis by hydrating the airway surface liquid. It reduces the degree of cross-linking and entanglement of mucous by breaking the mucous bond within mucous gel. It increases ciliary beat frequency via the release of Prostaglandin E₂; also it absorbs water from the mucosa and sub mucosa. Thus edema of the airway wall is reduced. With bronchodilators having no proven effect on course of acute viral bronchiolitis, it is currently recommended that they should not be routinely used in management of this condition^[8]. Search for an alternative like 3% HS or 0.9% normal

saline alone has led to various studies as described above. Hence, this study was planned.

65.7%) presented in the first 6 months of age. This is in accordance with the peak age of presentation of acute

The mean age of the patients in our study population was 6.5 ± 4.4 months. Most of the children (70%) presented in first 6 month of ages. Males were more affected than females.

In our study, 69.7% of the patients were males and 30.3% were females. In our study, males were more affected than females from acute bronchiolitis.

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This study show reduction in the CS score was 85%, 45% and 70% in 3% HS, 0.9% Saline and Salbutamol groups respectively. This suggest significant fall in CS scores in all the three groups. However, comparison by Post Hoc analysis showed that the difference was much greater in 3% HS group as compared to 0.9% Saline and Salbutamol groups. Sarell et al in a study of 70 patients with mild to moderate bronchiolitis on an outdoor basis concluded that in non-severely ill ambulatory children with bronchiolitis, nebulized 3% HS plus terbutaline is more effective in decreasing symptoms as compared to 0.9% normal saline plus terbutaline^[9]. Mandelberg et al in a study of 53 patients hospitalized with viral bronchiolitis concluded that in non – asthmatic non-severely ill patients with acute bronchiolitis, nebulized 3%HS (with epinephrine) decreases the symptoms significantly^[10]. It is possible that 3% HS through an improvement in mucociliary transport and a better elimination of intracellular debris may reduces viral load and decreases ongoing inflammation within the airways. This might have also reduced an opportunity for secondary bacterial overgrowth and thereby contributed to the more favorable effect of decreasing post inhalation therapy CS scores.

In this study, the mean duration of hospital stay was 3.0 ± 1.5 , 5.0 ± 1.2 and 3.5 ± 1.7 days in 3% HS, 0.9% Saline and Salbutamol groups respectively. The difference in Length of hospital stay between three groups was found to be statistically significant ($p = 0.001$). Post Hoc analysis showed that length of stay was significantly reduced in 3%HS (by as much as 40%) and Salbutamol (by 30%) groups as compared to 0.9% Saline group.

(65.7%) presented in the first 6 months of age. This is in accordance with the peak age of presentation of a The difference in Length of hospital stay between three groups was found to be statistically significant ($p = 0.001$). Post Hoc analysis showed that length of stay was significantly reduced in 3%HS and Salbutamol Groups. In fact the length of stay was reduced by as much as 30.6% in 3%HS Group and 24.9% in Salbutamol Group as compared to 0.9% Saline Group. A similar significant reduction in the length of hospital stay in HS groups in combination or alone, has been observed by various other authors cute The difference in Length of hospital stay between three groups was found to be statistically significant ($p = 0.001$). Post Hoc analysis showed that length of stay was significantly reduced in 3% HS and Salbutamol Groups. In fact the length of stay was reduced by as much as 30.6% in 3% HS Group and 24.9% in Salbutamol Group as compared to 0.9% Saline Group. A similar significant reduction in the length of hospital stay in HS groups in combination or alone, has been observed by various other authors

Mandelberg et al observed a mean duration of hospital stay of 3 ± 1.2 and 4 ± 1.9 days in 3%HS (with epinephrine) and 0.9% Saline (with epinephrine) groups respectively which was significant ($p < 0.05$) and there was 25% reduction in length of hospital stay^[10]. Kuzik et al observed a mean duration of hospital stay of 2.6 ± 1.9 and 3.5 ± 2.9 days in 3%HS and 0.9% Saline groups respectively. Infants in HS group had a clinically relevant 26% reduction in length of hospital stay ($p < 0.05$)^[11]. Luoz et al observed a mean duration

of hospital stay of 6 ± 1.2 and 7.4 ± 1.5 days in 3%HS (with Salbutamol) and 0.9% Saline (with Salbutamol) groups respectively which was also statistically significant ($p<0.05$)^[12].

Thus, we conclude that 3% HS nebulization (without additional bronchodilators) is an effective treatment in acute bronchiolitis. It significantly reduces the CS scores and length of hospital stay as compared to 0.9% Saline and Salbutamol nebulization. The economic benefit of this comparably priced modality of treatment can be enormous in terms of hospital costs with parents returning to work sooner.

Funding: none

Competitive interest: none.

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