

Original Research Article

Comparative evaluation of nebulised 3% saline versus nebulised 0.9% saline in the treatment of acute bronchiolitis

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ABSTRACT

Background: Acute bronchiolitis is the most common respiratory tract infection in young children. Despite the high prevalence of acute bronchiolitis, no consensus exists on the management. Studies have shown that except oxygen therapy, no other treatment found to be effective. Hence, the present study was conducted to find out the efficacy of nebulised 3% saline versus is 0.9% saline for the treatment of acute bronchiolitis.

Methods: A prospective randomized controlled study of 150 children between the age group of 2 months to 24 months with signs and symptoms of Acute Bronchiolitis admitted to Indira Gandhi Institute of Child Health, Bangalore from January 2016 to December 2016 formed the study group, they were randomized into 2 groups, one received 3% saline nebulization and the other received 0.9% saline.

Results: A total of 150 children were enrolled in the study, 75 children (group A) received 0.9% saline and 75 children (group B) received 3% saline. At 24 hours, the mean clinical severity score for group A was 2.49 ± 1.03 and group B was 2.16 ± 0.49 ($P=0.013$). The duration of hospital stay was shorter (1-3 days) in 3% saline with a mean of 2.35 days and was longer (3-5 days) in 0.9% saline with mean value of 4.04 days which was statistically significant ($p < 0.001$).

Conclusions: 3% saline nebulization can be used as an effective treatment for acute bronchiolitis. It significantly reduced the clinical severity score and length of hospital stay compared to 0.9% normal saline.

Keywords: 0.9% normal saline, Bronchiolitis, Nebulised 3% saline

INTRODUCTION

Acute bronchiolitis is one of the major causes for hospital admissions of infants younger than 1 year of age; most commonly, it affects infants between the ages of 2 and 6 months.¹

Up to 3% of all children are hospitalized for acute bronchiolitis in their first year of life.² RSV is responsible for >50% of cases. Other agents include parainfluenza, adenovirus, mycoplasma, rhinovirus, human

metapneumovirus and human bocavirus.^{3,4} Despite the high prevalence of acute bronchiolitis, no definite consensus exists on the optimal management of the disease.⁵

Management of acute bronchiolitis is mainly supportive. Humidified oxygen is delivered via nasal cannula or head box; the concentration required is determined by pulse-oximeter. Various other treatments have been proposed for acute bronchiolitis. Among them the use of nebulised 3% saline in the treatment of bronchiolitis is still in

controversy. Hence the current study was undertaken to compare the efficacy of nebulized 3% saline versus 0.9% saline in the treatment of acute bronchiolitis with an objective of improvement in clinical severity score, O₂ requirement and duration of hospital stay.

METHODS

A prospective randomized controlled study was carried out for a period of 12 months from January 2016 to December 2016. The study protocol was approved by the Institutional ethical committee. One hundred and fifty children between the age group of 2 months to 24 months with signs and symptoms of Acute Bronchiolitis admitted to Indira Gandhi Institute of Child Health, Bangalore formed the study group.

Informed written consent was obtained from parents of each patient before enrollment. Detailed clinical history and examination findings were recorded in a standard predesigned proforma. Assessment of patient’s clinical severity score (CSS) and SaO₂ readings by pulse-oximeter were done at admission, 30 minutes for the first 2 hours, 4th hourly and then every 6th hourly until discharge. The sum of the CSS scores ranged from 0-12, with increasing score indicating increasing respiratory distress as by Wang et al.⁶

These children were subjected to the need based investigations including Complete Blood count (CBC), Chest X Ray (CXR) and Arterial Blood Gas Analysis (ABG).

All children with mild and moderate bronchiolitis were started on standard treatment protocol with oxygen therapy, saturation monitoring, fluid and electrolyte management. They were randomized using custom random number generator into two groups.

- Group A: Received 3 ml of 0.9% saline nebulisation,
- Group B: Received 3 ml of 3% saline nebulisation.

They were reassessed every 30 min, clinical response was determined by improvement in CSS score, improvement in O₂ saturation, and duration of hospital stay, and for those CSS scores was not improving or were worsening, nebulised bronchodilators were added.

Inclusion criteria

All children aged between 2 months to 24 months with first episode of acute mild and moderate bronchiolitis.

Exclusion criteria

- Acute severe bronchiolitis with impending respiratory failure.
- Those who received treatment outside for acute bronchiolitis.

Statistical analysis

Statistical analysis was performed by STATA 11.2 (College Station TX USA). Shapiro Wilk test has been used to check the normality. Students t-test was used to find the significance between the clinical severity score and duration of hospital stay with the treatment groups (Nebulised 0.9% Saline and Nebulised 3% Saline) and these were expressed as mean and standard deviation. Chi square test was used to measure the association between the age groups, gender, symptoms, investigations and CSS score with treatment groups (Nebulised 0.9% Saline and Nebulised 3 % Saline) and these were expressed as frequency and percentage. P < 0.05 was considered as statistically significant.

RESULTS

A total of 150 children with signs and symptoms of Acute Bronchiolitis were enrolled in the study. They were randomized using custom random number generator into two groups:

- Group A: 75 children Received 3 ml of 0.9% saline
- Group B: 75 children Received 3 ml of 3% saline

Majority of the children were between the age group of 2 months and 6 months (33%; n=150), as shown in Table 1.

Table 1: Age distribution of children with acute bronchiolitis.

Age	Group A	Group B	Total
2 months-6 months	24 (32%)	26 (35%)	50
6 months-12 months	20 (27%)	21 (28%)	41
12 months-18 months	19 (25%)	9 (12%)	28
18 months-24 months	12 (16%)	19 (25%)	31
Total	75	75	150

Males and females were almost equally affected in a ratio of 1.08:1. Majority (84%) of the cases were admitted with moderate severity. Improvement in the clinical severity score was seen with 3% saline group in the first 24 hours which was statistically significant (p <0.05) as shown in Figure 1.

Improvement in O₂ saturation (55%) was observed in 3% saline group maximum in the first 24 hours of starting treatment which was statistically significant (p <0.05) as shown in Table 2.

Out of 75 patients in the 0.9% saline group 70% required additional treatment with inhaled bronchodilator, while only 40% in 3% saline group required bronchodilator. The mean duration of hospital stay was shorter in 3%

saline group 2.35±1.36 days while compared to 4.04±0.76 days in 0.9% saline group which was statistically significant (p <0.001), as shown in Table 3. There was no mortality.

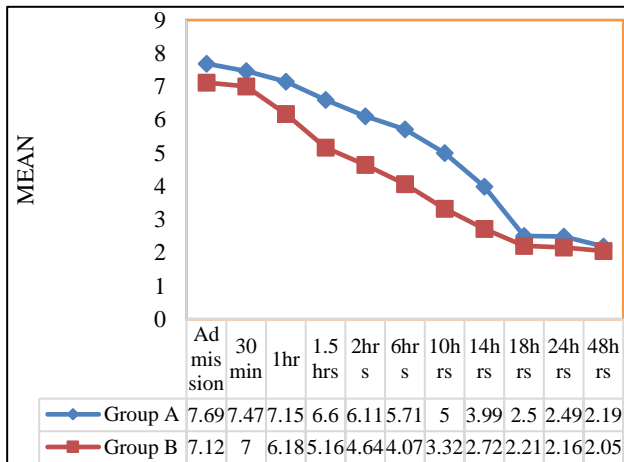


Figure 1: Improvement in clinical severity score.

Table 2: Improvement in O₂ saturation.

Hours	Group A	Group B	P- value
<24 hours	18 (28%)	41 (55%)	0.003
24-48 hours	32 (49%)	26 (35%)	
48-72 hours	10 (15%)	8 (10%)	
>72 hours	5 (8%)	0	

Table 3: Duration of hospital stay.

Days	Nebulised group A	Nebulised group B	P-Value
	Mean±SD	Mean±SD	
Hospital stay (days)	4.04±0.76	2.35±1.36	<0.001
Range	3-5	1-3	

DISCUSSION

Across various studies available, acute bronchiolitis is one of the major causes for hospital admissions of infants younger than 1 year of age, Table 1 shows the comparison of total number of cases studied with distribution of age, in the present study, the most common age group of children with acute bronchiolitis affected belongs to 2 months to 6 months. Similar observations were observed by Gaurav malik et al.⁷ This could be due to the fact that young infants have smaller airways and RSV infection is more common in that age group. Table 4 shows improvement in clinical severity score, the CSS improved more significantly in the 3% saline group (group B) from 7.12 to 2.05 compared to 0.9% saline group (group A). Similar observations were found in studies done by Gaurav et al, and Aayush et al.^{7,8} This is due to the fact that, more hypertonic a fluid better will be the mucociliary clearance. 3% saline breaks the

ionic bonds within the mucus gel, thereby reducing the degree of cross linking and entanglements and lowering the viscosity and elasticity of the mucus secretion. Table 5 shows the duration of hospital stay was shorter (1-3 days) in 3% saline group with a mean of 2.35 days and was longer (3-5 days) in 0.9% saline with a mean value of 4.04 days which was statistically significant (p <0.001). was comparable with the study done by Mandelberg et al, Tal et al, Kuzik et al, and Luo et al.⁹⁻¹²

Table 4: Improvement in clinical severity score.

CSS	Malik G et al ⁷ n = 100		Khanal A et al ⁸ n = 100		Present study n = 150	
	Gp A	Gp B	Gp A	Gp B	Gp A	Gp B
At admission	5.5	5.9	5.2	5.3	7.69	7.12
24 hours	-	-	4.9	4.3	2.49	2.16
48 hours	-	-	3.2	2.2	2.19	2.05
72 hours	13.3	1	-	-	-	-

Table 5: Duration of stay in comparison with other studies.

Study	3% saline	0.9% saline	P value
Mandelberg et al ⁹ n = 52	3	4	<0.05
Tal et al ¹⁰ n= 41	2.6	3.5	-
Kuzik et al ¹¹ n = 96	2.6	3.5	=0.05
Luo et al ¹² n = 135	6	7.4	<0.01
Present study n = 150	2.35	4.04	<0.001

CONCLUSION

In acute mild to moderate bronchiolitis the use of 3% nebulised saline significantly improved the clinical severity score, reduced the duration of O₂ requirement and length of hospital stay compared to 0.9% saline. The requirement of additional bronchodilator was significantly less with 3% hypertonic saline nebulisation. Therefore 3% hypertonic saline can be considered as a safe, inexpensive and effective treatment for patients with acute mild to moderate bronchiolitis.

Limitation of the study includes; acute bronchiolitis is a clinical diagnosis; however, the viral etiology could not be established due to logistic reasons. Sample size is too small to conclude. Further studies are required on a larger scale.

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REFERENCES

1. Christopher A Green, David Yeates, Allie Goldacre, Charles Sande, Roger C Parslow, et al. Admission to hospital for bronchiolitis in England: trends over five decades, geographical variation and association with perinatal characteristics and subsequent asthma. *Arch Dis Child.* 2016;101:140-6.
2. Scottish Intercollegiate Guidelines Network. Bronchiolitis in children. A national clinical guideline. Scotland. 2006. Available at: <http://www.lothianrespiratorymcn.scot.nhs.uk/wp-content/uploads/2010/11/Sign-91-Bronchiolitis-in-children.pdf>.
3. Rudolph CD, Rudolph AM, Hostetter MK, Lister G, Siegel NJ. Rudolph's Pediatrics. 21st ed. 2003:716-721.
4. Zorc JJ, Hall CB. Bronchiolitis: recent evidence on diagnosis and management. *Pediatr.* 2010;125:342-349.
5. Carvalho WBD, Johnston C, Fonseca MCM. Bronchiolitis and Pneumonia. Roger's Textbook of Intensive Care. 4th ed. Philadelphia: Wolters Kluwer Lippincott Williams & Wilkins. 2008:716-721.
6. Wang EE, Milner RA, Navas L, Maj H. Observer agreement for respiratory signs and oximetry in infants hospitalized with lower respiratory infections. *Am Rev Respir Dis.* 1992;145(1):106-9.
7. Malik G, Singh A, Singh K, Pannu MS, Singh P, Banga S, Jain R. A comparative study to assess the effects of nebulised 3% hypertonic saline, 0.9% normal saline and salbutalmol in management of acute bronchiolitis among Indian children. *J Evolution Med Dental Sci.* 2015;2278-4802.
8. Khanal A, Sharma A, Basnet S, Sharma PR, Gami FC. Nebulised hypertonic saline (3%) among children with mild to moderately severe bronchiolitis-a double blind randomized controlled trial. *BMC Pediatr.* 2015 Dec;15(1):115.
9. Mandelberg A, Amirav I. Hypertonic saline or high volume normal saline for viral bronchiolitis: mechanisms and rationale. *Pediatr Pulmonol.* 2010;45(1):36-40.
10. Tal G, Cesar K, Oron A, Houry S, Ballin A, Mandelberg A. Hypertonic saline / epinephrine treatment in hospitalized infants with viral bronchiolitis reduces hospitalization stay: 2 years experience. *Isr Med Assoc J.* 2006;8(3): 169-73.
11. Kuzik BA, Al Qadhi SA, Kent S, Flavin MP, Hopman W, Hotte S, et al. Nebulized hypertonic saline in the treatment of viral bronchiolitis in infants. *J Pediatr.* 2007;151(3):266-70.
12. Luo Z, Fu Z, Liu E, Xu X, Fu X, Peng D, et al. Nebulized hypertonic saline treatment in hospitalized children with moderate to severe viral bronchiolitis. *Clin Microbiol Infect.* 2011;17(12):1829-33.

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