

COMPARISON OF 3.0% HYPERTONIC SALINE VERSUS 0.9% NORMAL SALINE NEBULIZATION FOR ACUTE BRONCHIOLITIS IN CHILDREN

Muhammad Kashif Salman¹, Muhammad Sohail Ashraf², Ejaz Ahmad³

¹⁻³ Department of Pediatrics, Nishtar Medical University/ Hospital Multan – Pakistan.

Address for Correspondence:
Dr. Muhammad Kashif Salman

House no. 493/116, Street No. 22, Gulzeb Colony, Mumtazabad, Multan – Pakistan.

Email: dockashifmalik@gmail.com

Date Received: August 20, 2017

Date Revised: May 25, 2018

Date Accepted: June 03, 2018

ABSTRACT

Objective: To compare the use of 3.0% hypertonic saline versus 0.9% normal saline for nebulization in children who presented with acute bronchiolitis.

Methodology: We included 76 children having age less than 2 years who presented with acute bronchiolitis in Emergency Department of Nishtar Hospital, Multan, from September 2016 to April 2107. In group I patients, 0.9% normal saline was used for nebulization; and in group II patients 3.0% hypertonic saline was used for nebulization. Nebulization was repeated after every 6 hours. Reduction in modified respiratory assessment (MRA) score after 48 hours and hospital stay were primary outcomes of study.

Results: In our study, most of children were in age group of <6 months. The MRA score after 48 hours of nebulization was 4.89 ± 1.22 in normal saline group versus 3.34 ± 1.05 in patients of hypertonic saline group (p value <0.001). Reduction in MRA score was more in hypertonic saline group as compared to normal saline group. Mean hospital stay was 4.47 ± 1.03 days in normal saline group and 3.47 ± 0.89 in hypertonic saline group (P value <0.001).

Conclusion: Hypertonic saline resulted in significant reductions in modified respiratory assessment score (MRAS) and hospital stay as compared to normal saline in children with acute bronchiolitis.

Key Words: Hypertonic saline, Normal saline, Acute bronchiolitis, Modified respiratory assessment score

This article may be cited as: Salman MK, Ashraf MS, Ahmad E. Comparison of 3.0% hypertonic saline versus 0.9% normal saline nebulization for acute bronchiolitis in children. *J Postgrad Med Inst* 2018; 32(2): 128-31.

INTRODUCTION

Acute bronchiolitis is a highly prevalent disease in children and is most commonly caused due to viral infections such as respiratory syncytial virus (RSV)¹⁻³. The prevalence rate of acute bronchiolitis is about 11.6/100 in children with age upto 1 year and 6/100 in children with age upto 2 years, with a mortality rate of 0.5 to 1.5%^{4,5}. It most commonly effects children in winter and spring seasons. Lack of breast feeding, low socioeconomic status, malnutrition, exposure of child to tobacco smoking and positive history of asthma in family members are considered as general risk factors that can predispose a child to acute bronchiolitis⁶. It is characterized by the presence of upper respiratory tract symptoms such as rhinorrhea and sneezing, followed by loss of appetite moderate to high-grade fever and respiratory distress occurs in severe cases⁷. Diagnosis is based on clinical presentation and there is no need for laboratory investigations.

There is still no definitive available treatment of acute bronchiolitis and most of the children did not respond to any treatment modality. Nebulization with normal saline have been shown to be beneficial in these patients. Nebulization with hypertonic saline has been shown to be theoretically more beneficial as compared to the normal saline because it can absorb more water from the mucous plaques of bronchi and thus helps to decrease the symptoms of acute bronchiolitis. A recent systemic review has concluded that nebulization of hypertonic saline is associated with shorter hospital stay and rapid improvements in bronchiolitis severity symptoms⁸. On the other hand, some randomized trials have not found any significant effect of using hypertonic saline as compared to normal saline for nebulization in children with bronchiolitis^{9,10}. So there is still a discrepancy in available literature either hypertonic saline is beneficial or not. In this study, we compared the use of hypertonic saline with normal saline for nebulization in children who presented with acute bronchiolitis in pediatric unit.

METHODOLOGY

We included 76 children having age less than 2 years who presented with acute bronchiolitis in Emergency Department of Nishtar Hospital, Multan. The duration of this study was from September 2016 to April 2017. This study was a randomized clinical trial in nature. Approval from institutional ethics committee was taken. Before accepting the patient for study, we took a written consent from parents of each children. The sample size for this study was calculated by taking mean MRA score 1.0 ± 1.1 after nebulization with hypertonic saline and 1.9 ± 1.1 after nebulization with normal saline⁷, at power $(1-\beta) = 0.80$ and $\alpha = 0.05$; the sample size was 24 children in each group and we took 38 patients in each group.

Children were randomly allocated in to two group using draw randomization. Children having any congenital respiratory or cardiac anomaly and history of previous mechanical ventilatory support were excluded. Acute bronchiolitis was diagnosed if the child was presented with history of cough with/without fever, wheezing on chest examination or with first episode of wheezing. Information regarding, child's age, breast feeding, duration of bronchiolitis, presence of any respiratory or cardiac anomaly, history of asthma in first-degree sib-

lings, smoking habits in home persons and prior use of medications for bronchiolitis were taken from the parents of each patient. On admission, severity of acute bronchiolitis was determined using modified respiratory assessment score (MRAS). The full details of MRAS are given in Table 1. In group I patients; 0.9% normal saline was used for nebulization and in group II patients 3.0% hypertonic saline was used for nebulization. Nebulization was repeated after every 6 hours until the discharge of the patient from the hospital. MRA score was noted after 48 hours of starting the nebulization. Reduction in MRA score and hospital stay were primary outcomes of study.

All the patient's variables were entered in SPSS software V23. MRA score and hospital stay were compared using independent sample t-test between normal saline and hypertonic saline groups. Baseline and after 48 hours of nebulization, MRA score was also compared within the groups using paired sample statistics.

RESULTS

In our study, most of children were in age group of <6 months. There was no significant difference in gender, family history, breastfeeding, parenteral smoking habit, duration of bronchiolitis and baseline MRA score in patients of normal saline group and hypertonic saline

Table 1: Modified respiratory assessment score (MRAS)

Variable	Score 0	Score 1	Score 2	Score 3
Respiratory Rate/Minute	Less than 40	40-60	60-70	More than 70
Accessory Muscles Usage	No Use	1 Accessory Muscle	2 Accessory Muscles	≥3 Accessory Muscles
Cyanosis	No Cyanosis	Cyanosis during Crying	Cyanosis on Room Air	Cyanosed with Oxygen Or Cardio-Respiratory Arrest
Auscultatory Findings	Normal	Decreased Air Entry but no Rhonchi	Decreased Air Entry with Rhonchi	Silent Chest

Table 2: Baseline characteristics of study patients

Characteristics	Normal Saline Group (n=38)	Hypertonic Saline Group (n=38)	P Value	
Age (%)	<6 Months	27 (71.1)	30 (78.9)	0.69
	6-12 Months	6 (15.8)	5 (13.2)	
	>12 Months	5 (13.2)	3 (7.9)	
Gender (%)	Male	26 (68.4)	29 (76.3)	0.44
	Female	12 (31.6)	9 (23.7)	
Family History of Asthma (%)	6 (15.8)	5 (13.2)	0.74	
Breast Feeding (%)	24 (63.2)	21 (55.3)	0.48	
Parenteral Smoking (%)	19 (50.0)	17 (44.7)	0.65	
Duration of Bronchiolitis (%)	2.7 ± 0.84	3.0 ± 0.9	0.29	
Baseline MRAS	5.86 ± 1.59	6.13 ± 1.50	0.46	

Table 3: Comparison of clinical severity score and hospital stay

Variables	Normal Saline Group (n=38)	Hypertonic Saline Group (n=38)	P Value
Hospital Stay (days)	4.47 ± 1.03	3.47 ± 0.89	<0.001
MRAS after 24 hours	4.89 ± 1.22	3.34 ± 1.05	<0.001

Table 4: Comparison of modified respiratory assessment score (MRAS) within groups

Treatment Groups	Baseline MRA Score	MRA Score after 48 hours	P Value
Normal Saline Group	5.86 ± 1.59	5.26 ± 1.32	<0.001
Hypertonic Saline Group	6.13 ± 1.50	3.34 ± 1.04	<0.001

group (Table 2).

There was significant difference in the severity of MRA score after 48 hours of admission to hospital in patients of normal saline group and hypertonic saline group. The MRA score after 48 hours of nebulization was 4.89 ± 1.22 in normal saline group versus 3.34 ± 1.05 in patients of hypertonic saline group (p value <0.001). Mean hospital stay was 4.47 ± 1.03 days in normal saline group and 3.47 ± 0.89 in hypertonic saline group (P value <0.001, Table 3).

We also did within group comparison of MRA score in normal saline and hypertonic saline groups. There was a significant reduction in mean MRA score in both normal saline and hypertonic saline groups but the reduction in MRA score was more in hypertonic saline group as compared normal saline group (Table 4).

DISCUSSION

In this study, we compared the hospital stay and MRA score in children who presented with acute bronchiolitis and was given normal saline or hypertonic saline for nebulization. In our study, 75% patients (71.1% in normal saline and 78.9% in hypertonic saline group) were <6 months of age. In other studies, there were also higher number of patients in age group of <6 months with a reported prevalence rate of 66% to 80%^{7,11,12}. In our study, there was male predominance with 72.4% frequency. Other authors have reported 60% to 72% prevalence rate of male population in their studies^{7,9,11}.

In our study, we found a significant statistical reduction in MRA score after nebulization, and MRA score after 48 hours of nebulization was 4.89 ± 1.22 in normal saline (NS) group and 3.34 ± 1.05 in hypertonic saline group (p value <0.001). Wu et al¹³ did not found any superior effect of nebulization by using hypertonic saline, with a mean respiratory distress assessment instrument (RDSI) score of 5.32 ± 3.14 in NS group and 4.88 ± 2.95 in hypertonic saline group. Al-bahadily et al¹¹ also found

contrary results as compared to our study and did not found any significant differences in clinical severity score in hypertonic versus normal saline groups.

Gupta et al⁷ also concluded that nebulization with hypertonic saline results in significant reduction in mean MRA score as compared to nebulization with normal saline. In their study, mean clinical severity score after 72 hours of treatment was 1.0 ± 1.1 in hypertonic saline group and 1.9 ± 1.1 in normal saline group. In a review conducted by Baron et al¹⁴ it was concluded that use of hypertonic saline results in significant reduction in clinical severity of bronchiolitis and hospital stay as compared to normal saline and it also lessens the number of admissions due to bronchiolitis. Chen et al¹⁵ in a meta-analysis also found significant reductions in the severity and duration of hospitalization in patients who underwent nebulization by the use of hypertonic saline as compared to normal saline. Our results are consistent with the results of the review and meta-analysis reports.

In our study we also found a lesser hospital stay period in hypertonic saline group. The mean hospital stay in hypertonic saline group patients was 3.47 ± 0.89 days versus 4.47 ± 1.03 days in normal saline group patients. In analysis by Gupta et al⁷ mean hospital stay was lesser (3.4 ± 1.7) days in hypertonic saline versus 3.7 ± 1.9 days in normal saline group. Other analysis and meta-analysis also have found reduced period of hospital stay in hypertonic saline group of patients^{14,15}.

Zhang et al¹⁶ also found a shorter hospital stay by the use of hypertonic saline; these authors also concluded that it also reduces 20% risk of hospitalization as compared to normal saline. However, Florin et al¹⁷ in a randomized trial concluded that nebulization with normal saline is more effective as compared to hypertonic saline in patients of acute bronchiolitis in emergency departments and hypertonic saline should not be used in primary acute care settings. These results are contrary to many published clinical and meta-analysis trial and reports.

CONCLUSION

Hypertonic saline resulted in significant reductions in modified respiratory assessment score (MRAS) and hospital stay as compared to normal saline in children with acute bronchiolitis.

REFERENCES

1. Vece TJ, de Guzman MM, Langston C, Fan LL. Diffuse alveolar hemorrhage in children. In: Wilmott RW, Boat TF, Bush A, Chernick V, Deterding RR, Ratjen F, editors. Elsevier; Philadelphia PA, 2012: 848-57.
2. Handforth J, Friedland JS, Sharland M. Basic epidemiology and immunopathology of RSV in children. *Paediatr Respir Rev* 2000; 1:210-4.
3. Ralston SL, Lieberthal AS, Meissner HC, Alverson BK, Baley JE, Gadomski AM et al. Clinical practice guideline: the diagnosis, management, and prevention of bronchiolitis. *Pediatrics* 2014; 134:e1474-502.
4. Ray MS, Singh V. Comparison of nebulized adrenaline versus salbutamol in wheeze associated respiratory tract infection in infants. *Indian Pediatr* 2002; 39:12-22.
5. Salas Mallea A, Yucra Sea M. Características clínico-epidemiológicas de pacientes hospitalizados por bronquiolitis. *Rev Soc Bol Ped* 2005; 44:148-52.
6. Hacimustafaoglu M, Çelebi S, Bozdemir SE, Özgür T, Özcan İ, Güray A et al. RSV frequency in children below 2 years hospitalized for lower respiratory tract infections. *Turk J Pediatr* 2013; 55:130-9.
7. Gupta HV, Gupta VV, Kaur G, Baidwan AS, George PP, Shah JC et al. Effectiveness of 3% hypertonic saline nebulization in acute bronchiolitis among Indian children: A quasi-experimental study. *Perspect Clin Res* 2016; 7:88-93.
8. Zhang L, Mendoza-Sassi RA, Wainwright C, Klassen TP. Nebulised hypertonic saline solution for acute bronchiolitis in infants. *Cochrane Database Syst Rev* 2013:CD006458.
9. Koker O, Ozdogan S, Kose G, Yildirmak ZY. Comparison of the efficacies of normal saline versus hypertonic saline in the management of acute bronchiolitis. *Int J Contemp Pediatr* 2016; 3:795-800.
10. Sharma BS, Gupta MK, Rafik SP. Hypertonic (3%) saline vs 0.9% saline nebulization for acute viral bronchiolitis: A randomized controlled trial. *Indian Pediatr* 2013; 50:743-7.
11. Al-bahadily A-kJM, Al-Omrani AA-aM, Atiya AA. Hypertonic 3% saline in comparison with 0.9%(normal) saline in treatment of acute bronchiolitis. *Int J Pediatr* 2017; 5:4209-16.
12. Singh S, Kahlon PS, Neki N. A Comparative study to assess the efficacy of Nebulised 3% hypertonic saline and Nebulised I-adrenaline in treatment of acute bronchiolitis in children 1 month to 2 years. *Int J Curr Res Med Sci* 2017; 3:77-83.
13. Wu S, Baker C, Lang ME, Schrage SM, Liley FF, Papa C et al. Nebulized hypertonic saline for bronchiolitis: a randomized clinical trial. *J Am Med Asso Pediatr* 2014; 168:657-63.
14. Baron J, El-Chaar G. Hypertonic saline for the treatment of bronchiolitis in infants and young children: a critical review of the literature. *J Pediatr Pharmacol Ther* 2016; 21:7-26.
15. Chen YJ, Lee WL, Wang CM, Chou HH. Nebulized hypertonic saline treatment reduces both rate and duration of hospitalization for acute bronchiolitis in infants: an updated meta-analysis. *Pediatr Neonatol* 2014; 55:431-8.
16. Zhang L, Mendoza-Sassi RA, Klassen TP, Wainwright C. Nebulized hypertonic saline for acute bronchiolitis: a systematic review. *Pediatrics* 2015; 136:687-701.
17. Florin TA, Shaw KN, Kittick M, Yakscoe S, Zorc JJ. Nebulized hypertonic saline for bronchiolitis in the emergency department: a randomized clinical trial. *J Am Med Asso Pediatr* 2014; 168:664-70.

CONTRIBUTORS

MKS conceived the idea, planned the study, and drafted the manuscript. MSA and EA helped acquisition of data, did literature search and statistical analysis. All authors contributed significantly to the submitted manuscript.