RESEARCH ARTICLE

Comparison of 3% saline and 0.9% normal saline nebulization as diluent in children with bronchiolitis

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Abstract

Objective: To compare the outcome in terms of mean time to disappearance of cough, wheezing, crackles and length of hospital stay in patients treated with sodium chloride 3% with sodium chloride 0.9% as nebulisation diluent in children for suffering from bronchiolitis.

Methods: The prospective study was conducted at the Department of Paediatric Medicine Sheikh Zayed Hospital, Lahore, Pakistan, from November 2014 to April 2015, and comprised children aged between 6 weeks and 24 months having bronchiolitis. Group A received 3% sodium chloride and Group B received 0.9% of the same solution. Duration of cough, wheezing, crackles and duration of stay at hospital were compared between the groups. Data was analysed using SPSS 17.

Results: Of the 100 patients, there were 50(50%) in Group A with a mean age of 7.17±4.46 months, and as many in Group B with a mean age of 6.6±3.74 months. Overall, there were 55(55%) boys and 45(45%) girls. Mean cough and wheezing remission time as well as length of hospital stay was significantly different between the groups (p<0.05).

Conclusion: In children having bronchiolitis, 3% saline as nebuliser solution was found to be more effective than 0.9% saline solution.

Keywords: 3% saline solution, Bronchiolitis, Wheezing, Crepitations, Hospital stay. (JPMA 71: 822; 2021)

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Introduction

Respiratory syncytial virus is commonly responsible for causing bronchiolitis in paediatric patients aged <1 year. Infants aged <3 years are more prone to having complications related to disease nature. Premature babies, chronic lung disease, heart defects, overcrowding and exposing the baby to smoke are well-established risk factors complicating the disease.[1] Supportive measures, including hydration, oxygenation and continuing feed, are the mainstay of treatment.[2] Research has enumerated variation in results regarding investigation, management, admission to hospital and duration of time spent in hospital in patients of bronchiolitis, and, hence, there is room for improvement in disease management.[3] Adrenaline, bronchodilators, corticosteroids, anti-cholinergic, anti-bacterial, physical therapy for lung and pulmonary surfactant have been components of intervention so far. Precise and specific treatment of bronchiolitis is under debate among experts and is not supported by recent inconclusive data.[4]

Many studies are in favour of beneficial effects of hypertonic 3% saline for the treatment of bronchiolitis as it increases the clearance of mucus[5] by breaking the ionic bonds in the mucus, decreasing the thickness and elastic nature of the mucus. It also rehydrates mucus secretion through water-flow and stimulates by releasing prostaglandin.[6] Further, theoretically, it is helpful for reducing bronchial wall oedema. It is economical in the way of shorter hospital stay and low cost of treatment.[7]

There is no local data, but international data shows conflicting results to show which of the diluents is better. Cochrane meta-analysis comprising 28 trials reported 14% less hospitalisation with hypertonic saline, and the hospital stay was 10 hours shorter with hypertonic saline.[7] One study reported less time for stay in hospital with 3% sodium chloride (NaCl) solution.[8] Howeever, two studies[2,9] while comparing hypertonic saline and normal saline both with salbutamol showed no significant benefit. The current study was planned to compare the outcome in terms of mean time to disappearance of cough, wheezing, crackles and length of hospital stay in paediatric bronchiolitis patients treated with NaCl 3% and NaCl 0.9%.

Patients and methods

The prospective study was conducted at the Department of Paediatrics, Sheikh Zayed Hospital, Lahore, Pakistan, from November 2014 to April 2015.

After approval from the institutional ethics review committee, the sample size was calculated at 95% confidence interval (CI), 80% power of test with an expected duration of hospital stay taken from literature.[10] The smaple was raised from among the in-patients using

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consecutive convenient sampling method. Those included were bronchiolitis patients with age between 6 weeks and 24 months of either gender. Those excluded were children having any underlying cardiovascular disease by history and medical record, prior history of wheezing, history of eczema, allergies of the respiratory tract, including asthma and rhinitis, hypoxia with oxygen saturation (SpO_2) <85% without oxygenation by pulse oximetry, deterioration in consciousness, Glasgow Coma Scale (GCS) <15/15, use of bronchodilators within the preceding four hours, use of corticosteroids therapy within the preceding 48 hours, consolidation of lungs on X-ray chest and family history of asthma, atopy.

No randomisation was done. After informed consent was taken from each child's parent in the local language, the subjects were divided into Group A 3% NaCl nebulisation and Group 2 0.9% NaCl nebulisation. Nebulization was done by 2ml of the diluent in addition to salbutamol 2.5mg after every four hours. Nebulisations were supported with oxygen inhalation at 6-8 litre per min. Treatment was provided till the patient was allowed to go home.

Data was noted in a predesigned proforma That included name, age, gender and address of the patient. Weight, height and SpO_2 by pulse oximeter were measured. Data regarding manifestations of the disease, including cough, rhonchi, crepitations and duration of hospital stay, the Wang clinical score[11] were observed and documented by fully trained registrars on duty every 8 hours, which was later converted to days from first nebulisation to the order of discharge in round on disappearance of all the signs and symptoms of bronchiolitis.

Time to disappearance of symptoms and length of hospital stay were also recorded.

Data was analysed using SPSS 17. Qualitative data, like gender, was expressed as frequencies and percentages. Age, weight, height, time to disappearance of symptoms and stay in hospital were expressed mean and standard deviation (SD). The difference in terms of hospital stay and duration of disappearance of symptoms was analyzed using independent t-test. Pearson Chi square test was used when needed. P<0.05 was taken as significant.

Results

Of the 100 patients, there were 50(50%) in Group A with a mean age of 7.17±4.46 months, and as many in Group B with a mean age of 6.6±3.74 months. Overall, there were 55(55%) boys and 45(45%) girls (Table 1).

In Group B, mean time of disappearance of wheeze was 2.9±0.8 days and it was 2.47±07 days in Group A. Mean duration of disappearance of crackles was 3.34±1 days in

Table-1: Baseline characteristics.

Variables		0.9% saline group (n=50)	3% saline group (n=50)	*p*-value
Age (months)	0-6	30(60%)	25(50%)	0.256
	6-12	17(34%)	17(34%)	
	>12	3(6%)	8(16%)	
	Mean±SD	6.6±3.74	7.17±4.46	
Gender	Male	27(54%)	28(56%)	0.841
	Female	23(46%)	22(44%)	
Gestation	Preterm	10(20%)	14(28%)	0.349
	Term	40(80%)	36(72%)	
Weight(kg)	<5th percentile	11(22%)	18(36%)	0.516
	>5th percentile	39(78%)	32(64%)	
	Mean ±SD	6.67±2.52	7.04±3.24	
Height (cm)	<5th percentile	5(10%)	10(20%)	0.965
	>5th percentile	45(90%)	40(80%)	
	Mean ±SD	66.30±6.25	66.36±7.25	
Oxygen saturation		93.18±3.46	94.40±3.49	0.079

cm: Centimetre, kg: Kilograms, SD: Standard deviation

Table-2: Results of disappearance of symptoms and time period of stay in hospital in both groups.

Variables	0.9% saline group	3% saline group	*p*-value
Disappearance of wheeze(mean days)	2.9±0.8 1	2.47±0.72	0.006
Disappearance of crackle (mean days)	3.34±1.07	3.1±0.79	0.206
Disappearance of cough(mean days)	5.0±0.78	4.2±0.77	0.000
Time period for hospital stay	6.12±0.90	5.04±0.92	0.000
Age <6 m	6.26±0.86	5±0.95	0.000
Age >6 m	5.9±0.91	5±0.91	0.002
Male	6.15±0.81	4.89±0.87	0.000
Female	6.09±0.99	5.23±0.97	0.005
Preterm	6.10±0.94	5.11±1.06	0.000
Term	6±0.66	4.8±0.66	0.000
Weight < 5th percentile	6.36±0.67	5.5±0.924	0.012
Weight >5th percentile	6.05±0.94	4.78±0.832	0.000
Height <5th percentile	6.4±0.54	5.10±0.56	0.001
Height >5th percentile	6.09±0.925	5.03±1.04	0.000

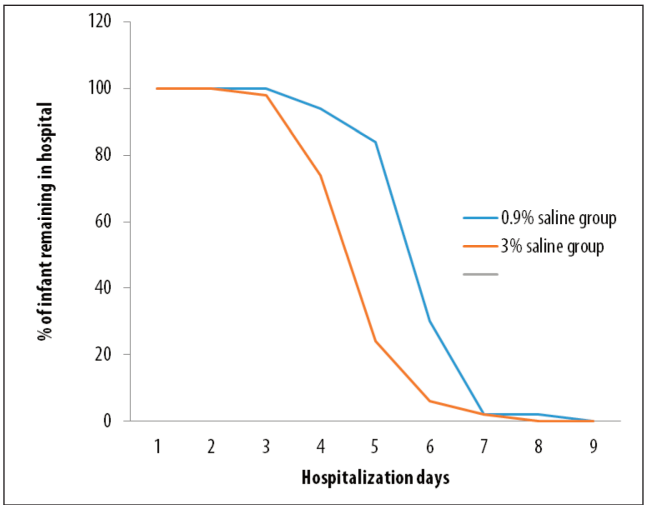

Figure: : Line graph showing percentage of infants remaining in hospital in both groups.

Table-3: Stratification of time for stay in hospital in 3% saline in terms of different variables.

Time for hospital stay in terms of:			*p*-value
Age	<6 months	5.08±0.95	0.763
	>6months	5±0.91	
Gender	Male	4.89±0.87	0.208
	Female	5.23±0.97	
Gestation age	Preterm	5.11±1.06	0.389
	Term	4.86±0.66	
Weight	<5th percentile	5.5±0.924	0.007
	>5th percentile	4.78±0.832	
Height	<5th percentile	5.1±0.568	0.821
	>5th percentile	5.03±1.04	

Group B and it was 3.1±0.8 in Group A. Cough disappeared in 5.0±0.8 days in Group B and in 4.2±0.8 days in Group A. Mean hospital stay was 6.12±0.9 days in Group B and it was 5.04±0.92 days in Group A. The time spent for stay in hospital was significantly shorter in Group A compared to Group B ($p<0.05$) (Figure). Significant difference was also noted in mean time for hospital stay in relation to age, gender, gestational age, weight and height between the groups ($p<0.05$) (Table 2).

Effectiveness of 3% NaCl saline was not significant for various variables (Table 3).

Discussion

Nebulisations with bronchodilators and normal saline have been widely used in the treatment of bronchiolitis. Studies have documented varying degree of success using terbutaline, salbutamol and adrenaline. Recent studies have observed better response in terms of decrease in the duration of symptoms and time for stay in hospital using 3% NaCl with normal saline.[12]

It has been documented that although hypertonic saline decreased the number of admissions to hospital (28.9%), the duration of hospital stay and assessment score for respiratory distress were unaffected when compared with normal saline[13] which is in contrast with the current study. Similarly, another study in Istanbul revealed contradictory results showing unremarkable differences between the study groups regarding disease management and hospital stay ($p>0.05$).[14] Two other studies[15,16] reported no noticeable difference between the two nebulisation groups.

A Cochrane review concluded that patients who received nebulisation with 3% NaCl solution spent 10 hours less in hospital compared to the group receiving normal saline nebulisation.[7] Another database revealed less time for hospital stay in patients with hypertonic saline than in patients treated with normal saline.[17] A study illustrated that when 3% NaCl solution was used with salbutamol, it resulted in marked reduction in time for settling cough, wheeze and crepitations ($p<0.05$). Moreover, duration of hospital stay was also reduced in 3% NaCl solution nebulisation group ($p<0.01$).[10]

There are certain limitations to the current study. the physical findings were assessed by registrars on duty and there was no randomisation of the subjects which could have led to bias in results. Moreover, diagnosis of bronchiolitis was clinical without any viral antigen studies. Finally, we did not included infants of out-patient department (OPD) having bronchiolitis.

Conclusion

The 3% NaCl inhalation in combination with salbutamol was found to be better than 0.9% NaCl solution. Pulmonary symptoms were resolved more quickly and reduced the economic burden due to less time for hospital stay.

Disclaimer: The first author was working at the Shaikh Zayed Hospital, Lahore, during the study period.

Conflict of interest: None.

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