Acute bronchiolitis management comparison between salbutamol with normal saline vs nebulized hypertonic saline

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Abstract

Background: When there is an acute lesion in the lower respiratory tract, this serious condition is known as bronchiolitis. RSV (respiratory syncytial virus) causes more than seventy percent of cases. However, influenza, rhinovirus, parainfluenza, mortal metapneumovirus, mycoplasma pneumonia, and human bocavirus are some other pathogens that are also the cause of acute bronchiolitis.**Objective:** The basic purpose of this research was to study the children who were diagnosed with acute bronchiolitis and determine the efficacy of nebulized hypertonic saline in them.**Study design:** An analytical cross-sectional study**Place and Duration: This study was conducted at** Kulsumbai Valika Social Security Site Hospital Karachi **from june 2021 to june 2022Methodology:** In this research, there were a total of 80 children enrolled. All of the 80 children involved in this research were aged from one month to one year (30 days to 365 days) irrespective of their gender. Every patient was clinically presented with bronchiolitis. The children were divided into two groups with 40 children each. One group was assigned to 0.4 ml salbutamol respiratory nebulization solution and 4 ml normal saline. The other group was assigned to 4 ml 3 percent nebulized hypertonic saline. The treatment was repeated 8 hours each day for 120 hours.**Results:** A total of60% of children (n=24) were quickly recovered and discharged from group 1 and the remaining 16 patients were gradually recovered and discharged. While 95% of children recovered as well discharged quickly from group 2 (n=38). The remaining 2 patients were gradually recovered and discharged. The average time period of oxygen therapy in group 1 was 26.4 hours while in group 2, it was 15.0 hours. The mean time period of hospital stay for group 1 was 74.7 hours while it was 58.1 hours for group 2.**Conclusion:** The time period for hospital stay and the severity of the acute bronchiolitis was reduced by nebulized hypertonic saline as compared to those who were treated with salbutamol nebulization and normal saline.

Keywords: Hypertonic saline, normal saline, salbutamol, children, bronchiolitis

Introduction

When there is an acute lesion in the lower respiratory tract, this serious condition is known as bronchiolitis. RSV (respiratory syncytial virus) causes more than seventy percent of cases[1]. However, influenza, rhinovirus, parainfluenza, mortal metapneumovirus, mycoplasma pneumonia, and human bocavirus are some other pathogens that are also the cause of acute bronchiolitis[2, 3]. RSV infections typically occur in children who are less than two years with the highest occurrence between 2 and 6 months[4]. Hospitalization is required for only a very small number of children, mainly for only 1 percent of children who are suffering from RSV. In a prior study conducted, 348 cases of bronchiolitis were identified, and 50% of them were positive for RSV antibodies[5].

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Despite efforts over the past 40 years, proper and effective treatment with evidence to treat bronchiolitis has not been found yet[6]. This is why, still the focus is on the standard treatment method which is focused on hydration, oxygenation, and nutrition. Various interventions, such as bronchodilators, anticholinergics, steroids, antibiotics, surfactants, and chest physiotherapy, have been tried, but there is insufficient evidence to support their efficiency[7]. Moreover, many antiviral agents are also present. However, these agents are not recommended to use and their use is also controversial.

While some studies have shown a short-term improvement with the use of bronchodilators, such as epinephrine, others have failed to demonstrate significant effects[8, 9]. Nebulized 3% NaCl solution has been suggested to improve mucociliary function, reduce the viscosity of secretions, and improve airway edema. The results of this research show that if we use nebulized hypertonic saline and do not use salbutamol, this can reduce the time period for hospital stay and the severity of acute bronchiolitis.

Methodology

In this research, there were a total of 80 children enrolled. All of the 80 children involved in this research were aged from one month to one year (30 days to 365 days) irrespective of their gender. Every patient was clinically presented with bronchiolitis.

Inclusion criteria

The clinical problems that the children had were the following; cough, runny nose, chest in-drawing, hyperinflation shown in chest x-ray, difficulty in breathing, and hyper-translucency without any cardiac problem. These children were admitted to the hospital during the time period of this research.

Exclusion criteria

Those children who had any prior history related to respiratory disease or chronic cardiac, wheezing, requiring mechanical ventilation, respiratory failure, and inhaling nebulized hypertonic saline within 12 hours of admission was not a part of this research.

The children were divided into two groups with 40 children each. Group 1 was assigned 0.4 ml salbutamol respiratory nebulization solution and 4 ml normal saline. Lottery Method was used for group 1. The other group (group 2) was assigned to 4 ml 3 percent nebulized hypertonic saline. The treatment was repeated 8 hours each day for 120 hours. The clinical history and physical findings were noted down before the treatment through questionnaires. The respiratory distress assessment instrument (RDAI) which was explained by Wang et al. was used in this research to examine the variables of this study[10].

A non-invasive pulse oximeter was used to measure the saturation of oxygen for every child upon admission. The oxygen saturation was noted as a baseline feature. If the value of oxygen saturation was below 90 percent, significant hypoxia was considered to be associated with the child. Before giving the drug, informed and written consent was taken. The drug was given according to a dosing schedule. Group 1 was assigned 0.4 ml salbutamol respiratory nebulization solution and 4 ml normal saline. The other group (group 2) was assigned to 4 ml 3 percent nebulized hypertonic saline. Each dose was given 3 times a day at intervals of eight hours till they were well enough to get discharged. The same supportive measures were used for both groups. These measures include oxygen therapy (if the saturation of oxygen was below 90 percent), propped-up positioning, IV fluids, antibiotics, nasal suction, counselling, feeding, and paracetamol.

After the intervals of 12 hours in the starting, the RDAI score was measured. Later, the RDAI score was measured after every 1 day till the day when the children were able to get discharged. Moreover, the time period was recorded which showed the requirement for the withdrawal of oxygen therapy. If the oxygen saturation level was above 95 percent, the oxygen therapy was put to an end. Moreover, the time period for hospital stay was measured by noting the time of admission to the time of discharge. The physician that was attending to the children was the one who made decisions regarding the discharge of the children. Before making the decision, the clinical grounds of the patients were considered. The variables of the outcome were the following; the time period of oxygen, time period of hospital stay, clinical severity score, oxygen saturation levels, any side effects of the drugs, and time period of oxygen supplementation.

SPSS software (version 19) was used to measure and evaluate the data collected. Moreover, the chi-square test and t-test were used to compare the data of both groups. The CI was 95 percent and any value below 0.05 was considered to be statistically significant.

Results

In this research, there were a total of 80 children enrolled. The children were divided into two groups with 40 children each. Group 1 was assigned 0.4 ml salbutamol respiratory nebulization solution and 4 ml normal saline. The other group (group 2) was assigned to 4 ml 3 percent nebulized hypertonic saline. Table number 1 shows the demographic features of all the children.

In group 1, the majority of the children were less than 6 months old. There were 22 children who were less than 6 months old, representing 55% of the total group population. There were 14 children from 6 to 12 months (35%) and the remaining 4 children were more than 12 months old. The males and females were equal in group 1 (20 males and 20 females). The mean of group 1 was 5.5.

In group 2, the majority of the children were less than 6 months old. There were 26 children who were less than 6 months old, representing 65% of the total group population. There were 12 children from 6 to 12 months (30%) and the remaining 2 children were more

than 12 months old. There were 21 males and 19 females in group 2. The mean of group 2 was 5.2. Table number 2 shows the clinical problems that the children had at the time of admission. Table number 3 shows the mean clinical severity scores of both of the groups. A total of 60% of children (n=24) were quickly recovered and discharged from group 1 and the remaining 16 patients were gradually recovered and discharged. While 95% of children recovered as well discharged quickly from group 2 (n=38). The remaining 2 patients were gradually recovered and discharged. The average time period of oxygen therapy in group 1 was 26.4 hours while in group 2, it was 15.0 hours. The mean time period of hospital stay for group 1 was 74.7 hours while it was 58.1 hours for group 2.

Table No. 1: demographic features of all the children		
Characteristics	Group 1	Group 2
Age (months)		
Less than 6	22	26
7-12	14	12
More than 12	4	2
Gender		
Male	20	21
Female	20	19
Mean age (Months)	5.5	5.2

Table No. 2: clinical problems that the children had at the time of admission		
Clinical presentation	Group 1	Group 2
Cough	40	40
Wheezing	38	37
Chest in-drawing	40	40
Runny nose	40	40
Fever	10	11
Feeding difficulty	23	22
Normal Oxygen saturation	94.6	94.9
Breathing difficulty	40	40
Nasal flaring	07	3
Rhonchi	40	40
Tachycardia	34	38
Tachypnea	35	36

Table No. 3: mean clinical severity scores of both of the groups		
Mean clinical severity score	Group 1	Group 2
At baseline	9.3	9.1
12 hours	9.1	8.2
24 hours	7.9	5.4
48 hours	4.2	2.5
72 hours	3.6	1.8

Discussion

In very young children, bronchiolitis is a very serious and common condition. This condition happens mostly in those children who are less than 2 years old. This condition leads to hospitalization[11]. There was research conducted to compare salbutamol and normal saline with 3% nebulized hypertonic saline[12]. That research was conducted to determine whether the use of nebulized hypertonic saline reduces the time period of hospital stay and the severity of the condition. Both of the groups in the research were the same in terms of demographics and clinical characteristics. Both treatment groups showed improvements in respiratory distress scores and clinical severity scores, as well as increased oxygen saturation within three days. However, those who received 3% nebulized hypertonic saline saw a faster reduction in symptoms compared to those who received salbutamol and 0.4 ml normal saline.

Chen et al. conducted a meta-analysis of 11 research studies[13]. He found out that the use of nebulized hypertonic saline has affected children with acute bronchiolitis positively. The time period of hospital stay was decreased which was more effective than the use of normal saline. Although the clinical severity score was also reduced by using nebulized hypertonic saline, the rate of readmission was not decreased. Hsieh et al. also performed a meta-analysis of 32 research studies[14]. He also stated that the use of nebulized hypertonic saline is more effective than the use of normal saline. In his meta-analysis, the time period of hospital stay was decreased by 0.54 days. Mandelberg et al found significant improvement in the hypertonic saline nebulization group, with three trials comparing the efficacy of hypertonic saline nebulization with normal saline and salbutamol nebulization using the same scoring system[15]. Despite differences in the delivery interval, the reported effect sizes of the 3% saline nebulization treatment were comparable across studies. All of these findings are similar to our research.

The mean time period of oxygen supplementation was 9 hours less in the children who were given 3% nebulized hypertonic saline as compared to those who were given normal saline and

salbutamol.Overall95% of children quickly recovered and discharged from the hypertonic saline group whereas only 60% of children were able to discharge rapidly in the normal saline group in the same time period. None of the children reported any kind of side effects. Since the clinical characteristics of the two groups were comparable at baseline, the intervention is the cause of the different results. In a research of 70 patients with bronchiolitis (age less than 2 years) conducted by Zamani et al., there were two groups each containing 35 patients[16]. Their research also showed similar results to our study. They also concluded that the nebulized hypertonic saline has a significant impact on the condition of children with bronchiolitis and recovered the children in a short period of time compared to the normal saline.

According to Khalid et al., the mean time period for hospital stay was lesser for the hypertonic saline group which is also the same as our research findings[17]. Another research study was performed by Singh et al. in Jaipur which was also on the same topic and it also showed that the clinical severity score and the average time period of hospital stay of the hypertonic saline group were lesser than the score of the normal saline group[18].

Apart from the above-mentioned research studies, there are a number of other studies which conclude that infants with acute bronchiolitis can be treated effectively if there would be the use of nebulized hypertonic saline instead of the use of normal saline[19, 20]. There were no side effects reported in any of these research studies. All of their results are similar to the results of our research which concludes that the average time period of hospital stay and clinical severity score is reduced by the use of the hypertonic saline solution. Both of the mean scores were less in the normal saline group. Patients in the hypertonic saline group were discharged from the hospital 17 hours earlier on average than those in the isotonic saline group, indicating that hypertonic saline is a safe and effective treatment for infantshaving bronchiolitis.

There were certain limitations of this research. First was that the sample size was very small and it was only performed in a single center which does not reflect the whole population. Hence, there is a need for research with a large sample size on this topic. Furthermore, after 72 hours of treatment, only 17 children were left in the hypertonic saline group. Whereas, there were 36 children left in the normal saline group, making valid statistical analysis between the groups impossible.

Conclusion

Overall, the current study and meta-analyses indicate that nebulized hypertonic saline is an effective treatment option for children with bronchiolitis, resulting in a decrease in clinical severity and length of hospital stay when compared to nebulized normal saline and salbutamol. Within three days of treatment, there was a reduction in clinical severity scores and an improvement in oxygen saturation, with the hypertonic saline group showing earlier improvement. It is worth noting that no significant reduction in readmission rates was found in the meta-analyses. Nonetheless, nebulized hypertonic saline appears to be a promising treatment option for children suffering from bronchiolitis.

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Conflict of interest

None

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