COMPARATIVE STUDY TO ASSESS THE EFFECTIVENESS OF NEBULIZED 3% HYPERTONIC SALINE AND NEBULIZED LEVOSALBUTAMOL IN THE MANAGEMENT OF BRONCHIOLITIS

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ABSTRACT

Objective: The objective of the study was to compare the effects of nebulized 3% hypertonic saline and nebulized levosalbutamol in the management of bronchiolitis.

Methods: Seventy children of age 1–24 months admitted into the hospital with the diagnosis of bronchiolitis. Participants were divided into two groups of 35 each. Group A was given nebulized 3% hypertonic saline and Group B was given nebulized levosalbutamol. Modified respiratory distress assessment instrument (RDAl) is used at admission, at 48 h after admission, and at the time of discharge to identify the reduction in scores between two groups.

Results: The mean age of patients in the study population was 10.1±6.4 months. The mean birth weight of patients in Group A and Group B was 3.00±0.61 and 3.12±0.75. The percentage of male patients was 57.1% and the percentage of female patients was 42.8%. The modified RDAl score in Group A and Group B at admission, 48 h of admission, and at the time of discharge was 4.34±0.87, 2.4±1.03, and 0.67±0.05 (p=0.04) and 4.11±0.58, 3.60±1.00, and 2.51±0.96 (p=0.12). The hospital stay was observed to be lowered in Group A (3.77±0.88) compared to Group B (5.43±0.92; p=0.04).

Conclusion: From the findings of our study, we conclude that nebulized 3% hypertonic saline, as it acts by hindering the pathophysiologic mechanism of bronchiolitis, is more effective in reducing the clinical severity score and length of hospital stay. Further, 3% hypertonic saline also have the additional benefit of decreasing the economic burden of disease as it is safe, inexpensive, reduces the inpatient hospital charges by reducing the length of stay.

Keywords: Bronchiolitis, 3% hypertonic saline, Levo-salbutamol, Modified respiratory distress assessment instrument, Nebulization.

INTRODUCTION

Bronchiolitis, an infection of the lower respiratory tract, is a common viral infection affecting the children below 2 years of lifetime. It is the principal cause of hospitalization, with remarkable morbidity and mortality in both advanced and growing countries [1]. The familiar viruses to cause bronchiolitis infection include respiratory syncytial virus, parainfluenza, influenza, rhinovirus, adenovirus, and metapneumovirus and bacteria like Mycoplasma pneumoniae have also been implicated in the etiology of bronchiolitis [2-4]. In general, no complex investigations are required in the diagnosis of bronchiolitis, it is simple based on signs and symptoms [5].

As stated in a report given by the WHO, approximately 150 million new cases of clinical pneumonia (primarily pneumonia and bronchiolitis) occur per annum. Among them, majority 11–20 million be in need of hospital admission [6]. Within the first 2 years of life, more than one-third of children suffer from bronchiolitis, among them 1 out of 10 infants require hospitalization [7,8]. Mortality rate of bronchiolitis is 0.5–1.5% among hospitalized children which is elevated to 3–4% in cases of children suffering with cardiopulmonary complications [9]. About 95% of the bronchiolitis cases occur in the growing countries, across the world [6]. Therefore, in India also, it is a significant problem due to high incidence and its associated health and economic impact [10,11].

The aim of our study was to compare the effects of nebulized 3% hypertonic saline and nebulized levosalbutamol in the management of bronchiolitis among hospitalized children in Indian setting.

METHODS

A single-centered prospective study was conducted on 70 children in the pediatric ward of Princess Esra Hospital, Hyderabad, during a period of 6 months.

Inclusion criteria

All children aged 1–24 months with clinical diagnosis of bronchiolitis were included in the study.

Exclusion criteria

Children of age <1 month and >24 months, children with chronic illness such as congenital heart disease, cystic lung disease, immunodeficiency syndrome, and children with preterm birth were excluded from the study.

A written informed consent was taken from the parents on a prescribed format. The study was approved by ethical committee of Deccan College of Medical Sciences, Hyderabad. The data of all cases were recorded on predetermined pro forma for the following characteristics: Age, gender, family history of atopy, temperature, heart rate, and modified respiratory distress assessment score (Fig. 1).

The children were assigned randomly in sequential manner into two groups of 35 each designated as A and B.

1. Children in Group A were nebulized with 4 ml of 3% hypertonic saline.
2. Children in Group B were given levosalbutamol nebulization 0.15 mg/3 ml.
The nebulizations were given 4 times daily till discharge. The modified respiratory distress assessment instrument (RDAI) score was recorded at the time of admission, at 48 h after admission, and at the time of discharge.

**Statistical analysis**

Descriptive statistical analysis was performed, the comparative study of different variables was done by unpaired "t"-test. One-way ANOVA used to compare modified RDAI scores between two groups. \( p < 0.05 \) was considered as statistically significant.

**RESULTS**

Among 70 patients included in the study, the percentage of male patients was 57.1% and the percentage of female patients was 42.8%.

The mean age of patients in the study population was 10.1±6.4 months. The maximum number of patients belongs to the age group of 1–12 months (78.5%). The mean birth weight of patients in Group A and Group B was 3.00±0.61 and 3.12±0.75, respectively (Table 1). Our study did not find any significant mean value difference with respect to age and birth weight between Group A and Group B.

About 3% hypertonic saline nebulization caused significant reduction in the modified RDAI score as compared to levosalbutamol nebulization. The modified RDAI score in nebulized 3% hypertonic saline and nebulized levosalbutamol at admission, 48 h after admission, and at the time of discharge was 4.3±0.87, 2.4±1.03, and 0.67±0.05 (\( p < 0.04 \)) and 4.11±0.58, 3.60±1.00, and 2.51±0.96 (\( p = 0.12 \)) (Table 2). Modified RDAI score was significantly decreased at 48 h of treatment and at the time of discharge in Group A patients compared to Group B patients (Table 3).

![Fig. 1: Modified respiratory distress assessment score (*Accessory muscle usage: suprasternal, subcostal, and intercostal retractions; mild bronchiolitis: Score 0–4; moderate bronchiolitis: Score 5–8; severe bronchiolitis: Score 9–12)](image)

**Table 1: Distribution of clinical variables between Group A and Group B (n=70)**

| Clinical characteristics         | Group A (n=35)       | Group B (n=35)       | \( p \) value |
|----------------------------------|----------------------|----------------------|--------------|
| Age (months)                     | 9.60±6.52            | 10.60±6.61           | 0.52         |
| Birth weight (kg)                | 3.00±0.61            | 3.12±0.75            | 0.43         |
| Male %                           | 74.29%               | 40.00%               | -            |
| Method of childbirth             | Vaginal              | Cesarean             | -            |
| Children exposed to passive smoking | Yes                | No                   | -            |
|                                  | 48.57%               | 51.43%               | -            |
|                                  | 28.57%               | 71.43%               | -            |
| *\( p < 0.05 \) is statistically significant* |

**Table 2: Mean score values of modified respiratory distress assessment instrument between Group A and Group B (n=70)**

| Group          | At admission   | At 48 h   | At discharge | \( F \) value | \( \ p \) value |
|----------------|----------------|-----------|--------------|---------------|----------------|
| Group A (n=35) | 4.34±0.87      | 2.40±1.03 | 0.67±0.05    | 10.58         | 0.04*          |
| Group B (n=35) | 4.11±0.58      | 3.60±1.00 | 2.51±0.96    | 2.41          | 0.12           |

*\( p < 0.05 \) is statistically significant

**Table 3: Intergroup comparison of modified respiratory distress assessment instrument score at different stages of treatment (n=70)**

| Modified respiratory distress assessment instrument | Group A (n=35) | Group B (n=35) | \( p \) value |
|----------------------------------------------------|----------------|----------------|--------------|
| At admission (Mean±SD)                             | 4.34±0.87      | 4.11±0.58      | 0.14         |
| At 48 h (Mean±SD)                                 | 2.40±1.03      | 3.60±1.00      | 0.05*        |
| At discharge (Mean±SD)                            | 0.67±0.05      | 2.51±0.96      | 0.01*        |

*\( p < 0.05 \) is statistically significant

There was a significant difference with respect to length of hospital stay between two groups. The hospital stay was observed to be lowered in Group A (3.77±0.08) compared to Group B (5.43±0.92; \( p = 0.04 \)) (Table 4).

**DISCUSSION**

In our investigation, the mean age of children was seen as 10.1±6.4 months, the youngest being 1.5 months, and the oldest being 2 years. These outcomes are similar with the investigations by Sarrell et al. in which the mean age of patients was noticed as 12.5±6 months.
A Cochrane review was done in 2013, this review was done with the comparative studies of Mandelberg et al. and Kuzik et al. [14,16].

A Cochrane review was led in 2013, this review was done with the intention to decide the impact of nebulized 3% hypertonic saline in patients with acute viral bronchiolitis. The result of this review was nebulized 3% hypertonic saline fundamentally reduced the length of hospital stay among inpatients and clinical serious score logically upgraded in both outpatient and hospitalized children. They additionally discovered that no unfavorable effects are accounted with 3% hypertonic saline nebulization [17].

With nebulized 3% hypertonic saline, the modified RDAI score decreased significantly after treatment (i.e., at 48 h and at the time of discharge). This might be because of interfering activity of 3% hypertonic saline on the pathophysiological component of bronchiolitis by decreasing the inflammation, promoting the intracellular debris clearance, and expanding the mucociliary transport.

The mean span of hospital stay in our examination was 3.77±0.88 and 5.43±0.92 days in nebulized 3% hypertonic saline and nebulized levosalbutamol groups, respectively, the difference of hospital stay in Group A patients compared with Group B patients; subsequently, our investigation showed that 3% hypertonic saline nebulization caused significant decrease in the modified RDAI when compared with levosalbutamol nebulization. This concurs with the results of comparable investigations of Mandelberg et al. and Kuzik et al. [14,16].

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CONCLUSION

From the findings of our study, we conclude that nebulized 3% hypertonic saline, as it acts by interfering with the pathophysiological mechanism of bronchiolitis, was more effective in reducing the clinical severity score and length of hospital stay. Further 3% hypertonic saline also has the additional benefit of decreasing the economic burden of disease as it is safe, cheap, gives a kind of relaxation from the inpatient hospital charges by reducing the length of stay.

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AUTHORS’ CONTRIBUTIONS

Dr. U. Narayan reddy and Sara Shireen have contributed to conception, design of the study, and statistical interpretation of data. Shafira Sultan, Khadija Akhtar Omir, and Atika Begum Qutub have contributed in acquisition, conduct of the study, interpretation of data, and preparation of the manuscript.

CONFLICTS OF INTEREST

The authors declared no conflicts of interest regarding the research, authorship, and publication of this article.