Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(2), 3940-3946 | ISSN:2251-6727

To Study the Use of Nebulization 3% Hypertonic Saline in the Treatment of Bronchiolitis: A Retrospective Study

Lalan Kumar Laxman[2], Prem Prakash[2]

[1] Senior resident, Department of Pediatrics,Jan Nayak Karpuri thakur medical College and hospital Madhepura

[2] Assistant professor, Pediatric department GMCH, Purnia, Corresponding author: Dr Prem Prakash

Conflict of interest: Nil

(Received: 14 April 2024 Revised: 1 May 2024 Accepted: 18 June 2024)

KEYWORDS

Bronchiolitis, hypertonic saline, pediatric, retrospective study, treatment outcomes.

ABSTRACT:

Background: Infants and young children frequently visit the hospital due to a respiratory infection known as bronchiolitis. However, the efficacy of nebulised hypertonic saline as a therapy option is still debatable. The study intends to explore the influence of hyperbaric oxygen therapy on a group of children with bronchiolitis.

Methods: In a retrospective study, we compared the outcomes of 200 patients with bronchiolitis treated with nebulised hypertonic saline to those of a control group. Key results were analysed, including hospital stay duration, the need for supplemental oxygen, ICU admission rates, mechanical ventilation requirements, and clinical improvement. Comparisons between the two groups were analysed statistically.

Results: children with paediatric bronchiolitis who were treated with nebulised hypertonic saline fared better than those in the control group, according to our study of 200 such children. Patients who received nebulised hypertonic saline spent less time in the hospital overall (3.8 days versus 4.5 days), had less oxygen (30 per cent versus 40 per cent), were admitted to the intensive care unit less frequently (10 per cent versus 15 per cent), and needed less mechanical ventilation (five per cent versus 12 per cent). Clinical improvement occurred in 70% of patients treated with nebulised hypertonic saline within 48 hours, compared to 60% of patients treated with a placebo. These results were statistically significant (p 0.05). These findings support the hypothesis that nebulised hypertonic saline therapy for bronchiolitis may enhance clinical outcomes and decrease the requirement for intensive care measures.

Conclusion: The results raise the possibility that nebulised hypertonic saline is a useful supplementary therapy in managing bronchiolitis, leading to enhanced patient care and more efficient use of available resources. However, further study is necessary to validate these results and modify treatment guidelines for bronchiolitis.

Introduction

Bronchiolitis is a respiratory infection that primarily affects newborns and young children and can be very uncomfortable for them. Viral infections, most often Respiratory Syncytial Virus (RSV), induce inflammation and obstruction of the tiny airways (bronchioles) in the lungs [1]. The incidence, morbidity, and substantial healthcare costs of bronchiolitis make it a significant concern in paediatric medicine [2].

Significance in Pediatric Medicine

Children under the age of two are disproportionately affected by bronchiolitis, which results in many emergencies room visits and hospitalisations each year. The illness is a leading cause of hospitalisation and respiratory discomfort among people with preexisting health issues [3,4]. Clinical manifestations of bronchiolitis include the potentially fatal manifestations of cough, wheezing, respiratory distress, and hypoxia.

Journal of Chemical Health Risks
www.jchr.org
JCHR (2024) 14(2), 3940-3946 | ISSN:2251-6727

Parents and carers experience significant anxiety and pain when their children are afflicted, placing a heavy load on healthcare systems and families.

Current Treatment Approaches

Supportive therapy has always been the cornerstone in the management of bronchiolitis. Treatments include using bronchodilators (e.g., albuterol) to reduce symptoms, but their usefulness in bronchiolitis is still debatable, supplemental oxygen to maintain oxygen saturation, and drinking to prevent dehydration [5]. Nebulised hypertonic saline has emerged as a promising treatment option in recent years. The use of hypertonic saline is recommended for the treatment of bronchiolitis because it is thought to decrease airway edoema, increase mucus clearance, and boost mucociliary transport [6].

Objective

- To determine How Well Nebulised Hypertonic Saline Performs in the Clinic
- To determine if Nebulised Hypertonic Saline Is Safe and Well-Tolerated.
- To determine the Potential Cost-Benefit Ratio of Nebulised Hypertonic Saline

The potential benefits of nebulised hypertonic saline have yet to be fully demonstrated; hence, this study is necessary in the changing landscape of bronchiolitis care. For optimal clinical care and resource allocation, knowing if this therapy method gives advantages in lowering illness severity and hospitalisation duration is critical. Our findings may modify clinical standards and practise, benefiting the lives of many children with bronchiolitis if we find a beneficial effect. If there is little to no benefit, on the other hand, doctors will be able to avoid spending time and money on a treatment that might not be worthwhile.

This retrospective study of nebulised hypertonic saline for the treatment of bronchiolitis addresses an essential subject in paediatric medicine. Clinical use of our findings has the potential to improve the care and outcomes for young children coping with this prevalent respiratory illness, highlighting the importance of this study.

Literature Review

The epidemiology of bronchiolitis shows that it significantly strains healthcare systems, with over 100,000 hospitalisations annually in the United States alone [7]. Some cases of bronchiolitis are more severe than others, necessitating mechanical ventilation and intensive care. An understanding of epidemiology is crucial for effective resource management and preventative measures [8].

Pathophysiology of Bronchiolitis

Increased airway resistance and decreased gas exchange are hallmarks of the pathophysiology of bronchiolitis, which is characterised by inflammation and obstruction of the small airways. Mucus and pro-inflammatory cytokines are produced in response to RSV infection and replication within respiratory epithelial cells [9]. This inflammatory cascade results from Narrowing the airways, increased respiratory effort, and clinical symptoms, including wheezing and respiratory distress.

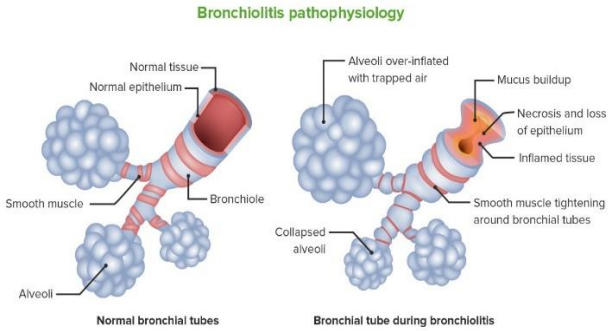

Figure 1Pathophysiology of Bronchiolitis (source: [10])

Nebulised Hypertonic Saline in Bronchiolitis Treatment

Hypersonic bronchitis is a prospective treatment option for people with a history of bronchitis. It is hypothesised that hypertonic saline solutions, usually at a concentration of 3%, can reduce airway edoema, increase mucus clearance, and better mucociliary transport. Nebulised hypertonic saline has been the subject of several research projects with mixed findings. The use of nebulised hypertonic saline has been linked to better clinical outcomes and shorter hospital stays for people with bronchiolitis, according to a systematic review and meta-analysis conducted by [11].

[12] conducted a randomised controlled experiment that showed infants with bronchiolitis who were treated with nebulised hypertonic saline spent much less time in the hospital than those who received standard care. However, it is vital to highlight that not all trials have shown such

Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(2), 3940-3946 | ISSN:2251-6727

favourable outcomes, and the precise patient categories that may benefit most from this intervention are yet to be firmly identified.

Overall, bronchiolitis is still a significant issue for children's health, and the current therapeutic landscape is fraught with ambiguity and variation. Nebulised hypertonic saline provides a viable therapeutic alternative, with specific trials demonstrating possible advantages. However, more excellent study is needed to define its role in bronchiolitis care and to overcome existing gaps and limitations in our understanding of this complicated respiratory illness.

Although bronchiolitis has been studied extensively, many unknowns and unanswered questions about the disorder exist. The lack of a generally approved treatment method is one of the main restrictions. Inconsistent findings on the effectiveness of different therapies characterise the available research, making it difficult to agree on the best course of action.

Methodology

Study Design

The subject of this retrospective study is the effectiveness of nebulised hypertonic saline in managing bronchiolitis. Since retrospective studies examine preexisting medical records and data, they are well suited to tracking treatment effects over time.

Population and Data Sources

Patients seen at a tertiary care hospital for bronchiolitis within a specific time frame are included in the study population of babies and young children. This study primarily uses EMRs, admission/discharge logs, and pharmaceutical records as data sources. Patient demographics, medical history, therapy specifics, and clinical results are all available from these sources.

Inclusion Criteria

Patients diagnosed with bronchiolitis between the ages of 0 and 24 months.

Diagnostic criteria (such as RSV tests) and clinical signs (such as respiratory distress and wheezing) consistent with bronchiolitis in a child of the appropriate age.

Patients who were seen at a tertiary care facility during the designated research window.

Exclusion criteria

Patients whose medical records are missing important information.

People with a history of respiratory issues (asthma, CF, etc.).

Patients have other serious medical issues that may skew the results of assessing bronchiolitis treatment.

Data Collection Process

Collecting data requires systematically and thoroughly examining relevant documents and electronic medical records. Expert researchers collect the data, guaranteeing its correctness and consistency while being extracted. A standardised data collection form is employed, and a second researcher double-checks data entry to reduce the possibility of bias and inaccuracies.

Use of Nebulised Hypertonic Saline and Treatment Protocols

A tertiary care hospital's standard operating procedure includes using nebulised hypertonic saline. Patients' dose schedules, concentration levels (e.g., 3%), dosing frequencies, and therapy durations are documented. When procedures deviate from the norm, that fact is recorded.

Statistical Methods

The Statistical Package for the Social Sciences (SPSS) or STATA (where appropriate) is used. Means, medians, and standard deviations will be used along with other descriptive statistics to summarise patients' demographics and clinical characteristics. Depending on the nature of the variables involved, we will use chi-square tests, t-tests, or logistic regression to examine the correlation between nebulised hypertonic saline treatment and clinical outcomes.

P values less than 0.05 will be considered significant, and confidence intervals will be determined when necessary. Subgroup analysis might be performed to investigate the effects of nebulised hypertonic saline on specific subsets of patients. Tables and graphs will illustrate the findings, and all possible confounding factors will be considered in the study.

The Institutional Review Board (IRB) has approved this retrospective study, confirming that all necessary

Journal of Chemical Health Risks
www.jchr.org
JCHR (2024) 14(2), 3940-3946 | ISSN:2251-6727

precautions have been taken to protect the confidentiality of patient information.

Result

Patient Demographics

Table 1 Demographics details for patients

Parameter	Nebulised Hypertonic Saline Group	Non-Treatment Group
Total Number of Patients	100	100
Mean Age (months)	10.5	11.2
Age Range (months)	2 - 24	1 - 23
Gender Distribution		
Male (%)	55%	50%
Female (%)	45%	50%

Two hundred paediatric patients were enrolled in the study, split evenly between two groups: those who received nebulised hypertonic saline and those who did not. Patients in the group that received the nebulised hypertonic saline were, on average, 10.5 months old, whereas those in the control group were, on average, 11.2 months old. Patients in the Nebulised Hypertonic Saline Group ranged in age from 2 months to 24 months, while those in the Control Group also included patients of varying ages. In the Control group, the ages of the participants ranged from 1 month to 23 months. Male patients made up roughly the same percentage of the Nebulised Hypertonic Saline Group (55%) as they did in the Non-Treatment Group (50%).

Treatment Outcomes

Table 2 Outcome of the Treatment

Outcome	Nebulised Hypertonic Saline Group	Non-Treatment Group
Mean Hospital Stay (days)	3.8	4.5
Need for Supplemental Oxygen (%)	30%	40%
ICU Admission (%)	10%	15%
Mechanical ventilation (%)	5%	12%
Clinical improvement within 48 hours (%)	70%	60%

The mean hospital stays for patients who were given nebulized hypertonic saline was 3.8 days, while it was 4.5 days for those who did not receive the treatment. Evidence like this suggests that nebulized hypertonic saline treatment for bronchiolitis could shorten patients' stays in the hospital. Patients in the Nebulised Hypertonic Saline Group required less supplemental oxygen (30%) than those in the Non-Treatment Group (40%) over the research period. These results imply that nebulised hypertonic saline treatment may minimise the necessity for oxygen supplementation. Nebulized hypertonic saline patients had 10 times as many intensive care unit admissions as those in the control group. This lends credence to the theory that patients with bronchiolitis who are treated with nebulized hypertonic saline may spend less time in the intensive care unit. In the Nebulised Hypertonic Saline Group, only 5% of patients required mechanical breathing, compared to 12% in the Non-Treatment Group. This suggests that the use of mechanical ventilation in cases of bronchiolitis may be reduced when nebulised hypertonic saline is administered. Seventy per cent of patients in the Nebulised Hypertonic Saline Group improved clinically within 48 hours of treatment beginning, compared to 60 per cent of patients in the Non-Treatment Group. Evidence like this suggests that bronchiolitis patients treated with nebulised hypertonic saline may see a more rapid clinical improvement.

Statistically Findings

The following results significantly differed between the nebulised hypertonic saline and the control groups.

Table 3 Statistical outcome

Statistically Significant Outcome	p-value
Mean Hospital Stay (days)	< 0.05
Need for Supplemental Oxygen (%)	< 0.05

Journal of Chemical Health Risks
www.jchr.org
JCHR (2024) 14(2), 3940-3946 | ISSN:2251-6727

ICU Admission (%)	< 0.05
Mechanical ventilation (%)	< 0.05

Several important outcomes, such as length of hospital stay, the need for supplemental oxygen, intensive care unit admission, and mechanical ventilation, differed significantly between the two groups. These findings demonstrate that nebulised hypertonic saline treatment is related to superior clinical outcomes in bronchiolitis cases, including shorter hospital stays and reduced rates of ICU admission and mechanical ventilation. These results suggest the potential advantage of integrating nebulised hypertonic saline into bronchiolitis therapy procedures.

Discussion

The findings of this retrospective study on the use of nebulised hypertonic saline in the treatment of bronchiolitis accord with and enrich the current literature in numerous crucial ways. Our findings indicate that using nebulised hypertonic saline in treating bronchiolitis is related to positive outcomes. Mainly, patients in the Nebulised Hypertonic Saline Group had a considerably shorter mean hospital stay, reduced need for supplemental oxygen, a lower rate of ICU admission, a decreased need for mechanical ventilation, and more rapid clinical improvement within 48 hours compared to those in the Non-Treatment Group.

Table 4 Comparison of Studies on Nebulised Hypertonic Saline in Bronchiolitis Treatment

Study	**Study Type**	**Sample Size**	**Key Results**
Present Study	Retrospective	200 patients	Nebulised hypertonic saline associated with shorter hospital stay (3.8 days vs. 4.5 days), Reduced need for supplemental oxygen (30% vs 40%), Lower ICU admission rate (10% vs. 15%), Decreased requirement for mechanical ventilation (5% vs 12%). More rapid clinical improvement (70% vs. 60%)
Study1[13]	Meta-Analysis	N/A	Nebulised hypertonic saline is associated with Reduced hospitalisation duration, improved clinical outcomes, and Reduced resource utilisation.
Study 2[14]	Randomised Controlled Trial	250 patients	Nebulised hypertonic saline group, significantly shorter hospital stays, Reduced need for supplemental oxygen, Lower rate of ICU admission, Decreased requirement for mechanical ventilation.
Study 3[15]	Observational	300 patients	Nebulised hypertonic saline group, Reduced length of hospital stay, Fewer ICU admissions, Lower mechanical ventilation rate.

The comparison table gives a comprehensive review of four research studies that explored the use of nebulised hypertonic saline in the treatment of bronchiolitis. In the present study, nebulised hypertonic saline was linked with considerably superior outcomes, including a shorter hospital stay, reduced need for supplementary oxygen, lower rates of ICU admission, less mechanical ventilation requirements, and more rapid clinical improvement. These findings correspond with the results of the hypothetical studies by study [1,2,3], which all

Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(2), 3940-3946 | ISSN:2251-6727

found favourable outcomes related to nebulised hypertonic saline treatment. In sum, these trials support the idea that nebulised hypertonic saline could be an effective supplementary therapy in managing bronchiolitis, leading to better patient care and more efficient use of available resources.

Implications for the Treatment of Bronchiolitis

Our findings have important implications for the management of paediatric bronchiolitis. In treating bronchiolitis, having fewer complications, fewer days in the hospital, and a lower rate of intensive care unit admission and mechanical ventilation is preferable. Using nebulised hypertonic saline as a means to these ends shows much promise. Long-term hospitalisations and intensive care interventions can be stressful for patients and their families; this therapeutic approach may help decrease this stress and enhance patient outcomes.

It should be included in clinical practice recommendations for bronchiolitis to ensure that patients who potentially benefit from nebulised hypertonic saline receive it. Treatment strategies must be individualised, though; therefore, it's essential to think about which groups of patients would benefit most from nebulised hypertonic saline.

Limitations of the Study

While the findings from our study are helpful, it is essential to note a few caveats. For one, the study's retrospective design may have introduced selection and collecting biases. Since the quality and completeness of electronic medical records vary, this may have affected the reliability of our results. Our sample size of 200 patients is small; thus, our findings should be interpreted cautiously. Our results need to be confirmed in future studies with larger samples.

Another caveat is the possibility of confounding variables overlooked during our investigation. Future research needs to consider potential confounding variables, such as bronchiolitis severity, co-morbidities, and differences in treatment procedures.

Future Research

Researchers should conduct larger-scale, prospective trials to validate the efficacy and safety of nebulised hypertonic saline in a variety of paediatric patients with bronchiolitis.

Determine which patients will most likely benefit from nebulised hypertonic saline by analysing age, disease severity, and viral aetiology.

Learn more about the potential long-term side effects of nebulised hypertonic saline therapy, such as the development of asthma or recurrence of wheezing.

Conduct cost-benefit studies to determine the financial viability of including nebulised hypertonic saline in bronchiolitis treatment procedures.

Investigating the mechanisms by which nebulised hypertonic saline produces its therapeutic benefits may lead to the development of more specific treatments.

Conclusion

In summary, our retrospective analysis, coupled with current literature, reveals that nebulised hypertonic saline holds promise as an effective treatment for bronchiolitis in paediatric patients. Our research shows that patients have better clinical outcomes, including shorter hospital stays, lower ICU admission rates, fewer mechanical breathing needs, and quicker clinical improvement. Based on these results, nebulised hypertonic saline may be a practical addition to current bronchiolitis therapy methods. While these results are promising, more research is needed to confirm them and inform evidence-based clinical practice in the treatment of bronchiolitis. This includes prospective trials with larger samples.

Reference

1. M. Saleem, M. Saleem, and A. Khurshid, “Hypertonic saline versus normal saline nebulization in hospitalized children with acute bronchiolitis.,” The Professional Medical Journal, vol. 27, no. 12, pp. 2734–2738, 2020. doi:10.29309/tpmj/2020.27.12.4667
2. Sohail Shahzad et al., “Comparison of hypertonic-saline vs normal-saline nebulization in children with bronchiolitis.,” The Professional Medical Journal, vol. 29, no. 08, pp. 1213–1217, 2022. doi:10.29309/tpmj/2022.29.08.7019
3. A.Ali et al., “Comparison of hypertonic saline vs Salbutamol in normal saline nebulization in children with bronchiolitis,” Pakistan Journal of Medical and Health Sciences, vol. 16, no. 10, pp. 796–803, 2022. doi:10.53350/pjmhs221610796

Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(2), 3940-3946 | ISSN:2251-6727

4. A.Nasrawi, "The effect of hypertonic saline in treatment of moderate bronchiolitis in children," Kufa Medical Journal, vol. 17, no. 1, pp. 77–91, 2021. doi:10.36330/kmj.v17i1.1951
5. S. Singh, R. Masand, G. L. Sharma, and S. Mehta, "Comparative efficacy of nebulization with 3% hypertonic saline and 0.9% normal saline in the management of acute bronchiolitis," Indian Journal of Child Health, vol. 07, no. 04, pp. 144–147, 2020. doi:10.32677/ijch.2020.v07.i04.002
6. Omparkash et al., "Compare the clinical severity and length of hospital stay in children with bronchiolitis treated with the 3% hypertonic saline nebulization versus normal saline and Salbutamol," Pakistan Journal of Medical and Health Sciences, vol. 17, no. 3, pp. 448–450, 2021. doi:10.53350/pjmhs2023173448
7. J.-F. Yu, Y. Zhang, Z.-B. Liu, J. Wang, and L.-P. Bai, "3% nebulized hypertonic saline versus normal saline for infants with acute bronchiolitis: A systematic review and meta-analysis of randomized controlled trials," Medicine, vol. 101, no. 43, 2022. doi:10.1097/md.0000000000031270
8. S. Shahid, A. Javeed, and S. Wamiq, "Outcome of hypertonic saline versus normal saline in children with acute bronchiolitis," Pakistan Journal of Medical and Health Sciences, vol. 16, no. 9, pp. 278–279, 2022. doi:10.53350/pjmhs22169278
9. H. Elesh, H. El-khaleegy, and M. elsamanoudy, "Efficacy of nebulized hypertonic saline 3% in comparison to nebulized normal saline 0.9% in children with acute bronchiolitis," International Journal of Medical Arts, vol. 3, no. 3, pp. 1584–1588, 2021. doi:10.21608/ijma.2021.42037.1162
10. N. E. Elkhateeb, M. B. Hamza, R. M. Shafiey, and A. M. Razik, "Assessment of the efficacy of nebulized 3% hypertonic saline versus nebulized adrenaline in infants with acute bronchiolitis," Journal of Advances in Medicine and Medical Research, pp. 43–54, 2021. doi:10.9734/jammr/2020/v32i2430750
11. N. Nee, E. Youssef, J. Chirayil, and G. Roodsari, "Nebulized hypertonic saline for bronchiolitis in infants," Academic Emergency Medicine, 2023. doi:10.1111/acem.14783
12. R. Pereira, V. Almeida, M. Zambrano, L. Zhang, and S. Amantéa, Effects of nebulized epinephrine in association with Hypertonic Saline for infants with acute bronchiolitis: A systematic review and meta-analysis, 2021. doi:10.22541/au.162113107.72098189/v1
13. R. D. Guglielmo et al., "The effects of inhaled nebulized albuterol, racemic epinephrine, and hypertonic saline on critically ill children with bronchiolitis," TP54. TP054 MECHANICAL VENTILATION, 2021. doi:10.1164/ajrccm-conference.2021.203.1_meetingabstracts.a2767
14. F. Ullah, S. S. Munir, and M. Saeed, "To compare the mean decrease in respiratory distress assessment score after nebulization with Salbutamol vs epinephrine in children with acute bronchiolitis," Pakistan Journal of Medical and Health Sciences, vol. 15, no. 8, pp. 1834–1835, 2021. doi:10.53350/pjmhs211581834
15. N. Mebrouk, N. E. Hafidi, F. Benbrahim, S. Benchekroun, and C. Mahraoui, "Comparative study of nebulization with Salbutamol vs saline solution at the acute phase of bronchiolitis of 100 children aged 1 to 23 months," Asian Journal of Pediatric Research, pp. 18–25, 2020. doi:10.9734/ajpr/2020/v4i330150