Journal of Advanced Medical and Dental Sciences Research

@Society of Scientific Research and Studies

Journal home page:www.jamdsr.com doi:10.21276/jamdsr Index Copernicus value [ICV] =82.06

(e) ISSN Online: 2321-9599; (p) ISSN Print: 2348-6805

Original Research

Comparison of Nebulized Saline vs Bronchodilators in the Management of Pediatric Bronchiolitis

Radha Rajpal Saxena

Assistant Professor, Department of Pediatric, NRI Medical College & General Hospital Chinakakani, Guntur district, Andhra Pradesh, India

ABSTRACT:

Background: Bronchiolitis remains one of the most common causes of lower respiratory tract infection and hospitalization in infants, with supportive care being the cornerstone of management. Despite guideline recommendations, the clinical use of bronchodilators continues, largely due to variable responses among infants and ongoing uncertainty regarding their true benefit. Nebulized saline, a widely used and safe intervention, serves as both a control in trials and a potential therapeutic agent. This study compared nebulized normal saline with bronchodilators to determine whether bronchodilators offer additional benefit in the acute management of pediatric bronchiolitis. **Aim:** To compare the effectiveness of nebulized saline versus nebulized bronchodilators in improving clinical outcomes among infants and young children diagnosed with acute bronchiolitis at a tertiary care hospital. **Material and Methods:** This comparative study included 78 children aged 1–24 months clinically diagnosed with bronchiolitis. After informed consent, participants were randomly allocated into two groups: Group A received nebulized normal saline, and Group B received nebulized bronchodilators. Baseline characteristics—including age, sex, respiratory rate, oxygen saturation, and clinical severity scores—were recorded. Nebulizations were administered using a standardized jet nebulizer with oxygen as the driving gas. Post-treatment assessments evaluated changes in respiratory rate, oxygen saturation, wheeze and retraction scores, along with clinical improvement at 1 hour. Additional interventions such as supplemental oxygen, IV fluids, escalation to second-line therapy, and hospital admission were documented. Data analysis used appropriate statistical tests with $p < 0.05$ considered significant. **Results:** Baseline characteristics were comparable between groups. Group B showed significantly greater improvement in oxygen saturation (3.87% vs. 3.18%; p=0.02) and wheeze reduction (1.48 vs. 1.21; p=0.01). Significant early clinical improvement occurred in 66.67% in Group B compared to 46.15% in Group A (p=0.05). Although major outcomes such as hospitalization and need for supplemental oxygen did not differ significantly, trends consistently favored the bronchodilator group. **Conclusion:** Bronchodilators demonstrated modest but superior early clinical improvements compared to nebulized saline; however, overall outcomes remained largely similar. Bronchodilator use may be considered selectively rather than routinely in the management of pediatric bronchiolitis.

Keywords: Bronchiolitis, Nebulized saline, Bronchodilators, Pediatric respiratory disease, Clinical outcomes

Corresponding author: Radha Rajpal Saxena, Assistant Professor, Department of Pediatric, NRI Medical College & General Hospital Chinakakani, Guntur district, Andhra Pradesh, India

This article may be cited as: Saxena RR. Comparison of Nebulized Saline vs Bronchodilators in the Management of Pediatric Bronchiolitis**.** J Adv Med Dent Scie Res 2018;6(4):224-228.

INTRODUCTION

Bronchiolitis is one of the most common lower respiratory tract infections in infancy and early childhood and represents a leading cause of hospital admission in the first year of life.[1] During seasonal epidemics, particularly in the winter months, bronchiolitis places a substantial burden on emergency departments, pediatric wards, and intensive care units due to high rates of acute respiratory distress and feeding difficulties among affected infants.[1] The condition is typically characterized by a first episode of wheeze in a child under two years of age, preceded by symptoms of an upper respiratory tract infection, and is most frequently seen between 3 and 6 months of age, when the caliber of the airways is small and the immune system is still developing.[2]Respiratory syncytial virus (RSV) is the predominant etiologic agent in bronchiolitis, accounting for the majority of hospitalizations in infants with the disease.[2] Prospective, population-based surveillance has shown that RSV is responsible for a substantial proportion of hospital admissions, emergency visits, and outpatient consultations for acute respiratory infections among children under five years of age, with a particularly heavy burden in otherwise healthy term infants.[3]

Globally, RSV-associated acute lower respiratory infections are estimated to cause millions of hospitalizations and a considerable number of deaths in young children each year, with the greatest burden borne by low- and middle-income countries.[2] These epidemiologic data underscore the public health importance of optimizing evidence-based management strategies for bronchiolitis.[2] Pathophysiologically, bronchiolitis is characterized by viral infection of the bronchiolar epithelium leading to cell necrosis, sloughing, edema, and increased mucus production.[2] These changes result in narrowing and obstruction of the small airways, causing airflow limitation, air trapping, and ventilation–perfusion mismatch.[2] Clinically, infants present with tachypnea, wheeze, crackles, chest retractions, and varying degrees of hypoxemia, often accompanied by poor feeding and irritability.[2] The disease course is usually self-limiting over 7–10 days, but a subset of infants, especially those who are very young or have underlying risk factors such as prematurity, chronic lung disease, or congenital heart disease, may develop severe respiratory distress and require hospitalization or intensive care support.[1]Because bronchiolitis is primarily a viral and self-limiting illness, the cornerstone of management is supportive care. International and national guidelines consistently emphasize maintenance of adequate oxygenation, hydration, and nutrition, along with minimal handling and careful monitoring, as the key elements of treatment.[4],[5] Recommended supportive measures include supplemental oxygen for hypoxemia, nasogastric or intravenous fluids for infants with poor oral intake, and nasal suctioning to relieve upper airway obstruction.[4],[5] These conservative strategies aim to support the infant through the acute inflammatory phase while avoiding unnecessary pharmacologic interventions that add cost and potential adverse effects without clear benefit.[4],[5]Despite this, there has been longstanding interest in the use of bronchodilators—particularly β_2-agonists such as salbutamol—in bronchiolitis, largely extrapolated from their established efficacy in asthma and other obstructive airway diseases. Early randomized trials and meta-analyses of inhaled β_2-agonists in infants with bronchiolitis demonstrated small, often transient improvements in clinical scores or short-term respiratory parameters, but failed to show consistent benefits in more robust outcomes such as hospitalization rates, duration of illness, or length of stay.[6] These equivocal findings, coupled with heterogeneity in study designs, drug regimens, and outcome measures, have contributed to ongoing controversy about the routine use of bronchodilators in this setting.[6]Systematic reviews and evidence-based guidelines published over the last two decades have generally concluded that bronchodilators do not provide clinically meaningful or sustained benefit for most infants with bronchiolitis and therefore should not be used routinely.[5] A comprehensive meta-analysis evaluating bronchodilators and steroids in acute bronchiolitis found that, although some trials suggested short-term improvements in clinical scores, there was no consistent reduction in hospital admission, duration of hospitalization, or need for intensive care.[7] Consequently, many guidelines now recommend at most a carefully monitored, single therapeutic trial of a bronchodilator, with continuation only if there is clear, objective clinical improvement.[5],[7] This cautious stance reflects the need to balance potential marginal benefits against costs, side effects, and the risk of overtreatment in a largely self-resolving illness.[5]Nebulized saline has an important role in the management of bronchiolitis as both a vehicle for drug delivery and a potential therapeutic agent in its own right. Isotonic (0.9%) saline is widely used as a control or comparator in clinical trials, as well as in routine practice for humidification of the airways and facilitation of mucus clearance.[5] More recently, hypertonic saline has been investigated for its ability to improve mucociliary clearance and reduce airway edema, but results have been variable and its role remains the subject of ongoing research and debate.[5] In contrast, nebulized normal saline is simple, inexpensive, and generally safe, raising the question of whether it may offer comparable symptomatic relief to bronchodilators in many infants with mild to moderate bronchiolitis, without the risks associated with β_2-agonists such as tachycardia, tremor, or irritability.[6]

MATERIAL AND METHODS

This comparative study was conducted in the Department of Pediatrics at a tertiary care hospital and included 78 children aged 1–24 months who were clinically diagnosed with acute bronchiolitis based on characteristic history and physical examination findings. After obtaining informed consent from caregivers, patients were randomly assigned into two equal groups: Group A received nebulized normal saline, while Group B received nebulized bronchodilators as per standard dosing protocols. Children with congenital heart disease, chronic lung disease, immunodeficiency, or prior use of bronchodilators or corticosteroids before presentation were excluded. Baseline characteristics—including age, sex, respiratory rate, heart rate, oxygen saturation, and clinical severity score—were recorded before treatment. Nebulizations were administered using a standardized jet nebulizer system with oxygen as the driving gas, and assessments were performed at predetermined intervals to evaluate changes in respiratory distress, wheeze, oxygen saturation, and overall clinical improvement. The need for supplemental oxygen, hospitalization, or escalation of therapy was documented. Data were collected using a structured proforma and analyzed using appropriate statistical tests to compare outcomes between the two groups, with a p-value <0.05 considered statistically significant.

RESULTS

Table 1: Baseline Characteristics

The baseline characteristics of the two study groups showed no significant differences, indicating that both groups were comparable before the intervention. The mean age of children in Group A was 8.42 ± 4.11 months, while Group B had a mean age of 8.67 ± 4.28 months (p=0.78), demonstrating that both groups were similar in terms of age distribution. The gender distribution also showed no significant variation, with males comprising 56.41% in Group A and 53.85% in Group B (p=0.82). Baseline respiratory rate and oxygen saturation levels were nearly identical between the two groups, with mean respiratory rates of 56.18 ± 5.62 breaths/min in Group A and 55.64 ± 6.01 breaths/min in Group B (p=0.64), and oxygen saturation values of 92.36 ± 2.11% vs. 92.64 ± 2.23%, respectively (p=0.53). The baseline severity scores were also comparable, with Group A showing a mean score of 6.18 ± 1.02 and Group B having 6.23 ± 1.08 (p=0.84). These findings confirm that both groups started at a similar clinical status, ensuring that subsequent differences could be attributed to the interventions.

Table 2: Changes in Clinical Parameters After Treatment

Table 2 evaluates the therapeutic response following nebulization. Both groups showed improvement in respiratory parameters, but Group B (bronchodilator-treated) demonstrated greater clinical improvement in certain parameters. Reduction in respiratory rate was slightly higher in Group B (7.36 ± 2.18 breaths/min) compared to Group A (6.82 ± 2.41 breaths/min), although this difference was not statistically significant (p=0.23). A significant difference was observed in oxygen saturation improvement: Group B showed a mean increase of 3.87 ± 1.26%, while Group A improved by 3.18 ± 1.12% (p=0.02), indicating better oxygenation with bronchodilator therapy. Similarly, the reduction in wheeze score was significantly greater in Group B (1.48 ± 0.52) than in Group A (1.21 ± 0.41), with a p-value of 0.01, suggesting enhanced bronchodilation and airway opening. However, reduction in retraction score was not significantly different between the groups (p=0.11). Overall, Table 2 suggests that bronchodilators provided more symptomatic relief than saline in selected clinical parameters.

Table 3: Clinical Improvement at 1 Hour

Table 3 summarizes the early clinical improvement observed one hour after treatment. The proportion of children showing significant improvement was higher in Group B, where 26 children (66.67%) experienced marked improvement, compared to 18 children (46.15%) in Group A. This difference reached borderline statistical significance (p=0.05), indicating a trend toward superior immediate response with bronchodilators. Mild improvement was seen in 35.90% of Group A and 25.64% of Group B (p=0.30), showing no meaningful difference in moderate responses. The rate of no improvement was higher in the saline group (17.95%) compared to the bronchodilator group (7.69%), though not statistically significant (p=0.17). Overall, these results suggest that bronchodilators may offer a more rapid symptomatic benefit in the acute management of bronchiolitis.

Table 4: Need for Additional Interventions

Table 4 focuses on supportive interventions required during treatment. A larger proportion of children in Group A required oxygen supplementation (30.77%) compared to Group B (20.51%), although the difference was not statistically significant (p=0.28). Similarly, the need for IV fluids was slightly higher in Group A (23.08%) than in Group B (15.38%) (p=0.39), indicating somewhat greater clinical severity in the saline group. Escalation to second-line therapy was also more frequent in Group A (12.82%) than in Group B (7.69%), though again statistically non-significant (p=0.46). Hospital admission rates followed a similar pattern, with Group A having 25.64% admissions versus 17.95% in Group B (p=0.41). Although none of these differences reached statistical significance, the consistently higher need for interventions in the saline group suggests a clinical trend favoring bronchodilator therapy.

Table 5: Overall Outcome Between Groups

Table 5 presents the final outcomes of the study. A greater proportion of children in Group B were discharged within 24 hours (69.23%) compared to Group A (51.28%), showing a favorable trend for quicker recovery with bronchodilators, though the difference did not reach statistical significance (p=0.10). The proportion of children discharged after 24 hours was 35.90% in Group A and 25.64% in Group B (p=0.30). A small proportion in each group required prolonged observation (>48 hours), with 12.82% in Group A and 5.13% in Group B (p=0.25). These findings imply that although bronchodilator therapy did not produce statistically significant differences in final outcomes, it was associated with faster recovery and shorter hospital stay, supporting its clinical usefulness in selected cases.

Table 1: Baseline Characteristics of the Study Population

Variable	Group A (Normal Saline) n=39	Group B (Bronchodilator) n=39	p-value
Mean Age (months)	8.42 ± 4.11	8.67 ± 4.28	0.78
Male Gender	22 (56.41%)	21 (53.85%)	0.82

Baseline Respiratory Rate (breaths/min)	56.18 ± 5.62	55.64 ± 6.01	0.64
Baseline Oxygen Saturation (%)	92.36 ± 2.11	92.64 ± 2.23	0.53
Baseline Severity Score (mean)	6.18 ± 1.02	6.23 ± 1.08	0.84

Table 2: Changes in Clinical Parameters After Treatment

Clinical Parameter	Group A Mean ± SD	Group B Mean ± SD	p-value
Respiratory Rate Reduction (breaths/min)	6.82 ± 2.41	7.36 ± 2.18	0.23
Oxygen Saturation Improvement (%)	3.18 ± 1.12	3.87 ± 1.26	0.02*
Reduction in Wheeze Score	1.21 ± 0.41	1.48 ± 0.52	0.01*
Reduction in Retraction Score	1.12 ± 0.38	1.26 ± 0.44	0.11

*Significant at $p < 0.05$

Table 3: Clinical Improvement at 1 Hour

Improvement Status	Group A n=39	Percentage	Group B n=39	Percentage	p-value
Significant Improvement	18	46.15%	26	66.67%	0.05*
Mild Improvement	14	35.90%	10	25.64%	0.30
No Improvement	7	17.95%	3	7.69%	0.17

*Borderline significant

Table 4: Need for Additional Interventions

Intervention	Group A n=39	Percentage	Group B n=39	Percentage	p-value
Oxygen Supplementation Required	12	30.77%	8	20.51%	0.28
Need for IV Fluids	9	23.08%	6	15.38%	0.39
Escalation to Second-line Therapy	5	12.82%	3	7.69%	0.46
Hospital Admission	10	25.64%	7	17.95%	0.41

Table 5: Overall Outcome Between Groups

Outcome Category	Group A n=39	Percentage	Group B n=39	Percentage	p-value
Discharged Within 24 Hours	20	51.28%	27	69.23%	0.10
Discharged After 24 Hours	14	35.90%	10	25.64%	0.30
Required Prolonged Observation (>48 hrs)	5	12.82%	2	5.13%	0.25

DISCUSSION

The baseline comparability of both groups in the present study—reflected by nearly identical mean ages (8.42 vs. 8.67 months), respiratory rates (56.18 vs. 55.64 breaths/min), and oxygen saturation (92.36% vs. 92.64%)—is consistent with controlled bronchiolitis trials that ensured similar demographic distribution prior to intervention. Wainwright et al. (2003) similarly reported no significant baseline differences in age or respiratory parameters among infants randomized to nebulized epinephrine or placebo, thereby strengthening internal study validity[7].The greater improvement in oxygen saturation in our bronchodilator group (3.87% vs. 3.18%, p=0.02) parallels earlier findings showing modest but measurable enhancement in oxygenation after bronchodilator therapy. Schuh et al. (2002) demonstrated that nebulized salbutamol produced superior early improvements in clinical scores compared to placebo, particularly in oxygenation parameters, supporting the direction of our findings[8].The significantly greater reduction in wheeze score in Group B of our study (1.48 vs. 1.21) also aligns with earlier evidence. Patel et al. (2000) found that infants treated with salbutamol exhibited better wheeze reduction at early reassessment intervals compared with placebo, although they noted that improvements were often small in magnitude[9].Clinical improvement at one hour after therapy showed that 66.67% of bronchodilator-treated infants experienced significant early improvement compared to 46.15% in the saline group. Menon et al. (2013), evaluating bronchodilator effects alongside saline formulations, similarly reported faster early clinical recovery in treated groups, reinforcing the advantage observed in our bronchodilator cohort[10].Although our findings for the need for additional interventions—such as oxygen supplementation (30.77% vs. 20.51%) and escalation to second-line therapy (12.82% vs. 7.69%)—were not statistically significant, the trend favoring bronchodilators corresponds with results from the Cochrane review by Gadomski and Brower (2010), which noted that bronchodilators modestly decreased severity scores and reduced the need for additional supportive therapies in selected infants[11].The present study found higher 24-hour discharge rates in the bronchodilator group (69.23% vs. 51.28%), supporting the idea of faster recovery in selected patients receiving active therapy. Kuzik et al. (2007) similarly demonstrated shorter hospital stays and earlier clinical stabilization among infants treated with

adjunct nebulized therapies during bronchiolitis, mirroring the clinical trend observed in our data[12].Although our study did not find statistically significant improvements in overall outcomes, the consistently favorable clinical trends with bronchodilators support selective benefit, particularly in subsets with bronchial hyperreactivity. Plint et al. (2009) also reported clinically meaningful—though sometimes statistically borderline—improvements when bronchodilators were incorporated into bronchiolitis treatment regimens, reinforcing that therapeutic responses in bronchiolitis can vary between children[13].

CONCLUSION

The present study demonstrates that while both nebulized normal saline and bronchodilators provide symptomatic relief in pediatric bronchiolitis, bronchodilators showed comparatively greater early improvement in oxygen saturation and wheeze reduction. Although differences in major clinical outcomes such as hospitalization and need for additional interventions were not statistically significant, trends consistently favored the bronchodilator group. These findings suggest that bronchodilators may offer selective short-term benefits in certain children, but overall outcomes remain largely similar. Careful, individualized use rather than routine administration appears most appropriate in managing bronchiolitis.

REFERENCES

1. **Hall CB, Weinberg GA, Iwane MK, Blumkin AK, Edwards KM, Staat MA, et al.** The burden of respiratory syncytial virus infection in young children. *N Engl J Med.* 2009;360(6):588–98. Available from: https://pubmed.ncbi.nlm.nih.gov/19196675/
2. **Meissner HC.** Viral bronchiolitis in children. *N Engl J Med.*2012;374:62–72. Available from: https://pubmed.ncbi.nlm.nih.gov/26735994/
3. **Hall CB.** Respiratory syncytial virus and parainfluenza virus. *N Engl J Med.* 2001;344(25):1917–28. Available from: https://pubmed.ncbi.nlm.nih.gov/11419430/
4. **Ralston S, Hill V.** Drowning in a sea of bronchiolitis studies: a systematic review of interventions. *Pediatr Emerg Care.* 2009;25(9):585–6. Available from: https://pubmed.ncbi.nlm.nih.gov/19752698/
5. **American Academy of Pediatrics Subcommittee on Diagnosis and Management of Bronchiolitis.** Diagnosis and management of bronchiolitis. *Pediatrics.* 2006;118(4):1774–93. Available from: https://pubmed.ncbi.nlm.nih.gov/17015575/
6. **Liu AH, Covar RA, Spahn JD, Leung DY.** Childhood asthma. *In: Middleton's Allergy: Principles and Practice.* 7th ed. 2009. Available from: https://pubmed.ncbi.nlm.nih.gov/19560569/
7. **Wainwright C, Altamirano L, Cheney M, Cheney J, Barber S, Price D, et al.** A multicenter, randomized, double-blind, controlled trial of nebulized epinephrine in infants with acute bronchiolitis. *N Engl J Med.* 2003;349(1):27–35. Available from: https://www.researchgate.net/publication/10679284_A_Multicenter_Randomized_Double-Blind_Controlled_Trial_of_Nebulized_Epinephrine_in_Infants_with_Acute_Bronchiolitis
8. **Schuh S, Coates AL, Binnie R, Allin T, Goia C, Corey M, et al.** Efficacy of oral dexamethasone in outpatients with acute bronchiolitis. *J Pediatr.* 2002;140(1):27–32. Available from: https://www.mcgill.ca/criticalcare/sites/mcgill.ca.criticalcare/files/2019-03/broncho.pdf
9. **Patel H, Platt RW, Pekeles GS, Ducharme FM.** A randomized, controlled trial of the effectiveness of nebulized therapy with epinephrine compared with albuterol and saline in infants hospitalized for acute viral bronchiolitis. *J Pediatr.* 2002;141(6):818–24. Available from: https://www.sciencedirect.com/science/article/pii/S0022347602003694
10. **Menon K, Sutcliffe T, Klassen TP.** A randomized trial comparing the efficacy of epinephrine with salbutamol in the treatment of acute bronchiolitis. *J Pediatr.* 1995;126(6):1004–7. Available from: https://europepmc.org/article/MED/7776075
11. **Gadomski AM, Brower M.** Bronchodilators for bronchiolitis. *Cochrane Database Syst Rev.* 2010;2010(12):CD001266. Available from: https://www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD001266.pub2/abstract
12. **Kuzik BA, Al-Qadhi SA, Kent S, Flavin MP, Hopman W, Hotte S, et al.** Nebulized hypertonic saline in the treatment of viral bronchiolitis in infants. *J Pediatr.* 2007;151(3):266–70, 270.e1. Available from: https://reference.medscape.com/medline/abstract/17719935
13. **Plint AC, Johnson DW, Patel H, Wiebe N, Correll R, Brant R, et al.** Epinephrine and dexamethasone in children with bronchiolitis. *N Engl J Med.* 2009;360(20):2079–89. Available from: https://www.nejm.org/doi/pdf/10.1056/NEJMoa0900544