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A study on the effectiveness of various treatment approaches for bronchiolitis

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Abstract

Bronchiolitis is a major cause of hospitalisation in infants, and its management varies widely across clinical settings. This observational study, conducted at SVS Medical College & Hospital over six months with 80 patients, assessed treatment patterns and outcomes. Bronchiolitis was most common in infants aged 5–8 months, with a higher incidence in males and rural populations, and mild disease was predominant. Treatment showed significant variation: intravenous fluids, especially dextrose normal saline with potassium supplementation, were frequently used to maintain hydration and electrolyte balance; parenteral antibiotics such as Augmentin were selectively administered when bacterial infection was suspected; and oral therapies including paracetamol, ambroxol, and vitamin D3 drops provided symptomatic relief. Saline nasal drops were universally prescribed, highlighting their essential role in airway clearance, while nebulised budesonide and salbutamol were used occasionally depending on severity. Heated Humidified High-Flow Nasal Cannula (HHHFNC) therapy was identified as the main supportive intervention, enhancing oxygenation and reducing respiratory distress. Overall, the combination of parenteral fluids, oral medications, nasal saline drops, and supportive care led to shorter hospital stays and quicker recovery, whereas reliance solely on supportive care and saline drops without targeted therapies was associated with extended hospitalisation. These findings emphasise the importance of integrated, evidence-based management strategies in bronchiolitis.

Keywords: Bronchiolitis, Respiratory Syncytial Virus (RSV), Intravenous fluids, Heated Humidified High-Flow Nasal Cannula (HHHFNC), Supportive care, Corticosteroids, Bronchodilators.

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Introduction

Bronchiolitis is one of the most common lower respiratory tract infections in infants and young children, usually caused by viral pathogens, with respiratory syncytial virus (RSV) being the main agent [1,2]. It is characterised by acute inflammation, oedema, and necrosis of epithelial cells lining the small airways, leading to increased mucus production and airway obstruction [3]. Globally, bronchiolitis remains a leading cause of hospitalisation among infants under 12 months, significantly contributing to morbidity and healthcare burden [4].

The clinical presentation ranges from mild symptoms such as cough and rhinorrhoea to severe respiratory distress requiring hospitalisation and intensive supportive care [5]. Current management strategies mainly depend on supportive therapy, including hydration, oxygen supplementation, and airway clearance [6]. Interventions like bronchodilators, corticosteroids, and antibiotics have been used inconsistently, despite evidence indicating limited benefit in routine cases [7]. Saline nasal drops and nebulised therapies are frequently prescribed for symptomatic relief. At the same time, Heated Humidified High-Flow Nasal Cannula (HHHFNC) has become an effective option for enhancing oxygenation in moderate-to-severe cases [8-10]. Despite the availability of guidelines, a wide variation in treatment approaches persists across different healthcare settings [11]. Comparative evaluation of supportive care, pharmacological interventions, and respiratory therapies is crucial to optimise management, minimise unnecessary medication use, and enhance patient outcomes [12]. This study aims to assess the effectiveness of various treatment approaches in bronchiolitis and compare clinical outcomes to support evidence-based practice.

Materials and Methodology

Data Collection Procedure, Type, and Duration of Study

This retrospective observational study was conducted on a sample size of 80 pediatric patients diagnosed with bronchiolitis. The study was conducted in the Department of Paediatrics at SVS Medical College and Hospital, Mahbubnagar, over a period of six months. Data were collected from patient medical records, physical examinations, laboratory investigations, and treatment charts. Relevant clinical information was systematically documented, analyzed using appropriate statistical methods, and evaluated to derive conclusions.

Study Setting and Source of Data

The study was conducted in the Department of Paediatrics, SVS Medical College and Hospital, Mahbubnagar. Data sources included patient medical records, physical examinations, chest X-rays, complete blood counts, enzyme-linked immunosorbent assays (ELISA) for RSV detection, and treatment regimens administered during hospitalisation [13-15].

Sample Size and Determination

The study included 80 patients who fulfilled the eligibility criteria.

Sample Selection Criteria

Inclusion Criteria

The study included pediatric patients aged ≤ 2 years who were clinically or laboratory-diagnosed with bronchiolitis. Only hospitalized patients (in-patients) were considered, ensuring comparability of treatment modalities. Enrolment was limited to those with sufficient medical record data to evaluate clinical manifestations, laboratory results, and treatment outcomes. Informed consent was obtained from parents or guardians before inclusion [16, 17].

Exclusion Criteria

Children older than 2 years, those with incomplete or insufficient medical records, and patients with significant comorbidities or complicated diseases that could confound treatment response were excluded. Additionally, children with pre-existing chronic respiratory illnesses, congenital anomalies, or prior pancreatectomy were not included. Patients whose parents or guardians were unable or unwilling to provide consent were also excluded from the study [18,19].

Brief Description of the Methodology

Bronchiolitis, an acute viral respiratory illness, was studied with emphasis on diagnosis, supportive care, and pharmacotherapy. Eligible patients meeting the inclusion criteria were enrolled, and their demographic, clinical, laboratory, and treatment details were documented in a pre-designed data collection form. Data were entered into Microsoft Excel sheets and analysed. Descriptive statistics were computed, and inferential statistical methods were applied to establish associations [20-22].

Study Procedure

The study followed a retrospective observational design. Patient details, including demographic characteristics, presenting symptoms, laboratory results, chest imaging, and prescribed medications, were systematically reviewed. Treatment patterns, including intravenous fluids, antibiotics, mucolytics, bronchodilators, corticosteroids, and supportive measures such as nasal saline drops or high-flow oxygen therapy, were recorded. Outcomes were analysed in terms of symptom resolution, hospital stay, and complications [23-27].

Materials and Investigations

Investigations included chest X-ray, complete blood picture, and ELISA for RSV. Additional data collected included physical findings, treatment regimens, and medication charts. No additional invasive procedures were performed beyond routine clinical care [28, 29].

Anticipated Risks

No lethal or sublethal risks were associated with this retrospective study, as it was based on medical record review and standard clinical management data [30].

Data Analysis Procedure

All patients presenting with bronchiolitis and meeting the inclusion criteria were included. Data were analyzed using descriptive statistics for demographic and clinical features. Associations between categorical variables were analysed using the chi-square test, while ANOVA was applied for continuous variables. The significance level was set at $p < 0.05$ with 95% confidence intervals [31-34].

Statistical Methods

Data were systematically entered in Microsoft Excel and analysed using SPSS (Version 23). GraphPad Prism (Version 9) was used for graphical representation and advanced statistical comparisons [35-38].

Ethical Clearance

The study was approved by the Institutional Ethics Committee (IEC) of SVS Medical College and Hospital before commencement. Ethical clearance reference number: IEC DHR-01/(02/07)/2025/021/7.

Results and Discussion

Gender-wise Distribution of Bronchiolitis Patients

In our study of 80 patients, the majority were males (51; 63.8%), while females accounted for 29 (36.2%). This clearly demonstrates a male predominance in bronchiolitis cases. The finding aligns with the well-documented higher susceptibility of male infants to respiratory infections, which may be attributed to anatomical and immunological factors. The distribution highlights that gender can be an influencing factor in bronchiolitis epidemiology. (Table 1; Fig.1)

Table 1: Gender-wise distribution of bronchiolitis patients

Gender	Frequency	Percentage
Male	51	63.8%
Female	29	36.2%
Total	80	100%

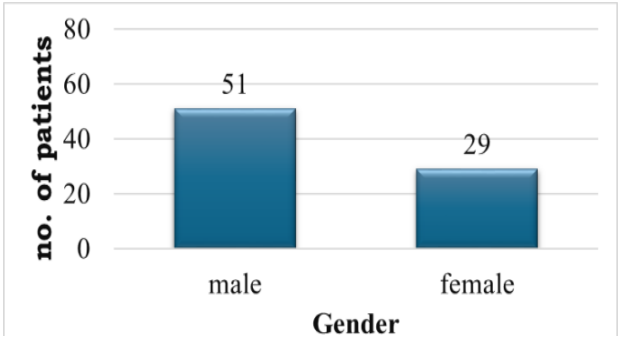

Fig.1: Bar graph showing gender-wise distribution.

Age-wise Distribution of Bronchiolitis Patients

The study revealed that bronchiolitis predominantly affected infants under 1 year of age. The highest incidence was observed in the 5–8 months group (31.2%), followed by the 1–4 months group (28.8%), which together accounted for nearly 60% of cases. The 9–12 months group contributed 20%, while children aged 1–2 years represented a smaller proportion. These findings confirm that bronchiolitis is largely a disease of early infancy. (Table 2; Fig. 2)

Table 2: Age-wise distribution of bronchiolitis patients

Age (Months)	Frequency	Percentage
01–04	23	28.8%
05–08	25	31.2%
09–12	16	20%
13–16	4	5%
17–20	4	5%
21–24	8	10%
Total	80	100%

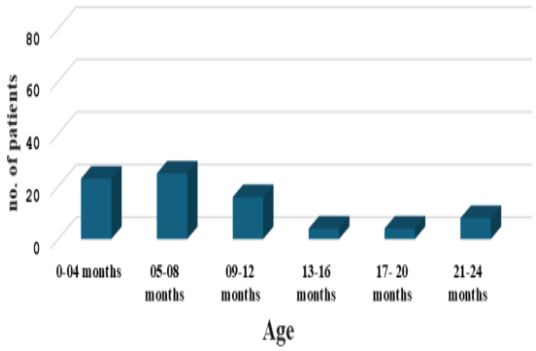

Fig.2: Bar graph showing age-wise distribution.

Area-wise Distribution of Bronchiolitis Patients

Of the total 80 cases, 52 children (65%) were from rural areas, whereas 28 (35%) belonged to urban areas. This suggests that bronchiolitis is more common among rural populations, possibly due to factors such as poor air quality, indoor smoke exposure, limited healthcare access, and delayed treatment-seeking behaviour. The rural predominance emphasizes the need for targeted interventions in such communities. (Table 3; Fig.3)

Table 3: Area-wise distribution of bronchiolitis patients

Area	Frequency	Percentage
Rural	52	65%
Urban	28	35%
Total	80	100%

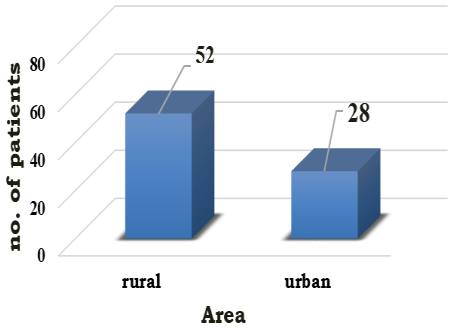

Fig.3: Bar graph showing area-wise distribution.

Severity-wise Distribution of Bronchiolitis Patients

The severity classification based on oxygen saturation levels revealed that 31 patients (38.8%) had mild disease, 23 patients (28.7%) had moderate disease, and 26 patients (32.5%) presented with severe bronchiolitis. This nearly equal spread across mild, moderate, and severe categories underlines the heterogeneity of disease presentation. Severe cases were not uncommon, highlighting the importance of timely intervention and continuous monitoring. (Table 4; Fig. 4)

Table 4: Severity-wise distribution of bronchiolitis patients

Severity	Frequency	Percentage
Mild	31	38.8%
Moderate	23	28.7%
Severe	26	32.5%
Total	80	100%

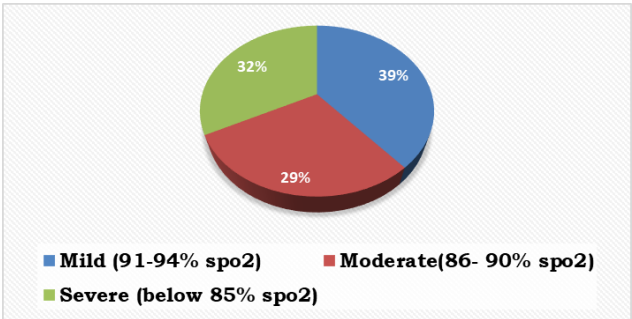

Fig.4: Pie chart showing distribution of patients based on severity.

Prescribing Patterns in Bronchiolitis Patients

Parenteral Prescription

In the current study involving 80 pediatric patients diagnosed with bronchiolitis, parenteral therapy was found to play a crucial role in clinical management. Out of the total cohort, 75% (n=60) received intravenous fluid therapy (IVFs), predominantly in the form of Dextrose Normal Saline (DNS) and Potassium Chloride (KCl) supplementation. These

interventions were aimed at restoring and maintaining fluid-electrolyte balance, which is often compromised in infants due to increased respiratory effort, fever, and poor oral intake associated with bronchiolitis. The DNS solution used in this study was prepared as a 250 mL formulation containing 2.25 g sodium chloride and 12.5 g dextrose, with doses carefully titrated based on the age of the child to avoid risks of overhydration or electrolyte imbalance. Specifically, infants aged 1–4 months received 150 mL (equivalent to 1.35 g sodium chloride and 7.5 g dextrose), those aged 5–12 months received 200 mL (1.8 g sodium chloride and 10 g dextrose), while children between 13–24 months were administered the full 250 mL bottle (2.25 g sodium chloride and 12.5 g dextrose).

In addition to DNS, Potassium Chloride (KCl) supplementation was administered in selected cases to correct hypokalemia secondary to persistent vomiting or poor intake. KCl (1000 mg/10 mL) was given in age-appropriate doses: 225 mg/1.5 mL for 1–4 months, 300 mg/2 mL for 5–12 months, and 375 mg/2.5 mL for 13–24 months. Notably, 20% of patients (n=12) also received parenteral antibiotics (Augmentin: Amoxicillin 250 mg + Clavulanic Acid 50 mg), particularly in cases with clinical suspicion of secondary bacterial infection or severe presentations requiring prophylactic coverage. This reflects the cautious yet selective approach to antimicrobial prescribing in bronchiolitis, where viral etiology predominates.

Conversely, 25% of patients (n = 20) did not require parenteral therapy, suggesting that their disease course was milder and could be adequately managed through oral medications and supportive measures alone. This heterogeneity in parenteral prescribing underscores the importance of tailoring therapy to clinical severity, hydration status, and the risk of complications. The age-stratified dosing schedules for DNS and KCl are summarised in Tables 5 and 6, which illustrate the precise quantities of sodium chloride, dextrose, and potassium administered across different pediatric subgroups. These findings underscore the pivotal role of parenteral interventions in bronchiolitis management, particularly for moderate-to-severe cases, while simultaneously reinforcing the need for judicious antibiotic use in alignment with evidence-based guidelines.

Table 5. Distribution of parenteral DNS dosage according to age

According To Age	DNS (2.25+12.5gm)		DNS (250ml)
	Sodium chloride	Dextrose	
01-04 Months	1.35gm	7.5gm	150ml
05-12 Months	1.8gm	10gm	200ml
13-24 Months	2.25gm	12.5gm	250ml

Table 6: Distribution of parenteral KCL dosage according to age

According To Age	KCL (1500Mg/10Ml) (Mg/Ml)
01-04 Months	225mg/1.5ml
05-12 Months	300mg/2ml
13-24 Months	375mg/2.5ml

Oral Prescription

In our cohort of 80 pediatric patients with bronchiolitis, oral therapy demonstrated significant variation in prescribing practices, reflecting a non-uniform clinical approach. The most frequently administered medications included paracetamol drops, mucolytics (Ambroxol hydrochloride), and vitamin D3 supplementation, either alone or in combination. Paracetamol was prescribed for fever and discomfort, with infants <1 year receiving 100 mg/mL and children aged 1–2 years receiving 150 mg/3 mL from a 250 mg/5 mL preparation. Ambroxol hydrochloride, intended to facilitate clearance of secretions, was administered as 7.5 mg/mL in infants and 15 mg/2.5 mL in older children. Vitamin D3 drops (800 IU/mL) were uniformly prescribed across all age groups. Combination therapy involving mucolytics, paracetamol, and vitamin D3 accounted for the largest proportion (37.5%) of prescriptions, while monotherapy was less frequent. This trend underscores the reliance on polypharmacy for symptomatic relief, despite limited guideline support for mucolytics in bronchiolitis management.

Nasal Prescription

Nasal therapy formed the most consistent element of treatment, with all patients (100%) receiving saline nasal drops (0.65% sodium chloride with 0.03% benzalkonium chloride). This intervention is widely recognised as a safe and effective first-line strategy for airway clearance and feeding facilitation. The prescribed dosage was two drops in each nostril, four times daily. Additionally, 43.8% of patients (n=35) were given nebulised therapy using budesonide (0.5 mg/2 mL diluted in 2 mL NS) and salbutamol (2.5 mg/2.5 mL), primarily in patients with respiratory distress or wheezing. While such therapy may provide short-term improvement in airway inflammation and bronchospasm, its routine use remains controversial, as major guidelines discourage the use of corticosteroids and bronchodilators in uncomplicated bronchiolitis. Nonetheless, their selective use in this cohort reflects clinician-driven, severity-based prescribing practices.

Supportive Care

Supportive care has become a fundamental part of managing bronchiolitis. Heated Humidified High-Flow Nasal Cannula (HHHFNC) therapy was used in 70% of patients (n=56), while 30% (n=24) did not need advanced respiratory support. HHHFNC was administered at a consistent flow rate of 2 L/kg/min, with FiO_2 adjusted between 25–40% to maintain optimal oxygen levels. This method significantly improved oxygenation and decreased respiratory distress, supporting current evidence that endorses high-flow therapy in cases of moderate to severe bronchiolitis. In addition to respiratory support, management included hydration, fever control, and close observation, ensuring personalised care based on each patient's severity.

Overall Interpretation

The findings from our study suggest that a multimodal approach—comprising parenteral hydration, oral symptom-directed therapy, universal nasal saline drops, and supportive care with HHHFNC—was most effective, resulting in shorter

hospital stays and faster recovery. Conversely, patients managed with only supportive care and nasal saline drops, without adjunctive oral or parenteral therapy, demonstrated relatively prolonged hospitalisations. Significantly, the use of antibiotics, corticosteroids, and bronchodilators exceeded the recommendations set by international guidelines, highlighting the need for greater standardisation and adherence to evidence-based practices.

Conclusion

This study highlights that bronchiolitis is most prevalent in infants under 1 year of age, especially in rural populations, with males being more commonly affected. Supportive care, including saline nasal drops and HHHFNC, formed the backbone of treatment and was associated with favourable outcomes. While combined treatment approaches showed improved recovery, the frequent use of antibiotics, corticosteroids, and bronchodilators indicates deviation from evidence-based guidelines. A patient-centred approach focusing on hydration, airway clearance, and selective pharmacological interventions provides the best outcomes.

Limitations and Recommendations

This was a retrospective, single-centre study with a small sample size (80 patients), limiting its generalisability. Excluding children with comorbidities reduced its applicability to higher-risk populations. Additionally, the observational design introduces selection bias, making it difficult to draw definitive conclusions. Future research should include larger, multicentre studies with prospective designs to validate treatment strategies. Rational prescribing of antibiotics, corticosteroids, and bronchodilators should be emphasised, with stronger adherence to evidence-based guidelines. Supportive care, including hydration and airway clearance, should remain the cornerstone of management, supplemented with targeted pharmacotherapy only when clinically indicated.

Funding

Nil

Conflict of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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Ethical Statement

Ethical clearance was obtained from the Institutional Ethics Committee of SVS Medical College and Hospital, Mahabubnagar, before the initiation of the study (Reference number: IEC/DHR-01/(02/07)/2025/021/7).

Author Contributions

Rangam Charitha conceptualised and supervised the study, contributed to the study design, and critically reviewed the manuscript. Ettae Vydehi, Maviya Sultana, Raheen Madiha Manzoor, Sumaiya Sultana, Afreen Khatoon, and Nabeela Nousheen were involved in data collection, patient record analysis, statistical evaluation, and drafting of the manuscript. All authors reviewed and approved the final version of the manuscript before submission.

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