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"A COMPARATIVE STUDY ON USE OF 3% SALINE VS 0.9%SALINE NEBULIZATION INCHILDREN WITH BRONCHIOLITIS IN TERMS OF EARLY RECOVERY AND OUTCOME"

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ABSTRACT Bronchiolitis is a common clinical problem in children under 2 years of age with tachypnea and increased respiratory activity following an upper airway prodrome[1]. It is characterized by inflammation of the bronchioles after an acute viral infection[2]. In bronchiolitis, there is necrosis and detachment of epithelial cells, edema, increased mucus secretion, and peribronchial mononuclear infiltration changes that obstruct flow in the large and small airways, leading to hyperinflation, atelectasis, and wheezing[3].Most of the children were in the age group of 2 to 6 months. Shorter cough & wheeze remission time in HS group compared to NS group ($p<0.01$)..There was an improvement in the clinical severity score, CSS improved more significantly in the 3% saline group (group B) from 6.62 to 1.02 compared to the 0.9% saline group (group A). The average duration of oxygen supplementation and use of bronchodilator treatment was significantly shorter (18 hours) in the HS group than in the NS group (33 hours), which was statistically significant ($p<0.001$).The requirement for CPAP support was reduced in 3% of the NS group compared to 0.9% of the NS group.

METHODS A total of 100 children were included in the study, by simple randomization we allotted both3% hypertonic and 0.9% normal saline equally ie 50 children each , along with other standard treatment ie humidified oxygen and results were compared and standardised.

RESULTS Bronchiolitis is a self-limiting disease that resolves without complications in most previously healthy infants. However, severely affected infants, particularly preterm infants and those with underlying cardiopulmonary disease or immunodeficiency, are at increased risk for complications (eg, apnea, respiratory arrest, secondary bacterial infection).Mortality in children hospitalized with RSV bronchiolitis is less than 2% in developed countries. Mortality is increased in small infants (6–12 weeks), in children with low birth weight and in children with underlying health conditions (eg underlying cardiopulmonary disease, immunodeficiency).

CONCLUSIONSNeither treatment modality was found to have any adverse effect.In light of the above results and observations, it was found that the use of nebulized hypertonic saline in infants aged 2 months to 24 months provides evidence of its role as an effective treatment modality in the treatment of acute bronchiolitis.

KEYWORDS bronchiolitis , hypertonic saline , normal saline , wheeze , oxygen.

INTRODUCTION

Bronchiolitis is a common clinical problem in children under 2 years of age with tachypnea and increased respiratory activity following an upper airway prodrome[1]. It is characterized by inflammation of the bronchioles after an acute viral infection[2]. In bronchiolitis, there is necrosis and detachment of epithelial cells, edema, increased mucus secretion, and peribronchial mononuclear infiltration changes that obstruct flow in the large and small airways, leading to hyperinflation, atelectasis, and wheezing[3]. Physical findings are nasal congestion, nasal discharge, cough, tachypnea, increased respiratory effort, nasal flaring, grunting, and intercostal, supracostal, and subcostal retractions[1]. It is usually seasonal and hospitalization peaks between 3 and 6 months of age[4]. Standard care is still supportive and involves making sure the baby is getting enough oxygen, fluids, and food[5]. Despite the fact that the evidence does not support it, the rate of ineffective bronchiolitis treatment is still significant according to current clinical practise guidelines[6].A lesser increase was also seen in December, January, and February.

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Children under the age of five in low-income and lower-middle-income nations have a higher burden of RSV-associated sickness, according to reports from 2020[7].Almost all commonly used therapies, such as inhaled epinephrine, bronchodilators, steroids, anticholinergics, antibiotics, surfactants, and chest physical therapy, lack adequate evidence. None of the therapy methods are particular.

Although antiviral drugs exist, it is questionable if the majority of patients should use them. Most studies using glucocorticoids to treat bronchiolitis disproved their therapeutic benefits[8]. Some patients with bronchiolitis who used ß2 agonists occasionally noticed a slight improvement, particularly when using epinephrine[9], while some did not notice a difference[10]. According to a study by Kabir et al, 99% of instances of bronchiolitis are treated with antibiotics, yet these medications have little effect on the condition's prognosis[11]. Nebulized 3% saline solution has been recommended in a number of studies, because it can minimise airway oedema, lower secretion viscosity, and enhance mucociliary function in babies with bronchiolitis.Evidence suggests that both healthy and sick lungs respond positively to hypertonic saline solution[12]. In the studies conducted by **Singh.S et al.[13]** and **Rakesh et al.[14]**, the clinical severity score and length of hospital stay considerably decreased in the hypertonic saline group.In the investigations conducted by **Sarrel et al.[15]** and **Mandelberg et al.[16]**, the group treated with hypertonic saline showed a significant improvement in the clinical severity scores. In studies by **Kuzik et al. [17]** and **Tal G et al.[18]**, the hypertonic saline group showed a clinically significant reduction in length of hospital stay.There is considerable debate over the use of nebulized 3% saline in the treatment of bronchiolitis. To the best of our knowledge very few studies were reported regarding efficacy (in terms of various parameters) of 3% NaCl over 0.9% NaCl in patients with acute bronchitis in India. This study is one of such kind and intended to compare the clinical severity score, length of hospital stay, remission of symptoms, requirement of further bronchodilators and CPAP between nebulized 3% saline and 0.9% saline in the treatment of acute bronchiolitis.

Pathophysiology

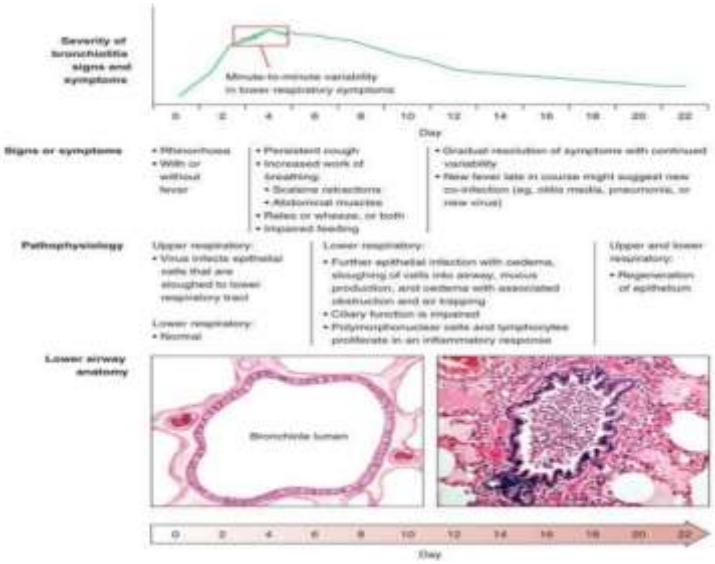

Figure No;1 Pathoiphysiology

By the age of two years, almost all infants have RSV, 40% to 50% will have a lower respiratory infection, and 1% to 2% will have a serious sickness that requires hospitalisation[32]. Worldwide, RSV acute lower respiratory tract infections caused 13,300 hospital-acquired deaths in 2019 and are predicted to have caused 1.4 million hospitalizations[33]

CLINICAL SIGNS

Children usually come for medical treatment 3-6 days after the onset of the disease. Bronchiolitis is often preceded by a 1-3 day history of upper respiratory symptoms such as: nasal congestion and/or discharge and mild cough. It usually presents with fever (usually ≤ 38.3°C), cough and mild dyspnea (e.g. slightly increased respiratory rate, mild retraction). Compared to other viruses that cause bronchiolitis, fever tends to be lower with RSV and higher with adenovirus infections. Characteristic examination findings are tachypnea, mild intercostal and subcostal retraction, and expiratory wheezing[34]. Other auscultatory findings may include a prolonged expiratory phase and coarse or soft

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crackles (rattles). A chest may appear hyperexpanded with enlarged anteroposterior diameter and may be hyperresonant to percussion. Mild hypoxemia (SpO2 < 95%) is common. Other findings may include mild conjunctivitis, pharyngitis, and acute otitis media. Severely affected patients have increased work of breathing (subcostal, intercostal and supraclavicular retraction; nasal flaring and expiratory grunting). They may appear cyanotic and have poor peripheral perfusion. Wheezing may not be audible when the airways are significantly narrowed or when the increased work of breathing causes exhaustion. Serious comorbid infections are rare in children with bronchiolitis.

COMPLICATIONS

In most previously healthy infants, bronchiolitis resolves without complications. However, severely affected patients, particularly those with risk factors and those requiring mechanical ventilation for apnea or respiratory failure, may develop an air leak, including pneumothorax or pneumomediastinum. Bronchiolitis can be complicated by apnea, especially in premature babies and children under 2 months of age[35]. Presentation with apnea is a risk factor for respiratory failure and the need for mechanical ventilation. Respiratory failure, severe dehydration and acidosis are other serious complications of bronchiolitis.

Risk factors	Investigations	Differential dignosis
Premature birth (gestational age < 37 weeks) • Age < 12 weeks •Chronic lung disease, especially bronchopulmonary dysplasia (BPD) • Congenital/anatomical airway defects •Congenital heart defect • Immunodeficiency •Neurological disease. •Environmental and other risk factors: Passive smoking, overcrowded household, attendance at kindergarten and high altitude (> 2500 m).	CBP ESR Chest X ray (hyper infalted lund fields) ABG in severe cases Virological studies	WALRI Pneumonia Aspiration of foreign body Chronic lung disease Aspiration pneumonia Congenital Heart diseases Vascular rings

Management

Always symptomatic like maintain htdration status of the baby, humidified oxygen support for respiratory distress , antipyretics for fever , adrenalline nebulisation for wheeze , 3 % nacl nebulization for mucosal clearance .

SEVERITY ASSESSMENT[47]

Hospitalization for supportive care and monitoring is indicated based on the severity of the disease. Aspects of the history that are useful in determining the severity of the illness and/or the need for hospitalization include;

• Assessment of hydration status (e.g. fluid intake, urine output)

•Symptoms of respiratory distress (tachypnea, nasal flaring, retraction, grunting, SpO2 < 95% on room air, respiratory rate ≥ 50 breaths/min)

•Cyanosis/toxic or morbid appearance

•Restlessness/lethargy (may indicate hypoxemia/impending breathing failure)

•History of apnea with cyanosis or bradycardia

HYPOXEMIA[4] It is associated with mucus obstruction and atelectasis and is common in children with bronchiolitis. May respond to supplemental oxygen alone, although sometimes requires supplemental respiratory support. Hypercapnic respiratory failure associated with fatigue usually requires additional respiratory support (eg, intubation and mechanical ventilation).

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SECONDARY BACTERIAL INFECTION[4] With the exception of otitis media, secondary bacterial infection is not uncommon in infants and young children with bronchiolitis or RSV infection. The risk of secondary bacterial pneumonia is increased in children admitted to the intensive care unit, especially in children requiring intubation. Routine use of antibiotics is therefore not recommended to prevent secondary bacterial infection.

SUPPORTIVE CARE[5] Supportive care includes maintaining adequate hydration, providing respiratory support as needed, and monitoring disease progression.

LIQUIDS Children with bronchiolitis may have difficulty maintaining adequate fluid intake due to increased fluid requirements and decreased intake. In children hospitalized with bronchiolitis and moderate to severe respiratory disease, only parenteral fluid intake may be necessary to control fluid intake and reduce the chance of aspiration. In children who tolerate enteral feedings, strategies to maintain fluid intake include small frequent meals or orogastric or nasogastric feeding.

NASAL CONGESTION MANAGEMEN Saline nasal drops and nasal bulb aspiration can help relieve partial nasal congestion.

MEDICINESMedicines used to treat bronchiolitis are

INHALATION BRONCHODILATORS -Assess the child before and within 1 hour after treatment. It is administered with normal (0.9%) saline and oxygen. A controlled trial of bronchodilators is an option that can only proceed if there is a documented objective clinical response[51]. Administer nebulized epinephrine (0.05 mL/kg of 2.25% epinephrine in 3 mL of normal saline). Continue for 4-6 hours until discharge in those who show a response.

MONITORING[52]Repeated clinical assessment of the respiratory system (respiratory rate, nasal flaring, retraction and grunting) is necessary to detect worsening respiratory status in both outpatient and inpatient settings. Heart rate, respiratory rate, and SpO2 should be monitored continuously in hospitalized infants soon after admission. Infants with severe distress or respiratory failure should be monitored in the NICU. In children in the intensive care unit, measurement of arterial or capillary blood gases may be indicated. If the clinical course improves, change from continuous to intermittent Spo2 measurement can be made

MORTALITY[54] Mortality in children hospitalized with RSV bronchiolitis is less than 2% in developed countries. Mortality is increased in small infants (6–12 weeks), in children with low birth weight and in children with underlying health conditions (eg underlying cardiopulmonary disease, immunodeficiency).

LONG-TERM CONSEQUENCESIncludes may have bronchial asthma and recurrent LRTI in future were observed as sequelae of bronchiolitis.

INTERVENTION AND IT'S MECHANISM OF ACTION

The recommended course of treatment for acute bronchiolitis is supportive care, which involves making sure the child has enough oxygen exchange, fluid intake, and nourishment[55]. The main pathological characteristics of acute bronchiolitis include mucus congestion and airway edema. Any treatment that might lessen these alterations and enhance airway secretion clearance may be helpful.

Because of its alpha-adrenergic effects, epinephrine causes vasoconstriction and reduces airway edema[56]. Nebulized epinephrine produced a small short-term benefit in outpatients with acute bronchiolitis but not inpatients, according to a Cochrane study[57]. Recombinant deoxyribonuclease (rhDNase), a mucolytic that is inhaled, primarily affects the airways by accelerating the clearance of secretions. But no discernible impact on clinical severity or length of hospital stay was seen[58].

Another popular strategy that enhances secretions and lessens respiratory effort is chest physiotherapy. However, current research indicates that chest physiotherapy, such as vibration and percussion or passive exhalation techniques, did not lessen the length of hospital stays, the need for oxygen, or the severity of respiratory disease in children with acute bronchiolitis who are hospitalised[59].

Infants with acute bronchiolitis are treated with hypertonic saline. Nebulized 3% saline can dramatically shorten hospital stays for infants with acute viral bronchiolitis and improve clinical severity, according to the majority of randomised trials[10].

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In healthy people as well as those with cystic fibrosis, bronchiectasis, asthma, and sinus illness, hypertonic saline has been demonstrated to enhance mucociliary clearance[60]. Infants with acute bronchiolitis might also anticipate these advantages.

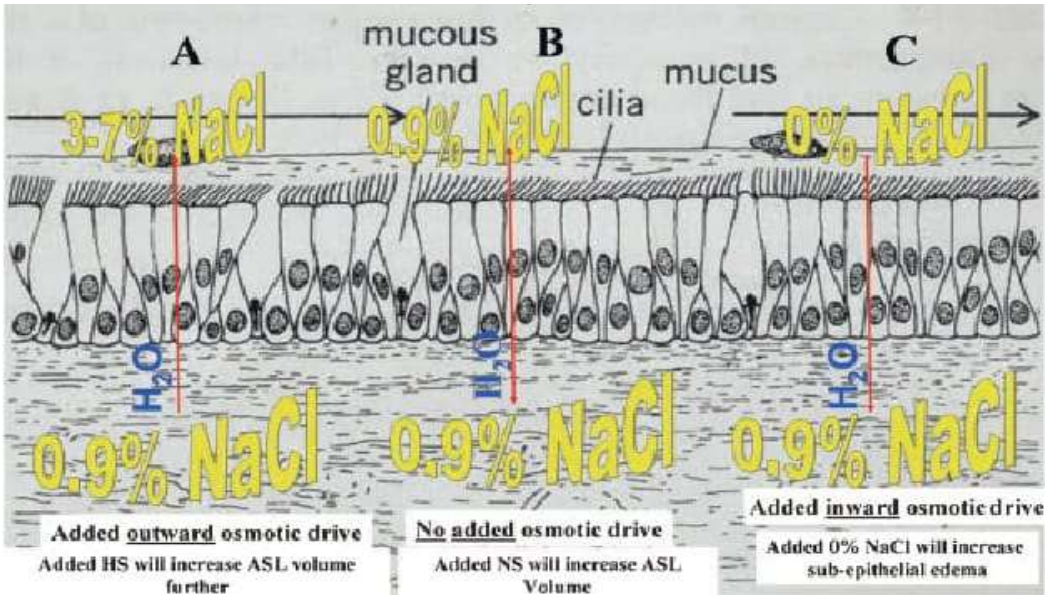
The hypothesized mechanisms of action of hypertonic saline are:

- It stimulates the clearance of mucus by causing an osmotic flow of water into the mucus layer and rehydrating the liquid on the surface of the airways[61].
- It dissociates the ionic connections in the mucus gel, which reduces the degree of cross-linking and tangling as well as the viscosity and elasticity of mucus secretion[62].
- It causes the release of prostaglandin E2, which induces the ciliary rhythm. Additionally, by removing water from the mucosa and submucosa, hypertonic saline has the potential to lessen airway wall edema in children with acute bronchiolitis[63].

Additionally, hypertonic saline inhalation may cause a cough and sputum production, which could help clear sputum from the bronchi and lessen airway obstruction[23].

Figure 4

Mechanism of action of NaCl



ASL – Airway Surface Liquid

METHODS AND MATERIALS

STUDY DESIGN & STUDY SETTING:

This study is an Institution based Randomized Controlled trial conducted in Government General Hospital, Guntur. Children of age group 6 weeks to 24 months with clinical presentation of Bronchiolitis are included in this study.

STUDY PERIOD: This study was conducted over a period of 18 months, from February 2021- July 2022.

INCLUSION CRITERIA: Children of age group 6 weeks to 24 months.History of preceding viral upper respiratory tract infection that is fever >38 ^{o}C and coryza.First episode of respiratory distress associated with wheezing,Children of parents who are willing to give consent.

EXCLUSION CRITERIA: Children < 6weeks and >24 months age. Children with pre-existing chronic cardiac, pulmonary disease or immunodeficiency.Children who had received nebulization with 3% hypertonic saline solution and salbutamol 12 hr before presentation.Critical illness at presentation suggesting incipient respiratory failure, who are not willing to give consent to participate in the study.

SAMPLING TECHNIQUE: sample was selected by simple random sampling.

SAMPLE SIZE: 100

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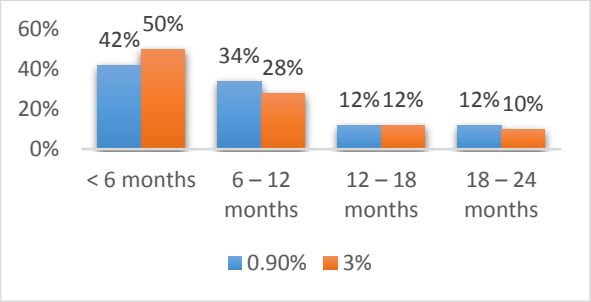
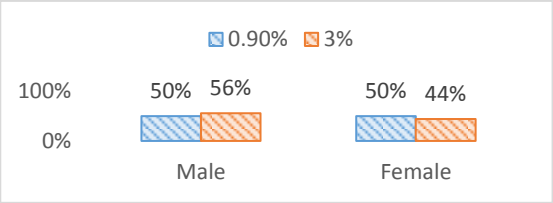
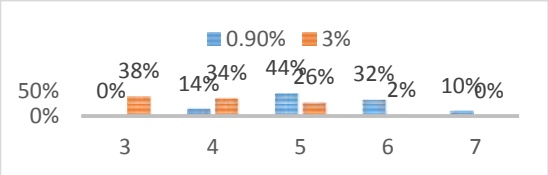
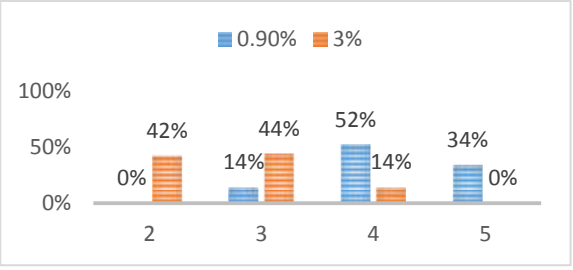
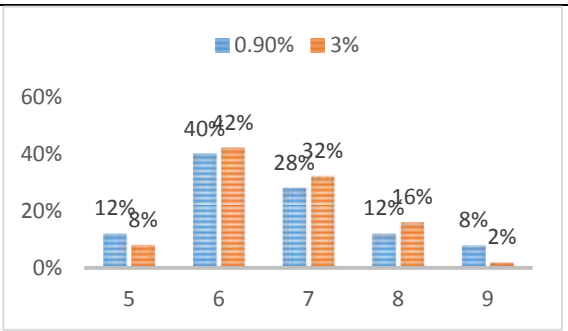
Results

Variant	Results	Discussion
1,Age distribution		Most of the children were between the ages of two months and six months. (46%; n=100)
2.Gender distribution	 Chi square test= 0.35, p=0.54, Not statistically significant	Males and females were almost equally affected in a ratio of 1.1:1.
3.Day of remission of wheeze	 Chi squaretest= 56.69, p=0.0001*, Statistically significant	In the NS group, the wheeze remission time was 4.9+/-1.0 days, while in the HS group it was 3.8+/-0.9 days. (p<0.01)
4.Clinical severity score - At admission	 Chi square test= 2.64, p=0.61*, Not statistically significant	Majority of the cases were admitted with moderate severity.
5.Clinical severity score at 24 hours	 Chi square test= 28.70, p=0.0001*, Statistically significant	With the 3% saline group, clinical severity score improvement was observed within the first 24 hours, and this improvement was statistically significant.(p<0.05)

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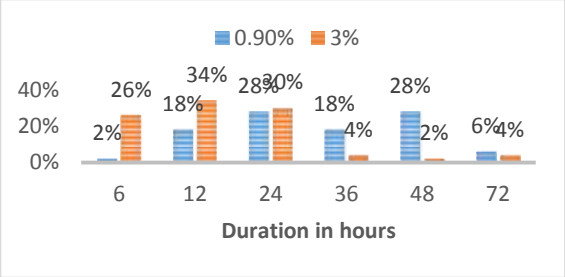
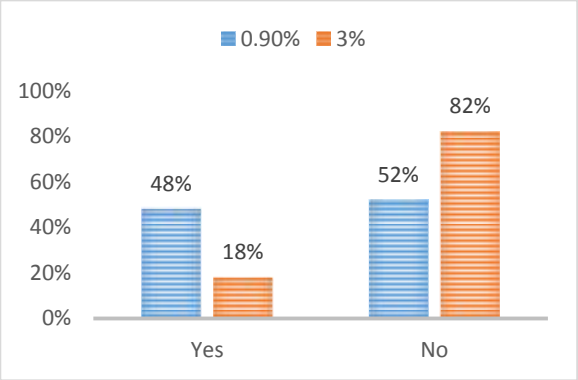
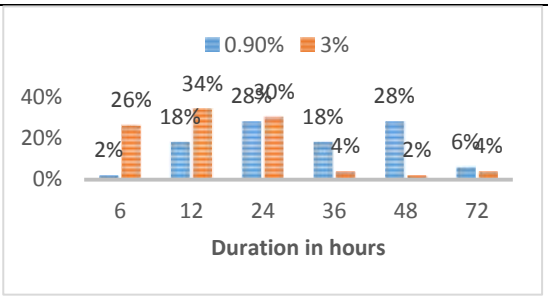
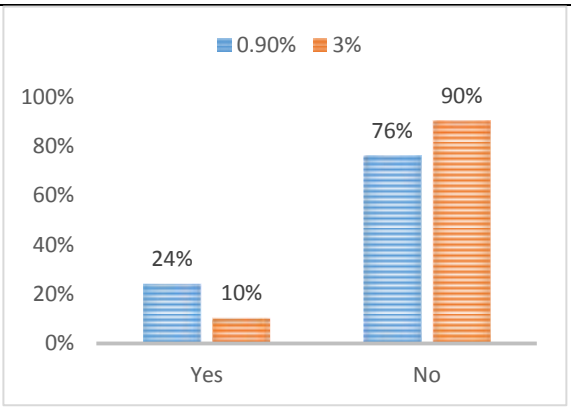
6.Need for broncho dilator therapy.	 Chi square test= 10.07, p=0.001*, Statistically significant	Only 18% of the 50 patients in the 3% saline group needed further treatment with an inhaled bronchodilator, compared to 48 percent of those in the 0.9% saline group.
7.Length of Hospital stay	 Chi square test= 3.43, p=0.06, Not Statistically significant	The mean duration of hospital stay was shorter in 3% saline group 2.82 ± 0.59 days while compared to 4.14 ± 0.96 days in 0.9% saline group which was statistically significant (p <0.001)
8.Duration of oxygen supplementation	 Chi square test= 28.70, p=0.0001*, Statistically significant	The patients of Group A (NS) on an average required 33.24 +/-16.67 hours of oxygen therapy, while the patients of Group B (HS) required 18.12 +/-14.57 hours of oxygen therapy. Duration of oxygen therapy significantly reduced in Group B compared to Group A.
9. **Need for CPAP/ Ventilator**	 As p value is > 0.05, it is considered as not significant.	Out of 50 in HS group, only 5 cases required CPAP / Ventilator support which is less compared to 12 cases requiring it in NS group.

CONCLUSIONSMost of the children were in the age group of 2 to 6 months. Cough remission time was shorter in HS group compared to NS group (p<0.01).Remission time of wheezing was shorter in

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HS group compared to HS group ($p<0.01$).There was an improvement in the clinical severity score, CSS improved more significantly in the 3% saline group (group B) from 6.62 to 1.02 compared to the 0.9% saline group (group A). Mean clinical severity score at base line (6.64) was decreased to 4.08 at 24 hours, 2.74 at 48 hours, and 68 at 72 hours , while in Group-B(HS) score at baseline (6.62) was decreased to 2.98 at 24 hours, 1.82 at 48 hours, and 1.02 at 72 hours. The average duration of oxygen supplementation was significantly shorter (18 hours) in the HS group than in the NS group (33 hours).The requirement for bronchodilator treatment was lower in 3% NS group compared to 0.9% NS group.Length of hospitalization was shorter (1–3 days) in the 3% saline group with a mean of 2.82 days and longer (3–5 days) in the 0.9% saline group with a mean value of 4.14 days, which was statistically significant ($p<0.001$).The requirement for CPAP support was reduced in 3% of the NS group compared to 0.9% of the NS group.Neither treatment modality was found to have any adverse effect.In light of the above results and observations, it was found that the use of nebulized hypertonic saline in infants aged 2 months to 24 months provides evidence of its role as an effective treatment modality in the treatment of acute bronchiolitis.

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