CE **1.5 ANCC Contact Hours**

Abstract

Bronchiolitis is a leading cause of emergency department visits and hospitalization in the first year of life with estimated costs to the healthcare system in the United States of $1.73 billion annually. The highest rates of admission occur in the first 3 to 6 months of life. Traditional therapies such as bronchodilators and antibiotics have repeatedly been shown to be ineffective. Thickened nasal secretions cause decreased oxygenation, difficulty sleeping, poor feeding, and respiratory distress symptoms. Bronchiolitis guidelines recommend supportive care such as noninvasive nasal airway clearance with saline to clear obstructed airways, improve oxygenation, and promote optimal infant eating and sleeping. Evidence on the safety and efficacy of use of noninvasive nasal airway clearance as supportive care for infants with bronchiolitis in the acute care setting is presented.

Key words: Bronchiolitis; Clinical practice guidelines; Nasal airway obstruction; Nasal irrigation.

NASAL AIRWAY CLEARANCE FOR BRONCHIOLITIS

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Bronchiolitis is a leading cause of healthcare resource utilization in the first year of life (Schiltz et al., 2014). It accounts for 32.6% of all infant emergency department (ED) discharges in the United States with the highest rates of hospital admission occurring between 30 and 60 days of age (Schiltz et al.; Weiss, Wier, Stocks, & Blanchard, 2014). The Centers for Disease Control and Prevention (CDC) estimates that bronchiolitis accounts for approximately 57,527 hospitalizations and 2.1 million outpatient visits in children under the age of 5 annually (Haynes, Prill, Iwane, & Gerber, 2014). Although most children tolerate bronchiolitis without major complications, it remains a leading cause of hospitalization for infants and children (Bracht, Basevitz, Cranis, & Paulley, 2011). Bronchiolitis-related hospitalizations in the United States from 2000 to 2009 were found to reflect an estimated annual cost of care of $1.73 billion (Hasegawa, Tsugawa, Brown, Mansbach, Camargo, 2013).

Infants are obligatory nose breathers in the first several months of life, putting them at higher risk of respiratory distress from respiratory tract infections. Infants with bronchiolitis experience symptoms of nasal congestion or obstruction, course cough, wheezing, and chest retractions at varying degrees of severity (Bracht et al., 2011; CDC, 2018), which can be frightening for parents. The etiology for bronchiolitis is viral, making it nonresponsive to traditional respiratory therapies unless the infant has a secondary infection or underlying disease process. Use of standard medicines such as antibiotics and bronchodilators is ineffective, yet the pressure of needing to respond to respiratory symptoms continues to guide care (Quinonez & Schroeder, 2015).

According to bronchiolitis treatment guidelines from the American Academy of Pediatrics (AAP) (Raltson et al., 2014) and National Institute for Health and Care Excellence (NICE, 2016), most infants can be managed with supportive care. Supportive care measures for bronchiolitis are defined as maintaining proper hydration, keeping stimulation to a minimum so as not to increase distress, and supporting adequate oxygenation by maintaining nasal airway patency through noninvasive nasal airway clearance (NAC) with saline drops to clear nasal secretions (Mussman, Parker, Statile, Sucharew, & Brady, 2013; Nagakumar & Doull, 2012; NICE; Ralston et al., 2014).

Nurses are responsible for identifying when an infant needs airway clearance, performing NAC, and educating parents about why the plan of care will focus on keeping the airways clear of secretions versus use of medications. An understanding of the evidence that supports the use of NAC over medication administration is necessary to provide safe, evidence-based care to pediatric patients. The purpose of this article is to provide evidence on the safety and efficacy of use of noninvasive NAC as supportive care for the infant with bronchiolitis in the inpatient setting.

Description of Bronchiolitis

Bronchiolitis is a viral infection in the lower airways or bronchioles, and usually begins with nasal congestion or rhinorrhea, low-grade fever, and a slight cough. Symptoms progress to lower respiratory symptoms within 1 to 3 days (CDC, 2018; Da Dalt, Bressan, Martinolli, Perilongo, & Baraldi, 2013; Ralston et al., 2014), are typically self-limiting, and last 2 to 4 weeks (Budhiraja, Verma, & Shields, 2013).

Most infants and children with bronchiolitis are easily cared for at home, yet almost 20% of infants less than 1 year old require supportive care in a hospital setting (Ralston, Comick, Nichols, Parker, & Lanter, 2014). A key to caring for infants with bronchiolitis is identifying worsening symptoms that require more advanced evaluation (McNaughten, Hart, & Shields, 2017). See Table 1. As the etiology of bronchiolitis is generally viral in nature, medications such as antibiotics are ineffective in treating the illness (Quinonez & Schroeder, 2015; Ralston et al., 2014). Bronchodilators have also not been found to be effective (Ralston et al.). Supportive care such as maintaining hydration, limiting stimulation that can increase respiratory distress, and noninvasive NAC is an effective treatment for most infants with bronchiolitis, yet variability in treatment modalities remains prevalent in acute care settings across the United States (Da Dalt et al., 2013; Macias et al., 2015; McNaughten et al.).

Treatment Options for Infants With Bronchiolitis

Bronchiolitis guidelines established by AAP (Ralston et al., 2014) and NICE (2016) call for a reduction in medical therapies such as antibiotics and bronchodilators and a focus on education of supportive measures when caring for infants with bronchiolitis. However, healthcare providers continue to prescribe these medications instead of providing thorough education about supportive care measures (Quinonez & Schroeder, 2015; Ralston et al.). Supportive intervention, such as using a suction device with nasal saline, clears congested airways, promotes adequate oxygenation, and improves feeding and sleeping patterns (Ralston et al.).

Nasal airway clearance is a current standard of practice according to the bronchiolitis guidelines (NICE, 2016; Ralston et al., 2014). The procedure involves using a suction device such as a bulb syringe. The bulb syringe is compressed and placed in the infants' nose, then released causing a suction pressure to remove nasal secretions. Other types of NAC include use of a nasal aspirator or suction catheter. The nasal aspirator is inserted at the tip of nose to

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TABLE 1. BRONCHIOLITIS SYMPTOMS AND CLINICAL IMPLICATIONS

Time Frame/Symptoms	Clinical Implications
Day 1–2 • Cough • Rhinorrhea • Low-grade fever possible	Prodromal symptoms usually upper airway
Day 3–5 • Worsening to continual cough • Tachypnea • Retractions • Wheezing • Decreased oxygen saturation	Worsening symptoms, due to lower airway involvement; leads to poor feeding and sleeping, irritability
Severe symptoms • Apnea • Persistent oxygen saturation <92% • Dehydration Decreased intake and output • Persistent severe respiratory distress Grunting, respiratory rate >70, marked retractions	Indications of respiratory failure and should be evaluated in a hospital setting as soon as possible

form a seal while suction is applied. A suction catheter is used for clearing secretions in the back of the throat or deeper in the pharynx. Frequent and vigorous use of a suction device can cause trauma and edema in the upper airways leading to further blockages (Mussman et al., 2013).

Nasal airway clearance is irritating to the infant and will lead to crying and agitation. Nasal airway clearance can result in parental anxiety if they are not correctly educated on proper use and procedure. Parents should be taught to continue suctioning the infant's nose after discharge to help maintain airway patency until the illness fully resolves.

Synthesis of the Evidence

A review of literature was conducted using CINAHL, Cochrane, and Google Scholar databases from January 2010 to June 2018 to find information on current bronchiolitis treatment trends, bronchiolitis protocols, effectiveness of NAC and normal saline for bronchiolitis, and associated clinical implications to inform practice. Search terms included bronchiolitis, treatments, bronchodilators, clinical guidelines, nasal suctioning/lavage, nasal saline, effectiveness of NAC, and clinical implications of nasal suctioning for infants. Primary and secondary peer-reviewed articles were retrieved and analyzed.

Bronchiolitis and Treatment Modalities

A review of literature was conducted focusing on therapies often prescribed for the treatment of bronchiolitis and their effectiveness. Multiple studies have shown standard medical therapies for respiratory illnesses to be ineffective to treat bronchiolitis. For the purposes of this review, articles focusing on treatments such as bronchodilators, antibiotics, and steroids were included. Articles relating to nebulized hypertonic saline, heliox, epinephrine, and chest physiotherapy were removed.

A systematic review of 30 randomized control trials comparing albuterol with control subjects in both 11 inpatient and 10 outpatient studies found albuterol had no effect on oxygen saturation (Gadomski & Scribani, 2014). There was a mean difference (MD) in oxygen saturations of -0.43 with a 95% confidence interval (CI) -0.92 to 0.06, n = 1,242 (Gadomski & Scribani). Gadomski and Scribani also found studies suggesting there was no change in hospitalization rates with groups who were treated with bronchodilators in the outpatient setting as compared with control groups (11.9% in bronchodilator group vs. 15.9% in placebo group, odds ratio 0.75, 95% CI 0.46 to 1.21, n = 710). They further found no reduction in length of stay (LOS) for inpatients treated with bronchodilators, MD 0.06, CI -0.27 to 0.39, n = 349 (Gadomski & Scribani).

Several studies identified common medical treatments (e.g., albuterol, steroids, etc.) to be ineffective in decreasing symptoms of illness or decreasing LOS in hospitalized infants and therefore should not be used unless warranted by secondary symptoms (Budhiraja et al., 2013; Gadomski & Scribani). A systematic review found a positive change in bronchiolitis symptom scores on three different scoring tools after bronchodilator administration (Rodriguez-Martinez & Castro-Rodriguez, 2015). However, this study also found bronchodilators did not show improved oxygenation, decreased hospital admission after outpatient treatment, shorten LOS, or shorten duration of illness at home. The authors concluded bronchodilators should be used with care and further studies with larger populations need to be conducted to yield stronger results (Rodriguez-Martinez & Castro-Rodriguez). A systematic review and meta-analysis comparing use of bronchodilators and steroids found no significant improvements in 48 trials, concluding that use of these therapies should be on a patient-by-patient basis and based on a clinical decision of the provider (Hartling et al., 2011). These clinical findings have been used to support the call for limited medical intervention and an increase in supportive care through bronchiolitis guidelines.

Bronchiolitis Guidelines and Nasal Airway Clearance

Bronchiolitis guidelines from professional associations provide information on the various aspects of diagnosis and care of the patient with bronchiolitis (NICE, 2016; Ralston et al., 2014). The guidelines discuss identification of symptoms and give evidence-based recommendations for treatment. Recommendations include limiting or not using traditional therapies such as bronchodilators and replacing them with supportive care measures as appropriate treatment options. Supportive care measures are defined as maintaining proper hydration,

minimal handling or refraining from frequent manipulation that causes further agitation, and maintaining nasal airway patency through NAC (Nagakumar & Doull, 2012). Guidelines encourage use of NAC to open congested airways that enhances airway patency and possibly oxygenation status while improving feeding and sleeping patterns (Ralston et al.).

In a study on efficacy of suctioning practices in the hospital and the effect on LOS, Mussman et al. (2013) found multiple deep (nasopharyngeal) suctioning events using a suction catheter performed in the first 24 hours of the hospitalization increased LOS by an average of 0.6 days. Lapses in noninvasive NAC of greater than 4 hours increased LOS up to 1 day (n = 740 for deep suction group; n = 695 for lapses in suction group) (Mussman et al.). Bronchiolitis guidelines support limiting invasive NAC and encourage timely noninvasive NAC (NICE, 2016; Ralston et al., 2014).

Moschino et al. (2016) reviewed the role of nasal obstruction in bronchiolitis and found that nasal passage obstruction from thickened secretions leads to decreased oxygen levels in the blood and was found to be one of the major determinants for hospitalization. Nasal airway clearance using a handheld suction device has been recommended as a form of supportive care for the infant with bronchiolitis (Ralston et al., 2014).

Nasal Airway Clearance With Saline

An early and ongoing clinical manifestation of bronchiolitis is nasal obstruction from thick, copious secretions blocking the nares. Infants cannot clear their nasal passages without assistance, leading to poor oxygen saturation and an increase in respiratory distress symptoms (Chirico, Quartarone, & Mallefet, 2014). Nasal airway clearance with saline is widely used in the hospital setting, yet there is a lack of data on its effectiveness. A Cochrane Review of five randomized control trials of both children and adults revealed that use of nasal saline for irrigation with NAC may be beneficial at alleviating symptoms for acute upper respiratory symptoms (King, Mitchell, Williams, & Spurling, 2015). Although most of the studies reviewed were small and contained high risk of bias, one large study of children showed a significant reduction of nasal secretion score (MD -0.31, 95% CI -0.48 to -0.14) and nasal breathing (obstruction) score (MD -0.33, 95% CI -0.47 to -0.19) in the saline group as compared with the control group (King et al.). Improvement in nasal secretion and obstruction scores indicates an improvement in the ability of the infant to maintain adequate oxygenation.

Schreiber et al. (2016) compared use of 1 mL each of isotonic saline, hypertonic saline, and infants receiving standard care to their effect on oxygen saturation levels. A total of 133 infants admitted to the ED with oxygen saturations between 88% and 94% were randomly assigned to study groups and monitored using a respiratory distress scoring tool and oxygen saturations at regular intervals over an hour (Schreiber et al.). At 5 minutes, the isotonic saline group showed an increase in oxygen saturation to 95%, whereas the hypertonic group (94%) and the standard care group (93%) remained lower throughout the hour (Schreiber et al.). The study showed a significant increase in oxygen saturation with the isotonic saline throughout the monitoring period compared with the hypertonic and supportive care groups indicating use of isotonic saline is beneficial to improving oxygenation to infants with bronchiolitis; however, it did not show a change in respiratory distress using a scoring tool (Schreiber et al.). Further studies with larger sample sizes are needed to continue to build evidence around saline with NAC.

Clinical Conditions Requiring Nasal Airway Clearance

Infants with bronchiolitis often have difficulty maintaining a patent nasal airway and require assistance clearing the secretions. Blocked nasal passages from thickened secretions lead to decreased oxygen saturation levels, poor feeding, and poor sleeping in infants (Mussman et al., 2013). Noninvasive NAC is used to promote comfort in breathing, to clear nasal secretions, and clear the airways prior to feeding and sleeping (Da Dalt et al., 2013; Jarvis et al., 2014). More vigorous, deep nasotracheal suctioning can lead to edema in the airways intensifying obstruction and is not recommended as routine practice (McNaughten et al., 2017; Mussman et al.). Instead, a gentle pressure suction device such as a bulb syringe or nasal tip aspirator with nasal saline should be used prior to feeding and sleeping to promote ease of both (Ralston et al., 2014; Verma, Lodha, & Kabra, 2013).

Barriers to Applying Evidence-Based Practice in Practice

Evidence-based bronchiolitis guidelines recommend the use of supportive care measures to decrease use of unnecessary treatments for infants with bronchiolitis, yet variations in care in acute care settings still exist (Cahill & Cohen, 2018). This lack of standardized care leads to misuse of resources, increased costs, and unnecessary hospitalizations (Cahill & Cohen). Nurses can improve care through initiation of an evidence-based bronchiolitis protocol.

Although evidence-based protocols have been found to decrease costs and improve practice, barriers to implementation continue to exist (Tacia, Biskupski, Pheley, & Lehto, 2015). Barriers to adopting evidence-based practice

Use of standard medicines such as antibiotics and bronchodilators has been shown to be ineffective in treating bronchiolitis.

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SUGGESTED CLINICAL IMPLICATIONS

- National guidelines from the American Academy of Pediatrics (Ralston et al., 2014) recommend noninvasive NAC versus invasive or deep nasotracheal suctioning for bronchiolitis
- Indications for noninvasive airway clearance include:
  - Nasal secretions or congestion
  - Signs of respiratory distress including:
    - Retractions, tachypnea, noisy breathing (rhonchi, wheezing)
- Noninvasive nasal irrigation with saline improves oxygenation status
- An understanding of current evidence-based practices for infants with bronchiolitis is required to guide care
- An evidence-based bronchiolitis protocol using a standardized screening tool for symptoms of respiratory distress and care responses can limit invasive suctioning episodes and improve patient outcomes (e.g., the respiratory component of the PEWS)

include lack of knowledge of instituting evidence-based practice, institutional and cultural barriers, lack of time and motivation, physician and patient resistance to changing practice, and lack of access to resources for research of best practices (Majid et al., 2011; Tacia et al.). Through creation of a multidisciplinary team consisting of vested stakeholders, nurses can use evidence to build bronchiolitis protocols to guide their care that can lead to improved patient outcomes, better use of resources, and decreased LOS (Jarvis et al., 2014).

Clinical Implications

Bronchiolitis causes significant airway obstruction in infants from thickened respiratory secretions leading to respiratory distress. It is usually viral in nature, thus antibiotics have not shown to be effective. Supportive care measures are recommended by AAP (Ralston et al., 2014) and NICE (2016) bronchiolitis guidelines. Noninvasive NAC with saline is a safe and effective way to improve oxygenation, feeding, and sleeping by removing secretions blocking the airways. Nasal airway clearance with saline is widely used in the inpatient setting and parents should be encouraged to continue NAC with saline after discharge until symptoms resolve. Nurses need to incorporate education for parents with return demonstration for home devices, such as a bulb syringe, on admission and continue throughout the hospital stay to prepare parents for care at home.

Nurses caring for infants with bronchiolitis can promote safe and effective airway patency using NAC. Nurses in inpatient settings can facilitate recovery from bronchiolitis by understanding the disease process and its clinical implications, see Table 1. Frequent clearing of congestion and thickened secretions from the nasal airway should be performed throughout the hospital stay (Mussman et al., 2013). Infants should be suctioned prior to eating, sleeping, and anytime the nares are blocked with visible secretions (Chirico et al., 2014; McNaughten et al., 2017). Noninvasive NAC with nasal saline should occur at least every 4 hours (Mussman et al.). Use of deep or nasotracheal suction is no longer recommended due to the probability of mucosal damage and trauma leading to further airway obstruction and prolonging of length of hospital stay (Mussman et al.). Gentle NAC can be performed using a variety of noninvasive suction devices.

Noninvasive NAC is an effective means of airway clearance when performed at least every 4 hours (Mussman et al., 2013). Nurses can be instrumental in instituting an interdisciplinary, nurse-driven suctioning protocol to identify symptoms requiring NAC, ensure NAC is completed in a timely manner, monitor for clinical improvement or decline in health status, and align care administered across disciplines (Jarvis et al., 2014). Use of a standardized screening tool for symptoms of respiratory distress and care responses, such as the respiratory portion of the Pediatric Early Warning Score (PEWS) can limit invasive suctioning episodes and improve patient outcomes (Jarvis et al.).

Infants with bronchiolitis are at greater risk for complications from airway obstruction due to thickened secretions in the nasal airways. With routine noninvasive NAC practices, nurses can assist with clearing secretions to promote adequate oxygenation, feeding, and sleeping patterns during the acute phase of the respiratory illness. ✜

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