CE **1.5 ANCC Contact Hours**

Abstract

Purpose: This descriptive, observational study explored the practice of airway clearance of the term newborn at birth. The American Academy of Pediatrics, the American Heart Association, and the European Resuscitation Council have established guidelines for suctioning the well newborn.

Study Design and Methods: Airway clearance practices of nurses, obstetricians, and respiratory therapists at 10 cesarean births and 10 vaginal births were observed. Data were analyzed using descriptive statistics and through content analysis of narratives.

Results: All newborns observed experienced at least one airway clearance event and multiple airway clearance passes. Indications for suctioning were not consistent with professional guidelines. Airway clearance procedures and practices were inconsistent. Two suction devices used: the blue bulb syringe and orogastric catheter. If a newborn was suctioned three times, the orogastric catheter was the predominate device used.

Clinical Implications: There was a lack of adherence to established clinical guidelines for newborn airway clearance. Further study is needed to identify education of airway clearance guidelines. Specific protocols such as safe suctioning methods, correct device use, and observation of complications associated with airway management need to be developed to support a newborn's healthy transition at birth.

Key words: Infant; Newborn; Nurses; Practice patterns; Suction.

AIRWAY CLEARANCE OF THE TERM NEWBORN

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The transition from intrauterine life to extrauterine life involves changing from placental management to newborn lung control. This dramatic alteration in gas exchange, blood flow, and initiation of personal thermoregulation occurs in 90% of newborns without difficulty or interference from those attending the birth (Morton & Brodsky, 2016; Perlman et al., 2012). The newborn's first cries are signs of adequate respiratory effort and assist in management of fluid that initially fill the alveoli (American Academy of Pediatrics [AAP] & American Heart Association [AHA], 2016).

The AAP, AHA, and the European Resuscitation Council support simple drying of the newborn, wiping away excess fluids from the newborn's mouth and nose, proper positioning of the airway and provision of a warm environment for the term newborn with spontaneous respirations, adequate crying, and good muscle tone (AAP & AHA, 2016; Vali, Mathew, & Lakshminrusimha, 2015; Wyckoff et al., 2015; Wyllie et al., 2015). Healthcare personnel in labor and delivery, nursery, and postpartum units are provided instruction on suctioning newborns in the *Textbook of Neonatal Resuscitation* (AAP & AHA).

The European Resuscitation Council guidelines for resuscitation support suctioning a newborn when there is an obstructed airway (Wyllie et al., 2015). Although routine suctioning of the term newborn at birth is discouraged by several professional healthcare organizations such as AAP and AHA (2016), it is frequently done by nurses, respiratory therapists, midwives, and obstetricians (Kelleher et al., 2013; Waltman, Brewer, Rogers, & May, 2004). The routine practice of airway clearance of the newborn at birth causes apnea, disturbances in heart rate, irritation to the mucous membranes, increased risk for nosocomial infections, blood gas alterations, pain, does not improve lung function or newborn oxygenation, and impairs cerebral tissue oxygenation (Foster, Dawson, Davis, & Dahlen, 2017; Gungor et al., 2006; Modarres Nejad, Hosseini, Sarrafi Nejad, & Shafiee, 2014; O'Neal et al., 2017; Pichler et al., 2010;

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Simple drying of the newborn, wiping away excess fluids from the newborn's mouth and nose, proper positioning of the airway and provision of a warm environment of a term newborn with spontaneous respirations, adequate crying, and good muscle tone is recommended practice.

Rodrigues et al., 2017; Waltman et al.). The negative effects may be related to vagal nerve stimulation and interference with the newborn's journey to extrauterine life.

Although the practice of routine suctioning at birth is not supported by international practice guidelines, there may be times when newborn resuscitation efforts are needed to promote airway clearance. The device of choice is the manual bulb syringe (AAP & AHA, 2016). Indications for airway clearance of the newborn include copious amounts of fluid or oral secretions that have the potential to compromise adequate respiration and create airway obstruction; inadequate efforts to breathe as evidenced by no crying or a weak crying effort; gasping; poor muscle tone; or if positive-pressure ventilation is anticipated (AAP & AHA; American College of Obstetricians and Gynecologists [ACOG], 2017). It should be noted that ACOG does not recommend routine suctioning in the presence of meconium-stained fluid.

Making decisions about newborn suctioning or airway clearance can present challenges for nurses and other healthcare professionals attending birth and for those providing postpartum newborn care. Without adherence to evidence-based clinical guidelines and the development of specific protocols, airway clearance of the newborn may be improperly implemented.

A unique, interprofessional approach to examine adherence to evidence-based clinical guidelines and to explore the development of specific practice protocols was used for this project. The CLEAR (Clearance of the Airways) Project is a nurse-led, interdisciplinary research team formed to develop a scientific basis for the practice of suctioning newborns and children. The team includes a variety of colleges and students from different disciplines and programs of study. The CLEAR team initially conducted a small observational study to provide foundational evidence in newborn airway clearance. Findings of the initial study included no consistency among healthcare providers on indications for airway clearance and no standardization of the procedure used including equipment, newborn positioning, specific procedure or documentation, and evaluation of the

TABLE 1. INDICATIONS TO SUCTION AND NUMBER OF AIRWAY CLEARANCE EVENTS

Indications	Airway Clearance Event 1 N 20(100%)	Airway Clearance Event 2 N 13 (65%)	Airway Clearance Event 3 or Greater N 11 (55%)
No indications. Routine	8 (40%)	7 (54%)	3 (27%)
Apnea, no crying or cyanosis	6 (30%)	1 (8%)	1 (9%)
Choking, gurgling, gasping, and/or grunting	6 (30%)	5 (38%)	4 (36%)
Spitting up fluids	0	0	3 (27%)

procedure effectiveness. These findings served to inform this study. The purpose of this study is to explore the practice of airway clearance of the term newborn at birth to provide evidence for specific protocol development including indications, choice of device, proper hand placement and pressure exerted, device storage and cleaning, and evaluation and documentation of effectiveness.

Study Design and Methods

In this descriptive observational study, demographic, birth history, and qualitative data were gathered on newborn suctioning at birth using a data collection form modified following the initial study. Researchers were provided orientation to the use of the observation form. Correct use was determined through role-play-based return demonstration. Interobserver agreement was estimated three times during data collection.

Ethical considerations and study procedures were approved by the hospital and university review boards. Discussions with service line directors, labor and delivery nurse managers, obstetricians, and staff nurses about observations during birth were conducted. The project details were explained to each laboring woman and written informed consent was obtained.

Setting and Sample

The study site is a publicly owned, regional, teaching hospital in a southeastern state with an annual birth rate of ~5,000. The intrapartum unit is staffed by 40 registered nurses. Birth attendants are obstetricians.

A convenience sample of mothers was recruited on admission to the intrapartum unit. Inclusion criteria were mothers at 38 weeks to 41 weeks gestation without prenatal complications and expected to give birth to healthy singleton newborns. Participants were expected to have spontaneous, vaginal births or nonemergent cesarean births; therefore, the sample included mothers giving birth vaginally or by cesarean.

Data Analysis

Observational data were transcribed into narrative content. Content analysis was applied to identify practices of newborn suctioning immediately following birth. Descriptive analyses were conducted, including frequencies, using IBM SPSS Statistics V.25 (IBM, Armonk, New York, USA).

Results

Twenty mother–newborn dyads were observed during birth. Birth routes were equally distributed with 10 cesarean and 10 vaginal births. Maternal age ranged between 22 and 37 years. Maternal race was predominantly White/Caucasian (95%). Gravidity ranged between 1 and 6, and parity between 0 and 3. Gestation ranged between 38 weeks, 1 day and 40 weeks. Each woman had adequate prenatal care. All newborn Apgar scores were 8 at 1 minute and 9 at 5 minutes. All newborns were admitted to the well-baby nursery without complications at 1 hour after birth.

Newborns experienced one to five total airway clearance events from birth up to 1 hour after birth. See Table 1. In this study, the authors defined an **airway clearance event** as suctioning of the newborn that occurs in a single pass or cluster of passes in successive order. An airway clearance event is considered complete when the suction device is no longer used and the airway clearance activity ceases. The authors defined **airway clearance pass** as occurring within a single airway clearance event and identified by an insertion and removal of the suction device in the newborn's mouth and/or nose. All newborns experienced one airway clearance event, 65% experienced a second airway clearance event, and 55% had three or greater airway clearance events.

> Without evidence-based clinical guidelines and specific protocols, airway clearance of the term newborn may not be properly implemented.

In addition to airway clearance events, numerous airway clearance passes were made. A total of 95 airway clearance passes ranging from 1 to 11 per newborn occurred in the entire sample. Eighty-five percent of newborns had three or more airway clearance passes immediately after birth. An orogastric (OG) catheter was used for 15% of the airway clearance passes, whereas the remaining 85% were suctioned using the blue bulb syringe (BBS).

There were no observed indications for airway clearance in 40% of first airway clearance events. The indications observed and warranted by international guidelines were

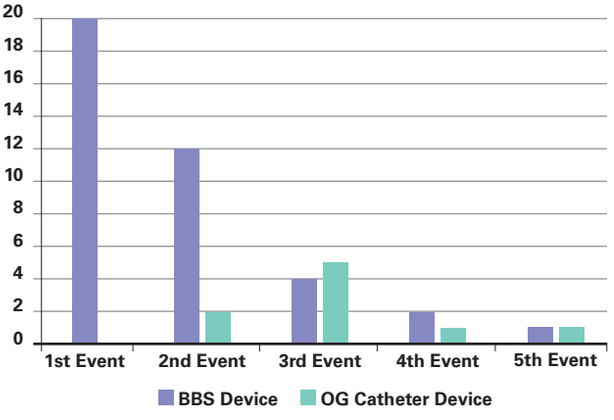
apnea, no crying, or cyanosis (30%); choking, gurgling, gasping; and/or grunting (30%). Of those newborns who experienced a second airway clearance event, 54% exhibited no observed indication; 38% were observed to be choking, gurgling, gasping, or grunting; and 8% experienced apnea.

For newborns with three, four, or five airway clearance events, 27% had no indication for airway clearance. In the remainder of airway clearance events, the following newborn symptoms were observed: choking, gurgling, gasping, and/or grunting (36%); spitting up fluids (27%); and apnea, no crying, or cyanosis (9%). Wiping of the newborn's nose and mouth was only observed in one baby.

Two different airway clearance devices were observed to be used: the BBS and OG catheter. See Figure 1. For airway clearance event 1, all newborns were suctioned exclusively with a BBS. In airway clearance events 2 and 4, the BBS was used more frequently. In event 3, however, the OG catheter was used more frequently. In event 5, both were used equally. Overall, a decrease in frequency of use of the two devices to promote airway clearance occurred in the immediate postpartum time frame.

It was observed that when the BBS was used, the healthcare provider most often squeezed the side of the BBS. The newborn's mouth was typically suctioned first then the nose, and on occasion only the mouth was suctioned. The BBS was squeezed, inserted in either the mouth then the nose, and contents were often expelled on a blanket in the crib. Secretions were not always expelled prior to reinserting the BBS into either the mouth or nose. No cleaning of the BBS was observed. The BBS was placed in a variety of locations, such as the crib and on the mother's chest with the infant, after initial use.

FIGURE 1. AIRWAY CLEARANCE EVENT FREQUENCY AND DEVICES USED



BBS: Blue bulb suction
OG Catheter: Oro-gastric catheter

TABLE 2. SAMPLE OBSERVER QUOTES RELATED TO OROGASTRIC CATHETER USE

The nurse decided that the birth fluids needed removing to facilitate breathing. Stated this to the father. Inserted OG catheter into baby's mouth with 10 ml syringe attached. Inserted approximately 6-7 inches of OG catheter. Withdrew thick bloody fluid. Repeated 3 times. Wiped mouth/nose following procedure. Did not document procedure.
Nurse used 10 ml syringe with OG catheter attached. Inserted catheter in baby's mouth. Pushed/advanced catheter without measuring for catheter placement. Pulled plunger while withdrawing catheter.
Nurse wiped mouth and nose for 2 minutes prior to first suction event (first event took place on mom's chest after birth). Mouth only [suctioned] by squeezing sides of bulb syringe, inserting and released using 4 passes. After placing infant skin to skin, same nurse suctioned second event on mom using 2 passes in mouth and 1 pass in each nostril. After moving infant to warmer another nurse suctioned gastric content with OG catheter, unmeasured, for 2 passes.

Following initial use of the BBS, researchers observed the nurse's decision in nine instances to use the OG catheter. Nurses stated the rationale for use of the OG catheter was to reduce gastric contents to facilitate respiratory effort. See Table 2 for examples of direct observer quotes. For each use of the OG catheter observed there was 1) no measurement of the length of the catheter for the appropriate placement; 2) a 10 mL syringe was attached to the OG catheter; 3) the newborn gagged frequently during the procedure; 4) newborn status was not evaluated during or following the procedure; 5) the contents of the syringe were not measured; and 6) the procedure was not documented.

The healthcare providers involved in airway clearance included nurses, respiratory therapists, and obstetricians. Nurses were involved in all airway clearance events and physicians were only involved in the first airway clearance event (20%) and the second airway clearance event (7%). Respiratory therapists were observed to be involved only in the second airway clearance event (14%).

Discussion

The AAP and AHA (2016) encourage simple drying of the newborn, wiping away excess fluids from the newborn's mouth and nose, proper positioning of the airway, and provision of a warm environment. Suctioning or airway clearance is only recommended when a newborn's airway is blocked (AAP & AHA; Perlman et al., 2010). In this study, all newborns experienced at least one airway clearance event and multiple airway clearance passes and most without indication. More than half had a second and third suctioning event with multiple suction passes per event. Therefore, a high frequency of nasopharyngeal and oropharyngeal airway clearance practices was observed in healthy newborns, and adherence to international clinical guidelines was minimally observed.

Newborns were suctioned with no indication of airway obstruction observed. The first breath of life mobilizes fluids from the alveolar space. Crying is a sign of adequate respiration and fluid management. Negative pressure introduced in the airway via airway clearance methods may impede oxygenation and ventilation mechanisms. This negative pressure introduced when secretions are not present, may remove oxygen, and compromise the newborn's ventilation status (AAP & AHA, 2016; Morton & Brodsky, 2016).

Two primary manual suction devices, without wall vacuum, were observed to be used in the first hour of the newborn's life: the BBS and OG catheter. The BBS was used as a multiuse device. Numerous airway clearance passes were made on all newborns, meaning that the BBS was inserted in the mouth and nose multiple times. The observed practice was to expel the secretions in the blanket, and then reintroduce the BBS into the mouth and nose again. The BBS was also observed to be stored in a variety of locations that may lead to environmental exposures. O'Neal et al. (2017) documented that the BBS device contains pathogenic bacteria and may be a health risk to newborns. Reinserting the BBS without proper cleaning after environmental exposure may be a medium for bacterial transfer to the newborn.

Use of the OG catheter and a 10 mL syringe to remove gastric contents at the time of birth is a practice concern. Nurses decided the BBS was no longer sufficient to clear the airway and a second device was necessary. An OG catheter was used in almost 1/5 of all airway clearance passes. Gastric aspiration at birth is not recommended (Kiremitci et al., 2011) and may be harmful to the newborn. Symptoms of distress in newborns identified by Kiremitci et al. included increased retractions and systolic blood pressure. By reintroducing an OG catheter multiple times in rapid succession and by not measuring for correct placement or identifying content returns, newborn injury may be possible.

The airway clearance procedure observed in this study was inconsistent. Only one nurse was observed wiping a newborn's mouth and nose, which is the standard of care. Sometimes the newborn's mouth and nose were suctioned and other times only the mouth was suctioned. When standard of care is not followed or when care is inconsistent, standards are difficult to evaluate for quality and safety. Negative outcomes for newborns are possible in the context of lack of adherence to evidence-based care.

Obstetricians, nurses, and respiratory therapists were involved with airway clearance in this study. However, the nurse primarily provided airway clearance to the newborn and acted independently in making decisions related to the procedure. Policy and protocol development for airway clearance procedures within specific clinical agencies should be interprofessional and include all members of birth team.

Limitations

The observational design of this study may have produced a Hawthorne effect and healthcare providers may have changed their airway clearance behaviors knowing that the purpose of the study was to observe suctioning practices. Generalizability of this study is limited due to the small sample size and the one hospital setting. Even though interrater reliability was established initially by pairing two observers and verifying data collection between the two observers, as the study progressed only one observer was available for births. Differences in observers' perceptions and the ability to visualize all birth activities may have influenced the level of detail collected during birth.

Clinical Nursing Implications

National and international experts (AAP & AHA, 2016; Vali et al., 2015; Wyllie et al., 2015) support wiping the mouth and nose of the newborn following birth as standard practice for airway clearance of the newborn and do not support routine nasopharyngeal suctioning. Airway clearance is recommended only when viscous mucus, amniotic fluid, or amniotic residue blocks the airway. A gap in the evidence remains about the specific use of manual suction devices to promote airway clearance when indicated. There is a need for the development of specific practice protocols for use of manual airway clearance devices. Written protocols can be helpful to guide care and to improve outcomes (ACOG, 2015). The practice protocol for a BBS would include recommendations for BBS size, positioning of the newborn, appropriate hand positions to promote adequate negative pressure, indications for use, and step-by-step actions for use with the newborn. Evidence-based protocols should include proper cleaning and storage of the BBS. Airway clearance with an OG catheter for the term newborn may be hazardous and should be avoided. Providers and nurses need further education. Protocols should be developed to reduce risk of injury to the newborn.

Knowledge of nurses, physicians, respiratory therapist, and other healthcare professionals on airway clearance procedures may be inadequate and should be assessed in clinical settings. There may be deficits in the basic education of healthcare professionals. In a review of 20 nursing, midwifery, and medical textbooks by the CLEAR team, there was minimal information about airway clearance of the newborn and the information discovered was inconsistent. Although most registered nurses who care for women during labor and birth are required to be certified in neonatal resuscitation, rigorous studies are needed to explore if these practices are consistent and if barriers to safe care exist.

More studies are needed to explore healthcare professionals' perception of indications to suction, decision in device type, and frequency of airway clearance events. Newborn physiological responses to airway clearance should be measured over time to assess health outcomes. More studies exploring the practice of airway clearance are needed to guide the development of protocols for safe and effective suctioning of newborns.

SUGGESTED CLINICAL IMPLICATIONS

- Nasopharyngeal suctioning is not recommended for well newborns.
- A handheld bulb syringe is the preferred device when suctioning the term newborn is necessary.
- Indications for suctioning of the newborn have been identified by professional organizations but do not appear to be followed routinely.
- Sufficient education and clinical competence statements should be available for professionals assisting in the birth process.
- More information is needed on why healthcare professionals do not follow the NRP (AAP & AHA, 2016) guidelines for suctioning of the term newborn at birth.
- Evidence-based specific protocols need to be developed for the procedure of newborn airway clearance.

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