Oxygen Therapy in Newborn Resuscitation

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During the transition from fetus to newborn, premature and full term babies may require supplemental oxygen to meet their metabolic demands. In recent years, a considerable number of studies have been performed to assess the need and the percentage of supplemental oxygen required in the delivery room. This review focuses on current recommendations for monitoring oxygenation during this transition.

The 2005 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care of Pediatric and Neonatal Patients: Neonatal Resuscitation Guidelines\(^1\) described neonatal transition as a gradual process. These guidelines warned against the potential for oxidative stress-related organ damage as a result of excessive oxygen administration. Rather than seeking to immediately maximize a neonate’s oxygenation status using 100% oxygen, individualized oxygen therapy using pulse oximetry monitoring and air/oxygen blenders was suggested. However, at that time, normative pulse oximetry data during neonatal transition were lacking, thus creating uncertainty regarding the specific oxygenation levels that should be targeted. Since these 2005 guidelines, substantial progress has been made in the approach to oxygen therapy during resuscitation. O’Donnell et al (2005)\(^2\) demonstrated that one can obtain a heart rate (and thus oximetry) signal most rapidly by attaching the oximeter probe to a newborn baby’s right hand/wrist prior to plugging the probe into the oximeter cable. These same researchers have since established that pulse oximetry is a better assessment tool than clinical evaluation of newborn color. Utilizing high-definition videos of newborn deliveries with real-time pulse oximetry, O’Donnell et al \(^3\) convincingly demonstrated the inability of both clinicians and non-clinician observers to detect “pink” in a given neonate.

Numerous projects have demonstrated the feasibility of oxygen titration in the delivery room, with attention paid to both short- and long-term outcomes. For example, Wang et al (2008)\(^4\) demonstrated adequate resuscitation outcomes in 23-32wk premature neonates utilizing a titration paradigm, although they also noted that all babies started on room air eventually required oxygen. Similar results were reported by Dawson et al (2009)\(^5\), who compared premature newborns <30wk subjected to a new resuscitation policy of titration starting with room air, to historical controls who had received 100% oxygen throughout resuscitation. Both groups demonstrated similar heart rate trends and resuscitation outcomes, however 92% of the babies started on room air eventually required supplemental oxygen administration. These studies both concluded that room air (Fraction of inspired oxygen - FiO\(_2\) = 0.21) may provide an inadequate supply of oxygen for resuscitation in the premature newborn population.

In an additional study, Escrig et al (2008)\(^6\) compared premature newborns <28wk randomly assigned to commence resuscitation with a FiO\(_2\) of either 0.30 or 0.90 and undergo oxygen titration with a goal oxygen saturation (SpO\(_2\)) of 85% at 10 minutes of postnatal age. In this short-term study, both groups achieved satisfactory outcomes with indistinguishable heart rates and pulse oximetry trends over the course of resuscitation. Interestingly, both groups were titrated to a similar mean FiO\(_2\) by 15 minutes of resuscitation (0.32 vs. 0.34) and at both 10 and 20 minutes into resuscitation, the low oxygen group (with initial FiO\(_2\) 0.30) was more likely than the high oxygen group to have been weaned to room air.

Further, a growing body of both animal and human studies have demonstrated the relationship between excess oxygen usage in the delivery room and both oxidative and inflammatory stress outcomes, both in the short- and long-term. For example, Ezaki et al (2009)\(^7\) compared measures of oxidative stress markers at one hour of age between groups of premature neonates (<35wk) randomized to receive either 100% oxygen throughout resuscitation versus an oxygen titration strategy. In this analysis, babies exposed to continuous 100% oxygen demonstrated elevated serum oxidative stress markers and diminished reduction potential compared to those who underwent oxygen titration.

In another study, Vento et al (2009)\(^8\) compared 24-28wk premature newborns randomized to commence resuscitation with FiO\(_2\) of either 0.30 or 0.90 with titration to SpO\(_2\) 75% at 5 minutes and 85% at 10 minutes. Short- and long-term clinical outcomes were compared along with oxidative stress and inflammatory markers. Consistent with previous studies, short-term outcomes...
NYS Premature Infant Health Network

The Association of Perinatal Networks

In an effort to better understand the challenges premature infants and their caregivers encounter both in the NICU and when care begins at home, the Association of Perinatal Networks - through the facilitation of the Premature Infant Health Network (PIHN) - brings together those that provide care to premature infants and children to determine ways to improve services both in the hospital setting as well as in the communities where families live.

The Association of Perinatal Networks of New York (APN) is an organization comprised of the perinatal networks located throughout New York State – www.associationofperinatalnetworks.org.

Our mission is to improve perinatal, maternal and child health and to support the work of the individual Perinatal Networks.

Helpful Resources: Special Delivery and Advocacy Tool Kit

It can be difficult for premature infant advocates of all levels to know where to begin. Parents in particular expressed a deep concern for not knowing how to advocate for their premature infant at the PIHN meetings in 2010. Resources like the Advocacy Tool Kit and the Special Delivery program can be equally useful for professionals, parents, families, and advocacy groups.

The Advocacy Tool Kit is a PDF named “Voices for the Voiceless: a Premature Infant Advocacy Training Guide.” The document provides the information, guidance and resources necessary to become an effective advocate for preemies, no matter what level of involvement you may have in advocacy action. The Tool Kit is also a comprehensive educational piece that gives an overview of the issues related to prematurity and their prevalence. Included in the document is a set of tools one can use on any level of advocacy, which can prepare someone for advocating for other families or their own.

The Special Delivery program is specifically directed at helping advocacy groups, allowing them to order materials with topics that are relevant to parents with premature infants and customize them with the organization's logo. This strategy helps advocacy groups promote their services while distributing information on preemies to parents. The topics include specific premature infant issues – from health problems like RSV and lung complications, to medical costs and special accommodations parents should make for their preemie. You can register for the Special Delivery program by visiting Navigating the Premature Journey – www.specialdeliveryhandlewithcare.com.

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demonstrated satisfactory resuscitation outcomes for both groups. In long-term follow-up, the high oxygen (FiO2 0.90) group demonstrated a longer duration of oxygen treatment (mean 32 vs. 6 d), of mechanical ventilation (mean 27 vs. 13 d), of CPAP therapy (mean 12 vs. 4 d), and a higher rate of bronchopulmonary dysplasia (BPD) -13 versus 6%. Furthermore, the high oxygen group also displayed elevated serum oxidative stress (oxidized/reduced glutathione ratio) and inflammatory markers (TNF-α and IL-8) on serial measurements when compared to the low oxygen group. Lastly, the authors demonstrated that elevated oxidative stress markers were more likely to be found in patients later diagnosed with BPD than those without this diagnosis, suggesting a possible causal link between high oxygen content used during resuscitation and later development of BPD.

In 2010, Dawson et al9 published normative curves for pulse oximetry data resulting from a multicenter study on healthy newborns not requiring oxygen therapy. In this benchmark publication, data were stratified for full term, for preterms between 32-36 weeks, and for preterms <32weeks as individual normative diagrams. These data demonstrate that newborn transition - as assessed by changes in SpO2, using pulse oximetry - is a gradual process with a wide degree of variation. Specifically, across all patient groups, it is normal for 4-6 minutes to elapse before oxygen saturations of >90% are achieved. Thinking forward, it is important to keep this in mind when evaluating a given neonate’s response to resuscitation in the delivery room.

In 2010, the International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations10 was published to include the results of these numerous studies in a formal set of resuscitation guidelines. Immediate preducltal pulse oximetry is now recommended for all neonates <37wk and full term babies with diminished respiratory effort, a weak cry, or poor tone. Further, where usage of oxygen is required, the new guidelines recommend starting with room air rather than 100% oxygen and titrating according to normative oxygen curves using mixed air/oxygen blenders. With this approach, current strategies are targeted to minimize oxidative stress and inflammatory injury caused by the delivery of excessive oxygen in the delivery room.

References:

Early Research Shows

Text4baby is Effective!

San Diego Researchers First to Report Positive Impact of Text4Baby Program

San Marcos, CA, November 1, 2011 – Researchers at the National Latino Research Center (NLRC) at Cal State San Marcos and the Department of Reproductive Medicine at UCSD will present data at the American Public Health Association Conference in Washington D.C. this week demonstrating impact of text4baby, a free mobile health information service for pregnant women and new mothers in San Diego.

Research indicates high satisfaction with the service and an increase in users’ health knowledge, improved interaction with healthcare providers, improved adherence to appointments and immunizations and increased access to health resources. The findings demonstrate the positive impact of mobile health interventions, like the text4baby program.

Funded by the Alliance Healthcare Foundation, researchers partnered with the San Diego County Medical Society Foundation, Voxiva, Healthy Mothers Healthy Babies Coalition and the San Diego Text4Baby Coalition to introduce text4baby to San Diego County. Text4baby is a free mobile health information service that provides pregnant women and new moms with maternal, fetal and newborn health information via text messages and connects them to national health resources.

The San Diego research team is the first in the nation to evaluate the text4baby service. Phase one of the evaluations describes the experience of San Diego women enrolled in text4baby and shows promising results.

- Women reported high satisfaction with text4baby, with Spanish speaking women reporting even higher satisfaction scores than English-speaking women.
- 63.1 percent of women reported that text4baby helped them remember an appointment or immunization that they or their child needed.
- 75.4 percent reported that text4baby messages informed them of medical warning signs they did not know.
- 71.3 percent reported talking to their doctor about a topic that they read on a text4baby message.
- 38.5 percent reported that they called a service or phone number that they received from text4baby.

According to principal investigator Dr. Konane Martinez, “the results of this phase of the research provide promising data that mobile technology can be an important source of health information.” Judy Meehan, CEO of the Healthy Mothers Healthy Babies Coalition says, “This independent, formal evaluation illustrates that text4baby is a practical, valuable resource for today’s moms. We appreciate the hard work of our San Diego partners in conducting the study and more broadly, promoting the service.”

Stuart Cohen, MD, vice chair for the California District, American Academy of Pediatrics and president of the San Diego County Medical Society Foundation Board, says the results show that text4baby can improve health outcomes for infants. “Not only are women getting information they did not know, but the information is starting conversations between the parent and healthcare provider. A better informed parent provides the best chance for a healthy baby.”

Alliance Healthcare Foundation Board chair Robert B. McCray, a healthcare technology entrepreneur and president of the Wireless-Life Sciences Alliance, is excited about the potential for mobile health information. “It’s clear from the results of the study that women like receiving health information via text messages, and will act upon the knowledge they receive. This should prove beneficial for other health issues as well, regardless of the socioeconomic status of the target population.”

The San Diego text4baby coalition and implementation team will begin customizing referrals to services in San Diego in lieu of the national resources and anticipates an evaluation of this customized San Diego Resource in 2012. Project coordinator Anna Hoff states that team hopes that “customization of local prenatal and newborn resources in San Diego will facilitate easier access and utilization of free and low cost services for expectant and new parents.”

To date, more than 2,200 individuals have enrolled in and used the text4baby mobile messaging service in San Diego. Expectant and new parents can enroll in text4baby by simply texting “baby,” or “bebé” for Spanish language messages, to 511411. The service is free. In addition to local funding from Alliance Healthcare Foundation and First 5 San Diego, the program receives support nationally from Founding Sponsor Johnson & Johnson.

For more information on text2baby, contact Anna Hoff at 760-750-3504 or ahoff@csusm.edu, or Konane Martinez at 760-750-8567 or kmartine@csusm.edu.
The morning keynote speaker and pre-conference grand rounds presenter was Raymond L. Cox, MD, MBA, Senior Vice President, Medical Affairs and Chief Medical Officer, Providence Hospital, Washington, DC. Dr. Cox spoke on “Achieving Equity in Women’s Health”. He shared how healthcare system inequalities impact health equity and suggested solutions for reducing health disparities.

Guest speaker, Judith Arnold, MPP, Director Division of Coverage and Enrollment, NYS Department of Health, described the charge of the Medicaid Redesign Team (MRT) and Medicaid changes in the Affordable Care Act; reviewed the update on MRT implementation and next steps and discussed the coordination of Medicaid with the Exchange in her presentation on “Reforming Medicaid in New York: The Opportunity of the Affordable Care Act and the Medicaid Redesign Team”.

Leonardo Trasande, MD, MPP, Associate Professor in Pediatrics and Preventive Medicine, New York University Medical College, delivered the afternoon keynote session “Early Life Determinants of Childhood Obesity and Early Cardiovascular Disease”. He discussed the role of environmental factors in childhood obesity and reviewed the approach epidemiologic studies take to unearthing the role of these factors.

“Maternal Benefits of Breastfeeding” presented by Andrew Elimian, MD, Professor, OB/GYN, NY Medical College; Chief, Maternal Fetal Medicine WMC; concluded the afternoon talks by reviewing the direct and indirect maternal benefits of breastfeeding.

Cheryl Hunter-Grant, LMSW, CLC, Executive Director, LHVPN wrapped up the conference with closing remarks. She urged conference participants to work collaboratively to deliver consistent clear messages our communities need to hear and to pool our resources in these financially challenging times to enhance the lives of women, children, and families.