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Diagnosis of Interrupted Aortic Arch & Aortopulmonary Window After CCHD Screening

By Jeffrey Nafash, MD, MPH; Adity Joshi, MD; David Sorrentino, MD; Benjamin Lentzner, MD

Introduction

Since 2011, the Secretary of Health and Human Services (HHS) has recommended that screening for Critical Congenital Heart Disease (CCHD) via pulse oximetry be included in the uniform screening panel for all newborn infants in the well-baby nursery.[1]

This screening test has subsequently been endorsed by the American Academy of Pediatrics (AAP). Today, it is estimated that >/= 90% of infants born in the United States undergo this screening prior to discharge from the hospital.[2] Before Universal CCHD screening, up to 37% of CCHD cases were not identified before the first day of life or before discharge from the hospital.[3-5] CCHD screening with pulse oximetry has been shown to have a sensitivity of 76.5% and a specificity of 99.9%.[5,6] Pulse oximetry does not seek to diagnose specific subtypes of heart disease; rather, it is designed to identify patients who would immediately benefit from further evaluation.

An Aortopulmonary Septal Defect, or Aortopulmonary Window (APW), is an abnormal residual interarterial communication between the ascending aorta and the pulmonary artery above the level of the semilunar valves. An Interrupted Aortic Arch (IAA) refers to a complete anatomic discontinuity between two adjacent segments of the aorta along the arch. APWs are rare, appearing in fewer than 0.1-0.2 % of patients with Congenital Heart Defects; in 52% of cases, patients have another accompanying cardiac lesion.[7] Reports of an association of an APW with an IAA (APW+IAA) are limited to isolated case reports and series.[8-11] In 2010, Hayashi et al. reported the first case of APW+IAA that was diagnosed via fetal echocardiography.[9] Here we present a case where pulse oximetry screening alerted medical staff to a possible CCHD that ultimately led to the diagnosis of an APW with a Type A IAA. To our knowledge, this is the first reported case in the published literature where a positive CCHD pulse oximetry screen led to the diagnosis of APW + IAA.

Case

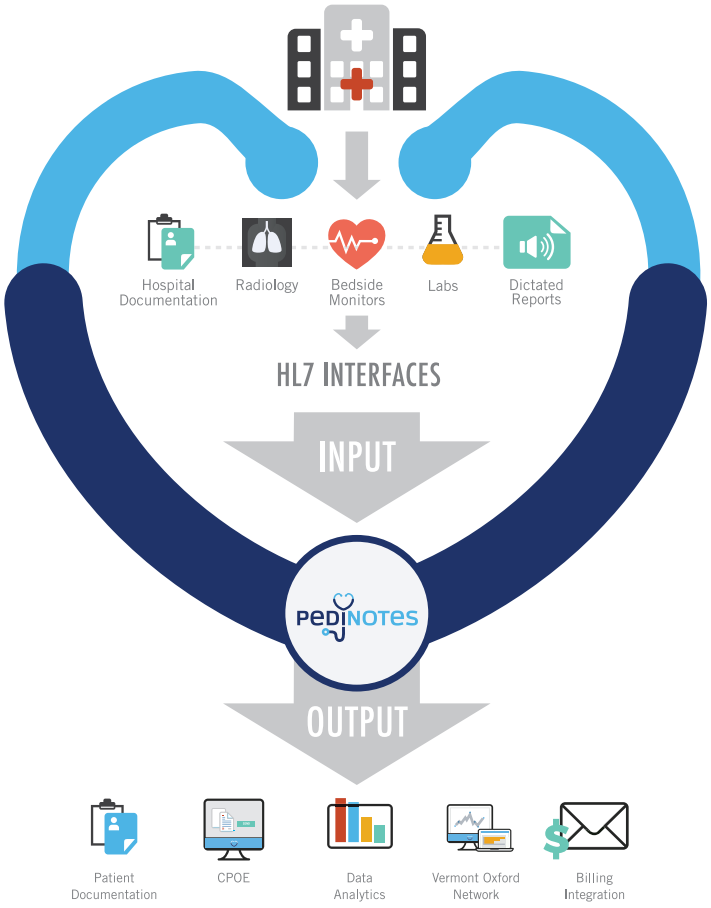
A 30-year-old, gravida 6 para 5, woman delivered at 37 weeks and 5 days a healthy-appearing, 2710g male via an uncomplicated vaginal delivery following an uncomplicated pregnancy. No cardiac malformations were noted during routine prenatal ultrasonography. The baby's initial physical examination in the delivery room was noted to be within normal limits, and he was transferred to the newborn nursery. Initially, he breastfed without difficulty, and was able to breathe comfortably on room air.

On Day of Life (DOL) 1, the infant underwent the Critical Congenital Heart Disease screen and failed. He was noted to have a preductal oxygen saturation of 96% and a post-ductal oxygen saturation of 90%. This was confirmed on repeat testing. On repeat physical exam in the newborn nursery, he was noted to have decreased femoral pulses bilaterally and a grade 1/6 systolic murmur heard best at the left upper sternal border.

> ***"CCHD screening with pulse oximetry has been shown to have a sensitivity of 76.5% and a specificity of 99.9%.[5,6] Pulse oximetry does not seek to diagnose specific subtypes of heart disease; rather, it is designed to identify patients who would immediately benefit from further evaluation."***

PEDINOTES

Better Data. Better Care.



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The lungs were clear to auscultation bilaterally and there was no hepatomegaly. Blood pressure assessment of all four limbs demonstrated a BP of 71/32 in the right arm, 69/32 in the left arm, 61/22 in the right leg, and 60/28 in the left leg. The infant was subsequently transferred to the Neonatal Intensive Care Unit (NICU) and an echocardiogram was performed. The echocardiogram demonstrated an interrupted aortic arch, Type A (Image 1), a large aortopulmonary window (Image 2 & 3), a moderate-sized Patent Ductus Arteriosus (PDA), a Patent Foramen Ovale, (PFO) and good biventricular systolic function. An alprostadil infusion was started to maintain patency of the ductus arteriosus. The infant was subsequently transported to a quaternary center with a pediatric cardiothoracic surgery program. He underwent successful surgical repair of both the aortic arch and the aortopulmonary window, and the ductus arteriosus was ligated and divided.

Discussion

Congenital Heart Defects (CHD) affect about 1% of births per year. Only 25% of those are considered to be critical and require surgical intervention within the first year of life.[5] Although there has been significant progress in diagnosis and treatment of these conditions, 30% of infant fatalities in the US are secondary to CCHD.[12] While CCHD is rare among live births with CHD, two distinct embryologic congenital heart defects occurring together is exceedingly rare. Our patient had a Type A IAA, which is a ductal-dependent CCHD, as well as an APW. There are three types of IAA based on the location of discontinuity of the aortic arch: Type A occurs between the left subclavian artery and the descending aorta; Type B occurs between the left common carotid and the left subclavian arteries; and Type C occurs between the brachiocephalic and the left common carotid arteries.[13] Interestingly, while type B is the most common type of IAA when it occurs in isolation, our patient presented with a type A IAA with an APW, which is consistent with other limited published case reports on IAA occurring with other Congenital Heart Defects.[8,9]

Prenatal diagnosis of aortic arch defects is challenging with ultrasound, and infants with such defects are often asymptomatic at birth. There have been reported cases of APW + IAA detected by fetal echocardiography, but the rarity of these defects makes detection difficult, and routine obstetrical sonography may not always be reliable. Identification of such defects antenatally depends on many factors, including operator expertise, gestational age of the fetus, fetal position, and the type of cardiac defect.[14,15] Vogel et al. in 2010 evaluated the overall fetal diagnosis of IAA, and noted that the ductus arteriosus can often be confused with the aortic arch on ultrasound. Many of the cases are not noted to have abnormalities on routine prenatal ultrasounds, and thus, do not undergo a fetal echocardiogram.[16] Peterson et al. analyzed the cost burden

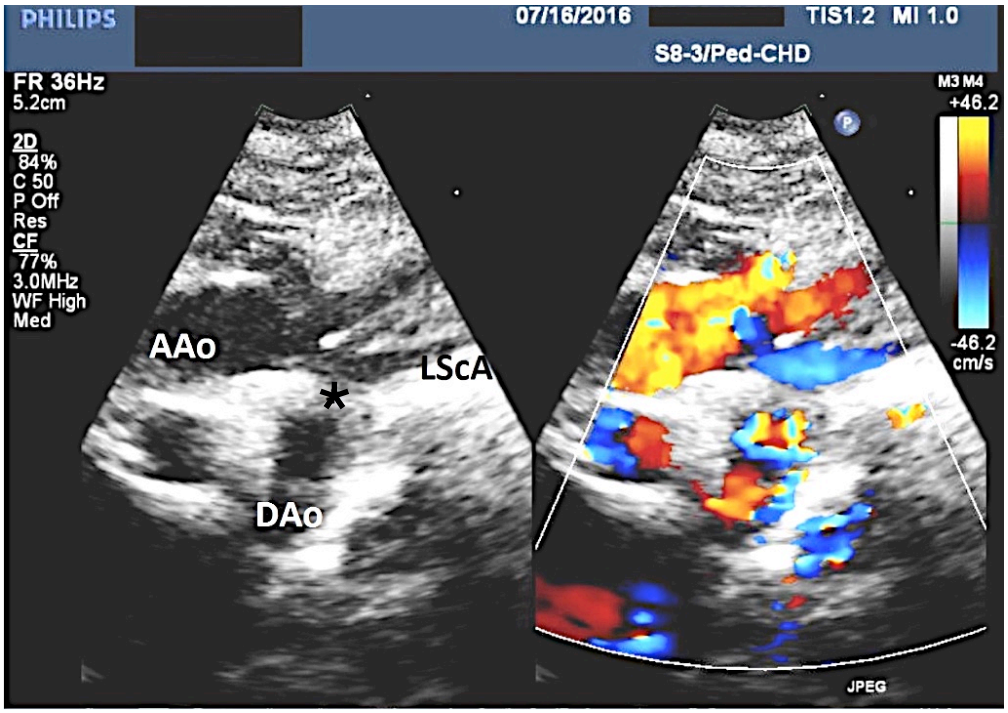

*Figure 1. Echocardiogram image of the interrupted aortic arch, with discontinuity of the aorta distal to the left subclavian artery (LScA). AAo = ascending aorta; Dao = descending aorta; * = region of the interruption.*

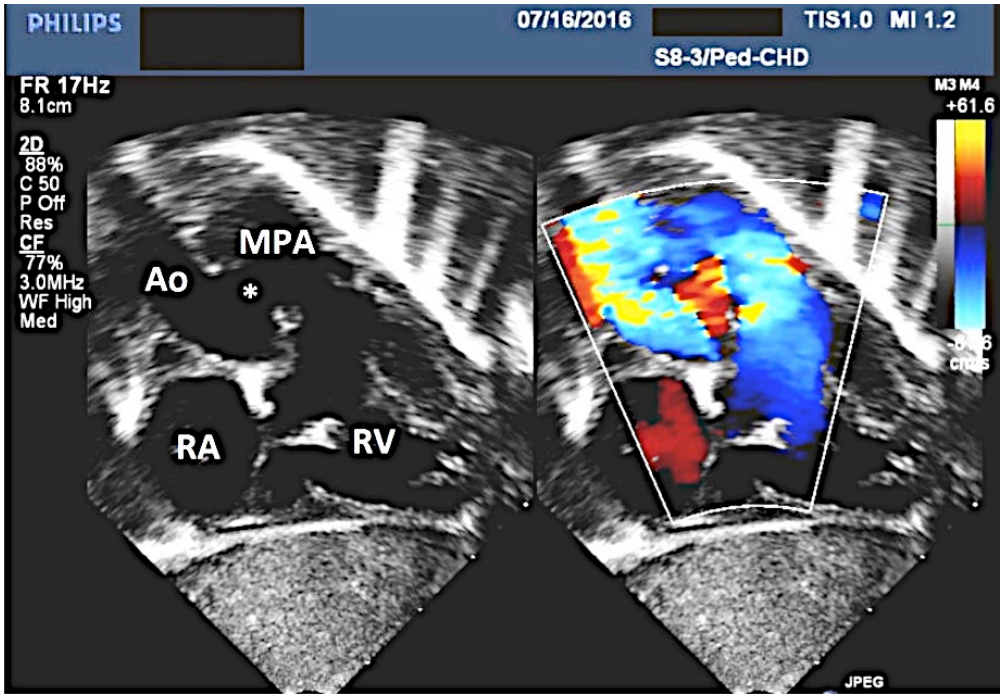

*Figure 2. Echocardiogram image of the Aortopulmonary Window. Ao = aorta; MPA = main pulmonary artery; RA = right atrium; RV = right ventricle; * = Aortopulmonary Window.*

EVIDENCE-BASED WEBINAR

Early Inhaled Nitric Oxide and Progression of Hypoxic Respiratory Failure (HRF)

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Review various elements of HRF treatment, including:

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- The pathophysiology of HRF
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Women and Children's Hospital of Buffalo

Ashley Darcy Mahoney, PhD, NNP-BC
Neonatal Nurse Practitioner, South Dade Neonatology
Assistant Professor, Emory University School of Nursing

Indication

INOMAX is indicated to improve oxygenation and reduce the need for extracorporeal membrane oxygenation in term and near-term (>34 weeks gestation) neonates with hypoxic respiratory failure associated with clinical or echocardiographic evidence of pulmonary hypertension in conjunction with ventilatory support and other appropriate agents.

Important Safety Information

- INOMAX is contraindicated in the treatment of neonates dependent on right-to-left shunting of blood.
- Abrupt discontinuation of INOMAX may lead to increasing pulmonary artery pressure and worsening oxygenation.
- Methemoglobinemia and NO_2 levels are dose dependent. Nitric oxide donor compounds may have an additive effect with INOMAX on the risk of developing methemoglobinemia. Nitrogen dioxide may cause airway inflammation and damage to lung tissues.
- In patients with pre-existing left ventricular dysfunction, INOMAX may increase pulmonary capillary wedge pressure leading to pulmonary edema.
- Monitor for PaO_2, inspired NO_2, and methemoglobin during INOMAX administration.
- INOMAX must be administered using a calibrated INOmax DS_{IR}® Nitric Oxide Delivery System operated by trained personnel. Only validated ventilator systems should be used in conjunction with INOMAX.

Please see Brief Summary of Prescribing Information on adjacent page.

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Brief Summary of Prescribing Information

INDICATIONS AND USAGE

Treatment of Hypoxic Respiratory Failure

INOmax® is indicated to improve oxygenation and reduce the need for extracorporeal membrane oxygenation in term and near-term (>34 weeks) neonates with hypoxic respiratory failure associated with clinical or echocardiographic evidence of pulmonary hypertension in conjunction with ventilator support and other appropriate agents.

CONTRAINDICATIONS

INOmax is contraindicated in neonates dependent on right-to-left shunting of blood.

WARNINGS AND PRECAUTIONS

Rebound Pulmonary Hypertension Syndrome following Abrupt Discontinuation

Wean from INOmax. Abrupt discontinuation of INOmax may lead to worsening oxygenation and increasing pulmonary artery pressure, i.e., Rebound Pulmonary Hypertension Syndrome. Signs and symptoms of Rebound Pulmonary Hypertension Syndrome include hypoxemia, systemic hypotension, bradycardia, and decreased cardiac output. If Rebound Pulmonary Hypertension occurs, reinstate INOmax therapy immediately.

Hypoxemia from Methemoglobinemia

Nitric oxide combines with hemoglobin to form methemoglobin, which does not transport oxygen. Methemoglobin levels increase with the dose of INOmax; it can take 8 hours or more before steady-state methemoglobin levels are attained. Monitor methemoglobin and adjust the dose of INOmax to optimize oxygenation.

If methemoglobin levels do not resolve with decrease in dose or discontinuation of INOmax, additional therapy may be warranted to treat methemoglobinemia.

Airway Injury from Nitrogen Dioxide

Nitrogen dioxide (NO_2) forms in gas mixtures containing NO and O_2. Nitrogen dioxide may cause airway inflammation and damage to lung tissues.

If there is an unexpected change in NO_2 concentration, or if the NO_2 concentration reaches 3 ppm when measured in the breathing circuit, then the delivery system should be assessed in accordance with the Nitric Oxide Delivery System O&M Manual troubleshooting section, and the NO_2 analyzer should be recalibrated. The dose of INOmax and/or FiO_2 should be adjusted as appropriate.

Worsening Heart Failure

Patients with left ventricular dysfunction treated with INOmax may experience pulmonary edema, increased pulmonary capillary wedge pressure, worsening of left ventricular dysfunction, systemic hypotension, bradycardia and cardiac arrest. Discontinue INOmax while providing symptomatic care.

ADVERSE REACTIONS

Because clinical trials are conducted under widely varying conditions, adverse reaction rates observed in the clinical trials of a drug cannot be directly compared to rates in the clinical trials of another drug and may not reflect the rates observed in practice. The adverse reaction information from the clinical studies does, however, provide a basis for identifying the adverse events that appear to be related to drug use and for approximating rates.

Controlled studies have included 325 patients on INOmax doses of 5 to 80 ppm and 251 patients on placebo. Total mortality in the pooled trials was 11% on placebo and 9% on INOmax, a result adequate to exclude INOmax mortality being more than 40% worse than placebo.

In both the NINOS and CINRGI studies, the duration of hospitalization was similar in INOmax and placebo-treated groups.

From all controlled studies, at least 6 months of follow-up is available for 278 patients who received INOmax and 212 patients who received placebo. Among these patients, there was no evidence of an adverse effect of treatment on the need for rehospitalization, special medical services, pulmonary disease, or neurological sequelae.

In the NINOS study, treatment groups were similar with respect to the incidence and severity of intracranial hemorrhage, Grade IV hemorrhage, periventricular leukomalacia, cerebral infarction, seizures requiring anticonvulsant therapy, pulmonary hemorrhage, or gastrointestinal hemorrhage.

In CINRGI, the only adverse reaction (>2% higher incidence on INOmax than on placebo) was hypotension (14% vs. 11%).

Based upon post-marketing experience, accidental exposure to nitric oxide for inhalation in hospital staff has been associated with chest discomfort, dizziness, dry throat, dyspnea, and headache.

DRUG INTERACTIONS

Nitric Oxide Donor Agents

Nitric oxide donor agents such as prilocaine, sodium nitroprusside and nitroglycerine may increase the risk of developing methemoglobinemia.

OVERDOSAGE

Overdosage with INOmax is manifest by elevations in methemoglobin and pulmonary toxicities associated with inspired NO_2. Elevated NO_2 may cause acute lung injury. Elevations in methemoglobin reduce the oxygen delivery capacity of the circulation. In clinical studies, NO_2 levels >3 ppm or methemoglobin levels >7% were treated by reducing the dose of, or discontinuing, INOmax.

Methemoglobinemia that does not resolve after reduction or discontinuation of therapy can be treated with intravenous vitamin C, intravenous methylene blue, or blood transfusion, based upon the clinical situation.

 IMK111-01540 R2 January 2016

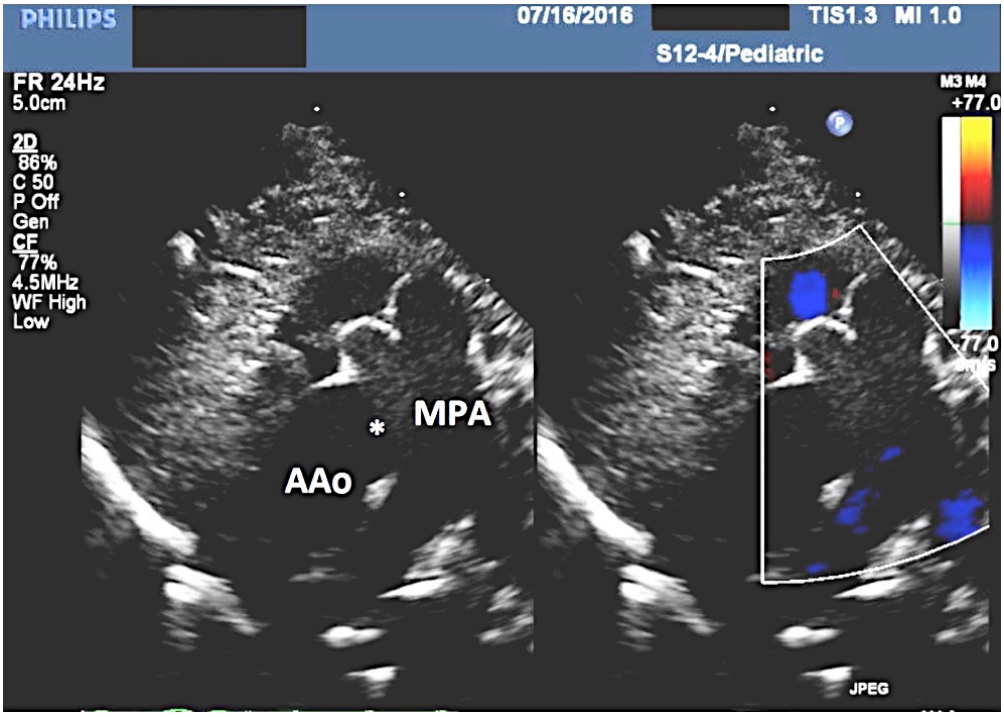

*Figure 3. Echocardiogram image of the Aortopulmonary Window. AAo = ascending aorta; MPA = main pulmonary artery; * = Aortopulmonary Window.*

of screening CCHD using pulse oximetry, and reported the screening test to be cost-effective. They found testing incurs a cost of $13.50 per newborn, potentially identifies 1189 newborns with CCHD per year at the birth hospital, and potentially averts 20 infant deaths annually.[17]

Early diagnosis is critical in these cases, whether in the prenatal or early postnatal period, as a delayed diagnosis can result in significant morbidity and mortality. It is also important to consider staff education on the screening tools available for CCHD and appropriate protocols for abnormal screen results. A recent brief in the *NeoReviews* discussed how the lack of staff knowledge and improper reporting systems can result in preventable death.[18] As CCHD screening becomes an integral part of routine newborn care, all members of staff caring for newborn infants need to be informed of this screening, the reason for it being widely adopted, and the important signs and symptoms relating to an abnormal CCHD screen. Garg et al. surveyed pediatric residents at a large academic center and found a significant gap in knowledge across all years of training. Educational interventions with simplified teaching programs can decrease the knowledge gap and empower residents, attending physicians and nurses with the knowledge to be more confident with the screening tool.[19]

Conclusion

Early diagnosis of CCHD is paramount for decreasing morbidity and mortality. Pulse oximetry screening for CCHD has been shown to be a cost-effective and simple test that is able to increase the swift identification of CCHD, and, therefore, subsequently reduce mortality. Our patient is the first known reported case in the medical literature where an abnormal CCHD pulse oximetry screen led to the diagnosis of APW + IAA, which is a very rare combination of CCHD with a potentially fatal outcome.

"Early diagnosis of CCHD is paramount for decreasing morbidity and mortality. Pulse oximetry screening for CCHD has been shown to be a cost-effective and simple test that is able to increase the swift identification of CCHD, and, therefore, subsequently reduce mortality. Our patient is the first known reported case in the medical literature where an abnormal CCHD pulse oximetry screen led to the diagnosis of APW + IAA, which is a very rare combination of CCHD with a potentially fatal outcome."

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Biographical Sketch – Dr. Jeffrey Nafash is a first year Pediatrics Resident at the Rutgers Robert Wood Johnson Medical School. He completed his medical education at the Royal College of Surgeons in Ireland and Masters of Public Health at Thomas Jefferson University.

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CONTEMPORARY FORUMS

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IMPROVING OUTCOMES IN PERINATAL AND NEONATAL CARE

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THIS CONFERENCE WILL ENABLE NEONATAL CLINICIANS TO:

- Describe new diagnostic tools and procedures, including the Sepsis Calculator, use of Ultrasound at the bedside and Rapid Human Genome Sequencing.
- Identify pre- and postoperative management of newborns with surgical conditions.
- Evaluate the effects on the neonate of prenatal drug exposure and maternal hypertensive-related crises.
- Determine optimal nutrition strategies utilizing evidence-based choice of formula, hypoglycemia management protocols and consideration of specific nutritional requirements of neonates.
- Investigate practical, realistic approaches to partnering with families to create a sense of collaboration and transparency.

WHO SHOULD ATTEND?

EVERYONE INVOLVED IN THE CARE OF HIGH-RISK NEWBORNS INCLUDING:

- Neonatologists
- Pediatricians
- Pharmacists
- Clinical Nurse Specialists
- Nurse Practitioners
- Staff Nurses
- Nurse Managers
- Physician Assistants
- Educators and Instructors
- Case Managers
- Transport Teams
- Respiratory Therapists

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The National Perinatal Association: Honoring the Past, Embracing the Future

By Cheryl A. Milford, EdS; Erika Goyer; Kristy Love

Members of the NPA write a regular column in *Neonatology Today*.

When you look around the modern Neonatal Intensive Care Unit (NICU), it is easy to forget how young the discipline of Neonatology is. The term "Neonatology" was first introduced by Alexander J. Schaffer in his textbook,"Diseases of the Newborn," published in 1960. And it wasn't until 1975 that the first examinations of the Sub-Board of Neonatal-Perinatal Medicine of the American Board of Pediatrics were administered, and the first meeting of the Perinatal Section of the American Academy of Pediatrics was held.

Our ability to care for sick and premature infants was enabled by the introduction of technology that supported thermoregulation, nutrition, and respiration – allowing a baby to survive. But advances in neonatal care have, ultimately, been driven by our desire to help babies thrive. We don't want to just save a baby, we want to return them to a family which is empowered, informed, and prepared to care for them.

That goal has been the guiding principle of the National Perinatal Association and this year the NPA celebrates its 40th Anniversary with the theme of "Honoring the Past; Embracing the Future."

Established in 1977, the National Perinatal Association (NPA) has a forty-year history of leadership and advocacy in improving perinatal care. Our founders knew that the key to improving care was collaboration. Perinatal professionals need to listen to and learn from each other, as well as from the families we serve. This sort of progress requires commitment and inspired leadership.

The NPA has benefitted from the contributions of luminary leadership, beginning with Stanley Graven and Sister Jeanne Meurer, and continuing to the present leadership. Since its inception, the NPA has been a home for new ideas and progressive practices. Our long history of interdisciplinary collaboration and parent involvement has made us unique among professional perinatal organizations, and has established our reputation as credible, progressive thought leaders.

The NPA Board of Directors leads the activities of this innovative nonprofit. They represent the fields of neonatology, pediatrics, obstetrics, midwifery, nursing, parenting, social work, law, psychology, education, nutrition, and research. Students in perinatal health are also on the board. By working together, the Board is able to integrate each member's expertise and experience into one interdisciplinary perspective. By engaging others within our varied fields of influence, the NPA provides a forum for communication and collaboration to create products and services that reach far beyond what each member could accomplish individually.

The NPA's mission is to Educate, Advocate and Integrate.

Education

NPA provides educational opportunities to increase knowledge of innovative, evidence-based practices in perinatal care including:

- Annual conferences that address current issues, practices, policies, and dilemmas in perinatal care and interdisciplinary perspective, like our March *2018 Perinatal Substance Use: Evidence-Based Solutions and Support for the Family.*
- Innovative, family-centered care recommendations like our State-of-the-Art article introducing the paradigm-shifted fundamentals of creating a Neonatal Intensive Parenting Unit (NIPU) and the forthcoming *Recommendation for Supporting Families and Babies Affected by Perinatal Substance Use*.

Advocacy

NPA advocates for the creation of professional standards, promotion of practices that improve perinatal outcomes, and enhamcement of policies that ensure justice for pregnant women, infants, and families at risk. We have created:

- A workgroup of psychiatrists, psychologists, social workers, and other metal health providers to advocate for mental health care and psychological services in the NICU and to address their training and competencies.
- Position papers, policy statements, and amici briefs to advocate for thoughtful healthcare reform, promote the Ethical Use of Assisted Reproductive Technologies, and support the Legal Autonomy of Pregnant Women.

Integration

NPA facilitates collaboration across all disciplines by bringing people together to share, listen, and learn from each other as we all work together to improve perinatal care. This has resulted in:

- Creation and publication of the *Interdisciplinary Recommendations for Psychosocial Support of NICU Parents.*
- Published guidelines like NPA's *Multidisciplinary Guidelines for Care of the Late Preterm Infant,* and our recently published *Interdisciplinary Guidelines for Care of Women Presenting to the Emergency Department with Pregnancy Loss*, as well as evidence-based *RSV Prevention Guidelines* - (http://www.neonatologytoday.net/newsletters/nt-nov14.pdf).

- Formation of the National Perinatal Association Student Society (NPASS) to mentor the next generation of perinatal professionals in NPASS chapters around the country.

The NPA's vision brings all stakeholders to the table to promote optimal perinatal care in the United States. Our uniqueness in the non-profit sector is our commitment to all voices being heard equally and respectfully. NPA is families and professionals working to improve perinatal care… together.

"The NPA's mission is to Educate, Advocate and Integrate"

The National Perinatal Association invites you to become a member. Join us in educating, advocating and integrating optimal perinatal care into our health care system and our communities. Your generous contributions to NPA provide us with the resources we need to embrace the future. To learn more, go to: www.nationalperinatal.org.

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JANUARY MEDICAL MEETING FOCUS

NeoPREP An Intensive Review & Update of Neonatal-Perinatal Medicine
Jan. 20-26, 2018; Atlanta. GA USA
https://shop.aap.org/live-activities/

Description & Learning Objectives:
An intensive review of neonatal-perinatal medicine emphasizing physiology and pathophysiology of neonatal conditions, and the scientific basis for the clinical practice of neonatology. The course content is guided by the American Board (ABP) of Pediatrics Neonatal-Perinatal Content Specifications Outline, and is appropriate for individuals preparing for the ABP neonatal-perinatal subspecialty examination or the ABP Maintenance of Certification (MOC).

The course takes an educational approach featuring lectures, audience response Q&A sessions, case-based problem solving discussions, and mock-review question sessions. A comprehensive electronic syllabus will be provided to each attendee.

Who Should Attend:
- A neonatology fellow or neonatologist who desires a comprehensive review of neonatal medicine as part of preparation for the initial board certification examination in neonatal-perinatal medicine administered by the ABP.
- An experienced neonatologist who wants a comprehensive review of neonatal medicine to enhance clinical care and/or as part of their preparation for the neonatal-perinatal medicine subspecialty Maintenance of Certification exam administered by the ABP
- A pediatrician, NP, PA, or others allied to the field.

Course Highlights:
- Case-based interactive sessions that include calculations and visual diagnosis.
- Concurrent Breakout Sessions.
- Taught by a well-known International faculty.

Objectives:
Upon completion of the course, attendees will be better able to:
- Integrate knowledge of physiology, pathophysiology, and evidence-based. treatments into the practice of neonatal-perinatal medicine.
- Diagnose and manage complex or difficult neonatal-perinatal cases through interactive case analysis.
- Discuss neonatal-perinatal practice issues through informal learning in group case-based discussion sessions.
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Can Video Laryngoscopy Improve Trainee Success in Intubation?

By Michael Narvey, MD

Originally Published on:

All Things Neonatal
http://www.allthingsneonatal.com
July 5, 2017; Republished here with permission.

Things aren't the way they used to be. When I was training, opportunities abounded for opportunities to intubate infants. Then we did away with intubating vigourous infants born through meconium and now won't be electively intubating them at all.

Then you can add in the move towards use of non-invasive respiratory support instead of intubating and giving surfactant and voila…you have the perfect barrier for training residents and others how to intubate. On top of all of this, the competition for learning has increased as the skill that was once the domain of the physician has now spread (quite rightly) to respiratory therapists and nurses. In some places, and with the growth of residency programs (ours is now 2.5X larger than when I trained), the scarce chances are divided among many.

Enter the Video Laryngoscope

To be clear this isn't a post to promote a product, but rather an examination of the effectiveness of a tool. I am putting this out there, recognizing the possibility that someone might have heard of or have been contemplating purchasing one of these items.

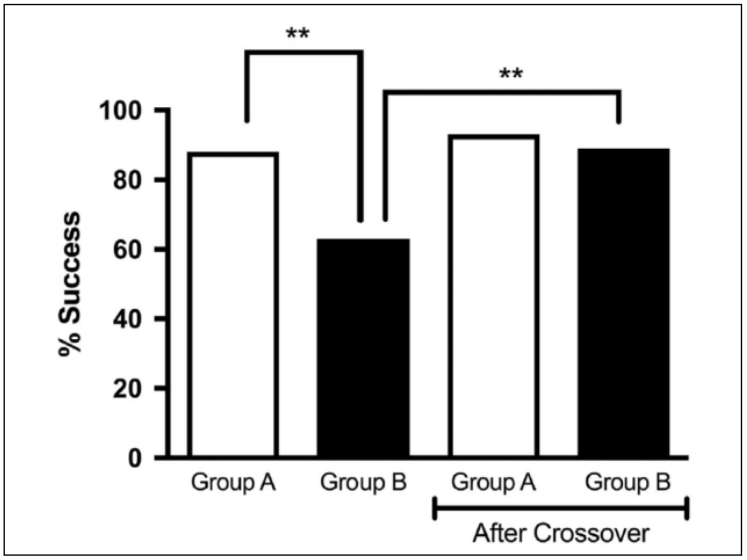

Figure. Percent success of mannequin intubation pf the pediatric trainees with the videolaryngoscope of direct laryngoscope.
*** denoted statistically significant (P<0.001) difference in the percent success between the indicated groups.*

Those that are quite proficient at intubation (likely trained in the "good old days") would likely question the need for such a device, but I believe the device isn't really aimed at that group, except to use perhaps, as a teaching tool. It really is targeted (at least I think) for those who don't perform the skill often.

Does Use of the Video Laryngoscope Improve Success Rates at Intubation?

There has now been an attempt at answering this question by Parmekar S. et al in their paper "Mind the gap: can videolaryngoscopy bridge the competency gap in neonatal endotracheal intubation among pediatric trainees? a randomized controlled study." The study involved taking 100 pediatric residents and randomizing them into two groups. The first would use the videolaryngoscope (VL group), and then intubate using the standard technique of direct laryngoscopy (DL group). The second group started with DL, and then changed to VL. Both groups took part in a training session on intubation, and then participated in three simulation scenarios from NRP.

"What I would have liked to see is a repeat assessment a week later after using a few more trials with the VL. I suspect, once you are used to it, the speed of intubation would improve as well. I suppose though, we will have to wait a little while until someone does such work, but as a means of improving success in intubation, I believe this tool has something to add."

The findings demonstrated a couple interesting things. The first as shown in the graph was that the group that started with the laryngoscope had a near 90% success rate compared to about 60% for the traditional approach. When the groups swapped though they were both equal in effectiveness. This suggests that by visualizing the airway with the VL, students were able to identify structures better after doing so, such that success was improved simply by having used the device.

The other finding worth mentioning was that when the times to intubation were looked at; there was no difference between the two groups at all. If the intubation success is no different, why might the times be the same? Having used the video laryngoscope myself, it does take some getting used to. Rather than looking directly at the airway, you find yourself looking off to the side, and adjusting the approach that is in front of you to place the ETT. No doubt, this does take some getting used to.

What I would have liked to see is a repeat assessment a week later after using a few more trials with the VL. I suspect, once you are used to it, the speed of intubation would improve as well. I suppose though, we will have to wait a little while until someone does such work, but as a means of improving success in intubation, I believe this tool has something to add.

NT

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http://ancc2017.info

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Oct. 5-7, 2017; Las Vegas, NV USA
www.edusymp.com/product/details/999

8th Phoenix Fetal Cardiology Symposium
Oct. 27-31, 2017; Phoenix, AZ USA
www.fetalcardio.com

20th International Conference on Neonatology and Perinatology
Dec. 4-6, 2017; Madrid, Spain
http://neonatology.conferenceseries.com

Hot Topics in Neonatology
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https://www.hottopicsinneonatology.com

NeoPREP An Intensive Review and Update of Neonatal-Perinatal Medicine
Jan. 20-26, 2018; Atlanta. GA USA
https://shop.aap.org/live-activities/

Specialty Review in Neonatology
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www.specialtyreview.com

NEO: The Conference on Neonatology
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Medical News, Products & Information

Compiled and Reviewed by Tony Carlson, Senior Editor

Detroit Neonatologist Dr. Seetha Shankaran Leads Long-Term NIH Study on Body-Cooling Technique for Newborns

Newswise — After more than 20 years of researching the best treatment for full-term infants affected by oxygen deprivation during the birthing process, Seetha Shankaran, MD, Nonatologist at DMC's Children's Hospital of Michigan and Hutzel Women's Hospital, served as the lead investigator in a definitive study, published in the *Journal of the American Medical Association* that documented the safest depth and duration of body-cooling to minimize injury from hypoxic ischemic encephalopathy (HIE) in newborns.

Credit: Children's Hospital of Michigan Seetha Shankaran, MD

The multi-center study funded by the Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD) Neonatal Research Network, was led by a nationally recognized pediatric researcher at the Detroit Medical Center (DMC) and Wayne State University School of Medicine on the treatment of injuries caused by oxygen deprivation ("hypoxia") during birth. The published study in the *Journal of the American Medical Association (JAMA)* has determined the safest temperature and duration for body-cooling ("hypothermia") of newborns in order to minimize the injuries during the first few days of life.

The study, which involved 364 infants over a six-year period, showed the results of the randomized clinical trial that concluded the safest depth and duration of hypothermia treatment – using a specially designed "cooling blanket" – consists of lowering the oxygen-starved newborns' body temperature to 33.5 degrees Celsius for a period of 72 hours.

"Neither longer cooling, nor deeper cooling nor both were more superior to cooling for 72 hours at 33.5 degrees Celsius in reducing death or survival with disability at 18 months of age," says Dr. Shankaran.

The finding is significant and surprising, according to Dr. Shankaran because earlier studies using animal models had suggested that lowering the temperature to 32 degrees Celsius and for a longer period (120 hours) might provide better injury protection for the oxygen-deprived newborns.

The study was conducted at 18 U.S. neonatal centers by the Neonatal Research Network (https://neonatal.rti.org) of the National Institute of Child Health and Human Development (NICHD) – and with Dr. Shankaran as lead investigator. The study reports the safety outcomes assessed during the neonates stay in the NICU. The neonates who survived were followed up to 18 months of age to examine the effect of longer or deeper cooling on overall rate of death or disability, which was the primary outcome of the study.

HIE occurs in approximately one in 1,000 full-term infants in the United States each year, as a result of interrupted blood-flow and lack of oxygen at birth. The condition can be caused by such problems as: umbilical cord strangulation in the newborn, placental abruption, cardiac or respiratory arrest in the mother during delivery or other disorders that decrease delivery of blood-borne oxygen to the neonate. About 4,000 of the 4 million babies born in this country each year are affected by HIE. Between 15% and 20% will die in infancy or early childhood from the ailment, and another 25% will develop severe and permanent neuropsychological deficits, including mental retardation, visual or motor dysfunction, epilepsy and cerebral palsy.

For Dr. Shankaran, a pioneer in finding effective methods for protecting HIE-affected newborns whose landmark 2005 study in the *New England Journal of Medicine* helped to make the 72-hour "cooling blanket" procedure the standard of care in treating this condition, the publication of the new clinical trial was "a very encouraging step forward."

"I think we have shown clearly and with a great deal of accuracy [in the new study] that using whole-body cooling in the neonatal period at 33.5 C for 72 hours is safer than either longer cooling, deeper cooling or both."

During the trial, Dr. Shankaran and her colleagues in the NICHD's Neonatal Research Network, randomly assigned full-term infants with moderate or severe encephalopathy within six hours of birth to four different hypothermia groups, 33.5C for 72 hours, 33.5 for 120 hours, 32.0C for 72 hours and 32.0C for 120 hours.

Mortality was 9% for the HIE-group that had been cooled at 33.5C for 72 hours, compared to 19%, 18% and 19% in the other groups.

The results should have an immediate positive impact on clinicians who treat HIE-affected newborns in Neonatal Intensive Care Units by providing assurance that cooling at 33.5C for 72 hours has now been demonstrated to be the treatment of choice. Clinicians should avoid cooling for either longer duration of time or at a greater depth of temperature.

"In this trial we saw that the rate of death or disability was 29.3% with cooling for 72 hours at 33.5 C. This is even lower than the 44% rate we achieved with cooling for 72 hours at 33.5 C with our first trial published in the *New England Journal of Medicine* in 2005. The reason for this reduced rate could be that the number of infants with severe encephalopathy was lower in this trial than our first trial, but other changes in care practices may also have helped to reduce this rate," Dr. Shankaran says.

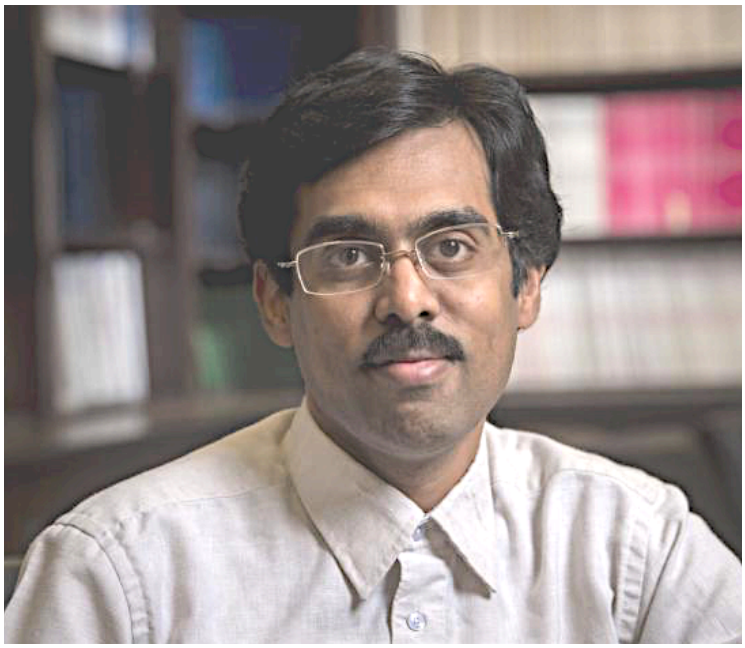
Investigators are now planning to examine adding additional therapies to hypothermia therapy. "They need to enroll larger numbers of study participants since

the rate of death or survival with disability is 29% as shown in this trial," she adds.

Dr. Shankaran, says the latest research breakthrough could not have occurred without "the tremendous amount of work that was done by all of the researchers in the Neonatal Research Network, nor without the public dollars provided for this effort over the years by the NICHD.

Children's Hospital of Michigan CEO Luanne Thomas Ewald noted, "Dr. Shankaran has devoted her career to improving the lives of high-risk newborns. This latest research is the latest example of how her leadership has paved the way for providing the best treatment and outcomes for pediatric patients affected with HIE throughout the world."

Extreme Preterm Infant Death or Disease May Be Predicted by Biomarker



Credit: UAB
Jegen Kandasamy, MD

Tests of cells collected from the umbilical cord blood vessel walls at birth can predict death or poor pulmonary outcomes in extremely preterm infants, say researchers at the University of Alabama at Birmingham.

"Now that we know there is useful information from cells we obtain from the umbilical cord, we could use their bioenergetics as a biomarker and for therapy approaches before Bronchopulmonary Dysplasia develops," said Jegen Kandasamy, MD, a neonatologist and Assistant Professor of Pediatrics at UAB, and corresponding author of a study detailing the findings.

Bronchopulmonary Dysplasia (BPD) is a lung-function abnormality that affects one-fourth to one-half of extremely low birthweight premature infants, mostly those who need to be given prolonged duration of oxygen therapy. This therapy creates reactive oxygen species in the lung, and that stress, along with some other contributors, can lead to chronic or life-threatening lung disease because it interferes with maturation of the still-developing lung. The blocked maturation includes the tiny terminal saccules that normally continue to develop through the

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last 14 weeks of a full-term gestation and about five weeks more after birth.

"Every baby who is born extremely prematurely needs to have such lung injury minimized, or else it can go downhill from there," Kandasamy said.

Researchers collected venous endothelial cells from umbilical cords of 69 infants born at 26 weeks average gestation. The average birthweight of these infants was 1.9 pounds; 34 of the infants survived without BPD, and 35 developed BPD and/or died. Of those 35, 24 survived with BPD and 11 died before BPD status could be assessed at 36 weeks gestational age.

These umbilical vascular endothelial cells were grown in culture and tested for mitochondrial energetic function and oxidant generation. Mitochondria are small organelles inside cells that are often called the powerhouses of the cell because they generate most of the cell's ATP, a chemical form of energy. Oxidative stress can damage mitochondria, causing the release of dangerous reactive oxygen species.

Kandasamy and colleagues found that the endothelial cells of infants who developed BPD or died -- as compared to endothelial cells of infants who survived without developing BPD -- had significantly lower maximal oxygen consumption rates, produced more superoxide after exposure to excess oxygen, and released more hydrogen peroxide after exposure to excess oxygen. Superoxide and hydrogen peroxide are two types of reactive oxygen species.

These changes in the endothelial cells of the infants who developed BPD or died, as well as increased damage to mitochondrial DNA and some other observed changes, indicated impaired vascular endothelial mitochondrial function. This impaired function is a potential biomarker for BPD susceptibility in preterm infants, and it could help modify therapeutic strategies to decrease the risk of poor lung outcomes.

The UAB researchers say this is the first study to suggest that mitochondrial dysfunction in human-derived vascular endothelial cells is a strong predictor for BPD risk in premature infants.

"We are the first to study these cells from a baby's umbilical cord and compare their function to risk for diseases in the same baby," Kandasamy said.

Kandasamy says that UAB is one of the few medical centers where this research can be done, since the academic medical center combines excellent expertise in mitochondrial biology along with strong leadership in research regarding neonatal lung injury and development. He says he helped collect the umbilical cords during two years of his Neonatology fellowship at UAB, including births that occurred at 3 AM, or other wee hours of the morning.

Besides Kandasamy, authors of the paper, "Vascular Endothelial Mitochondrial Function Predicts Death or Pulmonary Outcomes in Preterm Infants," published in the *American Journal of Respiratory and Critical Care Medicine*, are Nelida Olave, PhD, and Namasivayam Ambalavanan, MD, UAB Department of Pediatrics; and Scott W. Ballinger, PhD, UAB Department of Pathology.

Even Perfectly Clean Hands Can Lead to MRSA Transmission in NICU Babies

Even if hospital workers practice perfect hand hygiene, Methicillin-Resistant Staphylococcus Aureus (MRSA) can still spread among babies in the NICU, according to new research led by a Drexel University researcher.

Neal D. Goldstein, PhD, Assistant Research Professor in the Dornsife School of Public Health, and his team of researchers decided to look at how the complex patient care environment of a Neonatal Intensive Care Unit (NICU) may lead to MRSA transmission. Focusing on hand hygiene -- a top indicator of whether infections might spread in hospitals -- the researchers examined transmission from baby-to-baby, with the hospital workers that come into contact with newborns standing as the link.

And as it turns out, even theoretically perfect compliance with hand hygiene won't completely eliminate the chance for MRSA to spread: the averaged risk reduction was 86%.

"The biggest implication is that hospitals should not just rely upon hand hygiene alone for protecting patients from becoming colonized and possibility infected with a difficult-to-treat organism," Goldstein said. "Rather, infection control is a multi-pronged strategy. It can incorporate early detection and measures to mitigate spread that include possible decolonization or using an antibiotic to treat a patient even before infection."

The study, which was published in *Infection Control & Hospital Epidemiology*, used MRSA, a difficult to treat pathogen that can be deadly for people with weak or underdeveloped immune systems, as its subject.

"We wanted to focus on an organism that is frequently encountered in hospital environments," Goldstein said. "In our vulnerable population of babies in the ICU, MRSA is of particular importance because about one third of babies that are colonized will go on to develop an invasive infection."

In his simulation study, based out of Christiana Care's NICU (in Newark, Delaware), Goldstein discovered that even if health workers had absolutely perfect hand hygiene, just under one in every 100 contacts between a baby and a hospital worker could still result in a MRSA transmission. During the average nine-day stay, an infant is likely to have about 250 contacts with NICU workers who carry risk for MRSA transmission. While each contact is an opportunity for hygiene compliance, it is also potential for hygienic practices to break down.

"This sheds light on just how complex the patient care environment of a NICU is," Goldstein said. "There are so many opportunities to potentially pass an organism between healthcare workers and their patients."

Although it seemed that MRSA could not be completely wiped out through perfect hand hygiene, the study did show that the better hand hygiene was, the more it cut down on the spread of MRSA. The effect never quite leveled off, but continued to get better as hygiene levels improved.

When the team divided levels of hand hygiene into quartiles, the lowest level of cleanliness was associated with an averaged 29% decrease in MRSA prevalence when compared to no hand washing. And when the team looked at the two quartiles considered within the average range for hand hygiene of hospital workers, they found it correlated with a decrease in MRSA ranging between 51% and 67%.

However, having multiple lines of defense remains important.

"I think the reality is that infection control is not, nor can ever be, perfect," Goldstein said. "You may follow all guidelines and suggested procedures, have 100% adherence to these interventions, and patients can still become colonized and possibly infected."

So, beyond hospitals practicing good hand hygiene and antimicrobial management, Goldstein suggests that efforts by people beyond hospital workers, including parents, visitors and the patients themselves (the non-infant patients, of course) can make a difference.

"We can follow hygiene procedures, use gowns or gloves as needed, keep a clean environment, not bring in possible fomites such as cell phones, watches, or jewelry, and be a watchdog for the hospital, requesting that healthcare workers do hand hygiene if we don't see it being done," Goldstein said. "Outside the hospital, patients and parents can be more vigilant in requesting and using antibiotics appropriately so as not to give rise to antimicrobial resistant organisms. We're all participants in infection control, not just the clinicians."

Premature Infants at Greater Risk of SIDS

Rutgers University - Premature infants still have a greater risk compared to full-term babies of dying of SIDS and other sleep-related infant deaths despite recommendations from the American Academy of Pediatrics that hospital Neonatal Intensive Care Units (NICU) provide more safe infant sleep education to parents before they go home.

"While we can't undo a preterm birth, we can help compensate for the accompanying elevated risk of Sudden Infant Death Syndrome (SIDS) and other sleep-related infant deaths by helping families adopt the beneficial practices that include putting an infant on his back to sleep and keeping the sleep environment clutter free," said Barbara Ostfeld, Professor of Pediatrics at Rutgers Robert Wood Johnson Medical School and Program Director of the SIDS Center of New Jersey.

Ostfeld and co-author Thomas Hegyi, MD, Professor of Pediatrics at Robert Wood Johnson and Medical Director of the SIDS Center of New Jersey, published a study in July *Pediatrics*, which found that infants born between 24 to 27 weeks had a more than three times higher chance than babies born full-term of dying before their first birthday of a sudden unexpected infant death, which is comprised of SIDS and other sleep-related infant deaths.

The risk was high, according to researchers, even when factors, including smoking and inadequate prenatal care, were taken out of the equation. While the level of risk decreased for premature infants born closer to full-term, they were still significantly higher, according to the study.

In their research, Ostfeld and her colleagues analyzed United States infant birth and death certificates between 2012 and 2013, and found the risk of dying from SIDS and other sleep-related causes in the first year was highest for those born between 24 and 27 weeks. While 0.51 deaths were reported for every 1,000 births between 39 to 42 weeks, there were 2.68 deaths for every 1,000 births between 24 and 27 weeks.

Every year in the United States about 3,500 infants die of a sleep-related death, a significant decrease from 25 years ago when the American Academy of Pediatrics released its landmark guidelines that all babies should be placed on their back to sleep.

New recommendations were released again in 2011 and 2016 to address SIDS other sleep-related deaths - 25% of which are caused from suffocation, entrapment and asphyxia -- which have increased. The AAP also recommended keeping infants in a Consumer Product Safety Commission approved - crib, bassinet or portable crib near the parent's bed.

"It's important that Neonatal Intensive Care Units assess how well they are complying with these guidelines, and teaching about safe infant sleep practices," said Ostfeld. "Pediatricians need to remind parents and grandparents at every office visit."

Ostfeld said researchers need to develop more evidence-based interventions for increasing compliance with safe sleep practices, and also need to address potentially treatable intrinsic factors that elevate risk for the preterm infant. Besides unsafe sleep practices, other causes for infant mortality include smoking, poor prenatal care and poverty, she said.

Based on the most recently available national data, New Jersey has the lowest rate of sudden unexpected infant deaths in the nation."The extensive statewide education programs conducted by the SIDS Center of New Jersey in collaboration with its many partners have contributed to these improvements," Ostfeld said.

To reinforce the impact of advice given in the NICU, Ostfeld and Hegyi will be meeting with New Jersey's network of neonatal providers to discuss the research findings, and to re-enforce the long-standing recommendations of the AAP.

"Prematurity is a challenge," Hegyi said. "What we need to do is make sure parents and families understand what they can to do when they leave the hospital to keep their baby safe."

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