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Questions and Answers About

Newborn Resuscitation

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What's Inside

Problem Case — pg. 3
Outcomes Notes — pg. 3
Perinatal Guidelines — pg. 4
Message from Minnesota Neonatal Physicians — pg. 4

This newsletter reflects the opinions of the authors. It is not a guideline or protocol and does not delineate the standard of care.

Common Problem

About 10% of newborns require assistance to transition from intrauterine to extrauterine life,[1] and 1% require extensive resuscitation. Despite an unremarkable pregnancy, labor, and delivery some term and many preterm infants are depressed at birth.

Guidelines

From tongue pulling and rectal dilation in the 1800s[2] to endotracheal intubation and laryngeal masks in 2004, neonatal resuscitation has come a long way. The American Academy of Pediatrics' (AAP) Neonatal Resuscitation Program (NRP)[1] presents an evidence-based approach to neonatal resuscitation. What follows are answers to common questions that we receive when teaching this course.

Personnel

Q. Does someone capable of intubating an infant need to be present at each delivery?

A. No. However, someone whose primary responsibility is the newborn infant should be present.[1] This person should be NRP-certified and able to provide the initial steps in resuscitation, including positive pressure ventilation with a bag and mask. Someone who can provide advanced resuscitative measures, including intubation, should be IN THE FACILITY.

Equipment

Q. Should our hospital stock surfactant?

A. Maybe. This should be determined by the availability of 1) physicians skilled in endotracheal intubation *and* surfactant administration, 2) the needed equipment, and 3) a treatment protocol.[3] Although surfactant outdates after several months, some suppliers replace outdated surfactant at no cost.

Procedures

Q. With radiant warmers, does it matter that the delivery room is cool?

A. Yes, especially at preterm deliveries. Preterm infants have a large body surface to mass ratio and cool quickly, which increases mortality. Convective and radiant losses are excessive in a cool room.

Q. I find it hard to provide effective bag and mask ventilation. What am I doing wrong?

A. The most common errors are:

-Failure to clear the airway of secretions.
-Improper neck position. The head should be in a neutral position, neither hyperextended nor flexed.
-Inadequate seal of the mask on the face. Mask size and proper positioning of the hand around the mask with one or two fingers underneath the mandible generally permits effective ventilation.

Q. Shouldn't all meconium-stained infants receive tracheal intubation and suction?

A. No. Tracheal suctioning of vigorous infants does not reduce their risk of meconium aspiration syndrome.[4] The AAP defines a vigorous infant as one that has heart rate >100 bpm, normal tone and normal respiratory effort.[1]

Q. Should I use room air or 100% oxygen when resuscitating newborns?

A. Start with 100% O_2. Recent studies have reported good results with resuscitations using room air, rather than 100% O_2.[5,6] However, there is insufficient information on which to base a change to room air, and the AAP continues to recommend 100% oxygen initially.[7,8] The amount of supplemental oxygen should be reduced as quickly as possible. Some hospitals now use oxygen blenders in the delivery room.

Q. Does a baby that is gasping on his/her own need positive pressure ventilation?

A. Yes. Gasping and apnea both mandate positive pressure ventilation.[1]

Q. When should I use naloxone?

A. Only when the infant was born to a woman who received a narcotic analgesic within four hours of delivery. Naloxone offers no benefit to depressed newborns unless they have had recent exposure to narcotics.[9]

Q. In what order should medications be given in a resuscitation?

A. With adequate ventilation, newborns rarely require resuscitation medicines. We use medications in the delivery room infrequently (<1-2% of resuscitations, vaires by birth weight). The AAP recommends epinephrine, followed by $NaHCO_3$ and calcium.[1]

New Developments in Resuscitation

Laryngeal masks. These small, mask-like devices that are inserted over the larynx to provide positive pressure ventilation. They have been used extensively in older children, primarily by anesthesiologists. They are promising, but there is not enough information in neonates to recommend their use.

CO_2 detector. This device fits between the end of the endotracheal tube and the ventilation bag and detects exhaled CO_2. It quickly determines whether or not the endotracheal tube is in the trachea. The Pedi-cap™ CO_2 detector works with infants as small as 600 grams (personal experience). Pedi-cap™ is produced by Nellcor Puritan Bennett Inc. http://www.nellcor.com/_Catalog/PDF/Product/EasyCapIISalesCard.pdf

Neopuff™. When providing positive pressure using a bag (self-inflating or flow-inflating), it is easy to apply excessive pressure to a newborn's fragile lungs. The NeoPuff™ prevents this by applying a standard pressure (set on the device) with each puff. This device maintains PEEP and prevents excessive pressure in a resuscitation situation. The NeoPuff™ is available through Fisher & Paykel Healthcare, see: http://www.fphcare.com/neonatal/resuscitation_vital.asp

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Future Issues

November/December
Jaundice and Kernicterus

January/February
Criteria for Neonatal Transport

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Problem Case

Hypoxic Ischemic Brain Injury

History

This 3970 gram female was born to a 36 year-old, G2 P1-0-0-1 at 40 2/7 weeks. After an uncomplicated pregnancy and early labor, the infant developed a non-reassuring fetal heart rate pattern, which prompted a C-section. Apgar scores were 0^1, 3^5, and 3^{10}. Initially the infant was stimulated and suctioned with no response, then given positive pressure ventilation via bag-mask for about 30 seconds, following which chest compressions were started.

The need for a prolonged resuscitation prompted intubation with a 3.5 Fr. endotracheal tube (ETT) and administration of epinephrine through the ETT. After the epinephrine, the heart rate increased to 100 by 3-4 minutes of age. Umbilical catheters were placed and a blood gas drawn. Eight mEq of $NaHCO_3$ was given empirically. The initial arterial blood gas showed a pH=6.89 and a base deficit of -28. Following the $NaHCO_3$, the base deficit was -17. Infant was transferred to the NICU.

Physical Exam

Upon admission to the NICU the infant was flaccid with no spontaneous movement, no gag reflex, no withdrawal to pain, irregular respirations.

Lessons from this case:

1. Many depressed infants deliver after a relatively unremarkable pregnancy and labor. For some, the CNS injury occurs well before labor, resulting in a depressed infant that did not have a particularly abnormal fetal heart rate tracing. Alternatively, the infant may be much more depressed than is consistent with the abnormal heart rate tracing.

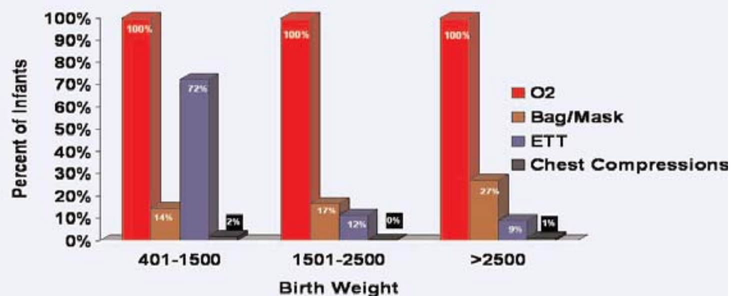
2. Patients needing chest compressions are much easier to ventilate with an endotracheal tube compared to bag and mask.

3. Brain cooling represents a new, promising therapy to reduce the degree of brain injury. This treatment is supported by early clinical trials, but more data is required before this therapy becomes routine. We are part of a multi-institutional study to evaluate this new therapy. Patients must be referred within the few hours after delivery to be enrolled in the study.

Outcomes Notes

Resuscitation Required By High-Risk Infants

Delivery Room Resuscitation



Data from CHC-Mpls database of inborn infants Jan 2001-> Sept 2004. N= 3,128 infants

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Perinatal Guidelines Highlight

Careful Usage of Abbreviations

One person's common abbreviation is another's gibberish. One of the patient safety goals emphasized by the JCAHO and by Childrens Hospitals and Clinics is to use only safe, easily understaood abbreviations. There is also a list of those abbreviations considered unsafe. The following chart lists some of the most common abbreviations that are considered unsafe and their "safe" alternatives. Abbreviations from the "Do Not Use" list apply not only to medication orders, but to all clinical documentation.

Do Not Use	Potential Problem	Safe Alternative
U or u	Mistaken as zero, four, or cc	Units
IU	Mistaken as IV or ten	Units
MS, MSO4, MgSO4	Confused for one another	Write out drug name
No leading zero(ex.= .1)	Decimal point is missed	0.1
Trailing zero (ex.= 1.0)	Decimal point is missed	1
QD or QOD	Confused for one another	Write out "daily",etc.
CC	Mistaken for u (units), if poorly written	Write "ml" for milliliters
µg	Misread as "mg" (1000-fold overdose)	Microgram or mcg
SQ, SC	Misread as SL (sublingual) or "5	subQ

For more information on JCAHO's list of "Do Not Use" Abbreviations, or National Patient Safety Goals please visit www.jcaho.org.

A Message from Minnesota Neonatal Physicians, P.A.

We understand the value of providing a prompt transport service for our referring physicians. Starting in January, 2005 we will publish our ground and helicopter transport times for all locations from which we have received a patient in the past year.

We commit to these standard transport times. We depend on the LifeLink III, a medical transportation company, for both ground and helicopter transports. They too have committed to these standards.

We encourage your suggestions or concerns regarding our transport service. We seek to provide the safest, quickest, most responsive transport service available anywhere.

If at any time you have questions regarding a patient we have treated, please contact us.

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Readers' suggestions are welcomed and appreciated.
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