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Summary of the Revised Neonatal Resuscitation Guidelines



Do you know how the 7th edition NRP materials originate? We've come a long way from the late 1980s and 1990s when NRP material was often derived from general consensus, delivery room experience, and best guesses of pediatricians and neonatologists across the country.

Since 1999, revised NRP science has come from the work of the International Liaison Committee on Resuscitation (ILCOR), a multinational group that provides a coordinated forum for researching, reporting, and developing an international consensus supported by scientific data. Every 5 years, ILCOR coordinates an in-depth international review, debates the science, and determines new international resuscitation treatment recommendations for newborns, children, and adults.

Evidence evaluation is conducted in stages and follows a very organized and rigorous process. First, key resuscitation issues are defined and hundreds of volunteer experts from around the world review and evaluate the peer-reviewed literature, and then develop a summary of evidence-based knowledge for each topic. These summaries are reviewed, debated, and their level of evidence is rated and classified. The summary is posted online for public comment. Finally, based upon the consensus of the assembled international experts, treatment recommendations are generated. This document, known as the *International Consensus on Science With Treatment Recommendations* (CoSTR) is the international consensus on resuscitation science for newborns, children, and adults.

Each resuscitation council that makes up ILCOR then uses the CoSTR document to develop resuscitation guidelines applicable to their country/region. The American Heart Association (AHA) leads this project in the United States, and members of the NRP Steering Committee who participated in the ILCOR neonatal task force develop the guidelines for neonatal resuscitation. The AHA's Guidelines for Emergency Cardiovascular Care (ECC) were released on October 15 eccguidelines.heart.org and will appear, once again, within the *Textbook of Neonatal Resuscitation*, 7th edition.

The NRP is the education program that translates the guidelines into practice. A summary of the biggest changes in neonatal resuscitation science are listed here.

Changes in the NRP Flow Diagram

The 7th edition NRP Flow Diagram is similar to the 6th edition diagram. Revisions include:

- Begin the resuscitation with antenatal counseling (when appropriate) and a team briefing and equipment check.
- Maintain the newborn's normal body temperature during resuscitation.
- Consider using a cardiac monitor when PPV begins.
- Ensure ventilation that inflates and moves the chest.
- Recommendation to intubate prior to beginning chest compressions.
- Recommendation to use cardiac monitoring to accurately assess heart rate during chest compressions.
- End the resuscitation with team debriefing.

Thermoregulation

It is recommended that the temperature of newly born nonasphyxiated infants be maintained between 36.5°C and 37.5°C after birth through resuscitation or stabilization.

Meconium-Stained Amniotic Fluid and Endotracheal Suctioning

Non-vigorous newborns with meconium-stained fluid do not require routine intubation and tracheal suctioning. Initial steps may be performed at the radiant warmer. Meconium-stained amniotic fluid is a perinatal risk factor that requires the presence of one resuscitation team member with full resuscitation skills, including endotracheal intubation.

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Delayed Cord Clamping

Current evidence suggests that cord clamping should be delayed for at least 30 to 60 seconds for most vigorous term and preterm newborns. If the placental circulation is not intact, such as after a placental abruption, bleeding placenta previa, bleeding vasa previa, or cord avulsion, the cord should be clamped immediately after birth. There is insufficient evidence to recommend an approach to cord clamping for newborns who require resuscitation at birth.

Assessment of Heart Rate

Your initial assessment of the heart rate will be made using a stethoscope. Auscultation along the left side of the chest is the most accurate physical examination method of determining a newborn's heart rate. Although pulsations may be felt at the umbilical cord base, palpation is less accurate and may underestimate the true heart rate. If you cannot determine the heart rate by auscultating and the baby is not vigorous, quickly connect a pulse oximetry sensor or ECG leads and use a pulse oximeter or cardiac monitor to assess the heart rate.

- When PPV begins, consider using a cardiac monitor for accurate assessment of the heart rate.
- An electronic cardiac monitor is the preferred method for assessing heart rate during chest compressions.

Oxygen Management

Resuscitation (positive-pressure ventilation) of newborns greater than or equal to 35 weeks' gestation begins with 21% oxygen (room air). Positive-pressure ventilation of newborns less than 35 weeks' gestation begins with 21-30% oxygen.

Free-flow oxygen administration may begin at 30%. Using the blender, adjust the oxygen concentration as needed to achieve the oxygen saturation target by pulse oximetry.

If the newborn has labored breathing or oxygen saturation cannot be maintained with the target range despite 100% free flow oxygen, consider a trial of CPAP.

Positive-Pressure Ventilation

If PPV is required for resuscitation of a preterm newborn, it is preferable to use a device that can provide positive end expiratory pressure (PEEP). Using PEEP (5 cm H₂O) helps the baby's lungs to remain inflated between positive pressure breaths.

When PPV begins, the assistant listens for increasing heart rate for the first 15 seconds of PPV.

- If the assistant announces "heart rate is increasing," PPV continues for another 15 seconds, then HR is re-assessed.
- If the assistant announces "heart rate is not increasing, chest is moving," PPV continues for another 15 seconds, then HR is re-assessed.
- If the assistant announces "the heart rate is not increasing and the chest is not moving," ventilation corrective steps (MR, SOPA) are administered until the chest moves with ventilation. The assistant announces, "The chest is moving now. Ventilate for 30 seconds." Reassess the heart rate after 30 seconds of PPV that moves the chest.

The second assessment of HR is performed after 30 seconds of PPV that moves the chest.

- If HR is at least 100 bpm: continue PPV 40-60 breaths/minute until spontaneous effort.
- If HR is 60-99 bpm: reassess ventilation. Perform ventilation corrective steps if necessary.
- If HR is less than 60 bpm: reassess ventilation. Perform ventilation corrective steps if necessary. Insert an alternative airway (ET tube or laryngeal mask). If no improvement in HR but chest is moving with PPV, begin 100% oxygen and chest compressions.

Chest Compressions

Intubation is strongly recommended prior to beginning chest compressions. If intubation is not successful or not feasible, a laryngeal mask may be used. To determine tip-to-lip depth of the endotracheal tube after insertion, use the endotracheal tube initial insertion depth table or measure the nasal-tragus length (NTL).

- Chest compressions are administered with the two-thumb technique.
- Once the endotracheal tube or laryngeal mask is secured, the compressor administers chest compressions from the head of the newborn.
- Chest compressions continue for 60 seconds prior to checking a heart rate.



Medication

The recommended solution for acutely treating hypovolemia is 0.9% NaCl (normal saline) or type-O Rh-negative blood. Ringer's lactate is no longer recommended for treating hypovolemia.

All medications and fluids that can be infused into a UVC can be infused into an intraosseous needle in term and preterm newborns.

Thermoregulation and Stabilization of Preterm Newborns

In preparation for the birth of a preterm newborn, increase the temperature in the room where the baby will receive initial care to approximately 23-25° C (74-77° F).

For newborns less than 32 weeks' gestation, it is recommended that you:

- Cover the newborn in food-grade plastic wrap or bag and use a hat and thermal mattress.
- Use a 3-lead electronic cardiac monitor (ECG) with chest leads or limb leads to provide a rapid and reliable method of continuously displaying the baby's heart rate if the pulse oximeter has difficulty acquiring a stable signal.
- Consider using CPAP immediately after birth as an alternative to routine intubation and prophylactic surfactant administration. Many preterm babies can be treated with early CPAP and avoid the risks of intubation and mechanical ventilation. Criteria for CPAP usage and the administration of prophylactic surfactant should be developed in coordination with local experts.

Ethics and Care at the End of Life

If the responsible physicians believe that there is no chance for survival, initiation of resuscitation is not an ethical treatment option and should not be offered. Examples include birth at a confirmed gestational age of less than 22 weeks' gestation and some congenital malformations and chromosomal anomalies.

In conditions associated with a high risk of mortality or significant burden of morbidity for the baby, caregivers should discuss the risks and benefits of life-sustaining treatment and allow the parents to participate in the decision whether attempting resuscitation is in their baby's best interest. If there is agreement between the parents and the caregivers that intensive medical care will not improve the chances for the newborn's survival or will pose an unacceptable burden on the child, it is ethical to provide compassionate palliative care and not initiate resuscitation.

A summary handout of the AAP/AHA Guidelines for CPR and ECC of the Neonate (available in English and Spanish) can be found at the following URL: www2.aap.org/nrp.