Neonatal Resuscitation

Aliases

None noted

Patient Care Goals

1. Provide routine care to the newly born infant.
2. Perform a neonatal assessment.
3. Rapidly identify newly born infants requiring resuscitative efforts.
4. Provide appropriate interventions to minimize distress in the newly born infant.
5. Recognize the need for additional resources based on patient condition and/or environmental factors.

Patient Presentation

Inclusion Criteria

Newly born infants

Exclusion Criteria

Documented gestational age less than 20 weeks (usually calculated by date of last menstrual period); if any doubt about accuracy of gestational age, initiate resuscitation

Patient Management

Assessment

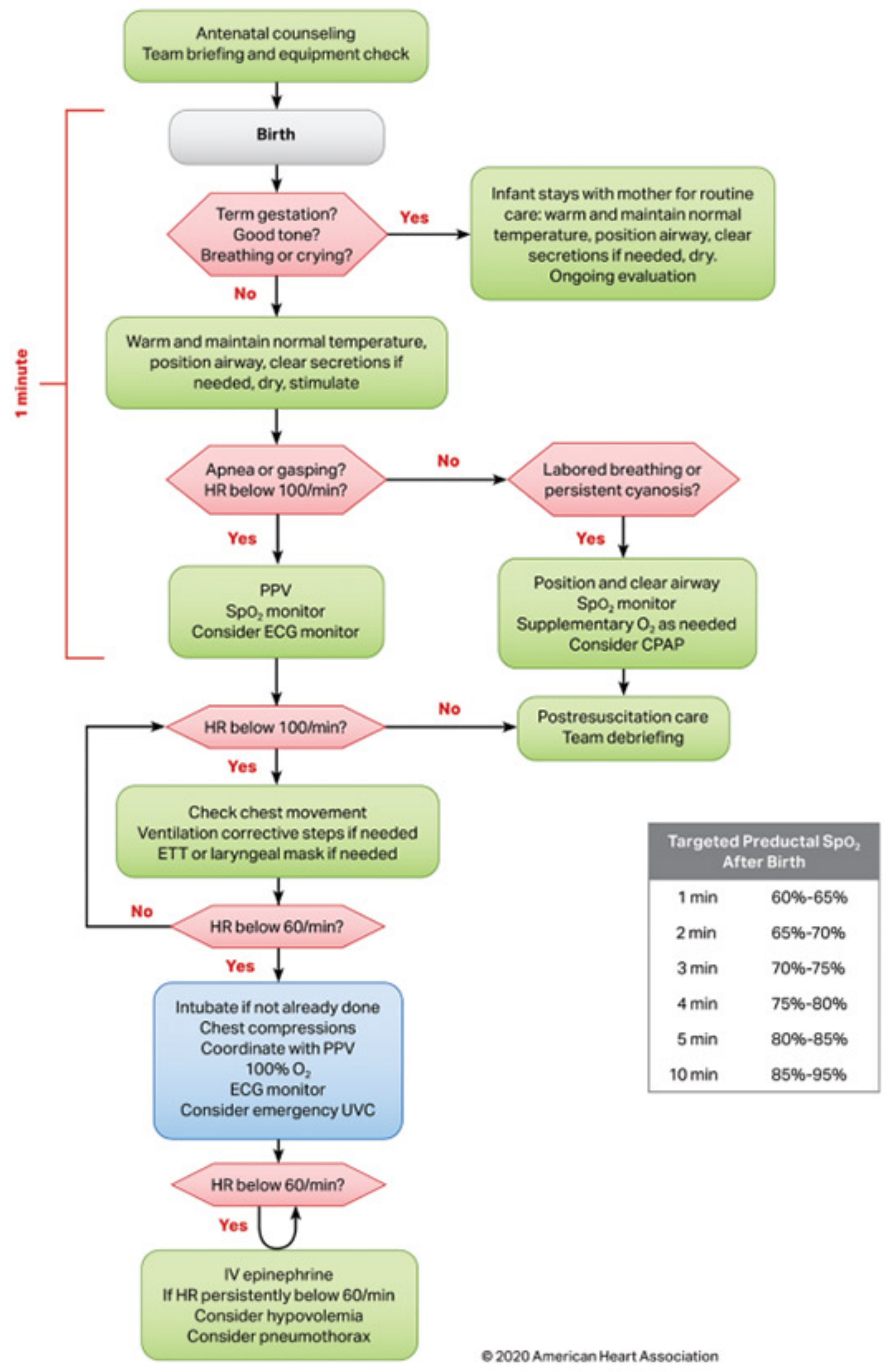
1. History
    a. Date and time of birth
    b. Onset of symptoms
    c. Prenatal history (prenatal care, substance abuse, multiple gestation, maternal illness)
    d. Birth history (maternal fever, presence of meconium, prolapsed or nuchal cord, maternal bleeding)
    e. Estimated gestational age (may be based on last menstrual period)
2. Exam
    a. Respiratory rate and effort (strong, weak, or absent; regular or irregular)
    b. Signs of respiratory distress (grunting, nasal flaring, retractions, gasping, apnea)
    c. Heart rate (fast, slow, or absent)
        i. Precordium, umbilical stump or brachial pulse may be used
        ii. Auscultation of chest is preferred since palpation of umbilical stump is less accurate
    d. Muscle tone (poor or strong)
    e. Color and appearance (central cyanosis, acrocyanosis, pallor, normal)
    f. APGAR score (appearance, pulse, grimace, activity, respiratory effort) may be calculated for documentation, but not necessary to guide resuscitative efforts.
    g. Estimated gestational age (term, late preterm, premature)
    h. Pulse oximetry should be considered if prolonged resuscitative efforts or if supplemental oxygen is administered. Goal: oxygen saturation at 10 minutes is 85–95%

Treatment and Interventions

1. If immediate resuscitation is required and the newborn is still attached to the mother, clamp the cord in two places and cut between the clamps. If no resuscitation is required, warm, dry, and stimulate the newborn and then cut and clamp the cord after 60 seconds or the cord stops pulsating.
2. **Warm, dry, and stimulate**
    a. Wrap infant in dry towel or thermal blanket to keep infant as warm as possible during resuscitation; keep head covered if possible.

    b. If strong cry, regular respiratory effort, good tone, and term gestation, place infant skin-to-skin with mother and covered with dry linen.
3. If weak cry, signs of respiratory distress, poor tone, or preterm gestation then position airway (sniffing position) and clear airway as needed. If thick meconium or secretions present *and* signs of respiratory distress, suction mouth then nose.
4. If heart rate greater than 100 beats per minute
    a. Monitor for central cyanosis; provide blow-by oxygen as needed
    b. Monitor for signs of respiratory distress. If apneic or in significant respiratory distress:
        a. **Ventilate**: BVM ventilation with room air at 40–60 breaths per minute.
            i. Positive pressure ventilation (PPV) with bag-mask device may be initiated with room air (21% oxygen) in term and late preterm babies otherwise use 100% oxygen [EMR].
            ii. Goal: SPO2 at 10 minutes is 85–95%
        b. Consider supraglottic airways or intubation [PARA] as appropriate
5. Apply cardiac monitor
6. **Evaluate:** If heart rate less than 100 beats per minute
    a. Initiate bag-valve-mask ventilation with room air at 40–60 breaths per minute.
        a. Primary indicator of effective ventilation is improvement in heart rate.
        b. Rates and volumes of ventilation required can be variable, only use the minimum necessary rate and volume to achieve chest rise and a change in heart rate.
    b. If no improvement after 90 seconds, change oxygen delivery to 30% FiO_2 if blender available, otherwise 100% FiO_2 until heart rate normalizes.
    c. Consider Non-visualized airway ***or*** endotracheal intubation ***[PARA]*** if bag-valve-mask ventilation is ineffective.
7. **Resuscitate**: If heart rate less than 60 beats per minute
    a. Ensure effective ventilations with supplementary oxygen and adequate chest rise.
    b. If no improvement after 30 seconds, initiate chest compressions;two-thumb- encircling-hands technique is preferred.
    c. Coordinate chest compressions with positive pressure ventilation (3:1 ratio, 90 compressions and 30 breaths per minute).
    d. Consider non-invasive airway or endotracheal intubation ***[PARA].***
    e. Administer **Epinephrine *[PARA].***
        a. **0.01 mg/kg IV/IO** q 3-5 mins (max 1mg) if heart rate remains less than 60 BPM
        b. **0.1 mg/kg** via ETT q3-5min if heart rate remains less than 60 BPM

8. Consider checking a blood glucose for ongoing resuscitation, maternal history of diabetes, ill appearing or unable to feed.
9. Administer 20 mL/kg normal saline IV/IO ***[AEMT]*** for signs of shock or post- resuscitative care.



Top 10 Take-Home Messages for Neonatal Life Support

1. Newborn resuscitation requires anticipation and preparation by providers who train individually and as teams.
2. Most newly born infants do not require immediate cord clamping or resuscitation and can be evaluated and monitored during skin-to-skin contact with their mothers after birth.
3. Inflation and ventilation of the lungs are the priority in newly born infants who need support after birth.

4. A rise in heart rate is the most important indicator of effective ventilation and response to resuscitative interventions.
5. Pulse oximetry is used to guide oxygen therapy and meet oxygen saturation goals.
6. Chest compressions are provided if there is a poor heart rate response to ventilation after appropriate ventilation corrective steps, which preferably include endotracheal intubation.
7. The heart rate response to chest compressions and medications should be monitored electrocardiographically.
8. If the response to chest compressions is poor, it may be reasonable to provide epinephrine, preferably via the intravenous route.
9. Failure to respond to epinephrine in a newborn with history or examination consistent with blood loss may require volume expansion.
10. If all these steps of resuscitation are effectively completed and there is no heart rate response by 20 minutes, redirection of care should be discussed with the team and family.

Patient Safety Considerations

1. Hypothermia is common in newborns and worsens outcomes of nearly all post-natal complications.
    a. Ensure heat retention by drying the infant thoroughly, covering the head, and wrapping the baby in dry cloth.
    b. When it does not encumber necessary assessment or required interventions, "kangaroo care" (i.e. placing the infant skin-to-skin directly against mother's chest and wrapping them together) is an effective warming technique.
    c. Newborn infants are prone to hypothermia which may lead to hypoglycemia, hypoxia and lethargy. Aggressive warming techniques should be initiated including drying, swaddling, and warm blankets covering body and head. Check blood glucose and follow Hypoglycemia guideline as appropriate.
2. During transport, neonate should be appropriately secured in seat or isolette and mother should be appropriately secured.

Notes and Educational Pearls Key Considerations

- Approximately 10% of newly born infants require some assistance to begin breathing at birth and 1% require resuscitation to support perfusion.
- Most newborns require only drying, warming, and stimulating to help them transition from fetal respiration to newborn respiration. The resuscitation sequence can be remembered as **Dry, Warm, and Stimulate – Ventilate – Evaluate – and Resuscitate**.
- Deliveries complicated by maternal bleeding (placenta previa, vas previa, or placental abruption) place the infant at risk for hypovolemia secondary to blood loss.
- Low birth weight infants are at high-risk for hypothermia due to heat loss.
- Measuring the pulse oximetry on the right hand provides the most accurate oxygen saturation (SpO_2) in infants that are transitioning from fetal to normal circulation. At 60 seconds, 60% is the target with an increase of 5% every minute until 5 minutes of life when pulse oximetry is 80–85%
    - Time Since Birth: Projected Increase in Pulse Oximeter Over Time
        - 1 minute: 60–65%
        - 2 minutes: 65–70%
        - 3 minutes: 70–75%
        - 4 minutes: 75–80%
        - 5 minutes: 80–85%
        - 10 minutes: 85–90%
- Both hypoxia and excess oxygen administration can result in harm to the infant. If prolonged oxygen use is required, titrate to maintain an SPO_2 of 85–95%.
- While not ideal, a larger facemask than indicated for patient size may be used to provide BVM ventilation if an appropriately sized mask is not available. Avoid pressure over the eyes as this may result in bradycardia.
- Increase in heart rate is the most reliable indicator of effective resuscitative efforts.

- A multiple gestation delivery may require additional resources and/or clinicians.
- There is no evidence to support the routine practice of administering sodium bicarbonate for the resuscitation of newborns.
- **APGAR** scoring is not critical during the resuscitation, although it may be prognostic after 20 minutes if the **APGAR** Score remains “0” despite resuscitation.
- **APGAR Score**

Sign	**0**	**1**	**2**
Appearance	Blue, Pale	Body pink, Extremities blue	Completely Pink
Pulse	Absent	Slow (less than 100)	Greater than 100
Grimace	No response	Grimace	Cough or Sneeze
Activity	Limp	Some flexion	Active motion if extremities
Respirations	Absent	Slow, irregular	Good, crying

Pertinent Assessment Findings

- It is difficult to determine gestational age in the field; if there is any doubt as to viability, resuscitation efforts should be initiated.
- Acrocyanosis, a blue discoloration of the distal extremities, is a common finding in the newly born infant transitioning to extra uterine life; this must be differentiated from central cyanosis.

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

- 9914133—Medical-Newborn/Neonatal Resuscitation

Key Documentation Elements

- Historical elements
  - Prenatal complications
  - Delivery complications
  - Date and time of birth
  - Estimated gestational age
- Physical exam findings
  - Heart rate
  - Respiratory rate
  - Respiratory effort
  - Appearance
  - APGAR score at 1 and 5 minutes

Performance Measures

- Prehospital on-scene time
- Call time for additional resources
- Arrival time of additional unit
- Time to initiation of interventions
- Use of oxygen during resuscitation

- Presence of advanced life support (ALS) versus basic life support (BLS) providers
- ROSC and/or normalization of heart rate
- Length of stay in neonatal intensive care unit
- Length of stay in newborn nursery
- Length of stay in hospital
- Knowledge retention of prehospital providers
- Number of advanced airway attempts
- Mortality

References

1. AGOG Recommends Delayed Umbilical Cord Clamping for All Healthy Infants. Agog.org. https://www.acog.org/About-ACOG/News-Room/News- Releases/2016/Delayed-Umbilical-Cord-Clamping-for-All-Healthy-Infants. Published December 21, 2006. Accessed August 27, 2017.
2. Kattwinkel J, Perlman JM, Aziz K, et al. Part 15: neonatal resuscitation: 2010 American Heart Association Guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation.* 2010;122(18 Suppl 3):S909-19.
3. Weiner GM, Zaichkin J. Textbook of neonatal resuscitation (NRP), 7th Ed. Elk Grove Village, IL: American Academy of Pediatrics; 2016.