

Management of an Unexpected Delivery in the Emergency Department
Clin Ped Emerg Med 2016 Jun;17(2):89-98. Arika G. Gupta, MD*, Mark D. Adler, MD†

KEY POINTS

Delay Clamping Cord for 30-60 seconds if not needing resuscitation

Warm/Dry/Stimulate

BVM if HR<100

Place Pulse Ox on RUE (preductal extremity) and 3 cardiac leads

Intubate (or LMA if >34weeks) if HR not improving

CPR/Epi (down ETT .1mg/kg or IV .01mg/kg of 1:10,000) if HR<60

CPR with 2 thumbs

Introduction

- 90% of deliveries require no special assistance, the remainder require some level of intervention and <1% require extensive resuscitative measures.

PREPARING FOR AN UNEXPECTED DELIVERY

HISTORY

1. Did the patient receive prenatal care?
2. Was the pregnancy known to the patient?
3. How many babies are expected to be delivered?
4. Approx. gestational age or LMP?
5. Any major complications during the pregnancy or labor (eg, gestational DM or HTN?, concerns about fetal growth, maternal infection or fever, prolonged rupture of membranes, any known anatomic congenital abnormalities on prenatal ultrasound)?

PREPARATION

- Call for help from OB and Neonatologist
- Assign a team to manage mother and second team to manage the newborn

PRINCIPLES AND STEPS OF NEWBORN RESUSCITATION

- The most important 3 questions to ask upon delivery of the neonate include the following:
 1. Term gestation?
 2. Good tone?
 3. Breathing or crying?
- If YES- then the newborn may stay with the mother and receive routine newborn care (warm baby).
- If NO
 1. Initial stabilization: warm, stimulate, dry, position airway
 2. If HR<100 at the first assessment (by 1 minute of life) or if the infant has inadequate respiratory effort (apnea, gasping, hypopnea), then effective ventilation and oxygen delivery must be delivered, via bag valve mask (BVM). Multiple corrective measures to ensure effective ventilations must be attempted, including endotracheal tube (ETT) or laryngeal mask airway (LMA) placement, if necessary. **Pulse Ox on RUE, 3 cardiac leads to monitor pulse.**
 3. If HR is below 60 bpm, despite adequate ventilation (including advanced airway placement), initiate **chest compressions/breaths at a ratio of 3:1**. Note the difference between this rate and the

pediatric advanced life support algorithm with a 15:2 ratio. You may need to be explicit with your team if they are not familiar with the neonatal resuscitation recommendations.

SPECIAL CONSIDERATIONS AT THE TIME OF DELIVERY

Delayed Cord Clamping

- Delayed umbilical cord clamping is now recommended for both term and preterm infants who do not require resuscitation at birth, defined as clamping the umbilical cord approximately 30 to 60 seconds after birth.

Thermoregulation

- Hypothermia is known to cause an increase in oxygen consumption and metabolic demand and is independently associated with increased morbidity and mortality in the neonate of all gestational ages.
- Low-birth weight and preterm infants, in particular, are at increased risk of hypothermia
- recommended that temperature be maintained between 36.5°C and 37.5°C (97.7°F-99.5°F).
- There is a commensurate increase in mortality for temperatures below 36.5°C.
- Strategies to ensure thermoregulation in the delivery room, or in this case the ED, include use of a preheated radiant warmer, plastic wrap for preterm neonates (Figure 2), warm and dry linens to dry and swaddle infant, hat.

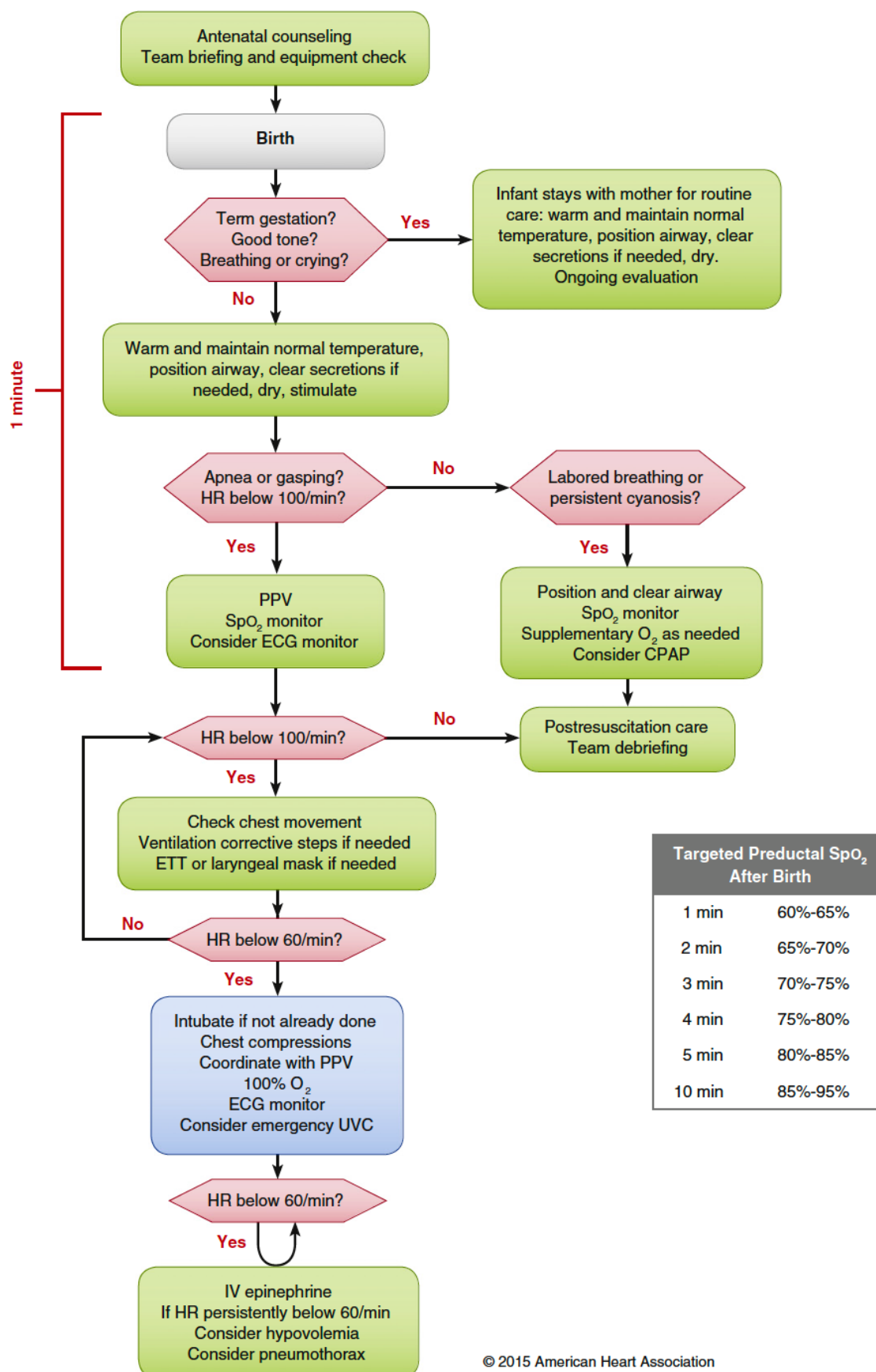
ELEMENTS OF NEONATAL RESUSCITATION

Airway

- If a newborn is demonstrating signs of airway obstruction or inadequate ventilation requiring positive pressure ventilation (PPV), it is appropriate to open the mouth, if needed, adjust the airway (using chin tilt or jaw thrust), and/or suction secretions from the airway.
- However, it is recommended that unnecessary suctioning of the nasopharynx be avoided given the risk of inducing a vagal response and reflexive bradycardia.
- In addition, the most recent AHA guideline no longer recommends routine tracheal intubation in the setting of a depressed newborn with meconium-stained amniotic fluids, as had previously been recommended.
- The focus in these patients should be on initiating ventilation within the first minute of life if the infant remains depressed and is not breathing or ineffectively breathing.

AGE	WEIGHT (KG)	ETT ID (mm) UNCUFFED	ETT ID (mm) MICROCUFF	ETT @ LIPS	LARYNGOSCOPE BLADE	LMA	Oral Airway	RR	HR	MAP
Neonate	<1	2-2.5		7	Miller 0			<60	140-160s	30s
Neonate	1-2	2.5-3.0		8	Miller 0	1	4	<60	140s	30s
Neonate	2-3	3.0	3.0	9	Miller 0 / Miller 1	1	4	<60	130-140s	30s
Neonate	>3	3.5	3.0	10	Miller 1	1	5	<60	130-140s	40s
1-6 months	4-6	3.5-4.0	3.0	11	Miller 1	1.5	5	24-30	130s	40s
6 mo – 1 yr	6-10	3.5-4.0	3.5	12	Miller 1 – Wis 1	1.5	6	22-26	130s	50s

Neonatal Resuscitation Algorithm—2015 Update



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Figure 1. 2015 Neonatal Resuscitation Algorithm. Reprinted with permission from *Circulation* (2015;132:S543-S560).⁴ Copyright 2015, AHA.

Breathing

- Despite the initial steps of drying, stimulation, and airway maneuvers, if the infant's HR is under 100 bpm at the first assessment at about 1 minute of life, it is essential to promptly begin PPV via BVM at a rate of 40 to 60 breaths per minute.
- If PPV is initiated, the team should consider placing a **pulse oximetry probe** on the right upper extremity (preductal) to monitor oxygen saturations.
- Resuscitation of all infants, including preterm infants, should be initiated with **low oxygen concentrations** (21% ideally, but up to 30% for preterm infants is reasonable).
- The oxygen concentration should subsequently be titrated to achieve target preductal oxygen saturations based on minutes of life, as seen in Figure 1. It is appropriate for a newborn with normal transition to have a preductal saturation ranging between 60 and 70% in the first minute of life with a gradual increase until about 10 minutes of life when the preductal saturations typically increase to 85 to 95%.
- If a blender device that allows the fine titration of FiO₂ is not available, it is reasonable to initiate PPV with room air and increase to 100% FiO₂, if resuscitation is necessary.
- The AHA recommendation to avoid administration of excessive oxygen is an attempt to limit the potential deleterious effects of hyperoxia.
- Throughout the resuscitation, once PPV has been initiated, the team should be consistently reevaluating the infant's HR, spontaneous respiratory effort, effectiveness of assisted ventilation, and the preductal oxygen saturations.
- Ventilation corrective measures should be considered if assisted breaths are not effective or HR does not quickly begin to rise. An increase in the newborn's HR is one of the most sensitive indicators we have during a resuscitation of the effectiveness of ventilation. If despite effective ventilations, the HR does not rise, the team should consider placement of an advanced airway, including an ETT or LMA. Laryngeal mask airways may be considered as an alternative to tracheal intubation in infants ≥34 weeks or ≥2 kg when tracheal intubation is unsuccessful or not feasible.
- If chest compressions are necessary, it is recommended that an advanced airway be placed prior, to ensure effective ventilation as well as to optimize compression performance. In addition, if compressions are being given, it is appropriate to increase the FiO₂ to 100% until the HR recovers and then titrate down the oxygen concentration once the HR improves.
- If at any point in the resuscitation, the HR is greater than 100 bpm and the neonate is breathing spontaneously, but is demonstrating signs of respiratory distress (labored breathing or grunting) or has persistent cyanosis, the team should consider initiation of continuous positive airway pressure. In the setting of the ED, continuous positive airway pressure is probably most easily provided using a flow-inflating bag with the positive end-expiratory pressure set to 5 to 6 cm H₂O.

Circulation

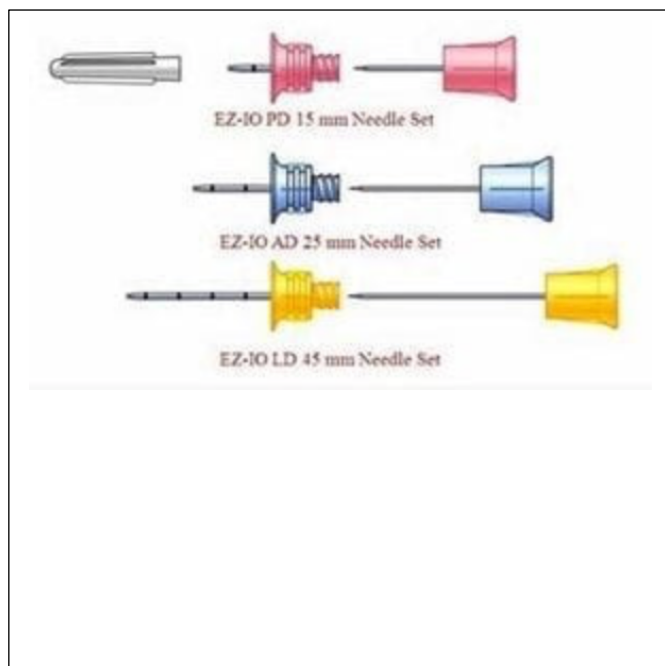
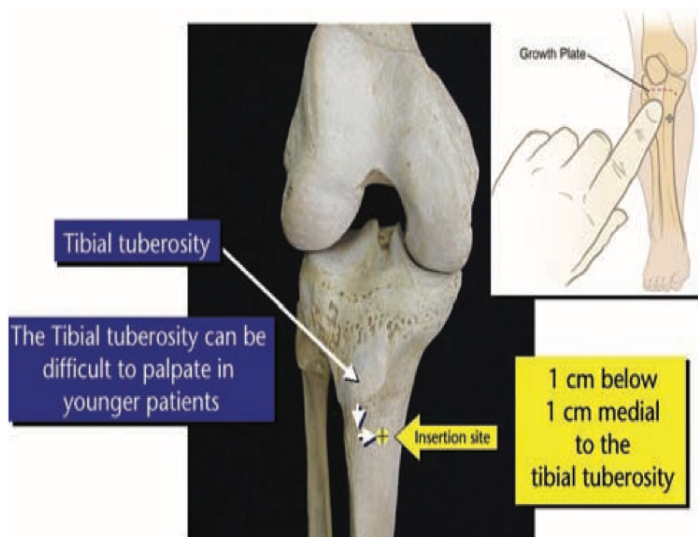
- As noted above, a newborn's HR is evaluated frequently throughout a resuscitation and is the most sensitive indicator of effective ventilation, whether from the infant's spontaneous respiratory effort or delivered mask ventilations.
- Typically, either auscultation of the HR or palpation of the pulse at the base of the umbilicus is the most effective method used to evaluate HR in the first minute of life.
- Previously, it was recommended to use pulse oximetry to supplement this assessment if the infant requires interventions. However, the newest recommendation is to use a three-lead electrocardiogram for monitoring HR during a resuscitation, in addition to continuous pulse oximetry for evaluation of oxygen saturation.

- If the HR remains less than 60 bpm despite adequate ventilation, including placement of an advanced airway, chest compressions should be initiated at a ratio of 3 compressions: 1 breath for a total of 120 events per minute.
- Compressions and ventilations should be coordinated to avoid simultaneous delivery, allowing the chest to fully recoil between compressions and optimize lung expansion during assisted ventilation. Note that this differs from pediatric advanced life support in which compressions and breaths are not coordinated after intubation. In terms of technique, the two-thumb technique is the preferred method for compressions, as it has been shown to be more effective and is associated with less rescuer fatigue.
- The two-thumb technique involves encircling the newborn's torso with the thumbs placed on the lower third of the sternum and the fingers under the infant's back, supporting the spine.

Medications and Fluids

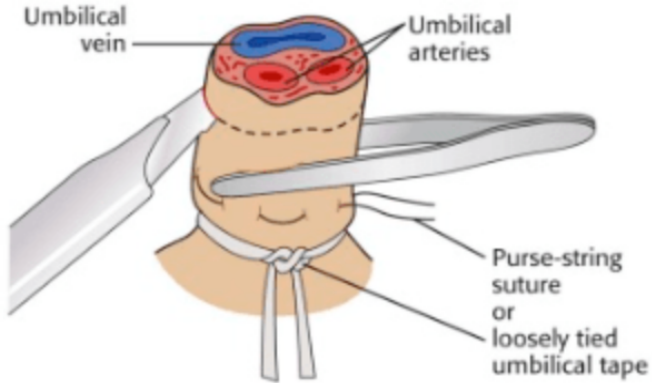
- establishing adequate ventilation remains the foundation of neonatal resuscitation.
- However, when the HR remains below 60 bpm despite adequate ventilation with an advanced airway and 100% FiO₂ and chest compressions, it is appropriate to administer either epinephrine or a volume expander, or both.
- For persistent bradycardia, intravenous epinephrine at a dose of 0.01 to 0.03 mg/kg, of 1:10 000 concentration, may be considered.
- If venous access is not available, the resuscitation team may consider a dose of endotracheal epinephrine at a dose of 0.05 to 0.1 mg/kg, until intravenous access is established.
- In such circumstances, once intravenous access has been obtained, an intravenous dose of epinephrine should be given immediately, irrespective of when the endotracheal dose was given.
- Options for emergency intravenous access in a neonate include placement of a peripheral intravenous catheter, low-lying umbilical venous catheter (UVC), or intraosseous line (IO).
- **The decision of which (UVC vs. IO) to place emergently should ultimately be guided by the clinician's experience and comfort level with each of the procedures.**
- When there is a known history of blood loss during delivery and/or signs of hypovolemic shock in the newborn, volume expansion may be considered when the infant has failed to respond to all other resuscitative measures.
- Appropriate volume expanders include isotonic crystalloid solution or emergency blood, at a dose of 10 mL/kg. In premature infants, it is recommended to avoid giving these volume expanders rapidly, as this may be associated with increased risk of IVH.

FIGURE 3 ■ Anterior tibial IO insertion site.



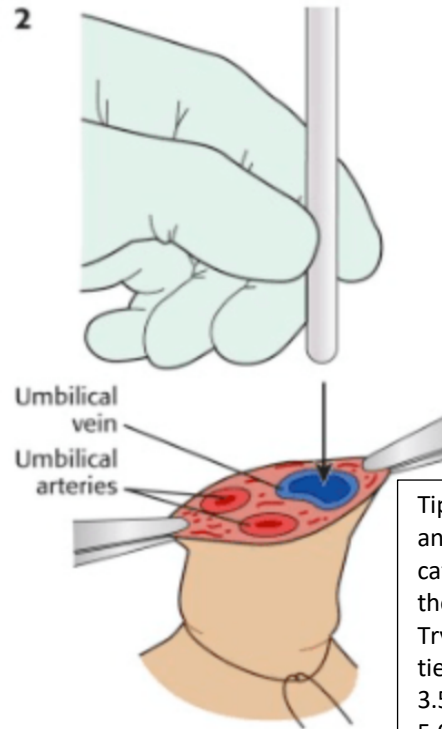
UMBILICAL VEIN CATHETERIZATION

1



Hold the umbilical stump up and scrub it with bactericidal solution. Place a loop of umbilical tape or a purse-string suture at the junction of the skin and the cord. Cut the cord with a scalpel 1 cm from the skin and identify the vessels. The single vein is thin walled, has a large lumen, and may continue to bleed after cutting. The two arteries have thicker walls and smaller lumens and do not usually bleed.

2



Advance a preflushed catheter into the vein and gently advance it.

For emergency use, advance only 1–2 cm beyond the point at which good blood return is obtained. This is usually only 4–5 cm for a term-sized infant.

For longer-term use, the catheter may be passed into the inferior vena cava. (See text for details.)

Tips if you meet resistance:
angle stump toward feet so catheter is directed toward the head.

Try loosening the umbilical tie just a tad.

3.5 fr for Preterm
5.0 fr for Term

POSTRESUSCITATION CARE, MONITORING, AND EVALUATION

- target temperature for a normal newborn, independent of gestational age, is between 36.5°C and 37.5°C (97.7°F–99.5°F).
- Therapeutic hypothermia—In special circumstances for infants ≥ 36 weeks gestation who have suspected moderate to severe hypoxic-ischemic encephalopathy, induced therapeutic hypothermia should be offered and implemented at a neonatal intensive care unit or other intensive care unit with the appropriate resources, monitoring, and nursing staff for this treatment protocol.
- treatment should ideally be initiated by 6 hours of life,
- Glucose monitoring—
- If hypoglycemia is present, a bolus of intravenous D10% water solution is given at a volume of 2 mL/kg, followed by initiation of intravenous dextrose-containing fluids, not saline-based fluids. Typically, a D10% water solution is used as the maintenance fluid in a newly born infant to provide a dextrose infusion rate of about 4 to 6 mg/kg/min, which is equivalent to total fluids of 60 to 80 mL/kg/day.
- Erythromycin eye ointment—In the United States, it is mandatory that all newborns receive prophylaxis against gonococcal eye infection by administration of ophthalmic antibiotic agents shortly after birth, ideally within the first hour of life. The current standard treatment, recommended by the American Academy of Pediatrics and Centers for Disease Control and Prevention, is 0.5% erythromycin ophthalmic ointment, with application of a 1-cm ribbon in each eye, in the lower eyelid.
- Vitamin K administration—The American Academy of Pediatrics recommends vitamin K1 be given to all newborns as a single intramuscular dose of 0.5 to 1 mg to prevent both early- and late-onset vitamin K deficient bleeding, previously referred to as hemorrhagic disease of the newborn.²⁹ This intramuscular medication is typically given in the anterolateral aspect of the proximal thigh.