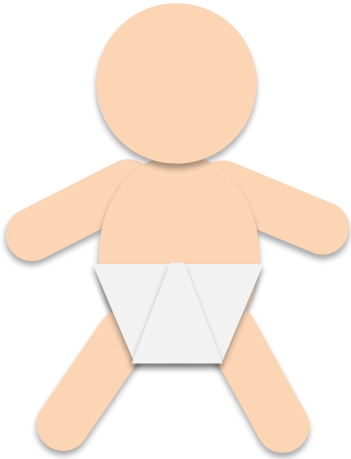
American College of Emergency Physicians

EMS SimBox

Peripheral Brain Booklet version 1.1



ACEP SIMBOX PERIPHERAL BRAIN BOOKLET

GOAL: THE FIRST FIVE MINUTES

Demonstrate a team-based approach to care for a critical neonate.

Knowledge

1. **Identify features of the neonate in shock.**
2. **Describe a cause neonatal shock that can be treated in the field.**
3. **List indications for transport to local ED or regional pediatric center.**

Skills

1. **Perform a systematic assessment of a critically ill neonate.**
2. **Select appropriate pediatric resuscitation equipment based on patient age.**
3. **Demonstrate use of a (medication dosing) cognitive aid(s).**

Attitudes

1. **Utilize team communication skills, such as the shared mental model and closed loop communication.**
2. **Demonstrate family centered care/interactions.**

GOAL: Demonstrate team-based approach to a critical neonate

Crisis (crew) Resource Management and Team Organization Tips

The Team leader (TL):

- Sets the tone for the room
- Encourages closed loop communication
- Maintains awareness of situation and member task load
- Provides a case summary often
- Shares thoughts with the team
- Is open to thoughts and suggestions from the team

Team members:

- Know their role assignments
- Are able to carry out their responsibilities and say so if not
- Know how to find equipment
- Know how to use a cognitive aid

AHA resuscitation team concepts:

https://co.grand.co.us/DocumentCenter/Home/View/610

https://lifeinthefastlane.com/ccc/crisis-resource-management-crm

TL

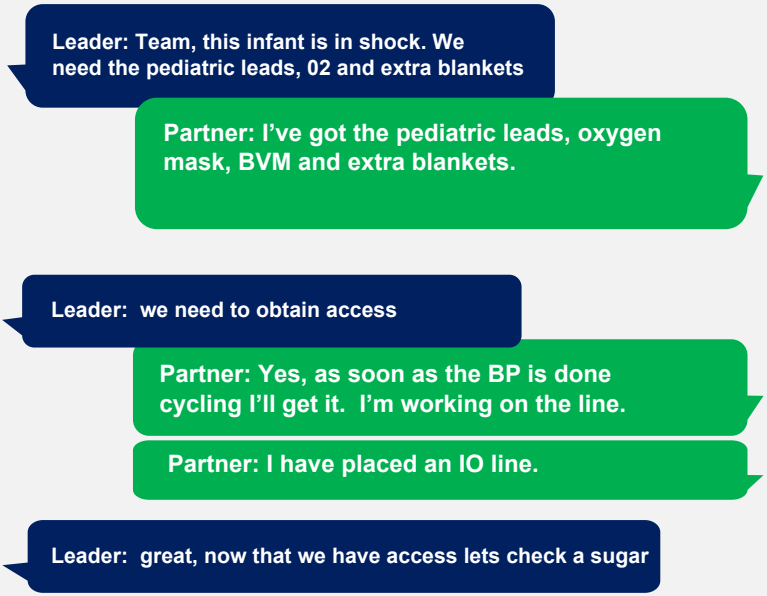
A1: ATTITUDES

Utilize team communication skills such as shared mental model and closed loop communication

A shared mental model allows a team to anticipate the plan for patient care and what equipment/medications might be needed.
Closed loop communication goals are for all team members to:

- Address team members by name when assigning tasks
- Give confirmation when tasks are acknowledged or completed
- Request clarification or help when needed

TIP: practice closed loop communication around assigning roles



A2: ATTITUDES

Demonstrate family centered care/interactions

- Allow family input and presence in most circumstances
- Communicate with the family while caring for the patient

K1: KNOWLEDGE

Identify features of the neonate in shock

Newborn exam tips

- **Sick or not sick? (use AVPU: see S1B)**
- **Fontanelle:** sunken or bulging?
- **Circulation:** capillary refill, pulses
- **Neuro**: tone, suck, reflexes
- **Skin**: color, rashes, jaundice, umbilical stump
- **Look in the diaper**: hernias, genitalia

Place blankets on infant, start oxygen and check a glucose

Temperature tip: if age < 1 month a rectal temp T < 36^0 C or ≥38^0 C will prompt a full sepsis workup

Normal VS	HR	BP	RR	Temp ®
0-3 months	110-160	SBP 65-86 DBP 45-55	35-55	36-37.9 C 96.8-100.3 F

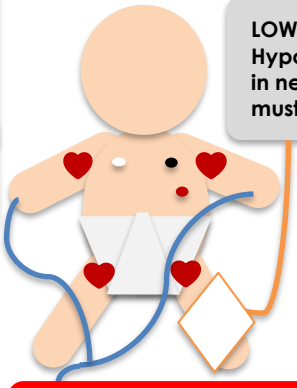
TACHYCARDIA IS ONE OF THE FIRST SIGNS OF SHOCK

Neonates have less myocardial contractility and a relatively fixed stroke volume. With increased metabolic demand, cardiac output is compensated by an increase in heart rate.

CO = HR X SV

IF PULSE <60 INITIATE CPR IMMEDIATELY

ALTERATIONS IN RESPIRATORY RATE: Neonates in shock may initially present with tachypnea. **Bradypnea or apnea is an ominous sign requiring prompt immediate airway rescue.**



LOW Blood Pressure: Hypotension is a late finding in neonates with shock and must be identified early.

Other features of shock:

- cap refill > 2 sec
- decreased urine output
- altered mental status

Cardiac issues: some lesions may present in the first few weeks of life if not diagnosed prenatally.

- ***Poor feeding***? Suspect Coarctation or other congenital heart disease.
- **Check for signs of heart failure**: palpate below costal margin for "liver edge."
- **Consider bedside ultrasound** POCUS ECHO if available.

Monitoring tips for cardiac suspects

- ***Pre(R)+ Post(L)* ductal pulse oximetry**
- **Check *Bilateral* brachial + femoral pulses** ❤ **locations above**
- **Four extremity BPs**

Defibrillator pads go front and back on children up to 15 kgs.

Note: *the sizing of "infant pads" is product specific, packaging can be misleading!*

K2: KNOWLEDGE

Describe treatable causes of shock and management priorities for this infant.

Use THE MISFITS mnemonic for differential diagnosis:
The differential of shock in a neonate is broad. In a crisis it can be difficult to remember the various H's and T's:

T	**Trauma**: must consider non-accidental causes
H	**Heart and lung**: congenital heart disease, apnea, lung infection (meconium, pertussis, respiratory syncytial virus)
E	Endocrine emergencies e.g. congenital adrenal hyperplasia, thyroid (hyper or hypo thyroidism)
M	**Metabolic disturbance:** electrolyte abnormalities due to underlying disorders* (hypoglycemia, Na, Ca)
I	**Inborn errors** of metabolism
S	**Sepsis** (Group B strep, *E Coli* more commonly, Listeria)
F	**Feeding mishaps**: dilutional hyponatremia versus concentrated formula and hypernatremia, free water
I	**Intestinal disasters**: diaphragmatic hernia, malrotation with volvulus, Hirschsprung's megacolon, necrotizing enterocolitis
T	**Toxins**: maternal exposure to opiates or other drugs of abuse
S	**Seizures**: CNS and infectious causes (TORCHES, neonatal HSV)

Adapted from Brousseau, Sharieff. Pediatr Clin N Am 53 (2006) 69–84.

*Profuse diarrhea can also cause shock in neonates.

K3: KNOWLEDGE

List indications for escalation/transfer of care

- Know the limitations of your treatment environment.
- Determine appropriate destination for transport: local ED or regional pediatric specialty center (even if longer transport time).
- Consider call to medical control.

S1a: SKILLS

Perform a systematic assessment of a critically ill neonate.

TIP: Think "sick or not sick"? Don't forget the ABCs and especially D.

A **B** **C**

Airway before compressions in a neonate

Dextrose

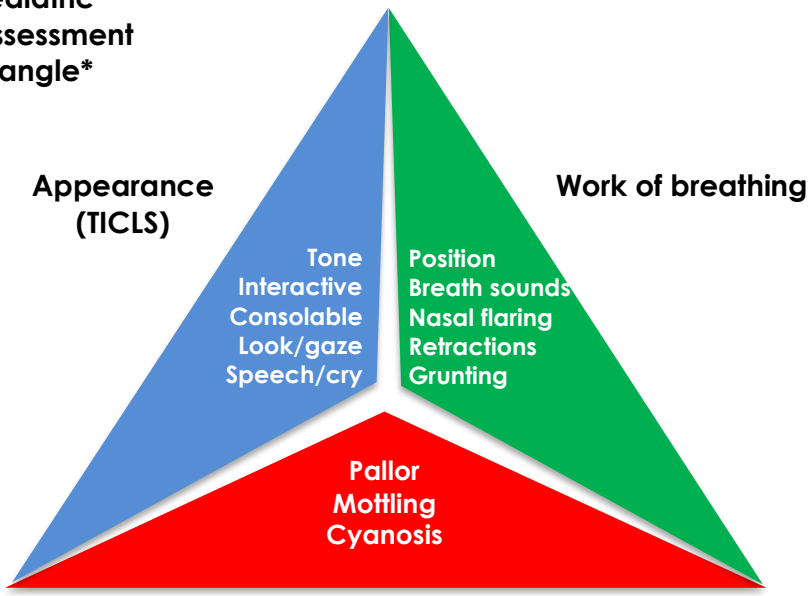
D10: 5 mL/kg
D25: 2 mL/kg
D50: 1 mL/kg

D50 can be given IO but not IV to neonates (it can damage vessels)

Dextrose replacement is a priority:

REMEMBER 5/2/1

Pediatric Assessment Triangle*



*REF: Horeczko T, Enriquez B, McGrath NE, Gausche-Hill M, Lewis RJ. The Pediatric Assessment Triangle: *Journal of Emerg Nur:*2013;39(2):182-189 doi:10.1016/j.jen.2011.12.020.

ABC TIPs: Airway and breathing considerations

Consider the following when caring for neonates in distress

***The neonatal airway is challenging due to these anatomic differences*:**

- Obligate nasal breathers
- Large tongue and occiput
- Short neck
- Anterior and superiorly placed airway
- Funnel shaped airway
- Floppy epiglottis

What special airway management should be considered in a neonate?

Consider non-invasive adjuncts

1) Positioning
   Shoulder roll
   Suction
2) Nasopharyngeal or oropharyngeal airway
3) Simple oxygen via nasal cannula or face mask
4) Oxygen

Airway checklists are helpful.

How many BVM respirations should you give a neonate that is:

1) breathing with RR < 20:
consider BVM assist

2) not breathing: BVM
*one breath every 2 sec***

How do you know if the bag ventilation you administer is effective?

- Watch for good chest rise and improvement in oxygen saturation.
- Beware of over-ventilation to avoid barotrauma and pneumothorax.

How do you decide when endotracheal intubation is necessary?

Consider patient status, need for airway protection and your location.

What are options for invasive ventilation

- **Supraglottic airways** (e.g. LMA): may consider if ≥34 weeks gestational age and ≥2000g.
- **Tracheal Intubation**: 3.5 un-cuffed or 3.0 cuffed ET tube in a term neonate.

Video assisted laryngoscopy can also be helpful if available.

*Wing R, James C, Maranda LS, Armsby, CC. Use of high-flow nasal cannula support in the emergency department reduces the need for intubation in pediatric acute respiratory in sufficiency. Pediatr Emerg Care. 2012 Nov;28(11):1117-23. doi: 10.1097/PEC.0b013e31827122a9

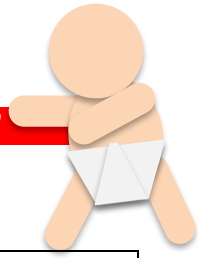
** Neonatal Resuscitation Program, American Academy of Pediatrics

S1b: SKILLS

Perform a systematic assessment of a critically ill neonate.

A	V	P	U
Alert	Verbal	Pain	Unresponsive

The Neonatal Past Medical History



TIP: This can be often be overlooked SO "Take a SAMPLE"

S	**Signs and symptoms**: newborn feeding, urinary and stooling patterns, evidence of jaundice, weight loss/gain, sleeping and activity
A	**Allergies:** may be unknown
M	**Medications**: includes whether or not infant received Vitamin K after birth, and any maternal medications including opiates
P	**PMH**: prenatal history, maternal health during pregnancy including Gestational DM Group B strep/ STI Hx, ill contacts in the home, school aged siblings and their vaccine status **Natal history**: details of the delivery and postnatal course
L	**Last feed**: Neonates feed approximately every 2 hours and are vulnerable to hypoglycemia. Maternal milk supply may not be sufficient in the first few days after delivery
E	**Events**: leading up to incident of unresponsiveness

S2: SKILLS

Select appropriate resuscitation equipment based on patient age

What and where do you keep this in your agency?

Be aware what equipment and medications are available in your agency. A full pediatric equipment list recommended for all EMS agencies can be found at: https://pediatrics.aappublications.org/content/145/1/e20193308

NOTE: The following equipment is specific only to *this* simulation case involving a 3-5 kg neonate:

Airway

- Bag valve mask + neonatal mask and bag
- Neonatal sized non-rebreather
- Suction
- OP/NP/NG/OG adjuncts
- Shoulder roll
- Supraglottic airway
- *Miller 1 laryngoscope blade
- 3.0-3.5 cuffed or uncuffed endotracheal tube
- *Video laryngoscopy equipment

Measurement/Monitors

- Neonatal monitor leads/defibrillation pads
- Pulse oximeter probe
- Length-based tape for equipment sizing
- Medication dosing guide

Access

- 24g IV and primed IV tubing
- Syringes
- 3 way stopcock
- Infant IO (traditional IO needle or mechanized driver with 3-39kg needle)
- Normal Saline flushes

A 3 way stop-cock and extender tubing is needed for "push pull" bolus administration.

Miscellaneous: Warm blankets

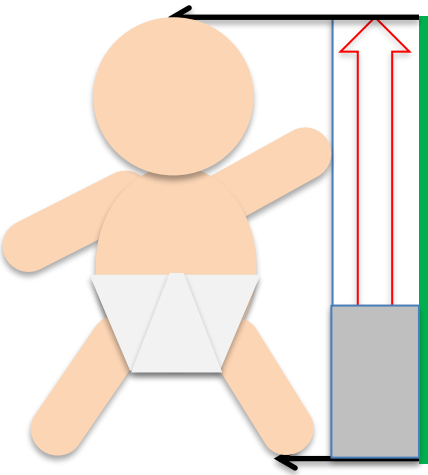
S3: SKILLS

Demonstrate how to use a cognitive aid(s) for medication dosing

Cognitive aids such as length-based tapes can reduce medical errors. Color coded zones provide pre-calculated medication doses and equipment sizes based on weight. Many products are available. Teams must be familiar with how to access and utilize cognitive aids in their ED.

How much does your baby weigh?

TIP: Most newborns weigh 3-5 kg.



Length based tape: measure from the crown to heel of supine patient with the arrow pointing UP

Tip: Practice closed loop communication in medication dosing*

Leader: We need to give 0.01 mg/kg of IV epinephrine. Med RN, can you give me the child's weight?

Partner: Baby is in the grey zone, 3-5 kg. I'm looking up the dose for epinephrine: is that the cardiac or the anaphylaxis concentration?

We need the cardiac dose, better draw up two.

OK, that's 0.1 mL/kg of the 1:10,000, so that's XX mls. I'm giving XX mls IV epi.

That is correct. Let me know when it is in.

Epi is in. I'll draw up another.

*Closed loop communication feels very unnatural to start! It does ensure that teams are actively listening and working together. Practice makes it easier.

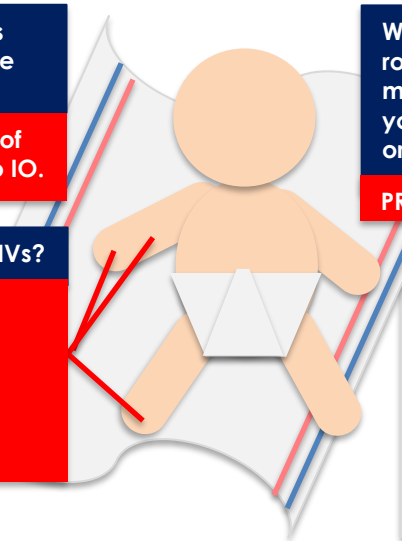
ABC TIPS — CIRCULATION: Vascular Access Tips

How many IV attempts should be made before considering an IO?

Per PALS*: 90 seconds of IV attempts, then go to IO.

Best sites for neonatal IVs?

Emergent:
Dorsal arch veins (hands or feet)
Cubital Fossa
Saphenous Vein
Scalp Veins



What are common routes to give medications when you can't give them orally?

PR, IN, IM, IV or IO

Neonates don't tolerate the cold: warmed blankets and a warm environment

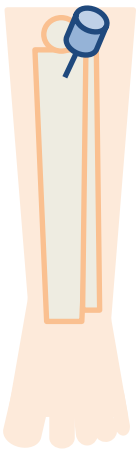
https://www2.health.vic.gov.au/hospitals-and-health-services/patient-care/perinatal-reproductive/neonatal-ehandbook/procedures/peripheral-intravenous-iv-catheter

Recommended sites for Neonatal Intra Osseous needle placement

The proximal tibia is a preferred IO site in neonates due to easier identification of landmarks and distance from the site of CPR compressions.

Troubleshooting:
If the IO infiltrates, attempt to place in opposite leg or in **distal femur**. The humeral head can also be used.

Do not attempt in a fractured extremity!



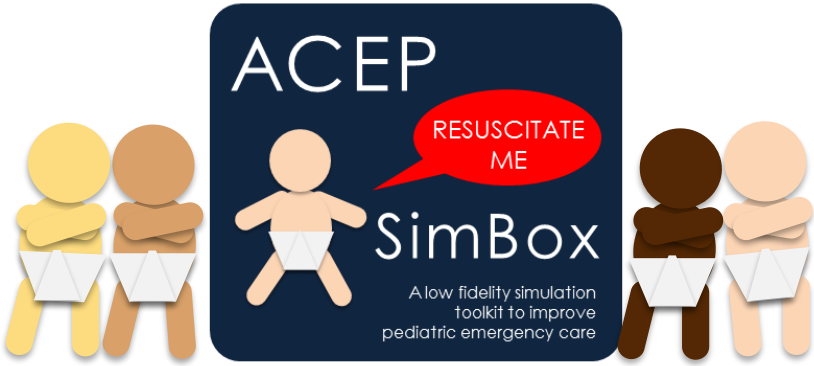
Tibial IO Landmarks:
1 fingerbreadth (FB) medial and 1 FB below the tibial tuberosity.
If unable to palpate the tibial tuberosity, aim 2 FB below lower pole of patella and 1 FB medial to that point.

DON'T: Puncture the growth plate or both cortices.

DO:
Consider a **3-way stopcock** for fluid administration

What size IO? Use "pink for premies, blue for babies"

IO placement Video: http://www.nejm.org/doi/full/10.1056/NEJMvcm0900916
Pediatric Advanced Life Support, American Heart Association 2015



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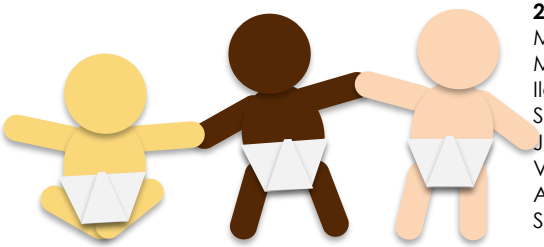

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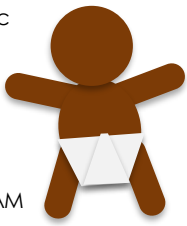

For additional information please visit the SimBox website www.acepsim.com