0-28 days

***Weight (KG):** 3.3- 4.15

Weight (Lbs): 7.2-9.14

Heart Rate (Beats per minute): 104-162

Respiratory Rate (Breaths per minute): 31-60

Blood Pressure (Systolic Range/ Diastolic Range): 60-80/30-53

MAP (mmHg): 40 or higher

Broselow color: Grey

* Weight based on Broselow Tape

**Vitals based on BC PEWS

Airway Equipment

Premature, 1.5 kg (3.3 lbs)

	Values	Formula
Tidal Volume	10 mL	4-8 mL/kg
Laryngoscope	0 - 1 Straight	-
Un-cuffed ETT	2.5 - 3 mm	(Age/4)+4
Cuffed ETT	2 - 2.5 mm	(Age/4)+3
ETT Depth	7.5 - 9 cm	3 (ETT Size)
i-Gel SGA	N/A	-
NPA	-	-
OPA	40 mm (pink)	-
Suction Cath	6 Fr	-

Airway Induction Doses

Premature, 1.5 kg (3.3 lbs)

	Values	Details
Normal Saline Bolus (IV)	15 ml	10 ml/kg
ketAMINE (IV/IO)	1.5 mg	1 mg/kg
EPINEPHrine (Slow IVP/IO)	15 mcg	1.0 mcg/kg
MIDAZOLam (IV/IO)	0.15 mg (150 mcg)	0.1 mg (100 mcg)/kg PRN

Maintenance doses on PR18: Anesthesia Induction Page

Respiratory & Allergic Reaction

Premature, 1.5 kg (3.3 lbs)

	Values	Details
DiphenhydrAMINE (IM/IV)	1.5 mg	1 mg/kg
EPINEPHrine (IM)	0.02 mg (20 mcg)	0.01 mg (10 mcg)/kg; Max 0.5 mg
EPINEPHrine (Neb)	5 mg	0.5 mg (500 mcg)/kg in 5 mL N/S; Max 5 mg
EPINEPHrine (IV)	0.01 mg (10 mcg)	0.005 mg (5 mcg)/kg; Max 0.3 mg
Salbutamol (Neb)	2.5 mg	-
Salbutamol (MDI)	---	NOT indicated
Magnesium Sulfate (IV infusion)	75 mg	50 mg/kg over 20 minutes; Max 2 g

Cardiac Arrest

Premature, 1.5 kg (3.3 lb)

	Values	Details
Defibrillation	3/6 J	2 & 4 J/kg
EPINEPHrine (IV)	0.02 mg (20 mcg)	0.01 mg (10 mcg)/kg; Max 1 mg
EPINEPHrine (ETT)	0.2 mg (200 mcg)	0.1 mg (100 mcg)/kg; Max 10 mg
Amiodarone (IV)	7.5 mg	5 mg/kg; Max 300 mg
Lidocaine (IV)	1.5 mg	1 mg/kg
Lidocaine (ETT)	1.5 mg	2 mg/kg
Sodium Bicarbonate (IV)	1.5 mEq	1 mEq/kg; May repeat
Magnesium Sulfate (IV)	75 mg	50 mg/kg; Max 4g
Calcium Chloride (IV)	30 mg	20 mg/kg; Max 500 mg
Naloxone (IV)	0.2 mg (200 mcg)	0.1 mg (100 mcg)/kg; Max 4 mg
Naloxone (ETT)	0.2 mg (200 mcg)	0.2 mg (200 mcg)/kg; Max 4 mg

Tachycardia

Premature, 1.5 kg (3.3 lbs)

	Values	Details
Adenosine (IV)	0.2/0.4 mg (200/400 mcg)	0.1 & 0.2 mg (100 mcg & 200 mcg)/kg
Amiodarone (IV infusion)	7.5 mg	5 mg/kg over 20 minutes; May repeat x2; Max 300 mg
Cardioversion	1/2 J	0.5 & 1.0 J/kg

Bradycardia

Premature, 1.5 kg (3.3 lbs)

	Values	Details
EPINEPHrine (IV)	0.02 mg (20 mcg)	0.01 mg (10 mcg)/kg; Max 0.5 mg (500 mcg); q 3-5 minutes
Atropine (IV)	0.1 mg (100 mcg)	0.02 mg (20 mcg)/kg; Max single dose 0.6 mg (600 mcg); Min single dose 0.1 mg (100 mcg); May repeat once
Atropine (ETT)	0.06 mg (60 mcg)	0.04 mg (40 mcg)/kg; Max single dose 1.2 mg; Max total dose 6 mg; May repeat x5 in 3-5 minutes

Fluid Resuscitation

Premature, 1.5 kg (3.3 lbs)

	Values	Details
Normal Saline	7.5 mL (Max 30 mL)	5 mL/kg bolus x4; Max 20 mL/kg

Sedation, Seizure, & Analgesia

Premature, 1.5 kg (3.3 lbs)

	Values	Details
Midazolam (IM/IN/ETT)	0.4 mg (400 mcg)	0.2 mg (200 mcg)/kg; Max 10 mg
Midazolam (IV)	0.2 mg (200 mcg)	0.1 mg (100 mcg)/kg; Max 5 mg
Morphine (IV/IM)	0.2 mg (200 mcg)	0.1 mg (100 mcg)/kg
DimenhyDRINATE (IV/IM)	1.5 mg	1 mg/kg
Acetaminophen (PO/PR)	20 mg (0.25 mL)	15 mg/kg (80 mg/mL)

Poisoning & Overdose

Premature, 1.5 kg (3.3 lbs)

	Values	Details
Naloxone (IV/IM)		Should not be administered to neonates due to risk of acute withdrawal. Contact CliniCall to discuss options.
Glucagon (IV)	0.15 mg (150 mcg)	0.1 mg (100 mcg)/kg IV for beta-blocker overdose

Diabetic

Premature, 1.5 kg (3.3 lbs)

	Values	Details
Dextrose 10% (D10W)	8 mL	5 mL/kg; May be repeated
Glucagon (SC/IM)	0.05 mg (50 mcg)	0.03 mg (30 mcg)/kg; Max 1 mg

1 month-3 months (<3 months)

***Weight (KG):** 3-5KG

Weight (Lbs): 6.6-11.0

Heart Rate (Beats per minute): 104-162

Respiratory Rate (Breaths per minute): 31-60

Blood Pressure (Systolic Range/ Diastolic Range): 73-105/36-68

MAP (mmHg):48 or higher

Broselow color: Grey

* Weight based on Broselow Tape

**Vitals based on BC PEWS

Airway Equipment

Newborn, 3.5 kg (7.7 lbs), Broselow Grey

	Values	Formula
Tidal Volume	20 mL	4-8 mL/kg
Laryngoscope	0-1 Straight	-
Un-cuffed ETT	2.5-3 mm	(Age/4)+4
Cuffed ETT	2-2.5 mm	(Age/4)+3
ETT Depth	7.5-9 cm	-
i-Gel SGA	Size 1 (pink)	2-5 kg
NPA	14 Fr	-
OPA	40 mm (pink)	-
Suction Cath	6-8 Fr	-

Airway Induction Doses

Newborn, 3.5 kg (7.7 lbs), Broselow Grey

	Values	Details
Normal Saline Bolus (IV)	35 mL	10 ml/kg
ketAMINE (IV/IO)	3.5 mg	1 mg/kg
EPINEPHrine (Slow IVP/IO)	3.5 mcg	1 mcg/kg
MIDAZOLam (IV/IO)	0.35 mg (350 mcg)	0.1 mg (100 mcg)/kg PRN

Maintenance doses on PR18: Anesthesia Induction Page

Respiratory & Allergic Reaction

Newborn, 3.5 kg (7.7 lbs), Broselow Grey

	Values	Details
diphenhydRAMINE (IM/IV)	3.5 mg	1 mg/kg
Epinephrine (IM)	0.04 mg (40 mcg)	0.01 mg (10 mcg)/kg; Max 0.5 mg (500 mcg)
Epinephrine (Neb)	5 mg	5mg/ in 5ml
Epinephrine (IV)	0.02 mg (20 mcg)	0.005 mg (5 mcg)/kg; Max 0.3 mg (300 mcg)
Salbutamol (Neb)	2.5 mg	-
Salbutamol (MDI)	---	NOT indicated
Magnesium Sulfate (IV infusion)	175 mg	50 mg/kg over 20 minutes; Max 2 g

Cardiac Arrest

Newborn, 3.5 kg (7.7 lbs), Broselow Grey

	Values	Details
Defibrillation	7/14 J	2 & 4 J/kg
EPINEPHrine (IV)	0.04 mg (40 mcg)	0.01 mg (10 mcg)/kg; Max 1 mg
EPINEPHrine (ETT)	0.4 mg (400 mcg)	0.1 mg (100 mcg)/kg; Max 10 mg
AmIODAROne (IV)	17.5 mg	5 mg/kg; Max 300 mg
Lidocaine (IV)	3.5 mg	1 mg/kg
Lidocaine (ETT)	3.5 mg	2 mg/kg
Sodium Bicarbonate (IV)	3.5 mEq	1 mEq/kg; May repeat
Magnesium Sulfate (IV)	175 mg	50 mg/kg; Max 4 g
Calcium Chloride (IV)	70 mg	20 mg/kg; Max 500 mg
Naloxone (IV)	0.4 mg (400 mcg)	0.1 mg (100 mcg)/kg; Max 4 mg
Naloxone (ETT)	0.4 mg (400 mcg)	0.2 mg (200 mcg)/kg; Max 4 mg

Tachycardia

Newborn, 3.5 kg (7.7 lbs), Broselow Grey

	Values	Details
Adenosine (IV)	0.4/0.8 mg (400/800 mcg)	0.1 & 0.2 mg (100 mcg & 200 mcg)/kg
Amiodarone (IV infusion)	17.5 mg	5 mg/kg over 20 minutes; May repeat x2; Max 300 mg
Cardioversion	2/4 J	0.5 & 1.0 J/kg

Bradycardia

Newborn, 3.5 kg (7.7 lbs), Broselow Grey

	Values	Details
EPINEPHrine (IV)	0.04 mg (40 mcg)	0.01 mg (10 mcg)/kg; Max 0.5 mg (500 mcg); q 3-5 minutes
Atropine (IV)	0.1 mg (100 mcg)	0.02 mg (20 mcg)/kg; Max single dose 0.6 mg (600 mcg); Min single dose 0.1 mg (100 mcg); May repeat once
Atropine (ETT)	0.14 mg (140 mcg)	0.04 mg (40 mcg)/kg; Max single dose 1.2 mg; Max total dose 6 mg; May repeat x5 in 3-5 minutes

Fluid Resuscitation

Newborn, 3.5 kg (7.7 lbs), Broselow Grey

	Values	Details
Normal Saline	17.5 mL (70 mL)	5 mL/kg bolus x4; Max 20 mL/kg

Tranexamic Acid

52 mg over 1 minute

Volume of Tranexamic Acid: 0.5 ml

Sedation, Seizure, & Analgesia

Newborn, 3.5 kg (7.7 lbs), Broselow Grey

	Values	Details
MIDAZOLam (IM/IN/ETT)	0.8 mg (800 mcg)	0.2 mg (200 mcg)/kg; Max 10 mg
MIDAZOLam (IV)	0.4 mg (400 mcg)	0.1 mg (100 mcg)/kg; Max 5 mg
Morphine (IV/IM)	0.4 mg (400 mcg)	0.1 mg (100 mcg)/kg
DimenhyDRINATE (IV/IM)	3.5 mg	1 mg/kg
Acetaminophen (PO)	50 mg (0.6 mL)	15 mg/kg (80 mg/mL)

Poisoning & Overdose

Newborn, 3.5 kg (7.7 lbs), Broselow Grey

	Values	Details
Naloxone (IV/IM)		Should not be administered to neonates due to risk of acute withdrawal. Contact CliniCall to discuss options.
Glucagon (IV)	0.35 mg (350 mcg)	Beta-blocker overdose 0.1 mg (100 mcg)/kg IV

Diabetic

Newborn, 3.5 kg (7.72 lbs), Broselow Grey

	Values	Details
Dextrose 10% (D10W)	18 mL	5 mL/kg; May be repeated
Glucagon (SC/IM)	0.1 mg (100 mcg)	0.03 mg (30 mcg)/kg; Max 1 mg

3-5 months

***Weight (KG):** 6-7 KG

Weight (Lbs): 13.2- 15.4

Heart Rate (Beats per minute): 109-159

Respiratory Rate (Breaths per minute: 29-56

Blood Pressure (Systolic Range/ Diastolic Range): 75-105/40-68

MAP (mmHg): 52 or higher

Broselow color: Pink

* Weight based on Broselow Tape

**Vitals based on BC PEWS

Airway Equipment

3 months, 6 kg (12.3 lbs), Broselow Pink

	Values	Formula
Tidal Volume	35 mL	4-8 mL/kg
Laryngoscope	0-1 Straight	-
Un-cuffed ETT	3.5 mm	(Age/4)+4
Cuffed ETT	3.0 mm	(Age/4)+3
ETT Depth	10.5 cm	-
i-Gel SGA	Size 1.5 (blue)	5-12 kg
NPA	14 Fr	-
OPA	50 mm (blue)	-
Suction Cath	6-8 Fr	-

Airway Induction Doses

3 months, 6 kg (12.3 lbs), Broselow Pink

	Values	Details
Normal Saline Bolus (IV)	60 mL	10 mL/kg
ketAMINE (IV/IO)	6 mg	1 mg/kg
EPINEPHrine (Slow IVP/IO)	6 mcg	1 mcg/kg
MIDAZOLam (IV/IO)	0.6 mg (600 mcg)	0.1 mg (100 mcg)/kg PRN

Maintenance doses on Pediatric Induction Guideline Page

Respiratory & Allergic Reaction

3 months, 6 kg (12.3 lbs), Broselow Pink

	Values	Details
DiphenhydrAMINE (IM/IV)	6 mg	1 mg/kg
EPINEPHrine (IM)	0.06 mg (60 mcg)	0.01 mg (10 mcg)/kg; Max 0.5 mg (500 mcg)
EPINEPHrine (Neb)	5 mg	5mg in 5ml
EPINEPHrine (IV)	0.03 mg (30 mcg)	0.005 mg (5 mcg)/kg; Max 0.3 mg (300 mcg)
Salbutamol (Neb)	2.5 mg	-
Salbutamol (MDI)	---	NOT indicated
Ipratropium (Neb)	250mcg	½ nebule
Ipratropium (MDI)	80mcg	20mcg x 4 sprays
Magnesium Sulfate (IV infusion)	300 mg	50 mg/kg over 20 minutes; Max 2 g

Cardiac Arrest

3 months, 6 kg (12.3 lbs), Broselow Pink

	Values	Details
Defibrillation	12/24 J	2 & 4 J/kg
EPINEPHrine (IV)	0.06 mg (60 mcg)	0.01 mg (10 mcg)/kg; Max 1 mg
EPINEPHrine (ETT)	0.6 mg (600 mcg)	0.1 mg (100 mcg)/kg; Max 10 mg
Amiodarone (IV)	30 mg	5 mg/kg; Max 300 mg
Lidocaine (IV)	6 mg	1 mg/kg
Lidocaine (ETT)	6 mg	2 mg/kg
Sodium Bicarbonate (IV)	6 mEq	1 mEq/kg; May repeat
Magnesium Sulfate (IV)	300 mg	50 mg/kg; Max 4 g
Calcium Chloride (IV)	120 mg	20 mg/kg; Max 500 mg
Naloxone (IV)	0.6 mg (600 mcg)	0.1 mg (100 mcg)/kg; Max 4 mg
Naloxone (ETT)	1.2 mg	0.2 mg (200 mcg)/kg; Max 8 mg

Tachycardia

3 months, 6 kg (12.3 lbs), Broselow Pink

	Values	Details
Adenosine (IV)	0.6 mg (600 mcg)/1.2 mg	0.1 & 0.2 mg (100 & 200 mcg)/kg
Amiodarone (IV infusion)	30 mg	5 mg/kg over 20 minutes; May repeat x2; Max 300 mg
Cardioversion	3/6 J	0.5 & 1.0 J/kg

Bradycardia

3 months, 6 kg (12.3 lbs), Broselow Pink

	Values	Details
EPINEPHrine (IV)	0.06 mg (60 mcg)	0.01 mg (10 mcg)/kg; Max 0.5 mg (500 mcg); q 3-5 minutes
Atropine (IV)	0.12 mg (120 mcg)	0.02 mg (20 mcg)/kg; Max single dose 0.6 mg (600 mcg); May repeat once
Atropine (ETT)	0.24 mg (240 mcg)	0.04 mg (40 mcg)/kg; Max single dose 1.2 mg; Max total dose 6 mg; May repeat x5 in 3-5 minutes

Fluid Resuscitation

3 months, 6 kg (12.3 lbs), Broselow Pink

	Values	Details
Normal Saline	30 mL (120 mL)	5 mL/kg bolus x4; Max 20 mL/kg

Tranexamic Acid

90 mg over 1 minute

Volume of Tranexamic Acid: 0.9 ml

Sedation, Seizure, & Analgesia

3 months, 6 kg (12.3 lbs), Broselow Pink

	Values	Details
MIDAZOLam (IM/IN/ETT)	1.2 mg	0.2 mg (200 mcg)/kg; Max 10 mg
MIDAZOLam (IV)	0.6 mg (600 mcg)	0.1 mg (100 mcg)/kg; Max 5 mg
Morphine (IV/IM)	0.6 mg (600 mcg)	0.1 mg (100 mcg)/kg
DimenhyDRINATE (IV/IM) ***ACP & Above***	7.5 mg	1.25 mg/kg, Max 5 mg/kg/day or Single dose of 25 mg
Acetaminophen (PO/)	90 mg (1.1 mL)	15 mg/kg (80 mg/mL)

Poisoning & Overdose

3 months, 6 kg (12.3 lbs), Broselow Pink

	Values	Details
Naloxone (IV/IM)	0.6 mg (600 mcg)	0.1 mg (100 mcg)/kg; to a maximum of 2 mg/dose. Repeat q 3 mins to effect. No maximum cumulative dose.
Glucagon (IV)	0.6 mg (600 mcg)	Beta-blocker overdose 0.1 mg (100 mcg)/kg IV

***Note: Higher doses for naloxone in pediatrics are prescribed as pediatric patients are unlikely to experience withdrawal*

Diabetic

3 months, 6 kg (12.3 lbs), Broselow Pink

	Values	Details
Dextrose 10% (D10W)	30 mL	5 mL/kg; May be repeated
Glucagon (SC/IM)	0.18 mg (180 mcg)	0.03 mg (30 mcg)/kg; Max 1 mg

6-11 months

***Weight (KG):** 8-9 kg

Weight (Lbs): 17.6-19.8

Heart Rate (Beats per minute): 95-159

Respiratory Rate (Breaths per minute: 27-53

Blood Pressure (Systolic Range/ Diastolic Range): 82-109/ 40-67

MAP (mmHg): 55-81

Broselow color: Red

* Weight based on Broselow Tape

**Vitals based on BC PEWS

Airway Management

6 months, 8 kg (17.6 lbs), Broselow Red

	Values	Formula
Tidal Volume	50 mL	4-8 mL/kg
Laryngoscope	1 Straight	-
Un-cuffed ETT	3.5-4.0 mm	(Age/4)+4
Cuffed ETT	3.0-3.5 mm	(Age/4)+3
ETT Depth	10.5-12 cm	-
i-Gel SGA	Size 1.5 (blue)	5-12 kg
NPA	14 Fr	-
OPA	50 mm (blue)	-
Suction Cath	6-8 Fr	-

Airway Induction Doses

6 months, 8 kg (17.6 lbs), Broselow Red

	Values	Details
Normal Saline Bolus (IV)	80 mL	10 ml/kg
ketAMINE (IV/IO)	8 mg	1 mg/kg
EPINEPHrine (Slow IVP/IO)	8 mcg	1.0 mcg/kg
MIDAZOLam (IV/IO)	0.8 mg (800 mcg)	0.1 mg (100 mcg)/kg PRN

Maintenance doses on PR18: Anesthesia Induction Page

Respiratory & Allergic Reaction

6 months, 8 kg (17.6 lbs), Broselow Red

	Values	Details
Dexamethasone (PO,IM/IV)	4mg dose = 1ml of (4mg/ml) Dexamethasone Solution administered	0.05mg/kg x 8kg; Supplied 4mg/ml
DiphenhydrAMINE (IM/IV)	8 mg	1 mg/kg
EPINEPHrine (IM)	0.08 mg (80 mcg)	0.01 mg (10 mcg)/kg; Max 0.5 mg (500 mcg)
EPINEPHrine (Neb)	5 mg	5mg in 5ml
EPINEPHrine (IV)	0.04 mg (40 mcg)	0.005 mg (5 mcg)/kg; Max 0.3 mg (300 mcg)
Salbutamol (Neb)	2.5 mg	1 nebule
Salbutamol (MDI)	---	NOT indicated
Ipratropium (Neb)	250mcg	½ nebule
Ipratropium (MDI)	80mcg	20mcg x 4 sprays
Magnesium Sulfate (IV infusion)	400 mg	50 mg/kg over 20 minutes; Max 2 g

Cardiac Arrest

6 months, 8 kg (17.6 lbs), Broselow Red

	Values	Details
Defibrillation	16/32 J	2 & 4 J/kg
EPINEPHrine (IV)	0.08 mg (80 mcg)	0.01 mg (10 mcg)/kg; Max 1 mg
EPINEPHrine (ETT)	0.8 mg (800 mcg)	0.1 mg (100 mcg)/kg; Max 10 mg
Amiodarone (IV)	40 mg	5 mg/kg; Max 300 mg
Lidocaine (IV)	8 mg	1 mg/kg
Lidocaine (ETT)	16 mg	2 mg/kg
Sodium Bicarbonate (IV)	8 mEq	1 mEq/kg; May repeat
Magnesium Sulfate (IV)	400 mg	50 mg/kg; Max 4 g
Calcium Chloride (IV)	160 mg	20 mg/kg; Max 500 mg
Naloxone (IV)	0.8 mg (800 mcg)	0.1 mg (100 mcg)/kg; Max 4 mg
Naloxone (ETT)	1.6 mg	0.2 mg (200 mcg)/kg; Max 8 mg

Tachycardia

6 months, 8 kg (17.6 lbs), Broselow Red

	Values	Details
Adenosine (IV)	0.8 (800 mcg)/1.6 mg	0.1 & 0.2 mg (100 & 200 mcg)/kg
Amiodarone (IV infusion)	40 mg	5 mg/kg over 20 minutes; May repeat x2; Max 300 mg
Cardioversion	4/8 J	0.5 & 1.0 J/kg

Bradycardia

6 months, 8 kg (17.6 lbs), Broselow Red

	Values	Details
EPINEPHrine (IV)	0.08 mg (80 mcg)	0.01 mg (10 mcg)/kg; Max 0.5 mg (500 mcg); q 3-5 minutes
Atropine (IV)	0.16 mg (160 mcg)	0.02 mg (20 mcg)/kg; Max single dose 0.6 mg (600 mcg); May repeat once
Atropine (ETT)	0.32 mg (320 mcg)	0.04 mg (40 mcg)/kg; Max single dose 1.2 mg; Max total dose 6 mg; May repeat x5 in 3-5 minutes

Fluid Resuscitation

6 months, 8 kg (17.6 lbs), Broselow Red

	Values	Details
Normal Saline	40 mL (160 mL)	5 mL/kg bolus x4; Max 20 mL/kg

Tranexamic Acid

120 mg over 1 minute

Volume of Tranexamic Acid: 1.2 ml

Sedation, Seizure, & Analgesia

6 months, 8 kg (17.6 lbs), Broselow Red

	Values	Details
MIDAZOLam (IM/IN/ETT)	1.6 mg	0.2 mg (200 mcg)/kg; Max 10 mg
MIDAZOLam (IV/IO)	0.8 mg (800 mcg)	0.1 mg (100 mcg)/kg; Max 5 mg
Morphine (IV/IM)	0.8 mg (800 mcg)	0.1 mg (100 mcg)/kg
DimenhyDRINATE (IV/IM) ***ACP & Above***	10 mg	1.25 mg/kg, Max 5 mg/kg/day or Single dose of 25 mg
Acetaminophen (PO)	120 mg (1.5 mL)	15 mg/kg (80 mg/mL)

Poisoning & Overdose

6 months, 8 kg (17.6 lbs), Broselow Red

	Values	Details
Naloxone (IV/IM)	0.8 mg (800 mcg)	0.1 mg (100 mcg)/kg; to a maximum of 2 mg/dose. Repeat q 3 mins to effect. No maximum cumulative dose.
Glucagon (IV)	0.8 mg (800 mcg)	Beta-blocker overdose 0.1 mg (100 mcg/kg IV

***Note: Higher doses for naloxone in pediatrics are prescribed as pediatric patients are unlikely to experience withdrawal*

Diabetic

6 months, 8 kg (17.6 lbs), Broselow Red

	Values	Details
Dextrose 10% (D10W)	40 mL	5 mL/kg; May be repeated
Glucagon (SC/IM)	0.24 mg (240 mcg)	0.03 mg (30 mcg)/kg; Max 1 mg

Normal Vital Signs

12-24 months

***Weight (KG):** 10-11kg

Weight (Lbs): 22-24.3

Heart Rate (Beats per minute): 89-149

Respiratory Rate (Breaths per minute): 27-44

Blood Pressure (Systolic Range/ Diastolic Range): 85-107/ 40-67

MAP (mmHg): 55-81

Broselow color: Purple

* Weight based on Broselow Tape

**Vitals based on BC PEWS

Airway Equipment

1 Year, 10 kg (20 lbs), Broselow Purple

	Values	Formula
Tidal Volume	60 mL	4-8 mL/kg
Laryngoscope	1 Straight	-
Un-cuffed ETT	4.0 mm	(Age/4)+4
Cuffed ETT	3.5 mm	(Age/4)+3
ETT Depth	12 cm	-
i-Gel SGA	Size 1.5 (blue)	5-12 kg
NPA	14 Fr	-
OPA	50 mm (blue)	-
Suction Cath	8 Fr	-

Airway Induction Doses

1 Year, 10 kg (20 lbs), Broselow Purple

	Values	Details
Normal Saline Bolus (IV)	100 mL	10 mL/kg
ketAMINE (IV/IO)	10 mg	1 mg/kg
EPINEPHrine (Slow IVP/IO)	10 mcg	1.0 mcg/kg
MIDAZOLam (IV/IO)	1.0 mg	0.1 mg (100 mcg)/kg PRN

Maintenance doses on PR18: Anesthesia Induction Page

Respiratory & Allergic Reaction

1 Year, 10 kg (20 lbs), Broselow Purple

	Values	Details
Dexamethasone (PO/IM/IV)	5 mg dose = 1.25mL Dexamethasone solution administered	10kg x 0.5mg/kg = 5mg 4mg/mL Dextrose solution =1.25mL
DiphenhydrAMINE (IM/IV)	10 mg	1 mg/kg
EPINEPHrine (IM)	0.1 mg (100 mcg)	0.01 mg (10 mcg)/kg; Max 0.5 mg (500 mcg)
EPINEPHrine (Neb)	5 mg	0.5 mg (500 mcg in 5 mL N/S; Max 5 mg
EPINEPHrine (IV)	0.05 mg (50 mcg)	0.005 mg (5 mcg)/kg; Max 0.3 mg (300 mcg)
Salbutamol (Neb)	5 mg	2 nebules
Salbutamol (MDI)	500 mcg	5 x 100 mcg per course; may repeat up to 3 times
Ipratropium (Neb)	250mcg	½ nebule
Ipratropium (MDI)	80 mcg	20mcg x 4 sprays
Magnesium Sulfate (IV infusion)	500 mg	50 mg/kg over 20 minutes; Max 2 g

Cardiac Arrest

1 Year, 10kg (20.05lbs), Broselow Purple

	Values	Details
Defibrillation	20/40 J	2 & 4 J/kg
Epinephrine (IV)	0.1 mg (100 mcg)	0.01 mg (10 mcg)/kg; Max 1 mg
Epinephrine (ETT)	1 mg	0.1 mg (100 mcg)/kg; Max 10 mg
Amiodarone (IV)	50 mg	5 mg/kg; Max 300 mg
Lidocaine (IV)	10 mg	1 mg/kg
Lidocaine (ETT)	20 mg	2 mg/kg
Bicarb (IV)	10 mEq	1 mEq/kg; May repeat
MgSO4 (IV)	500 mg	50 mg/kg; Max 4 g
Calcium (IV)	200 mg	20 mg/kg; Max 500 mg
Naloxone (IV)	1 mg	0.1 mg (100 mcg)/kg; Max 4 mg
Naloxone (ETT)	2 mg	0.2 mg (200 mcg)/kg; Max 8 mg

Tachycardia

1 Year, 10 kg (20 lbs), Broselow Purple

	Values	Details
Adenosine (IV)	1/2 mg	0.1 & 0.2 mg (100 & 200 mcg)/kg
Amiodarone (IV infusion)	50 mg	5 mg/kg over 20 minutes; May repeat x2; Max 300 mg
Cardioversion	5/12 J	0.5 & 1.0 J/kg

Bradycardia

1 Year, 10 kg (20 lbs), Broselow Purple

	Values	Details
EPINEPHrine (IV)	0.1 mg (100 mcg)	0.01 mg (10 mcg)/kg; Max 0.5 mg (500 mcg); q 3-5 minutes
Atropine (IV)	0.2 mg (200 mcg)	0.02 mg (20 mcg)/kg; Max single dose 0.6 mg (600 mcg); May repeat once
Atropine (ETT)	0.4 mg (400 mcg)	0.04 mg (40 mcg)/kg; Max single dose 1.2 mg; Max total dose 6 mg; May repeat x5 in 3-5 minutes

Fluid Resuscitation

1 Year, 10 kg (20 lbs), Broselow Purple

	Values	Details
Normal Saline	50 mL (200 mL)	5 mL/kg bolus x4; Max 20 mL/kg

Tranexamic Acid

150 mg over 1 minute

Volume of Tranexamic Acid: 1.5 ml

Sedation, Seizure, & Analgesia

1 Year, 10 kg (20 lbs), Broselow Purple

	Values	Details
KetAMINE (IN)	15 mg	1.5 mg/kg, Max 50 mg *
KetAMINE (IM)	5 mg	0.5 mg (500 mcg)/kg *
KetAMINE (IV/IO)	3 mg	0.3 mg (300 mcg)/kg, Single Dose Max 20 mg, Max Total 0.6 mg (600 mcg)/kg *
MIDAZOLam (IM/IN)	2 mg	0.2 mg (200 mcg)/kg; Max 10 mg
MIDAZOLam (IV/IO)	1 mg	0.1 mg (100 mcg)/kg; Max 5 mg
FentaNYL (IN)	15 mcg - 20 mcg	1.5-2.0 mcg/kg, Single Dose Max 100 mcg
FentaNYL (IM/IV/IO)	10 mcg - 20 mcg	1-2 mcg/kg, Single Dose Max 50 mcg q 5 min, Max Total 200 mcg
Morphine (IV/IM)	1 mg	0.1 mg (100 mcg)/kg
DimenhyDRINATE (IV/IM) ***ACP & Above***	12.5 mg	1.25 mg/kg, Max 5 mg/kg/day or Single dose of 25 mg
Ondansetron (IV)	1 mg	0.1 mg (100 mcg)/kg
Ibuprofen (PO)	100 mg	10 mg/kg
Acetaminophen (PO)	150 mg (1.9 mL)	15 mg/kg (80 mg/mL)

*See drug monographs for repeat dosages

Poisoning & Overdose

1 Year, 10 kg (20 lbs), Broselow Purple

	Values	Details
Naloxone (IV/IM)	1 mg	0.1 mg (100 mcg)/kg; to a maximum of 2 mg/dose. Repeat q 3 mins to effect. No maximum cumulative dose.
Glucagon (IV)	1 mg	Beta-blocker overdose 0.1 mg (100 mcg)/kg IV

***Note: Higher doses for naloxone in pediatrics are prescribed as pediatric patients are unlikely to experience withdrawal*

Diabetic

1 Year, 10 kg (20 lbs), Broselow Purple

	Values	Details
Dextrose 10% (D10W)	50 mL	5 mL/kg; May be repeated
Glucagon (SC/IM)	0.3 mg (300 mcg)	0.03 mg (30 mcg)/kg; Max 1 mg

Normal Vital Signs

2 years

***Weight (KG):** 12-14kg

Weight (Lbs): 26.5-30.9

Heart Rate (Beats per minute): 89-145

Respiratory Rate (Breaths per minute): 25-39

Blood Pressure (Systolic Range/ Diastolic Range): 87-112/44-74

MAP (mmHg): 57-81

Broselow color: Yellow

* Weight based on Broselow Tape

**Vitals based on BC PEWS

Airway Management

2 Years, 12 kg (26.5 lbs), Broselow Yellow

	Values	Formula
Tidal Volume	70 mL	4-8 mL/kg
Laryngoscope	1 Straight	-
Un-cuffed ETT	4 mm	(Age/4)+4
Cuffed ETT	3.5 mm	(Age/4)+3
ETT Depth	12 cm	-
i-Gel SGA	Size 2 (grey)	10-25 kg
NPA	18 Fr	-
OPA	60 mm (black)	-
Suction Cath	8 Fr	-

Airway Induction Doses

2 Years, 12 kg (26.5 lbs), Broselow Yellow

	Values	Details
Normal Saline Bolus (IV)	120 mL	10 ml/kg
ketAMINE (IV/IO)	12 mg	1 mg/kg
EPINEPHrine (Slow IVP/IO)	12 mcg	1.0 mcg/kg
MIDAZOLam (IV/IO)	1.2 mg	0.1 mg/kg PRN

Maintenance doses on PR18: Anesthesia Induction Page

Respiratory & Allergic Reaction

2 Years, 12 kg (26.5 lbs), Broselow Yellow

	Values	Details
Dexamethasone	6mg dose = 1.50 mL Dexamethasone solution administered	12kg x 0.5mg/kg = 6mg 4mg/ml Dexamethasone supplied =1.5mL
DiphenhydrAMINE (IM/IV)	12 mg	1 mg/kg
EPINEPHrine (IM)	0.12 mg (120 mcg)	0.01 mg (10 mcg)/kg; Max 0.5 mg (500 mcg)
EPINEPHrine (Neb)	5 mg	0.5 mg (500 mcg) in 5 mL N/S; Max 5 mg
EPINEPHrine (IV)	0.06 mg (60 mcg)	0.005 mg (5 mcg)/kg; Max 0.3 mg (300 mcg)
Salbutamol (Neb)	5 mg	-
Salbutamol (MDI)	500 mcg	5 x 100 mcg per course; may repeat up to 3 times
Ipratropium (Neb)	250mcg	½ nebule
Ipratropium (MDI)	80 mcg	20mcg x 4 sprays
Magnesium Sulfate (IV infusion)	600 mg	50 mg/kg over 20 minutes; Max 2 g

Cardiac Arrest

2 Years, 12 kg (26.5 lbs), Broselow Yellow

	Values	Details
Defibrillation	24/48 J	2 & 4 J/kg
EPINEPHrine (IV)	0.12 mg (120 mcg)	0.01 mg (10 mcg)/kg; Max 1 mg
EPINEPHrine (ETT)	1.2 mg	0.1 mg (100 mcg)/kg; Max 1 0mg
Amiodarone (IV)	60 mg	5 mg/kg; Max 300 mg
Lidocaine (IV)	12 mg	1 mg/kg
Lidocaine (ETT)	24 mg	2 mg/kg
Sodium Bicarbonate (IV)	12 mEq	1 mEq/kg; May repeat
Magnesium Sulfate (IV)	600 mg	50 mg/kg; Max 4 g
Calcium Chloride (IV)	240 mg	20 mg/kg; Max 500 mg
Naloxone (IV)	1.2 mg	0.1 mg (100 mcg)/kg; Max 4 mg
Naloxone (ETT)	1.2 mg	0.2 mg (200 mcg)/kg; Max 8 mg

Tachycardia

2 Years, 12 kg (26.5 lbs), Broselow Yellow

	Values	Details
Adenosine (IV)	1.2/2.4 mg	0.1 & 0.2 mg (100 & 200 mcg)/kg
Amiodarone (IV infusion)	60 mg	5 mg/kg over 20 minutes; May repeat x2; Max 300 mg
Cardioversion	6/12 J	0.5 & 1.0 J/kg

Bradycardia

2 Years, 12 kg (26.5 lbs), Broselow Yellow

	Values	Details
EPINEPHrine (IV)	0.12 mg (120 mcg)	0.01 mg (10 mcg)/kg; Max 0.5 mg (500 mcg); q 3-5 minutes
Atropine (IV)	0.24 mg (240 mcg)	0.02 mg (20 mcg)/kg; Max single dose 0.6 mg (600 mcg); May repeat once
Atropine (ETT)	0.48 mg (480 mcg)	0.04 mg (40 mcg)/kg; Max single dose 1.2 mg; Max total dose 6 mg; May repeat x5 in 3-5 minutes

Fluid Resuscitation

2 Years, 12 kg (26.5 lbs), Broselow Yellow

	Values	Details
Normal Saline	60 mL (240 mL)	5 mL/kg bolus x4; Max 20 mL/kg

Tranexamic Acid

180 mg over 1 minute

Volume of Tranexamic Acid: 1.8 ml

Sedation, Seizure, & Analgesia

2 Years, 12 kg (26.5 lbs), Broselow Yellow

	Values	Details
KetAMINE (IN)	18 mg	1.5 mg/kg, Max 50 mg*
KetAMINE (IM)	6 mg	0.5 mg (500 mcg)/kg*
KetAMINE (IV/IO)	3.6 mg	0.3 mg (300 mcg)/kg, Single Dose Max 20 mg, Max Total 0.6 mg (600 mcg)/kg*
MIDAZOLam (IM/IN)	2.4 mg	0.2 mg (200 mcg)/kg; Max 10 mg
MIDAZOLam (IV/IO)	1.2 mg	0.1 mg (100 mcg)/kg; Max 5 mg
FentaNYL (IN)	18 mcg - 24 mcg	1.5-2.0 mcg/kg, Single Dose Max 100 mcg
FentaNYL (IM/IV/IO)	12 mcg - 24 mcg	1-2 mcg/kg, Single Dose Max 50 mcg q 5 min, Max Total 200 mcg
Morphine (IV/IM)	1.2 mg	0.1 mg (100 mcg)/kg
DimenhyDRINATE (IV/IM) ***ACP & Above***	15 mg	1.25 mg/kg, Max 5 mg/kg/day or Single dose of 25 mg
Ondansetron (IV)	1.2 mg	0.1 mg (100 mcg)/kg
Ibuprofen (PO)	120 mg	10 mg/kg
Acetaminophen (PO)	180 mg (2.3 mL)	15 mg/kg (80 mg/mL)

*See drug monographs for repeat dosages

Poisoning & Overdose

2 Years, 12 kg (26.5 lbs), Broselow Yellow

	Values	Details
Naloxone (IV/IM)	1.2 mg	0.1 mg (100 mcg)/kg; to a maximum of 2 mg/dose. Repeat q 3 mins to effect. No maximum cumulative dose.
Glucagon (IV)	1.2 mg	Beta-blocker overdose 0.1 mg (100 mcg)/kg IV

***Note: Higher doses for naloxone in pediatrics are prescribed as pediatric patients are unlikely to experience withdrawal*

Diabetic

2 Years, 12 kg (26.5 lbs), Broselow Yellow

	Values	Details
Dextrose 10% (D10W)	60 mL	5 mL/kg; May be repeated
Glucagon (SC/IM)	0.36 mg (360 mcg)	0.03 mg (30 mcg)/kg; Max 1 mg

Normal Vital Signs

3-4 years

***Weight (KG):** 15-18kg

Weight (Lbs): 33-40

Heart Rate (Beats per minute): 85-132

Respiratory Rate (Breaths per minute): 20-33

Blood Pressure (Systolic Range/ Diastolic Range): 87-112/44-70

MAP (mmHg):58-83

Broselow color: White

* Weight based on Broselow Tape

**Vitals based on BC PEWS

Airway Equipment

3 Years, 15 kg (33 lbs), Broselow White

	Values	Formula
Tidal Volume	90 mL	4-8 mL/kg
Laryngoscope	2 Straight/Curved	-
Un-cuffed ETT	5 mm	(Age/4)+4
Cuffed ETT	4.5 mm	(Age/4)+3
ETT Depth	15 cm	-
i-Gel SGA	Size 2 (grey)	10-25 kg
NPA	20 Fr	-
OPA	60 mm (black)	-
Suction Cath	10 Fr	-

Airway Induction Doses

3 Years, 15 kg (33 lbs), Broselow White

	Values	Details
Normal Saline Bolus (IV)	150 mL	10 mL/kg
ketAMINE (IV/IO)	15 mg	1 mg/kg
EPINEPHrine (Slow IVP/IO)	15 mcg	1.0 mcg/kg
MIDAZOLam (IV/IO)	1.5 mg	0.1 mg (100 mcg)/kg PRN

Maintenance doses on PR18: Anesthesia Induction Page

Respiratory & Allergic Reaction

3 Years, 15 kg (33 lbs), Broselow White

	Values	Details
Dexamethasone (PO/IM/IV)	7.5mg dose = 1.88mL Dexamethasone solution administered	15kg x 0.5mg/kg = 7.5 4mg/mL Dexamethasone supplied
DiphenhydrAMINE (IM/IV)	15 mg	1 mg/kg
EPINEPHrine (IM)	0.15 mg (150 mcg)	0.01 mg (10 mcg)/kg; Max 0.5 mg (500 mcg)
EPINEPHrine (Neb)	5 mg	0.5 mg (500 mcg)/kg in 5 mL
EPINEPHrine (IV)	0.08 mg (80 mcg)	0.005 mg (5 mcg)/kg; Max 0.3 mg (300 mcg)
Salbutamol (Neb)	5 mg	-
Salbutamol (MDI)	500 mcg	5 x 100 mcg per course; may repeat up to 3 times
Ipratropium (Neb)	250mcg	½ nebule
Ipratropium (MDI)	80 mcg	20mcg x 4 sprays
Magnesium Sulfate (IV infusion)	750 mg	50 mg/kg over 20 minutes; Max 2 g

Cardiac Arrest

3 Years, 15 kg (33 lbs), Broselow White

	Values	Details
Defibrillation	30/60 J	2 & 4 J/kg
EPINEPHrine (IV)	0.15 mg (150 mcg)	0.01 mg (10 mcg)/kg; Max 1 mg
EPINEPHrine (ETT)	1.5 mg	0.1 mg (100 mcg)/kg; Max 10 mg
Amiodarone (IV)	75 mg	5 mg/kg; Max 300 mg
Lidocaine (IV)	15 mg	1 mg/kg
Lidocaine (ETT)	30 mg	2 mg/kg
Sodium Bicarbonate (IV)	15 mEq	1 mEq/kg; May repeat
Magnesium Sulfate (IV)	750 mg	50 mg/kg; Max 4 g
Calcium Chloride (IV)	300 mg	20 mg/kg; Max 500 mg
Naloxone (IV)	1.5 mg	0.1 mg (100 mcg)/kg; Max 4 mg
Naloxone (ETT)	1.5 mg	0.2 mg (200 mcg)/kg; Max 8 mg

Tachycardia

3 Years, 15 kg (33 lbs), Broselow White

	Values	Details
Adenosine (IV)	1.5/3.0 mg	0.1 & 0.2 mg (100 & 200 mcg)/kg
Amiodarone (IV infusion)	75 mg	5 mg/kg over 20 minutes; May repeat x2; Max 300 mg
Cardioversion	8/15 J	0.5 & 1.0 J/kg

Bradycardia

3 Years, 15 kg (33 lbs), Broselow White

	Values	Details
EPINEPHrine (IV)	0.15 mg (150 mcg)	0.01 mg (10 mcg)/kg; Max 0.5 mg (500 mcg); q 3-5 minutes
Atropine (IV)	0.3 mg (300 mcg)	0.02 mg (20 mcg)/kg; Max single dose 0.6 mg (600 mcg); May repeat once
Atropine (ETT)	0.6 mg (600 mcg)	0.04 mg (40 mcg)/kg; Max single dose 1.2 mg; Max total dose 6 mg; May repeat x5 in 3-5 minutes

Fluid Resuscitation

3 Years, 15 kg (33 lbs), Broselow White

	Values	Details
Normal Saline	75 mL (300 mL)	5 mL/kg bolus x4; (Max 20 mL/kg)

Tranexamic Acid

225 mg over 1 minute

Volume of Tranexamic Acid: 2.25 ml

Sedation, Seizure, & Analgesia

3 Years, 15 kg (33 lbs) Broselow White

	Values	Details
KetAMINE (IN)	22.5 mg	1.5 mg/kg, Max 50 mg *
KetAMINE (IM)	7.5 mg	0.5 mg (500 mcg)/kg *
KetAMINE (IV/IO)	4.5 mg	0.3 mg (300 mcg)/kg, Single Dose Max 20 mg, Max Total 0.6 mg (600 mcg)/kg *
MiIDAZOLam (IM/IN)	3.0 mg	0.2 mg (200 mcg)/kg; Max 10 mg
MIDAZOLam (IV/IO)	1.5 mg	0.1 mg (100 mcg)/kg; Max 5 mg
FentaNYL (IN)	22.5 mcg - 30 mcg	1.5-2.0 mcg/kg, Single Dose Max 100 mcg
FentaNYL (IM/IV/IO)	15 mcg - 30 mcg	1-2 mcg/kg, Single Dose Max 50 mcg q 5 min, Max Total 200 mcg
Morphine (IV/IM)	1.5 mg	0.1 mg (100 mcg)/kg
DimenhyDRINATE (IV/IM) *ACP & Above*	18.75 mg	1.25 mg/kg, Max 5 mg/kg/day or Single dose of 25 mg
Ondansetron (IV)	1.5 mg	0.1 mg (100 mcg)/kg
Ibuprofen (PO)	150 mg	10 mg/kg
Acetaminophen (PO)	225 mg (2.8 mL)	15 mg/kg (80 mg/mL)

*See drug monographs for repeat dosages

Poisoning & Overdose

3 Years, 15 kg (33 lbs), Broselow White

	Values	Details
Naloxone (IV/IM)	1.5 mg	0.1 mg (100 mcg)/kg; to a maximum of 2 mg/dose. Repeat q 3 mins to effect. No maximum cumulative dose.
Glucagon (IV)	1.5 mg	Beta-blocker overdose 0.1 mg (100 mcg)/kg IV

***Note: Higher doses for naloxone in pediatrics are prescribed as pediatric patients are unlikely to experience withdrawal*

Diabetic

3 Years, 15 kg (33 lbs), Broselow White

	Values	Details
Dextrose 10% (D10W)	75 mL	5 mL/kg; May be repeated
Glucagon (SC/IM)	0.45 mg (450 mcg)	0.03 mg (30 mcg)/kg; Max 1 mg

Normal Vital Signs

5-6 years

***Weight (KG):**19-23kg

Weight (Lbs): 41.9-50.7

Heart Rate (Beats per minute): 66-120

Respiratory Rate (Breaths per minute): 16-30

Blood Pressure (Systolic Range/ Diastolic Range): 94-118/52-78

MAP (mmHg): 66-87

Broselow color: Blue

* Weight based on Broselow Tape

**Vitals based on BC PEWS

Airway Equipment

5 Years, 21 kg (46.2 lbs), Broselow Blue

	Values	Formula
Tidal Volume	104-168 mL	4-8 mL/kg
Laryngoscope	2 Straight/Curved	-
Un-cuffed ETT	5.5 mm	(Age/4)+4
Cuffed ETT	5.0 mm	(Age/4)+3
ETT Depth	16.5 cm	-
i-Gel SGA	Size 2 (grey)	10-25 kg
NPA	24 Fr	-
OPA	70 mm (white)	-
Suction Cath	10 Fr	-

Airway Induction Doses

5 Years, 21 kg (46.2), Broselow Blue

	Values	Details
Normal Saline Bolus (IV)	210 mL	10 ml/kg
ketAMINE (IV/IO)	21 mg	1 mg/kg
EPINEPHrine (Slow IVP/IO)	21 mcg	1.0 mcg/kg
MIDAZOLam (IV/IO)	2.1 mg	0.1 mg (100 mcg)/kg PRN

Maintenance doses on PR18: Anesthesia Induction Page

Respiratory & Allergic Reaction

5 Years, 21 kg (46.2 lbs), Broselow Blue

	Values	Details
Dexamethasone (PO/IM/IV)	10.5mg Dose = 2.63mL Dexamethasone Solution	21kg x 0.5mg/kg = 10.5mg Dose Supplied Dexamethasone 4mg/ml
DiphenhydrAMINE (IM/IV)	21 mg	1 mg/kg
EPINEPHrine (IM)	0.21 mg (210 mcg)	0.01 mg (10 mcg)/kg; Max 0.5 mg (500 mcg)
EPINEPHrine (Neb)	5 mg	5mgin 5 ml dose
EPINEPHrine (IV)	0.105 mg (105 mcg)	0.005 mg (5 mcg)/kg; Max 0.3 mg (300 mcg)
Ipratropium (Neb)	250mcg	½ nebule
Ipratropium (MDI)	80 mcg	20 mcg x 4
Salbutamol (Neb)	5 mg	
Salbutamol (MDI)	1000 mcg	10 x 100 mcg per course; may repeat up to 3 times
Magnesium Sulfate (IV infusion)	1,050 mg	50 mg/kg over 20 minutes; Max 2 g

Cardiac Arrest

5 Years, 21 kg (46.2 lbs), Broselow Blue

	Values	Details
Defibrillation	42/84 J	2 & 4 J/kg
EPINEPHrine (IV)	0.21 mg (210 mcg)	0.01 mg (10 mcg)/kg; Max 1 mg
EPINEPHrine (ETT)	2.1 mg	0.1 mg (100 mcg)/kg; Max 10 mg
Amiodarone (IV)	105 mg	5 mg/kg; Max 300 mg
Lidocaine (IV)	21 mg	1 mg/kg
Lidocaine (ETT)	42 mg	2 mg/kg
Sodium Bicarbonate (IV)	21 mEq	1 mEq/kg; May repeat
Magnesium Sulfate (IV)	1,050 mg	50 mg/kg; Max 4 g
Calcium Chloride (IV)	420 mg	20 mg/kg; Max 500 mg
Naloxone (IV)	2.1 mg	0.1 mg (100 mcg)/kg; Max 4 mg
Naloxone (ETT)	4.2 mg	0.2 mg (200 mcg)/kg; Max 8 mg

Tachycardia

5 Years, 21 kg (46.2 lbs), Broselow Blue

	Values	Details
Adenosine (IV)	2.1/4.2 mg	0.1 & 0.2 mg (100 & 200 mcg)/kg
Amiodarone (IV infusion)	105 mg	5 mg/kg over 20 minutes; May repeat x2; Max 300 mg
Cardioversion	11/20 J	0.5 & 1.0 J/kg

Bradycardia

5 Years, 21 kg (46.2 lbs), Broselow Blue

	Values	Details
EPINEPHrine (IV)	0.21mg (210 mcg)	0.01 mg (10 mcg)/kg; Max 0.5 mg (500 mcg); q 3-5 minutes.
Atropine (IV)	0.42 mg (420 mcg)	0.02 mg (20 mcg)/kg; Max single dose 0.6 mg (600 mcg); May repeat once
Atropine (ETT)	0.84 mg (840 mcg)	0.04 mg (40 mcg)/kg; Max single dose 1.2 mg; Max total dose 6 mg; May repeat x5 in 3-5 minutes

Fluid Resuscitation

5 Years, 21 kg (46.2 lbs), Broselow Blue

	Values	Details
Normal Saline	105 mL (420 mL)	5 mL/kg bolus x4; (Max 20 mL/kg)

Tranexamic Acid

315 mg over 1 minute

Volume of Tranexamic Acid: 3.1 ml

Sedation, Seizure, & Analgesia

5 Years, 21 kg (46.2 lbs), Broselow Blue

	Values	Details
KetAMINE (IN)	31.5 mg	1.5 mg/kg, Max 50 mg *
KetAMINE (IM)	10.5 mg	0.5 mg (500 mcg)/kg *
KetAMINE (IV/IO)	6.3 mg	0.3 mg (300 mcg)/kg, Single Dose Max 20 mg, Max Total 0.6 mg (600 mcg)/kg *
MIDAZOLam (IM/IN)	4.2 mg	0.2 mg (200 mcg)/kg; Max 10 mg
MIDAZOLam (IV/IO)	1.8 mg	0.1 mg (100 mcg)/kg; Max 5 mg
FentaNYL (IN)	31.5mcg-42mcg	1.5-2.0 mcg/kg, Single Dose Max 100 mcg
FentaNYL (IM/IV/IO)	21 mcg - 42 mcg	1-2 mcg/kg, Single Dose Max 50 mcg q 5 min, Max Total 200 mcg
Morphine (IV/IM)	2.1 mg	0.1 mg (100 mcg)/kg
DimenhyDRINATE (IV/IM) ***ACP & Above***	26.25 mg	1.25 mg/kg, Max 5 mg/kg/day or Single dose of 25 mg
Ondansetron (IV)	2.1 mg	0.1 mg (100 mcg)/kg
Ibuprofen (PO)	210 mg	10 mg/kg
Acetaminophen (PO)	315 mg (4 mL)	15 mg/kg (80 mg/mL)

*See drug monographs for repeat dosages

Poisoning & Overdose

5 Years, 21 kg (46.2 lbs), Broselow Blue

	Values	Details
Naloxone (IV/IM)	2.0 mg	0.1 mg (100 mcg)/kg; to a maximum of 2 mg/dose. Repeat q 3 mins to effect. No maximum cumulative dose.
Glucagon (IV)	2.1 mg	Beta-blocker overdose 0.1 mg (100 mcg)/kg IV

***Note: Higher doses for naloxone in pediatrics are prescribed as pediatric patients are unlikely to experience withdrawal*

Diabetic

5 Years, 21 kg (46.2 lbs), Broselow Blue

	Values	Details
Dextrose 10% (D10W)	105 mL	5 mL/kg; May be repeated
Glucagon (SC/IM)	0.63 mg (630 mcg)	0.03 mg (30 mcg)/kg; Max 1 mg

Normal Vital Signs

7-9 years

***Weight (KG):** 24-29kg

Weight (Lbs): 52.9-63.9

Heart Rate (Beats per minute): 60-120

Respiratory Rate (Breaths per minute): 16-30

Blood Pressure (Systolic Range/ Diastolic Range): 96-118/ 53-76

MAP (mmHg): 70-90

Broselow color: Orange

* Weight based on Broselow Tape

**Vitals based on BC PEWS

Airway Equipment

8 Years, 25 kg (55.1 lbs), Broselow Orange

	Values	Formula
Tidal Volume	150 mL	4-8 mL/kg
Laryngoscope	2-3 Straight/Curved	-
Un-cuffed ETT	6 mm	(Age/4)+4
Cuffed ETT	5.5 m	(Age/4)+3
ETT Depth	18 cm	-
i-Gel SGA	Size 2.5 (white)	25-35 kg
NPA	26 Fr	-
OPA	80 mm (green)	-
Suction Cath	10-12 Fr	-

Airway Induction Doses

8 Years, 25kg (55.12lbs), Broselow Orange

	Values	Details
Normal Saline Bolus (IV)	250ml	10ml/kg
ketAMINE (IV/IO)	25mg	1mg/kg
EPINEPHrine (Slow IVP/IO)	25mcg	1.0mcg/kg
MIDAZOLam (IV/IO)	2.5mg	0.1mg (100 mcg)/kg PRN

Maintenance doses on PR18: Anesthesia Induction Page

Respiratory & Allergic Reaction

8 Years, 25 kg (55.1 lbs), Broselow Orange

	Values	Details
Dexamethasone (PO/IM/IV)	12.5mg Dose = 3.13mL Dexamethasone solution administered	25 x 0.5mg/kg=12.5mg 4mg/ml Supplied Dexamethasone
DiphenhydrAMINE (IM/IV)	25 mg	1 mg/kg
EPINEPHrine (IM)	0.25 mg (250 mcg)	0.01 mg (10 mcg)/kg; Max 0.5 mg (500 mcg)
EPINEPHrine (Neb)	5 mg	5mg dose
EPINEPHrine (IV)	0.12 mg (120 mcg)	0.005 mg (5 mcg)/kg; Max 0.3 mg (300 mcg)
Salbutamol (Neb)	5 mg	-
Salbutamol (MDI)	1000 mcg	10 x 100 mcg per course, May repeat up to 3x
Ipratropium (Neb)	250 mcg	½ nebule
Ipratropium (MDI)	80 mcg	20mcg x 4 sprays
Magnesium Sulfate (IV infusion)	1.2 g	50 mg/kg over 20 minutes; Max 2 g

Cardiac Arrest

8 Years, 25 kg (55.1 lbs), Broselow Orange

	Values	Details
Defibrillation	50/100 J	2 & 4 J/kg
EPINEPHrine (IV)	0.25 mg (250 mcg)	0.01 mg (10 mcg)/kg; Max 1 mg
EPINEPHrine (ETT)	2.5 mg	0.1 mg (100 mcg)/kg; Max 10 mg
Amiodarone (IV)	125 mg	5 mg/kg; Max 300 mg
Lidocaine (IV)	25 mg	1 mg/kg
Lidocaine (ETT)	50 mg	2 mg/kg
Sodium Bicarbonate (IV)	25 mEq	1 mEq/kg; May repeat
Magnesium Sulfate (IV)	1.2 g	50 mg/kg; Max 4 g
Calcium Chloride (IV)	500 mg	20 mg/kg; Max 500 mg
Naloxone (IV)	2.5 g	0.1 mg (100 mcg)/kg; Max 4 mg
Naloxone (ETT)	5 mg	0.2 mg (200 mcg)/kg; Max 8 mg

Tachycardia

8 Years, 25 kg (55.1 lbs), Broselow Orange

	Values	Details
Adenosine (IV)	2.5/5.0 mg	0.1 & 0.2 mg (100 & 200 mcg)/kg
Amiodarone (IV infusion)	125 mg	5 mg/kg over 20 minutes; May repeat x2; Max 300 mg
Cardioversion	12/25 J	0.5 & 1.0 J/kg

Bradycardia

8 Years, 25 kg (55.1 lbs), Broselow Orange

	Values	Details
EPINEPHrine (IV)	0.25 mg	0.01 mg (10 mcg)/kg; Max 0.5 mg (500 mcg); q 3-5 minutes.
Atropine (IV)	0.5 mg (500 mcg)	0.02 mg (20 mcg)/kg; Max single dose 0.6 mg (600 mcg); May repeat once
Atropine (ETT)	1.0 mg	0.04 mg (40 mcg)/kg; Max single dose 1.2 mg; Max total dose 6 mg; May repeat x 5 in 3-5 minutes

Fluid Resuscitation

8 Years, 25 kg (55.1 lbs), Broselow Orange

	Values	Details
Normal Saline	125 mL (500 mL)	5 mL/kg bolus x4; Max 20 mL/kg

Tranexamic Acid

375 mg over 1 minute

Volume of Tranexamic Acid: 3.75 ml

Sedation, Seizure, & Analgesia

8 Years, 25 kg (55.1 lbs), Broselow Orange

	Values	Details
KetAMINE (IN)	37.5 mg	1.5 mg/kg, Max 50 mg *
KetAMINE (IM)	12.5 mg	0.5 mg (500 mcg)/kg *
KetAMINE (IV/IO)	7.5 mg	0.3 mg (300 mcg)/kg, Single Dose Max 20 mg, Max Total 0.6 mg (600 mcg)/kg *
MIDAZOLam (IM/IN)	5.0 mg	0.2 mg (200 mcg)/kg; Max 10 mg
MIDAZOLam (IV/IO)	2.5 mg	0.1 mg (100 mcg)/kg; Max 5 mg
FentaNYL (IN)	37.5 mcg - 50 mcg	1.5-2 mcg/kg, Single Dose Max 100 mcg
FentaNYL (IM/IV/IO)	25 mcg - 50 mcg	1-2 mcg/kg, Single Dose Max 50 mcg q 5 min, Max Total 200 mcg
Morphine (IV/IM)	2.5 mg	0.1 mg (100 mcg)/kg
DimenhyDRINATE (IV/IM) ***ACP & Above***	25 mg	1.25 mg/kg, Max single dose of 25 mg or Max 5 mg/kg/day
Ondansetron (IV)	2.5 mg	0.1 mg (100 mcg)/kg
Ibuprofen (PO)	250 mg	10 mg/kg
Acetaminophen (PO)	375 mg (4.7 mL)	15 mg/kg (80 mg/mL)

*See drug monographs for repeat dosages

Poisoning & Overdose

8 Years, 25 kg (55.1 lbs), Broselow Orange

	Values	Details
Naloxone (IV/IM)	2 mg	0.1 mg (100 mcg)/kg; to a maximum of 2 mg/dose. Repeat q 3 mins to effect. No maximum cumulative dose.
Glucagon (IV)	2.5 mg	Beta-blocker overdose 0.1 mg (100 mcg)/kg IV

Diabetic

8 Years, 25 kg (55.1 lbs), Broselow Orange

	Values	Details
Dextrose 10% (D10W)	125 mL	5 mL/kg; May be repeated
Glucagon (SC/IM)	0.75 mg (750 mcg)	0.03 mg (30 mcg)/kg; Max 1 mg

Normal Vital Signs

10-11 years

***Weight (KG):** 30-36kg

Weight (Lbs): 66.1-79.3

Heart Rate (Beats per minute): 60-110

Respiratory Rate (Breaths per minute): 15-29

Blood Pressure (Systolic Range/ Diastolic Range): 100-121/ 60-80

MAP (mmHg): 72-94

Broselow color: Green

*Weight based on Broselow tape

** Vital approxmiations based on BC PEWS

Airway Equipment

12 Years, 40 kg (88.2 lbs)

	Values	Formula
Tidal Volume	240 mL	4-8 mL/kg
Laryngoscope	3 Straight/Curved	-
Un-cuffed ETT	6.5 mm	(Age/4)+4
Cuffed ETT	6 mm	(Age/4)+3
ETT Depth	19.5 cm	-
i-Gel SGA	Size 3 (yellow)	30-60 kg
NPA	28-30 Fr	-
OPA	80 mm (green)	-
Suction Cath	12-14 Fr	-

Airway Induction Doses

12 Years, 40 kg (88.2 lbs)

	Values	Details
Normal Saline Bolus (IV)	400 mL	10 mL/kg
ketAMINE (IV/IO)	40 mg	1 mg/kg
EPINEPHrine (Slow IVP/IO)	40 mcg	1 mcg/kg
MIDAZOLam (IV/IO)	4 mg	0.1 mg (100 mcg)/kg PRN

Maintenance doses on PR18: Anesthesia Induction Page

Respiratory & Allergic Reaction

12 Years, 40 kg (88.2 lbs)

	Values	Details
Dexamethasone (PO/IM/IV)	16mg dose = 4.00mL Dexamethasone solution administered	40kg x0.5mg/kg 4mg/ml Dexamethasone solution supplied
DiphenhydrAMINE (IM/IV)	40 mg	1 mg/kg
Epinephrine (IM)	0.4 mg (400 mcg)	0.01 mg (10 mcg)/kg; Max 0.5 mg (500 mcg)
Epinephrine (Neb)	5 mg	5 mg
Epinephrine (IV)	0.2 mg (200 mcg)	0.005 mg (5 mcg)/kg; Max 0.3 mg (300 mcg)
Salbutamol (Neb)	5 mg	-
Salbutamol (MDI)	1000 mcg	10 x 100 mcg per course, May repeat up to 3x
Ipratropium (Neb)	250mcg	½ nebule
Ipratropium (MDI)	80mcg	20mcg x 4 sprays
Magnesium Sulfate (IV infusion)	2 g	50 mg/kg over 20 minutes; Max 2 g

Cardiac Arrest

12 Years, 40 kg (88.2 lbs)

	Values	Details
Defibrillation	80/160 J	2 & 4 J/kg
EPINEPHrine (IV)	0.4 mg (400 mcg)	0.01 mg (10 mcg)/kg; Max 1 mg
EPINEPHrine (ETT)	4 mg	0.1 mg (100 mcg)/kg; Max 10 mg
Amiodarone (IV)	150 mg	5 mg/kg; Max 300 mg
Lidocaine (IV)	40 mg	1 mg/kg
Lidocaine (ETT)	80 mg	2 mg/kg
Sodium Bicarbonate (IV)	40 mEq	1 mEq/kg; May repeat
Magnesium Sulfate (IV)	2 g	50 mg/kg; Max 4 g
Calcium Chloride (IV)	500 mg	20 mg/kg; Max 500 mg
Naloxone (IV)	4 mg	0.1 mg (100 mcg)/kg; Max 4 mg
Naloxone (ETT)	8 mg	0.2 mg (200 mcg)/kg; Max 8 mg

Tachycardia

12 Years, 40 kg (88.2 lbs)

	Values	Details
Adenosine (IV)	4/8 mg	0.1 & 0.2 mg (100 & 200 mcg)/kg
Amiodarone (IV infusion)	150 mg	5 mg/kg over 20 minutes; May repeat x2; Max 300 mg
Cardioversion	20/40 J	0.5 & 1.0 J/kg

Bradycardia

12 Years, 40 kg (88.2 lbs)

	Values	Details
EPINEPHrine (IV)	0.4 mg (400 mcg)	0.01 mg (10 mcg)/kg; Max 0.5 mg (500 mcg); q 3-5 minutes
Atropine (IV)	0.6 mg (600 mcg)	0.02 mg (20 mcg)/kg; Max single dose 0.6 mg (600 mcg); May repeat once
Atropine (ETT)	1.2 mg	0.04 mg (40 mcg)/kg; Max single dose 1.2 mg; Max total dose 6 mg; May repeat x5 in 3-5 minutes

Fluid Resuscitation

12 Years, 40 kg (88.2 lbs)

	Values	Details
Normal Saline	200 mL (800 mL)	5 mL/kg bolus x4; Max 20 mL/kg

Tranexamic Acid

2 g over 1 minute

Volume of Tranexamic Acid: 20 ml

Sedation, Seizure, & Analgesia

12 Years, 40 kg (88.2 lbs)

	Values	Details
KetAMINE (IN)	50 mg	1.5 mg/kg, Max 50 mg*
KetAMINE (IM)	20 mg	0.5 mg (500 mcg)/kg*
KetAMINE (IV/IO)	12 mg	0.3 mg (300 mcg)/kg, Single Dose Max 20 mg, Max Total 0.6 mg (600 mcg)/kg *
MIDAZOLam (IM/IN)	8 mg	0.2 mg (200 mcg)/kg; Max 10 mg
MIDAZOLam (IV/IO)	4 mg	0.1 mg (100 mcg)/kg; Max 5 mg
FentaNYL (IN)	60 mcg - 80 mcg	1.5-2 mcg/kg, Single Dose Max 100 mcg
FentaNYL (IM/IV/IO)	40 mcg - 50 mcg	1-2 mcg/kg, Single Dose Max 50 mcg q 5 min, Max Total 200 mcg
Morphine (IV/IM)	4 mg	0.1 mg (100 mcg)/kg
DimenhyDRINATE (IV/IM) ***PCP & Above***	25 mg	1.25 mg/kg, Max single dose of 25 mg or Max 5 mg/kg/day
Ondansetron (IV)	4 mg	0.1 mg (100 mcg)/kg
Ibuprofen (PO)	300 mg	10 mg/kg
Acetaminophen (PO)	600 mg (7.5 mL)	15 mg/kg (80 mg/mL)

*See drug monographs for repeat dosages

Poisoning & Overdose

12 Years, 40 kg (88.2 lbs)

	Values	Details
Naloxone (IV/IM)	2 mg	0.1 mg (100 mcg)/kg; to a maximum of 2 mg/dose. Repeat q 3 mins to effect. No maximum cumulative dose.
Glucagon (IV)	4 mg	Beta-blocker overdose 0.1 mg (100 mcg)/kg IV

***Note: Higher doses for naloxone in pediatrics are prescribed as pediatric patients are unlikely to experience withdrawal*

Diabetic

12 Years, 40 kg (88.2 lbs)

	Values	Details
Dextrose 10% (D10W)	200 mL	5 mL/kg; May be repeated
Glucagon (SC/IM)	1 mg	0.03 mg (30 mcg)/kg; Max 1 mg

BC PEWS Vital Signs Reference Card

Age	Heart Rate Beats per minute	Respiratory Rate Breaths per minute	Systolic / Diastolic BP	MAP mmHg
0 – 28 days*	104 – 162	31 – 60	60 – 80 / 30 – 53	40 or higher
1 – 3 months*	104 – 162	31 – 60	73 – 105 / 36 – 68	48 or higher
4 – 11 months*	109 – 159	29 – 53	82 – 105 / 46 – 68	58 – 80
1 – 3 years†	89 – 139	25 – 39	85 – 109 / 37 – 67	53 – 81
4 – 6 years†	71 – 128	17 – 31	91 – 114 / 50 – 74	63 – 87
7 – 11 years†	60 – 114	15 – 28	96 – 121 / 57 – 80	70 – 94
12 plus years†	50 – 104	12 – 25	105 – 136 / 62 – 87	76 – 103
Temperature °C	**Oral:** 35.5 – 37.5, **Axilla:** 36.5 – 37.5, **Rectal:** 36.6 – 38.0, **Temporal:** 36.3 – 37.8			

HR and RR ranges: CTAS 2013
Temperature ranges: CPS 2015
BP ranges: *Modified from American Heart Association (2012). *Pediatric emergency assessment, recognition, and stabilization (PEARS) provider manual.*† National Heart, Lung and Blood Pressure Institute (2004). The fourth report on the diagnosis, evaluation, and treatment of high blood pressure in children and adolescents. *Pediatrics, 114(2)*, 555-556.

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BC PEWS Vital Signs Reference Card

Body Weight (kg)	Fluid Requirements Per Day
Below 10 kg	100 mL per kg
10 – 20 kg	1000 mL + 50 mL per kg over 10 kg
Greater than 20 kg	1500 mL + 20 mL per kg over 20 kg
Body Weight (kg)	**Fluid Requirements Per Hour**
Below 10 kg	4 mL per kg
10 – 20 kg	2 mL per kg for each kg greater than 10 kg
Greater than 20 kg	1 mL per kg for each kg greater than 20 kg
Urine Output	**0.5 – 1.0 mL per kg per hr**

Pickard, G. & Abernathy, A.P. (2013). *Dosage calculations, Ninth edition.* Delmar, Cengage Learning.

PHSA331 Jan.2016

BCEHS Adoption of BC Pediatric Early Warning Systems

Pediatric Early Warning Systems (PEWS) are used internationally to promote early identification and mitigation of deterioration in hospitalized pediatric patients. BC health authority leaders and clinicians have identified the implementation of PEWS as a high priority in hospitals that care for children across sites at all Tiers of Service.

The Child Health BC Steering Committee endorsed a standardized approach to the development, implementation and evaluation of PEWS in BC hospitals (BC PEWS) .
BC PEWS is a five-component system that provides a standardized framework and language to identify potential

deterioration in a child, mitigate the risk and escalate care as needed as early as possible.

Child Health BC in collaboration with the BC Regional Health Authorities, have become the first jurisdiction in North America to adapt a province-wide standardized early warning system for pediatrics. To date:

- 50 hospitals have implemented BC PEWS in their inpatient units.
- 97 hospitals/health centers & 7 First Nations Health Authority Nursing Outposts have implemented BC PEWS ED in their Emergency Departments
- The inpatient implementation was comprehensively evaluated after one year, showing positive outcomes overall with some opportunity for further development.
- A research pilot at Richmond Hospital Emergency Department (ED) demonstrated the potential value of using PEWS in the ED and has been published in BMC Emergency Medicine.

References

ChildhealthBC. (2023). Pediatric early warning system (PEWS). CHBC. https://www.childhealthbc.ca/initiatives/pediatric-early-warning-system-pews

M00: Pediatrics - General

Heather Rose and Ryan Casselman

Updated: December 25, 2023
Reviewed: March 01, 2021

Introduction

This comprehensive guideline is designed to equip BCEHS employees with the knowledge necessary to recognize and address the unique needs of pediatric patients. It acknowledges the critical importance of tailoring medical management to the specific physiological parameters of different age groups and provides in-depth information on the distinct anatomical structures, physiological functions, and developmental factors that paramedics must consider when assessing and treating pediatric patients within the prehospital realm.

By gaining understanding of both the commonalities and variations between adult and pediatric patients, paramedics will be better prepared to deliver care that is safe, effective, and compassionate to patients across the entire age spectrum. This readiness extends to routine medical situations as well as critical emergencies, ensuring that optimal outcomes are achieved.

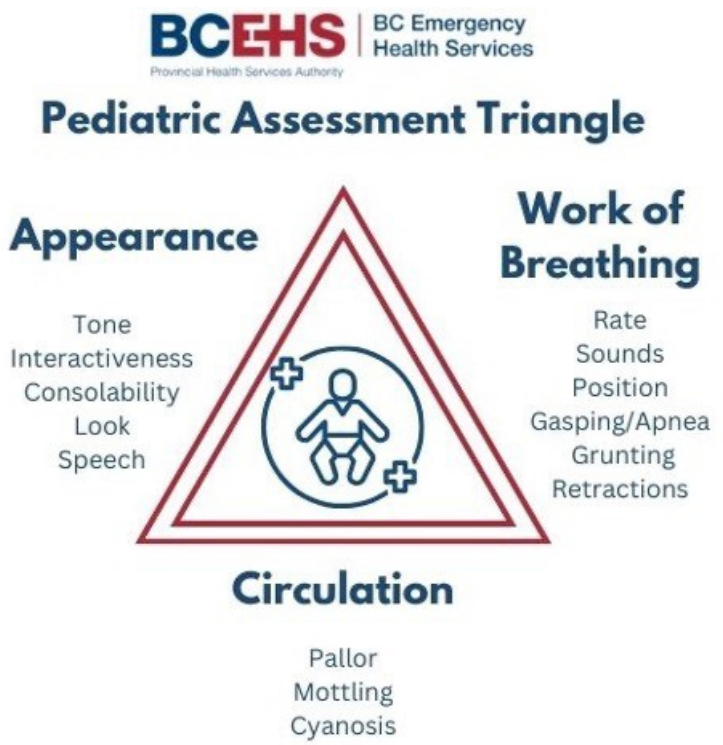
Essentials

For clinical consideration within BCEHS, pediatric patients are those who are **≤ 12 years of age,** whereas adults are defined as **> 12 years of age or showing signs of puberty.** There is widespread variation on this definition across BC health authorities. This does not apply to matters of consent.

Children differ anatomically and physiologically in comparison to adults in a number of ways. The table below highlights so of the key distinctions:

Anatomical and Physiological Differences	**Implications for the Pediatric Patient**
Children have a larger head and trunk compared to the rest of their body	More susceptible to heat and fluid loss
Children have small and narrow airways, larger tongues, shorter tracheas, more elastic cartilage, and are obligate nose breathers for the first 2-4 months of life	Increased risk of airway obstruction and ineffective oxygenation in the event of respiratory illness
Children have an increased metabolic rate and increased fluid requirements, as a greater percentage of their body weight is water	Require more energy and consumer more oxygen to sustain their basal metabolic rate, and in cases of decreased oxygenation or decreased intravascular volume, they can dehydrate and deteriorate quickly
Children have an underdeveloped nervous system response such as shivering, vasoconstriction, and the ability to sweat. Infants under 6 months cannot shiver, and rely on brown fat metabolism to generate heat.	Unstable temperature control requires close monitoring to ensure that normothermia can be maintained. Children can get cold quickly when exposed for examinations or procedures.

General Information



General Appearance: "Tickles" TICLS

When assessing the patient's general appearance, remember the mnemonic TICLS, which stands for **Tone, Interactiveness, Consolability, Look and Speech**.

- **Tone:** Muscle tone. Is the patient demonstrating independent, voluntary movement of all four extremities? Or are they laying limp/flaccid? When an extremity is touched, how do they respond? Are they quick to pull away or tense the arm/leg? Or do they let it drop heavily back to the original position?
  - Overarching question: **Is the child moving appropriately, or are they floppy or listless?**
- **Interactive:** This component will vary greatly depending on age of the child. Pediatric patients 1 to 5 months interact by opening their eyes, moving their arms and legs, or crying when they are unhappy. By 6 months of age, they can smile, and grab onto things you present in front of them. By 8 months, children are usually learning how to crawl, and can sit up independently.
  - Overarching question: **How alert is the child?**
- **Consolability**: Can the parent calm the patient as they usually do, or are they unable to help them regulate? Children ages 3-5 may have difficulty communicating when they are in pain or discomfort, and their caregivers may be the best source of information about their normal behaviour versus their current response. Does the child respond the same to your presence as a stranger as they do to the comfort of their caregiver?
  - Overarching Question: **Does the child settle like they usually would?**
- **Look/Gaze:** Do they make eye contact? Are their eyes tracking or vacant stares? Do their eyes stay closed? Does the child look to the caregiver? Did they notice you enter the room?
  - Overarching Question: **How does the child visually observe the environment?**
- **Speech/Cry**: Are they attempting to speak? Sick children may be unable to express themselves. Crying again can be a good sign! It safeguards the practitioner that the patient has an open airway and is effectively breathing. Note any abnormal sounds to the cry. Is there a high pitcher wheeze present? Is there a barking-like cough?
  - Overarching Question: **Does the child speak/cry as usual, or is something unusual?**

Final general impression question: *Is there anything concerning in the appearance of the child?*

Work of Breathing

Children's breathing should be noiseless, effortless, and painless.

Observing changes in respirations should be made before further assessment to avoid causing the child to become upset and changing their respiratory efforts from baseline. Changes in pediatric respirations are much more subtle than in adults and may require close attention to distinguish. This will require removing the shirt or lifting it to assess adequately. Note the rate, rhythm, and depth of respirations. Notice any patterns. Children up to 5 are belly breathers - meaning they utilize their stomach muscles with inhalation. This will cause their abdomen to protrude with inhalation and retract with exhalation.

※ **Pearl:** From a distance, you can ask the caregiver to assist you in your assessment by lifting or removing the child's clothing, if appropriate. The "doorway" respiratory assessment performed as part of the PAT can yield valuable information, informing the practitioner on possible aetiologies associated with specific abnormal breathing patterns and sounds.

Respiratory patterns

Quick, shallow breaths accompanied by extended exhalation are commonly observed in cases of air trapping, such as those seen in conditions like asthma, bronchiolitis, or when a foreign object obstructs the airway beyond the carina. This breathing pattern can also occur due to chest or abdominal discomfort or dysfunction in the chest wall.

Other concerning breathing patterns include:

- Kussmaul respirations (rapid and deep breathing pattern potentially indicating metabolic acidosis)
- Cheyne-Stokes or ataxic respirations (variable rates of breathing associated with periods of apnea can be indicative of CNS damage or injury)
- Paradoxical breathing (chest collapses on inspiration and abdomen is pushed outward, can be a sign of fatigue or muscle weakness)

Please review this video for further information on these breathing patterns.

Accessory muscle use

- Nasal flaring: exaggerated opening of the nostrils during inspiration, is a subtle form of severe accessory muscle use
- Head bobbing: extension of the head and neck during inhalation and falling forward of the head during exhalation,

is most likely to be seen in infants and can be easily overlooked

- Chest wall muscle retractions and abnormal movement: muscles surrounding the ribs, sternum and clavicle retract inward due to high intrathoracic negative pressure generated by increased respiratory effort Look at the child's chest. Notice any indrawing between the rib spaces, around the trachea (tracheal tugging) or directly underneath the diaphragm.
- Abdominal breathing: Characterized by thoracoabdominal dissociation, in which the chest collapses, and the abdomen protrudes on inspiration, may be normal in infants, but, beyond infancy or in patients with poor muscle tone, is concerning for respiratory muscle fatigue.

Please review this video for more information and examples

Final breathing question: *Are you concerned about their breathing?*

Circulation

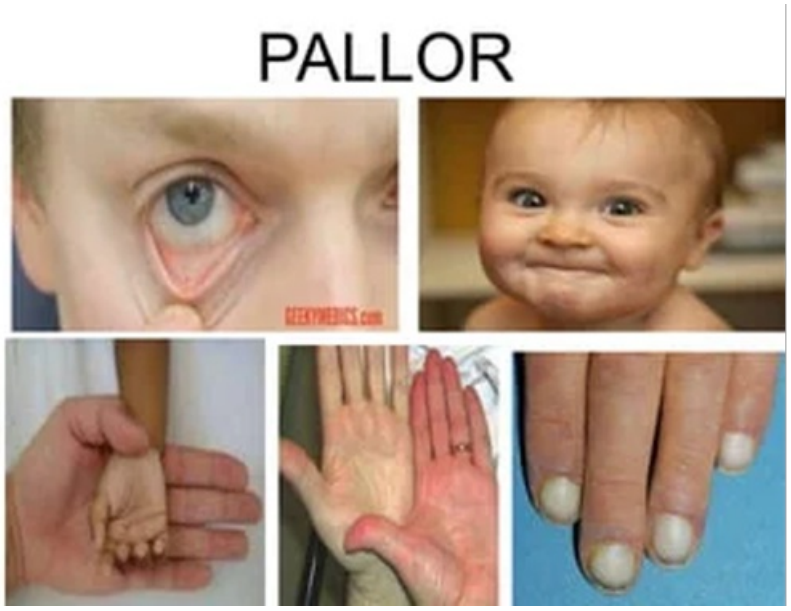
Evaluating the adequacy of systemic blood flow is a critical element of pediatric patient care. Pediatric patients communicate valuable information about their circulatory health through the condition of their skin. In healthy children, the skin presents with a natural color and feels dry and comfortably warm. Any deviation from this normal state should immediately catch the attention of healthcare providers. It is crucial to consider the child's ethnic background and the lighting conditions in the environment when assessing the child's skin.

During the PAT, pay close attention to a patient's circulation to the skin. When approaching the child, note the general appearance of their skin.

- Are they pale/white in appearance?
- Are they red/flushed?
- Do they appear to have a grey/blueish tone (cyanosis) to their skin?

Consider asking the parent or primary caregiver: Does the child look their usual colour?

Pallor: Paler than normal. Pallor can be a sign of anemia, hypothermia or hypoperfusion.



MOTTLING = RED FLAG FOR HYPOPERFUSION

Cyanosis: Blueish discoloration of skin. Predominant around lips. Cyanosis may indicate hypoxia, a lack of oxygen.

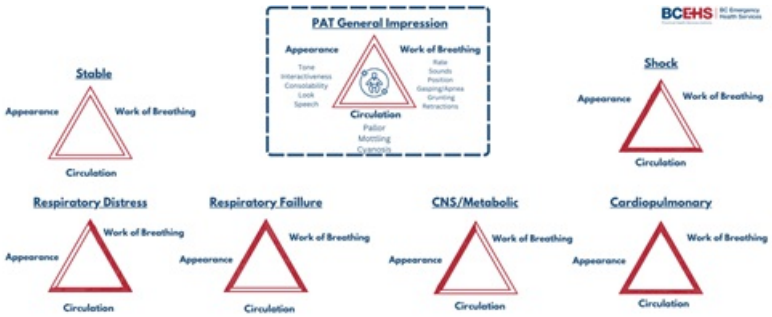
CYANOISIS = RED FLAG FOR HYPOXIA

Lightly press down on the nailbed using a finger or toe (which may be preferred in children). How long does it take to return to baseline colour? 1 second? 2 seconds? Anything over 2 seconds can be a sign of decreased perfusion.

Lightly pulling a section of skin on the hand or chest, does it snap back into place quickly? Or does it "tent" and return slowly? This can be a great sign of hydration/dehydration.

Are there any rashes present? If so, where are they located, and how would you describe them?

Final breathing question: **Are you concerned about their circulatory state?**



Pediatric Early Warning System

Efficiently conveying and documenting potential signs of illness in a child, as indicated by the Pediatric Assessment Tool (PAT), is of utmost importance.

Internationally, Pediatric Early Warning Systems (PEWS) play a vital role in proactively recognizing and addressing deteriorating health conditions in pediatric patients who are admitted to hospitals. "The PEWS provides evidence-informed methods to assess children in different age groups, using vital signs parameters and risk indicators supported by evidence to be reliable indicators of deterioration" (Child Health BC, 2023). Leaders and healthcare practitioners within the British Columbia (BC) health authorities have recognized the critical need for the widespread adoption of PEWS in healthcare facilities catering to children across various service tiers. This includes extending its implementation to BCEHS. Using the PEWS early warning score, along with the PEWS vital signs reference card will align BCEHS practices with the rest of the healthcare team and minimize margins for error.

BC PEWS Vital Signs Reference Card

Age	Heart Rate Beats per minute	Respiratory Rate Breaths per minute	Systolic / Diastolic BP	MAP mmHg
0 – 28 days*	104 – 162	31 – 60	60 – 80 / 30 – 53	40 or higher
1 – 3 months*	104 – 162	31 – 60	73 – 105 / 36 – 68	48 or higher
4 – 11 months*	109 – 159	29 – 53	82 – 105 / 46 – 68	58 – 80
1 – 3 years†	89 – 139	25 – 39	85 – 109 / 37 – 67	53 – 81
4 – 6 years†	71 – 128	17 – 31	91 – 114 / 50 – 74	63 – 87
7 – 11 years†	60 – 114	15 – 28	96 – 121 / 57 – 80	70 – 94
12 plus years†	50 – 104	12 – 25	105 – 136 / 62 – 87	76 – 103
Temperature °C	**Oral:** 35.5 – 37.5, **Axilla:** 36.5 – 37.5, **Rectal:** 36.6 – 38.0, **Temporal:** 36.3 – 37.8			

HR and RR ranges: CTAS 2013
Temperature ranges: CPS 2015
BP ranges: *Modified from American Heart Association (2012). *Pediatric emergency assessment, recognition, and stabilization (PEARS) provider manual.* † National Heart, Lung and Blood Pressure Institute (2004). The fourth report on the diagnosis, evaluation, and treatment of high blood pressure in children and adolescents. *Pediatrics, 114(2)*, 555-556.

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BCEHS paramedics should have awareness of the factors associated with the risk of pediatric clinical deterioration. For PEWS this consists of 5 risk factors: Patient/Family/Caregiver Concern, Watcher Patient, Communication Breakdown, Unusual Therapy, and PEWS Score 2 or higher. (Childhealth BC, 2023).

Calculating Weight

Weight based dosing

It is recommended to use the following methods in order of most accurate to least accurate:

1. Parent or primary caregiver estimation is most accurate (within 10 percent of actual body weight approximately 80 percent of the time
2. Use of length-based measurements (eg, Broselow, Handtevy, PAWPER, or Mercy tapes)" (Fuchs, 2023) . For example, the Broselow tape provided a weight estimate within 10 percent of actual weight 54 percent of the time
3. Age-based methods can be used but will often be highly inaccurate. We recommend using the following formula for patients aged 1 to 10 years: Weight (kg) = 2x(age in years)+8

M01: Pediatrics - Cardiac Emergencies

Heather Rose and Ryan Casselman

Updated: October 24, 2023
Reviewed: October 24, 2023

Introduction

In the pediatric population, cardiac emergencies originating from the cardiac system are much less frequent than in adults. Cardiac chief complaints stem predominantly from respiratory causes or other systems in the body being out of homeostasis, creating a secondary cardiac issue. The exception to these cases is pediatric patients with congenital heart defects or cardiac dysfunction diseases. The importance of the history and physical examination cannot be overemphasized in the evaluation of infants and children with suspected cardiovascular disorders (1). Unlike adults, ACS is not in the top list of differentials for pediatric chest pain complaints. Understanding the nature of the complaint, pediatric physiology, paired with a PAT assessment will aid BCEHS practitioners in further treatment and conveyance options to best suit these pediatric patients.

Essentials

- A slow (bradycardic)heart rate is often a result of hypoxia.
- Effective airway management is paramount in pediatrics with low heart rates. Ensuring adequate oxygen and ventilation while correcting the source of hypoxia is crucial.
- Concerning Cardiac Signs/Symptoms:
  - For infants:
    - Decreased growth
    - Decreased feeding
    - Cyanosis
    - Respiratory Distress

    For older children:

    - Poor exercise tolerance
    - Fatigue
    - Dyspnea
    - Orthopnea

Additional Treatment Information

- **Differential Diagnosis of Chest Pain in Pediatric Patients**

  Arrhythmias: Supraventricular Tachycardia (SVT), Ventricular Tachycardia (V-Tach), Bradycardia

  Structural abnormalities: Cardiomyopathies, Pulmonary Stenosis, Murmurs, Mitral Valve Prolapse, Aortic stenosis, Marfan syndrome (dissecting aortic aneurysm)

  Infection/Inflammation: Pericarditis, Myocarditis, Pancreatitis, Cholecystitis, Pneumonia, Esophagitis, Herpes simplex

  Coronary Artery: Ischemia/infarction. Vasospasm

  Trauma: Overuse injury (Sprain/Strains), Pneumothorax,

  Substance: sympathomimetic ingestion

  Psychosocial: Anxiety, Hyperventilation

  (Kliegman, 2020)

General Information

- Sinus arrhythmia is a normal variant seen in children and is described as a variation in heart rate over time without symptoms. The variation coincides with breathing. Typically, the rate increases during inhalation and decreases during exhalation. There is no concern if this is the lone finding.
- Tachycardia is a sustained increased heart rate. A heart rate > 180 bpm in a child, or > 220 bpm in an infant, is unlikely to be rapid sinus tachycardia and more likely to be an arrhythmia.
  - Narrow complex tachycardia (QRS < 0.09 seconds) with visible p-waves is considered to be sinus tachycardia and a primary cause should be determined. No specific cardiac management of sinus tachycardia is needed. Treat the underlying cause (e.g., pain, fever, hypovolemia, hypoxia, or anemia) as appropriate.
  - Narrow complex tachycardia with no visible p-waves, with abrupt onset or termination and no change with activity, is considered to be SVT. Stable patients with no previous history and no hemodynamic compromise require support with oxygen, continuous cardiac monitoring, and conveyance to ED, with equipment for electrical cardioversion immediately available. Symptomatic patients should be treated with a vagal maneuver, adenosine, or cardioversion if unstable.
  - Wide complex tachycardia (QRS > 0.08 seconds) in a conscious patient with adequate perfusion and a heart rate > 150 bpm is probably in stable ventricular tachycardia and requires support with oxygen, continuous cardiac monitoring, and conveyance to ED, with equipment for electrical cardioversion immediately available.
  - Wide complex unstable tachycardia in a child with poor perfusion should be considered ventricular tachycardia and be treated rapidly with synchronized cardioversion with sedation if readily available.
  - In refractory cases or situations where appropriate treatment options are unclear, contact Clinicall.
- Bradycardia is a sustained decreased heart rate. In the pediatric populations, bradycardia is usually secondary to a different pathology and treatment focuses on the underlying cause.
  - As hypoxia may be a contributor, ensure optimized oxygenation and ventilation, including bag-valve mask if needed.
  - Consider a 20cc/kg crystalloid bolus to address hypotension.
  - In a pediatric patient with a HR < 60 bpm coupled with poor perfusion, CPR is indicated. Ensure maximal oxygenation and bag-valve mask ventilation is provided. If heart rate remains < 60 bpm for 30 seconds of effective oxygenation and ventilation, begin chest compressions. Signs of poor perfusion include cyanosis, mottling, decreased LOC, and lethargy.
  - Epinephrine 0.01 mg/kg IV/IO is indicated for bradycardia unresolved by oxygenation, ventilation, and chest compressions.
  - Atropine is only indicated when increased vagal tone or primary AV block is the suspected etiology of the bradycardia; with all other causes, epinephrine is preferred.
  - Bradycardia with complete heart block or a history of congenital or acquired heart disease, pacing may be indicated.
- BRUE (Brief Resolved Unexplained Event) and ALTE (Apparent Life Threatening Event) are not specific disorders but terms for a group of alarming symptoms that can occur in infants. They involve the sudden appearance of respiratory symptoms (such as apnea), change in colour or muscle tone, and/or altered responsiveness. Events typically occur in children < 1 year with peak incidence at 10 to 12 weeks. Some of these events are unexplained (and designated BRUEs), but others result from numerous possible causes including digestive, neurologic, respiratory, infectious, cardiac, metabolic, or traumatic (e.g., resulting from abuse) disorders.

Interventions

First Responder

- Keep the patient at rest
- Position the patient: if symptoms suggest hypotension, position supine
- Provide supplemental oxygen as appropriate
  - → A07: Oxygen Administration
- Manage airway as appropriate
  - → B01: Airway Management
- If HR < 60 bpm with signs of poor perfusion, provide 100% oxygen and bag-valve mask ventilation; if no improvement after 30 seconds, begin CPR
  - → PR06: High Performance CPR
  - → M06: Pediatric Cardiac Arrest

- Consider underlying causes
  - → M03: Pediatric Respiratory Emergencies
  - → M04: Pediatric Neurological Emergencies

Emergency Medical Responder – All FR interventions, plus:

- Initiate rapid conveyance with notification
- Consider intercept with additional resources

Primary Care Paramedic – All FR and EMR interventions, plus:

- Consider vascular access (in patients ≥ 12 years of age)
  - → D03: Vascular Access
  - CliniCall consultation required prior to fluid administration for pediatric fluid requirements

Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:

→ PR16: 12-Lead ECG

Tachycardia

- Asymptomatic: no treatment required
  - Consider crystalloid bolus if no cardiac history
- Unstable narrow complex tachycardia
  - Vagal maneuver
    - → PR28: Modified Valsalva
  - Adenosine
    - Do not use adenosine if the patient is taking carbamazepine or dipyridamole
  - Synchronized cardioversion; initial at 1 J/kg, repeat at 2 J/kg
    - → PR20: Synchronized Cardioversion
    - For sedation prior to cardioversion, consider:
      - MIDAZOLam
        - MIDAZOLam may depress respiratory rate and blood pressure
      - KetAMINE
        - KetAMINE should be used with caution where the shock index is > 1 – have push dose EPINEPHrine readily available in these cases
- Unstable wide complex tachycardia
  - Vagal maneuver
    - → PR28: Modified Valsalva
  - Synchronized cardioversion; initial at 0.5 – 1 J/kg, repeat at 2 J/kg
    - → PR20: Synchronized Cardioversion
  - CliniCall consultation required for refractory cases or where treatment options are unclear.

Bradycardia

- Asymptomatic: no treatment required
  - Consider crystalloid bolus if no cardiac history
- Unstable bradycardia
  - EPINEPHrine
  - Atropine – if increased vagal tone suspected
    - CliniCall consultation required prior to repeat dose Q 3-5 min to a maximum total dose of 0.4 mg/kg or 1 mg, whichever is less (1-833-829-4099)
  - Transcutaneous pacing
    - → PR19: Transcutaneous Pacing
    - CliniCall consultation required prior to transcutaneous pacing (1-833-829-4099)

Critical Care Paramedic – All FR, EMR, PCP, and ACP interventions, plus:

- Tachyarrhythmias

- Amiodarone
- Lidocaine
- Digoxin has many drug incompatibilities and administration should be done in consultation with BC Children's Cardiology

Evidence Based Practice

Pediatric Bradycardia

Supportive

Neutral

Against

Pediatric Tachycardia

Supportive

- Vagal Maneuver / ice water
- Adenosine
- Amiodarone
- Electrical Cardioversion

Neutral

- Digoxin

Against

- Verapamil

M02: Pediatrics - Circulatory Emergencies

Heather Rose

Updated: October 30, 2023
Reviewed: October 24, 2023

Introduction

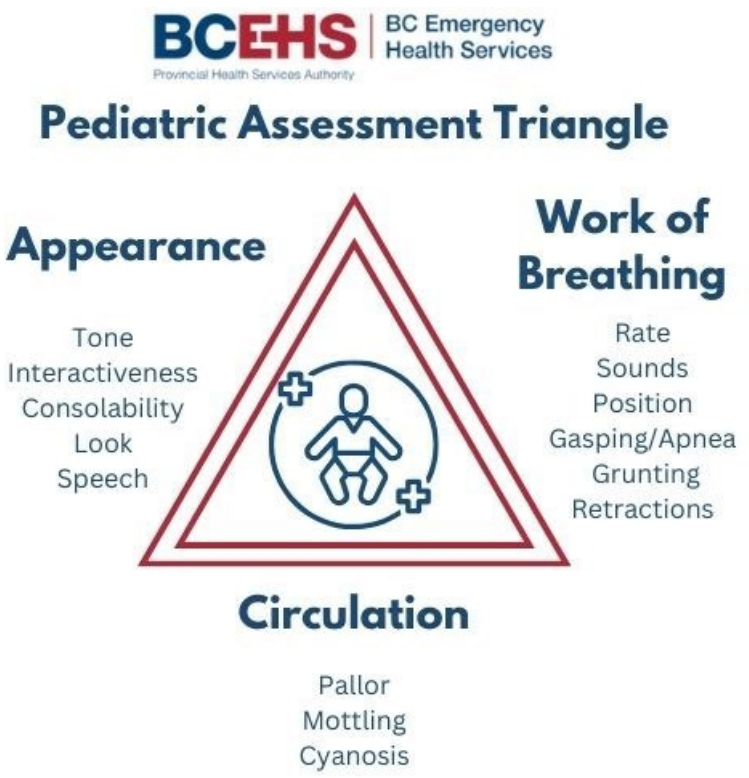
Shock is a dynamic and unstable pathophysiologic state characterized by inadequate tissue perfusion [1]. Shock develops as the result of conditions that cause decreased intravascular volume, abnormal distribution of intravascular volume, and/or impaired cardiovascular function. These conditions can then cause:

- Insufficient circulating blood volume (preload)
- Changes in vascular resistance (afterload)
- Heart failure (contractility)
- Obstruction to blood flow

The leading cause of pediatric shock globally is hypovolemia resulting from gastroenteritis [2]. The widespread adoption of oral rehydration therapy has significantly decreased mortality rates in these cases. Another significant contributor to pediatric mortality is trauma, including instances of hemorrhagic shock. Severe sepsis is also a common occurrence among children worldwide. It particularly affects low birth weight newborns, infants under one month old, immunosuppressed individuals, and children with chronic debilitating conditions. Cardiogenic and obstructive shock are relatively rare occurrences in the pediatric population.

The initial signs of shock may be subtle in children and infants as their compensatory mechanisms are very effective. A child may lose 25% of their circulating blood volume before becoming hypotensive [3]. When the compensatory mechanisms fail, the child progresses quickly to decompensated shock where the "classic" signs and symptoms of shock are present such as: tachycardia, pallor, cold extremities, and altered levels of consciousness. When this occurs, cardiopulmonary arrest may be imminent. Key considerations when assessing pediatric patients in potential shock states:

- **Compensatory Mechanisms**: Children are often better at compensating for certain medical conditions compared to adults. Their bodies may maintain stable vital signs for a longer period before decompensating, which means they can hide signs of illness or shock until they reach a critical stage.
- **Early Recognition and Intervention**: Recognizing signs of shock in pediatric patients early on is crucial because they can deteriorate rapidly once their compensatory mechanisms begin to fail. Timely intervention is essential to improve outcomes.
- **Observation at Rest**: One way to identify shock symptoms in children is by observing them while at rest. This means paying close attention to their overall appearance and behavior, as well as monitoring vital signs like heart rate and blood pressure.
- **Pediatric Assessment Triangle (PAT)**: The pediatric assessment triangle is a tool used to quickly assess the overall condition of a pediatric patient. It consists of three components:
  - **Appearance**: This refers to the child's overall appearance, including their level of alertness, interaction with the environment, and skin color.
  - **Work of Breathing**: It involves assessing the child's breathing effort, such as retractions (visible sinking of the chest or ribs during breathing), grunting, or abnormal breath sounds.
  - **Circulation**: This component looks at the child's heart rate and perfusion, including skin temperature, capillary refill time, and pulses.



- **Transport to the Emergency Department (ED)**: Any pediatric patient showing signs of shock or concerning symptoms should be promptly transported to the nearest appropriate medical facility, typically an Emergency Department. Early access to specialized care is crucial.
- **Basic Priorities**: At a basic level, there are several priorities when managing pediatric patients in shock, including:
  - **Adequate Oxygenation**: Ensuring that the child is receiving enough oxygen to meet their body's needs.
  - **Appropriate Patient Positioning**: Positioning the child in a way that maximizes their comfort and respiratory function.
  - **Fluid Administration**: Administering fluids as needed to help restore circulating blood volume and improve circulation.

Essentials

- Know and be familiar with normal vital signs for given ages. Use BC PEWS vital signs reference card for most accurate parameters.
- Classic systems-based shock categories are septic, hypovolemic, anaphylactic, cardiogenic, obstructive, and neurogenic.
  - **Compensated shock:** An adequate age-appropriate blood pressure is maintained
  - **Decompensated shock:** Classic signs of shock present: Tachycardia, altered level of consciousness, pale skin, cool extremities
- → Shock states
- → Pediatric sepsis criteria

Additional Treatment Information

- Treatments must be targeted to the underlying cause. Vascular access is critical, but not all problems are responsive to fluid.

Signs of shock or other serious illness may mimic those in adults, but may also include:

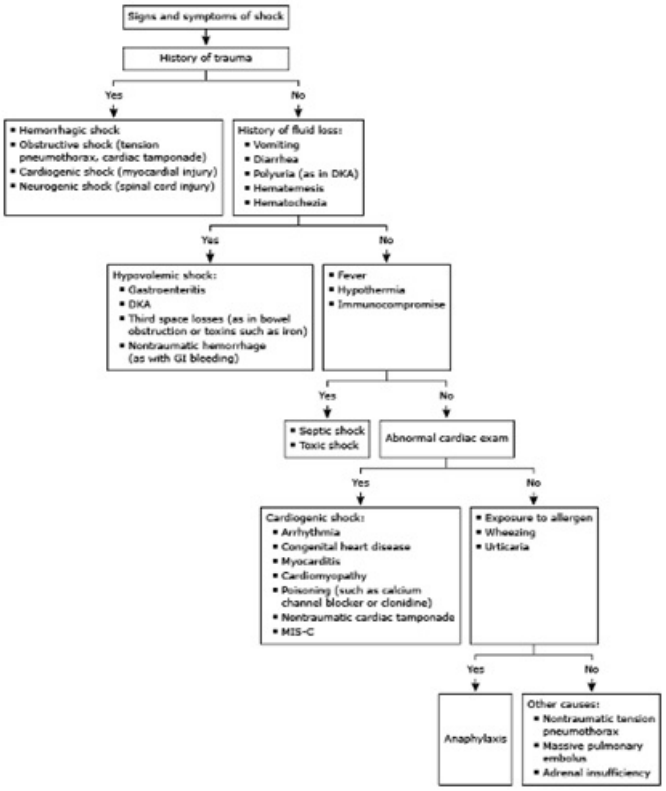
- Tachycardia/bradycardia
- Pale/cool/mottled skin
- Capillary refill > 2 seconds

- Narrowing pulse pressure
- Tachypnea
- Relative flaccidity
- Change in level of consciousness (LOC) – especially failure to recognize/respond to carer(s)

In addition to oxygen, vascular access, and patient positioning, type-specific priorities are:

- Septic shock: 10-20 mL/kg crystalloid bolus, early antibiotics, vasopressors, steroids, and blood products
- Anaphylactic shock: EPINEPHrine 0.01 mg/kg, 10 mL/kg crystalloid bolus (repeated as necessary), vasopressors, and steroids
- Hypovolemic: 20 mL/kg crystalloid bolus, packed red blood cells, platelets, and plasma
- Cardiogenic: 5-10 mL/kg crystalloid bolus (Clinicall/TA consult), arterial line monitoring, vasopressors, inotropes, and chronotropes
- Obstructive: Identify and treat cause
- Neurogenic: 10 mL/kg fluid bolus (may repeat as necessary), vasopressors, and inotropes

General Information



Interventions

First Responder

- Place the patient in a position of comfort, as permitted by clinical condition; in general, this will include laying the patient supine and keeping them warm.
- Provide supplemental oxygen as required
  - → A07: Oxygen Administration
- Conduct ongoing assessment and gather collateral information, such as medication and identification documents
- Communicate patient deterioration to follow-on responders
- Manage airway and breathing as required
  - → B01: Airway Management
  - Most pediatric airways can be effectively managed with proper positioning and an OPA/NPA (as per license level) and BVM without any requirements for further airway interventions. The gold standard for airway management is a self-maintained airway. Two-person bag-valve mask, with a viral filter attached and a tight seal, is the preferred technique for airway management in pediatric resuscitation and is reasonable compared with advanced airway interventions (endotracheal intubation or supraglottic airway) in the management of pediatrics during a cardiac arrest in the out-of-hospital setting.

Emergency Medical Responder – All FR interventions, plus:

- Expedite conveyance
- Assess for treatable cause of shock
- Consider intercept with additional resources

Primary Care Paramedic – All FR and EMR interventions, plus:

- Consider vascular access while en route; depending on suspected pathology, consider volume replacement (in patients ≥ 12 years of age)
  - → D03: Vascular Access and Fluid Administration

- Consider reversible causes:
  - → E01: Hypoglycemia and Hyperglycemia
  - → J12: Opioids

Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:

- Attach monitor and evaluate rhythm for cardiac disturbances or arrhythmias secondary to shock physiology
- Consider vascular access
  - → D03: Vascular Access and Fluid Administration
  - → PR12: Intraosseous Cannulation
- Consider treatable causes
- Consider vasopressors
  - EPINEPHrine

Critical Care Paramedic – All FR, EMR, PCP, and ACP interventions, plus:

- Aggressive fluid replacement including blood products for suspected hemorrhagic shock
- Maintain normothermia. Actively rewarm if necessary
- Ultrasonography to assess pneumothorax, tamponade, and cardiac contractility
- Post-return of spontaneous circulation care:
- Advanced airway
- Crystalloid bolus 20 ml/kg IV/IO
- **EPINEPHrine** infusion

Evidence Based Practice

Hypovolemic Shock

Supportive

- Fluid Resuscitation
- Mechanical Intraosseous Insertion
- Shock Prediction Tool
- Blood transfusion

Neutral

- Manual Intraosseous Insertion
- Aggressive Crystalloids
- Restricted Crystalloids

Against

Pediatric Anaphylaxis

Supportive

- Epinephrine

Neutral

Against

Septic Shock

Supportive

- Aggressive Crystalloids
- Colloid Infusion
- Pressors
- Early Goal Directed Therapy
- Identification tools
- Manual Intraosseous Insertion
- Mechanical Intraosseous Insertion

Neutral

- Restricted Crystalloids

Against

M03: Pediatrics - Respiratory Emergencies

Heather Rose

Updated: February 11, 2024
Reviewed: October 24, 2023

Introduction

The respiratory system is responsible for the exchange of oxygen and carbon dioxide in the body. It consists of organs and structures that work together to facilitate breathing and ensure the body receives the oxygen it needs while eliminating waste carbon dioxide.

Respiratory conditions in children can be categorized into upper airway obstructions, lower airway obstructions, lower airway restrictive pathology, and disordered control of breathing.

Upper airway obstructions occur when there is an increased work of breathing due to an obstruction above the thorax. This is demonstrated in croup and epiglottitis. Lower airway obstructions, by contrast, result from obstructive problems below the thorax such as increased swelling, or bronchospasm. Obstructions can originate from multiple causes, a few common ones being foreign bodies, infections, or anaphylaxis.

Restrictions in the lower airways can be a result of "stiffening" of lung tissue, caused by increased fluid accumulation, toxic exposure, allergic reactions, infiltration, or inflammation. These situations can be best managed with a staged approach of oxygenation and/or ventilation strategies.

Dysfunction within the respiratory center of the brain is responsible for the development of disordered breathing. These situations typically stem from neurological disfunction and secondarily affect respiratory patterns. This can include problems such as increased intracranial pressure, neuromuscular disease, and some poisonings and overdoses.

Respiratory failure occurs when a patient's breathing becomes inadequate and results in ineffective oxygenation and/or ventilation.

Essentials

- The PAT is designed to be a quick and efficient assessment tool. In emergency situations, where time is crucial, healthcare providers can rapidly observe a child's appearance, breathing, and circulation to gather essential primary assessment information about the patient's condition in a short amount of time.
- The PAT relies on visual observation and doesn't require any specialized equipment or extensive medical knowledge
- The component of appearance can be assessed utilizing the mnemonic TICLS, which stands for **Tone, Interactiveness, Consolability, Look and Speech.**
- Upper airway obstruction can be an uncomfortable call to attend as many patients may look ill or unwell, but require purely comfort levels for treatment.
  - See → B04: Croup and Epiglottitis for additional information on the management of upper airway obstructions
- Lower airway obstruction results in an inability for the patient to get air out of the chest. This is usually due to excessive swelling or bronchospasm.
- Lower airway restrictive pathologies consist of numerous conditions that result in decreasing lung compliance or stiffening of the lung. The general management of these conditions concern correcting oxygenation and ventilation utilizing an escalation pathway of increasing FiO_2 via nasal cannula, face mask, heated HiFlow nasal cannula (2 L/min to a max of 60 L/min), NIV therapy, then intubation. Bronchospasm can be treated with a B_2 agonist.
- Disordered Control of Breathing are a series of conditions affecting the respiratory control center in the brain or neuromuscular diseases.

Additional Treatment Information

Refer to the additional clinical practice guidelines for symptom-specific treatment planning:

- → B01: Airway Management

- → B02: Airway Obstruction
- → B03: Asthma and Bronchospasm
- → B04: Croup and Epiglottitis

General Information

- Continuous salbutamol can decrease serum potassium.
- Ventilating the lower airway restrictive disease patient may require high peak inspired pressure of up to 32 cmH_2O and high PEEP of up to 10-15 cmH_2O. Diligent monitoring for the development of a pneumothorax is required.
- Succinylcholine should be avoided in the patient with neuromuscular disease due to the possibility of triggering hyperkalemia or malignant hyperthermia.

Interventions

First Responder

- Provide reassurance and a calming environment
- Keep the patient warm and protect from further heat loss
- Place the patient in a position of comfort, as permitted by clinical condition. In general, limit patient movement.
- Provide supplemental oxygen as required to maintain oxygen saturation ≥97%
  - → A07: Oxygen Administration
- Conduct ongoing assessment and gather collateral information, such as medications and identification documents
- Establish ingress and egress routes from the patient's location
- Communicate patient deterioration to follow-on responders
- Manual airway maneuvers as required
  - → B01: Airway Management
  - Most pediatric airways can be effectively managed with proper positioning and an OPA/NPA (as per license level) and BVM without any requirements for further airway interventions. The gold standard for airway management is a self-maintained airway. Bag-valve mask is the preferred technique for airway management in pediatric respiratory emergencies and is reasonable compared with advanced airway interventions (endotracheal intubation or supraglottic airway).

Emergency Medical Responder – All FR interventions, plus:

- Provide supplemental oxygen to maintain SpO_2 ≥ 97%
  - → A07: Oxygen Administration
- If functional airway obstruction present
  - → B02: Airway Obstruction
  - → PR07: Nasopharyngeal Airway
- Convey with notification
- Consider intercept with additional resources

Primary Care Paramedic – All FR and EMR interventions, plus:

- Supraglottic airway devices may be used to support oxygenation and ventilation in a staged approach, following confirmation of the ability to ventilate the patient with a bag-valve mask and oropharyngeal airway:
  - → PR08: Supraglottic Airway
- For bronchospasm, reactive airway disease, and asthma:
  - Salbutamol via MDI
  - ☐☐ **Requires completion of PCP scope expansion education:**
    - Consider nebulized Salbutamol and ipratropium
  - Consider intramuscular EPINEPHrine; epinephrine via intramuscular injection should be considered for a patient with

SpO2 < 90% and moderate to severe symptoms of asthma that are unresolved with the use of salbutamol administered by MDIs

- See → B03: Asthma and Bronchospasm for additional information

- For croup and epiglottitis
  - Croup: consider nebulized EPINEPHrine (NOT for epiglottitis)
  - See → B04: Croup and Epiglottitis for additional information
- Consider vascular access and fluid administration (in patients ≥ 12 years of age)
  - → D03: Vascular Access and Fluid Administration

Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:

- Consider addition of ipratropium to supplement salbutamol
- Consider magnesium sulfate for significant and protracted bronchospasm
- Consider intraosseous cannulation if peripheral access is unavailable
  - → PR12: Intraosseous Cannulation
- Consider procedural sedation to facilitate airway management. Where SGAs and/or bag-valve mask ventilation fail to provide adequate oxygenation, tracheal intubation may be permissible in cases where paramedics are otherwise unable to obtain and maintain a patent airway. To be clear, this is for actual or immediately impending failure of airway patency unable to be managed by any other means other than intubation. CliniCall consultation required prior to attempting intubation.
  - → PR17: Procedural Sedation
- Consider intubation in patients whose airways cannot be managed through less invasive means
  - → PR18: Anesthesia Induction
- Decompress suspected tension pneumothorax
  - Out-of-hospital needle thoracentesis should be considered AGMP. Although this is a low occurrence procedure, it does potentially expose the paramedic to an increased risk of exposure. If this procedure is needed, crews are directed to proceed with airborne PPE including face-shield, EHFR/N95 mask, gown, and gloves.
  - → PR21: Needle Thoracentesis

Critical Care Paramedic – All FR, EMR, PCP, and ACP interventions, plus:

- Mechanical ventilation (NIV and invasive)
- Chest tube maintenance
- Osmotic agents
- 3% Saline
- Infusion medication
- Antibiotic therapy
- Steroid therapy
- Nonselective adenosine receptor antagonist and phosphodiesterase inhibitor

Evidence Based Practice

Pediatric Wheeze/Bronchospasm

Supportive

- Anticholinergic
- Beta Agonist-MDI
- Beta Agonist-Nebulized
- Beta Agonist-Parenteral
- Epinephrine-Nebulized
- Epinephrine-Parenteral
- Hypertonic Saline-Nebulized
- Oxymetry Monitoring

- Steroids-Parenteral
- High flow nasal canula
- Ketamine

Neutral

- Magnesium Sulfate-IV
- Magnesium Sulfate-nebulized
- Oxygen-Humidified
- PEEP
- Steroids-Inhaled
- Steroids-Oral
- NiPPV
- ETCO2
- Temperature Monitoring

Against

Pediatric Stridor

Supportive

- Epinephrine-Nebulized
- Oxygen-Humidified
- Steroids-Oral

Neutral

Against

M04: Pediatrics - Neurological Emergencies

Heather Rose

Updated: November 05, 2023
Reviewed: October 24, 2023

Introduction

An altered level of consciousness is an abnormal neurological state where a child is less alert or responsive than would be appropriate for their baseline neurological state. Establishing what the child is usually capable of with regards to any preexisting neurological impairments is of utmost importance.

Signs of an altered level of consciousness range from unresponsive or unconscious (GCS 3), to severely agitated and heightened (RASS +4). There are numerous causes behind altered LOC, some being life threatening and others less concerning. Distinguishing the variances and causes can be challenging in the prehospital setting.

When assessing and providing care for these patients, paramedics and EMRs/FRs should prioritize overarching objectives. These include ensuring an open airway, offering support for adequate oxygenation, ventilation, and circulation. It's crucial to remain vigilant for any potential reversible causes of altered consciousness throughout the evaluation and treatments. These situations may be inherently stressful for parents or caregivers of the child.

Common causes of pediatric altered level of consciousness may include but is not limited to: Syncopal episodes, Seizures due to fever (febrile), Hypoglycemia secondary to juvenile diabetes, and head injuries.

Essentials

Regardless of the underlying cause, patients with altered levels of consciousness are at high risk of functional airway obstruction and hypoxia. Management of oxygenation and ventilation must take priority over a search for potentially reversible causes.

The search for reversible causes should be conducted systematically. A number of mnemonics exist to guide paramedics and EMRs/FRs in their investigations. Regardless of which tool is used, paramedics and EMRs/FRs should consider, at a minimum **AEIOUTIPS**:

- Alcohol and intoxicants
- Epilepsy, endocrine (hypoglycemia), electrolytes
- Insulin
- Overdoses, accidental or intentional
- Underdosing of medication or uremia
- Trauma
- Infection
- Psychosis
- Sepsis, shock, stroke
- Hypotension
- Hypoxia
- Hypo or hyperthermia
- If a potentially reversible cause is found, refer to the appropriate CPG for management details.

Syncope should be considered a diagnosis of exclusion. Paramedics and EMRs/FRs must look for reversible or life-threatening causes of unconsciousness and rule these out prior to considering syncope as the cause of the altered level of consciousness.

Additional Treatment Information

- As with adults, assessments of patients with an altered level of consciousness should focus on airway protection, oxygenation, ventilation, and an evaluation of blood glucose.
- Febrile seizures are generally benign and do not require treatment if of short duration. Treating a fever does not prevent recurrence of seizures.

- Assessment and treatment priorities of stroke are primarily maintaining ABCs and attaining vascular access if it does not interfere with rapid conveyance to a tertiary facility.
- If not associated with a primary cause that requires intervention (such as trauma), headaches can be treated with support, position of comfort, and a calm dark environment.
- Treatment in spinal emergencies is supportive and prioritization of conveyance to a tertiary facility.
- Syncope is frequently benign, but should not necessarily prompt a decision to avoid conveyance. In cases where a patient has a cardiovascular history, careful monitoring of an ECG and vital signs are important.

Referral Information

All patients exhibiting signs and symptoms of an altered LOC and neurological disorder require evaluation in hospital, even if transient.

General Information

Syncope

Syncope is a clinical syndrome in which a transient loss of consciousness is caused by a period of diminished cerebral blood flow. By definition, the duration of the event is usually brief with a spontaneous to normal baseline consciousness. Recovery from syncope is usually rapid and complete with episodes rarely lasting more than a minute or two. Syncope can also be a sign of a potentially serious and life-threatening condition. Some patients experience syncope without warning. They lack pre-syncope signs or symptoms and experience a sudden collapse followed immediately by a return to normal mental status.

- Vasovagal syncope is a common and benign cause of syncope. It occurs due to an inappropriate response by the autonomic nervous system, typically to triggers such as changes in posture, pain, the sight of blood, or extreme emotional distress. Prodromal symptoms are common and can include a feeling of lightheadedness or dizziness, weakness, nausea, blurred vision, and a general sensation of unwellness or unease. Patients may be pale and diaphoretic. Vasovagal syncope is a diagnosis of exclusion
- Patients who experience syncope (and caregivers of) are often inclined to refuse service. The diagnostic tests required to safely include or exclude potential causes of syncope or transient loss of consciousness are not available in the out-of-hospital environment. This may include ECG monitoring, lab work, or imagining. Paramedics and EMRs are expected to follow the appropriate guidelines with respect to these refusals which may include CliniCall consultation and having refusal of care signed on the ePCR.

Febrile Seizure

A febrile seizure is a type of convulsion or seizure that occurs in young children, typically between the ages of 6 months and 5 years, as a result of a sudden spike in body temperature, often associated with a fever secondary to respiratory or gastrointestinal viruses. The fever itself, rather than the underlying illness, is what triggers the seizure. This is the bodies way of trying to reset the system back into normal physiological parameters to maintain homeostasis. These seizures can be quite frightening for parents or caregivers to witness but are usually not harmful and do not indicate underlying epilepsy or a serious medical condition. Febrile seizures can vary in duration and severity but typically involve the child losing consciousness and experiencing rhythmic jerking or twitching movements, often involving both arms and legs. The child may also become unresponsive during the seizure. Most febrile seizures are brief and last for less than 5 minutes. If a seizure persists for longer than 5 minutes or if multiple seizures occur in a short period, it is considered a complex febrile seizure, which may require medical attention. After the seizure ends, the child may appear confused, drowsy, or irritable for a short time. This is called the postictal state and is a normal part of the seizure as the brain responds. Pediatric seizure management is the same as adults in the sense that proper airway management is the hallmark priority.

→ F02: Seizure CPG

Assessment of the Altered LOC Patient

The Richmond Agitation-Sedation Scale (RASS) is a numerical scale used to assess a patient's level of sedation or agitation. This is particularly useful in patients that have previously been sedated either in or prehospitally by a healthcare professional, or if they have ingested recreational illicit substances. It is also useful in excited delirium situations either from psychological or illicit substance use causes.

The Glasgow Coma Scale/Score is a numerical scale used to evaluate a patient's neurological state or level of

consciousness after head injury or trauma that caused an altered level of consciousness. This is useful in trauma patients, stroke patients, or other causes of altered LOC that are not related to sedative substances.

Richmond Agitation and Sedation Score

Glasgow Coma Scale/Score

There is a pediatric Glasgow coma scale available for use in patients under 2 years old that do not yet communicate verbally or follow simple commands.

Pediatric Glasgow Coma Scale

Pediatric Altered Level of Consciousness Podcast

Interventions

First Responder

- Position of comfort for the patient. If symptoms suggest hypotension, lay the patient flat provided this does not exacerbate other symptoms.
- Provide supplemental oxygen as required to maintain saturation ≥97%.
  - → A07: Oxygen Administration
- Provide positive pressure ventilation if respirations are inadequate
  - → B01: Airway Management
- Obtain capillary blood sample and correct as appropriate as per license level
  - → E01: Hypoglycemia and Hyperglycemia
  - Oral 40% Glucose Gel
- Correct suspected narcotic intoxication
  - → J12: Opioids (do not administer naloxone to neonates)

Emergency Medical Responder – All FR interventions, plus:

- Provide supplemental oxygen to maintain SpO2 ≥97%
  - → A07: Oxygen Administration
- Convey urgently
- Consider intercept with additional resources

Primary Care Paramedic – All FR and EMR interventions, plus:

- Consider use of nasopharyngeal airway if unsuitable for oropharyngeal airway
  - → PR07: Nasopharyngeal Airway
- Consider use of supraglottic airway in obtunded patients
  - → PR08: Supraglottic Airway
- Consider vascular access and fluid administration (in patients ≥ 12 years of age)
  - → D03: Vascular Access
- Consider need for analgesia:
  - → E08: Pain Management
- Consider Glucagon

Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:

- Advanced airway management as required
  - → PR18: Anesthesia Induction
- Monitor for cardiac dysrhythmia
- Control seizures where required.
  - → F02: Seizures
  - MIDAZOLam
- Analgesia

- FentaNYL
- KetAMINE
- CliniCall consultation required if additional analgesia necessary.
- Unlike with adults, pre-treatment with ondansetron significantly decreases ketamine induced vomiting; consider ondansetron whenever using ketamine in children aged 12-18

- **Sedation, Seizure, Analgesia:**
  - **3 month old (Broselow Pink)**
  - **6 month old (Broselow Red)**
  - **1 year old (Broselow Purple)**
  - **2 year old (Broselow Yellow)**
  - **3 year old (Broselow White)**
  - **4 year old (Broselow White)**
  - **6 year old (Broselow Blue)**
  - **10 year old (Broselow Blue)**
  - **12 year old**

Evidence Based Practice

Pediatric Altered Mental Status (NYD)

Supportive

Neutral

Against

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M05: Pediatrics - Trauma

Alex Kuzmin

Updated: June 02, 2021
Reviewed: March 01, 2021

Introduction

Trauma is the leading cause of death in children and is responsible for more deaths and potential years of life lost than all other causes combined. Blunt injury accounts for 90% of these trauma cases, with 10% attributable to penetrating injury. The recognition of hidden injuries and rapid stabilization and conveyance of critically injured patients are the foundations of trauma care in all patients, including children.

Essentials

- In general, trauma patients cannot be stabilized in the out-of-hospital environment. They will continue to deteriorate until they receive definitive surgical care.
- Paramedics and EMRs/FRs should maintain a high index of suspicion when confronted with what appear to be minor injuries associated with a significant mechanism.
- Children are at higher risk for cervical spine injury because of their larger, heavier heads, and weakly developed spine and neck muscles.
- Early deaths in hospital are most commonly due to uncontrolled shock or head injury.
- Due to their relatively healthy cardiovascular systems, children are known to be able to compensate well for blood loss. Heart rate is a more useful guide to resuscitation than blood pressure.

Additional Treatment Information

- The only interventions that should be carried out prior to conveyance are:
  - Identification and control of hemorrhage
  - Basic C-spine stabilization when required; C-spine stabilization should not delay ABC management and rapid conveyance of patients with head injury or shock
  - Airway management and ventilatory support
  - Relief of tension pneumothorax
  - Simple stabilization of long bone and pelvic fractures; use a pelvic binder for suspected open book fractures
- Except for very long conveyances, the value of an IV and fluids, even for a patient in moderate shock, is controversial and certainly does not warrant any delay.
- Radical deformities should be pulled gently to normal anatomical positioning for packaging.
- Flush grossly contaminated wounds with saline prior to applying a sterile dressing.
- If adequate airway protection and ventilatory support can be achieved through the use of a bag-valve mask and pharyngeal airway, consideration should be given to avoiding intubation in order to minimize delay at the scene.

General Information

- Pediatric airway specific considerations:
  - Due to disproportion between size of cranium and midface, consider passive C-spine flexion with padding under the shoulders
  - Relatively large, soft tissues within the laryngopharynx
  - Funnel-shaped larynx, more cephalad, and anterior epiglottis
  - Short trachea
- Failure to ensure appropriate ventilation is the most common preventable cause of death in injured children; under-recognized and under-treated hypovolemic shock is the second.
- Opiates and/or Ketamine are the preferred choices of analgesia for the pediatric population. Nitrous oxide is less effective but can also be used due to license level, unless contraindications exist.
- Unlike adults, children rarely die from isolated pelvic fractures. If hemodynamic instability exists in what appears

to be an isolated pelvic fracture, look for other causes of blood loss.

- Most major pediatric intra-abdominal trauma is now managed non-operatively. Bleeding is usually self-limiting even with significant lacerations of the liver, spleen, or a kidney.
- Major trauma criteria define patients who clearly have a high risk of death. They include but are not limited to:
  - Pediatric Trauma Score ≤ 8
  - Altered level of consciousness, GCS ≤ 13, or focal neurologic deficit
  - Respiratory distress – change in RR from normal
  - Change in HR from normal
  - Signs of hypo-perfusion – decrease in SBP by 5 mmHg from normal [80 + (2x age)]
  - Penetrating injury
  - Long bone fractures – 2 or more
  - Flail chest or open chest wound
  - Major amputation of extremity – proximal to wrist/ankle
  - Airway compromised with significant burns

Interventions

First Responder

- Assess wakefulness and perfusion
- Provide basic airway management and supplemental oxygen as required
  - → B01: Airway Management
  - → A07: Oxygen Administration
- Control life threatening bleeding
  - → D02: Bleeding
- Cover open chest wounds with a three-sided occlusive dressing
- Apply spinal motion restriction as required

Emergency Medical Responder – All FR interventions, plus:

- Provide supplemental oxygen to maintain SpO_2 ≥ 94%
  - → A07: Oxygen Administration
- Wound packing
  - → PR04: Wound Packing
- Apply chest seal to open chest wounds
- Pelvic binding if patient is > 20 kg (44 lbs)
  - → PR02: Pelvic Binders
- Consider need for inhalational analgesia: Nitrous Oxide
- Facilitate conveyance with early hospital notification
- Consider intercept with additional resources

Primary Care Paramedic – All FR and EMR interventions, plus:

- Consider vascular access (in patients ≥ 12 years of age)
  - → D03: Vascular Access
- Consider need for analgesia
  - → E08: Pain Management
- Correct blood glucose
  - → E01: Hypoglycemia and Hyperglycemia
  - Assessment and correction of blood glucose level is mandatory for all patients with a head injury that presents with an altered level of consciousness (GCS < 15)

Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:

- Consider vascular access
  - → D03: Vascular Access
  - → PR12: Intraosseous Cannulation
  - Target BP = values by age below:
    - < 28 days; > 60 mmHg
    - 1-12 months; > 70 mmHg
    - 1-10 years; > 70 mmHg + (2x age in years)
    - 10 years to adulthood; > 90 mmHg
  - Tranexamic acid
- Advanced airway management as required
  - → PR18: Anesthesia Induction
- Assess for tension pneumothorax
  - → PR21: Needle Thoracentesis

Critical Care Paramedic – All FR, EMR, PCP, and ACP interventions, plus:

- Advanced airway interventions
- Advanced diagnostics: US, CT, Angio, Xray
- Central IV access
- Blood products
  - Call ETP prior to blood product
- CBC, type & crossmatch, PT/PTT, electrolytes etc.

Evidence Based Practice

Pediatric General Trauma Care

Supportive

- Fentanyl
- Ketamine
- Morphine
- C-Spine Clearance
- HEMS
- Mechanical Intraosseous Insertion
- Nitrous Oxide
- Optimal Trip Destination
- Shock Prediction Tool
- Blood transfusion
- Intubation with in-line stabilization

Neutral

- BVM
- Cervical Collar
- Intubation
- Manual Intraosseous Insertion
- Sedation
- Spinal Precautions

Against

- Long Spinal Immobilization Devices

M06: Pediatrics - Cardiac Arrest

Heather Rose and Ryan Casselman

Updated: December 08, 2023
Reviewed: December 08, 2023

Introduction

In 2021 and 2022, 80 out of a total of 10,596 BCEHS calls pertaining to children aged 0 to 12 years were coded as cases involving respiratory or cardiac arrest. This represents 0.8% of overall pediatric calls. While infrequent, these occurrences, categorized as "High Acuity, Low Occurrence" (HALO) calls, can be inherently stressful. It has been documented that Survival is less than 10% for pediatric patients following out-of-hospital cardiac arrest (Tijssen,2015).

When managing pediatric cardiac arrests, priority is placed on delivering high-quality cardiopulmonary resuscitation (CPR) in conjunction with effective airway management. It may be challenging to immediately discern if a child's pulse is below 60 BPM. One partner may begin establishing airway management techniques if intrinsic respirations are deemed ineffective, while the other partner can focus on physically obtaining an accurate pulse reading. This may seem to prioritize airway management over initiation of compressions but in reality, these interventions should be happening simultaneously.

Upon establishing optimal oxygenation and proficient CPR, the attachment of a defibrillator assumes significance to discern the presence of a shockable rhythm. Pediatric cardiac arrests are not frequently cardiac in nature, so the application of a defibrillator should be considered only after establishment of effective airway management and high-quality CPR. Special considerations for cases involving blunt chest trauma, electrocution, cardiac history, or congenital heart anomalies may warrant expedited defibrillator application, given the heightened probability of ventricular tachycardia or ventricular fibrillation.

Pediatric cardiac arrests display distinct characteristics in comparison to neonatal and adult arrest cases. Unlike adult cardiac arrests which are typically abrupt, pediatric cases are usually not of primary cardiac origin and tend to evolve gradually as progression from respiratory failure or shock states. Consequently, indicators of deterioration such as respiratory failure, bradycardia, and hypotension, often precede cardiac arrest due to the prevailing hypoxic component. The extended decline offers a timeframe for accurate and timely pediatric assessment that is not usually demonstrated in adult or neonatal cases. With appropriate assessment and treatment, complete progression to a cardiac arrest state can be avoided

Distinct consideration is merited for hypothermic patients without a palpable pulse. The progressive impact of hypothermia is characterized by substantial reduction in respiratory and heart rates. Consequently, the assessment duration for breathing and pulse should be extended to 60 seconds, accounting for the considerably diminished rates.

- Transportation of children in cardiac arrest should not minimize or lessen quality of CPR and ventilation. Consult with CliniCall if unsure of transport decisions in prolonged arrest states with no response to treatments. High quality CPR, appropriate ventilation, timely vascular access, and a moderate scene time (10 to 35 minutes) are proven elements that improve survival from cardiac arrest with good outcomes (Tijssen, 2015).

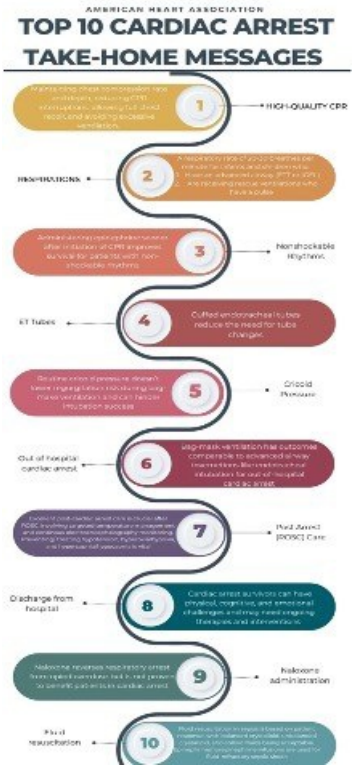
In summary, the infrequency of pediatric cardiac arrests portrays the significance of tailored management strategies emphasizing early, accurate assessment, high-quality CPR, and suitable interventions. These interventions stand to be pivotal in offsetting the complex physiological nuances that differentiate pediatric cases.

Essentials

American Heart Association Top 10 Cardiac Arrest Take Home Messages

1. High-quality cardiopulmonary resuscitation (CPR) is the foundation of resuscitation. New data reaffirm the key components of high-quality CPR: providing adequate chest compression rate and depth, minimizing interruptions in CPR, allowing full chest recoil between compressions, and avoiding excessive ventilation.
2. A respiratory rate of 20 to 30 breaths per minute is new for infants and children who are (a) receiving CPR with an advanced airway in place or (b) receiving rescue breathing and have a pulse.
3. For patients with non-shockable rhythms, the earlier epinephrine is administered after CPR initiation, the more likely the patient is to survive.
4. Using a cuffed endotracheal tube decreases the need for endotracheal tube changes.

5. The routine use of cricoid pressure does not reduce the risk of regurgitation during bag-mask ventilation and may impede intubation success.
6. For out-of-hospital cardiac arrest, bag-mask ventilation results in the same resuscitation outcomes as advanced airway interventions such as endotracheal intubation.
7. Resuscitation does not end with return of spontaneous circulation (ROSC). Excellent post–cardiac arrest care is critically important to achieving the best patient outcomes. For children who do not regain consciousness after ROSC, this care includes targeted temperature management and continuous electroencephalography monitoring. The prevention and/or treatment of hypotension, hyperoxia or hypoxia, and hypercapnia or hypocapnia is important.
8. After discharge from the hospital, cardiac arrest survivors can have physical, cognitive, and emotional challenges and may need ongoing therapies and interventions.
9. Naloxone can reverse respiratory arrest due to opioid overdose, but there is no evidence that it benefits patients in cardiac arrest.
10. Fluid resuscitation in sepsis is based on patient response and requires frequent reassessment. Balanced crystalloid, unbalanced crystalloid, and colloid fluids are all acceptable for sepsis resuscitation. Epinephrine or norepinephrine infusions are used for fluid-refractory septic shock.



Additional Treatment Information

→ Post Cardiac Arrest Debriefing Checklist

→ Resuscitation Decision Making

For means of arrest guidelines/algorithms pediatric patients are infants, children, and adolescents up to 18 years of age, excluding newborns (0-29 days).

- Infant guidelines apply to infants younger than approximately 1 year of age.
- Child guidelines apply to children approximately 1 year of age until puberty. For teaching purposes, puberty is defined as breast development in females and the presence of axillary hair in males.
- For those patients with signs of puberty and beyond, adult basic life support guidelines should be followed.

Referral Information

All pediatric cardiac arrest patients with ROSC require emergency conveyance to hospital. Pediatric patients with a prolonged pulseless condition should be discussed with CliniCall. Non-viable or futile cases should also be discussed with CliniCall.

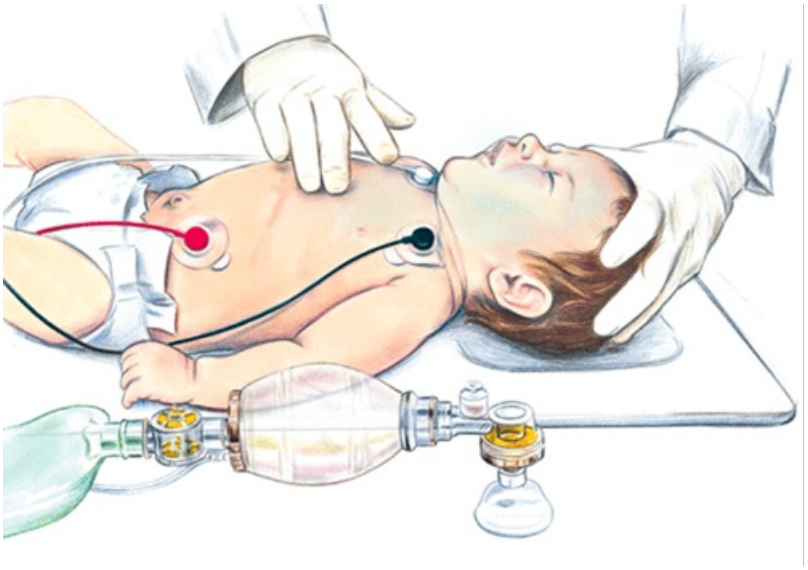
General Information

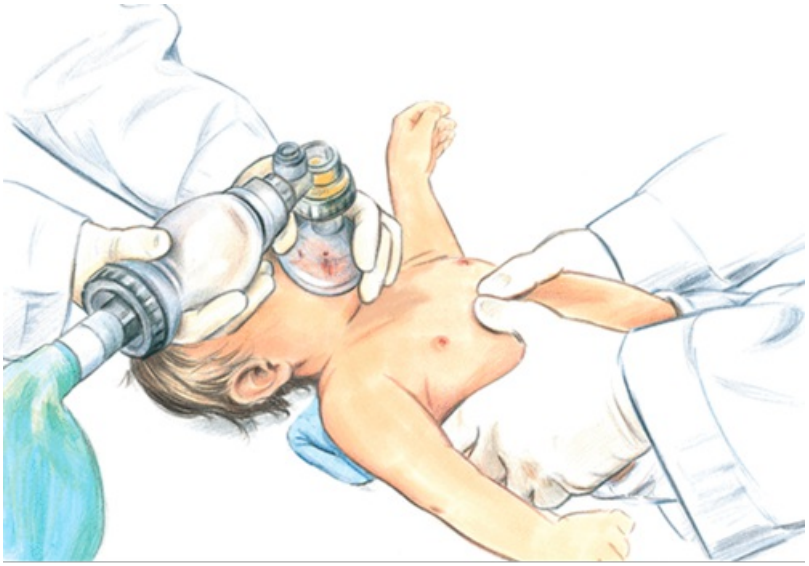
- Bystander CPR, plus early defibrillation, can more than double the rate of survival from out-of-hospital cardiac arrest. As such, paramedics and EMRs should carry out a full resuscitation in settings where first responder or bystander CPR has been initiated, unless obvious signs of death are present.
- Although survival from asystole or pulseless electrical activity is rare, patients who receive immediate, high quality CPR occasionally survive.
- Asystole in cardiac arrest is usually an ominous prognostic sign indicating prolonged hypoperfusion and myocardial ischemia with deterioration to asystole from more treatable dysrhythmias. Asystole must be confirmed in two or more leads.
- Pulseless electrical activity (PEA) is evidence of organized electrical activity on the ECG without effective myocardial contraction. Patients with wide complex PEA rhythms usually have poor survival and there are often indications of severe malfunction of the myocardium or cardiac conduction system. There are numerous possible causes of PEA, some of which are amenable to out-of-hospital treatment. Paramedics (and EMRs where applicable) should follow a step-wise approach to identifying and treating reversible causes of PEA.
- Special consideration must be given to hypothermic patients without a pulse. As hypothermia progresses, the patient's respiratory and heart rate slow significantly. For this reason, breathing and pulse checks must be sufficiently long (60 seconds) to register very slow rates.
  - "Circum-rescue collapse" is a term that describes a death that occurs shortly before, during, or soon after rescue from exposure to a cold environment, usually cold water immersion; it often presents as an apparently stable, conscious patient who suffers ventricular fibrillation and cardiac arrest shortly thereafter
  - A patient with a core body temperature < 30°C will most likely develop arrhythmias with progression to ventricular fibrillation
  - Medications are more slowly metabolized in hypothermic patients; limit vasopressors to a maximum of 3 doses; refer to → I01: Hypothermia for additional information
- The most common causes of traumatic cardiac arrest include:
  - Hypoxemia from airway obstruction and hypoventilation
  - Obstructive shock resulting from cardiac tamponade or pneumothorax
  - Hemorrhagic shock from any source of major hemorrhage
  - Myocardial contusions cause dysrhythmias, perforation, and valve rupture
  - Electrical shock produces a fall; ventricular fibrillation may also be present

Interventions

First Responder

- Ensure high performance CPR and appropriate ventilation; Chest compressions and ventilations should be provided at a ratio of 15:2 with pauses to allow for ventilation
  - → PR06: High Performance CPR
  - → B01: Airway Management
  -





- Most pediatric airways can be effectively managed with proper positioning and an OPA/NPA (as per license level) and BVM without any requirements for further airway interventions. The gold standard for airway management is a self-maintained airway. Two-person bag-valve mask, with a viral filter attached and a tight seal, is the preferred technique for airway management in pediatric resuscitation and is reasonable compared with advanced airway interventions (endotracheal intubation or supraglottic airway) in the management of pediatrics during a cardiac arrest in the out-of-hospital setting.
- → A07: Oxygen Administration

- Apply AED and follow prompts
- Communicate clinical scenario to follow-on personnel
- Obtain clinical history from caregivers or bystanders

Emergency Medical Responder – All FR interventions, plus:

- Investigate for precipitating cause
- Ensure scene time is no less than 10 minutes and no greater than 35 minutes
- OiniCall consultation required for guidance in peri-arrest treatment planning.
- Seek assistance from additional resources.
- For low mechanism blunt trauma: continue CPR according to medical guidelines
- For penetrating trauma or high-mechanism blunt trauma:
  - Immediately prepare for rapid conveyance and CPR (→ N04: Traumatic Cardiac Arrest)
  - Control life threatening bleeding while facilitating conveyance

- Direct pressure to sites of obvious ongoing blood loss
- Rapid application of tight tourniquet for catastrophic extremity injury with ongoing large volume blood loss

Primary Care Paramedic – All FR and EMR interventions, plus:

WARNING: PRIMARY CARE PARAMEDICS EQUIPPED WITH LIFEPAK 15 MONITOR/DEFIBRILLATORS (LP15) MUST USE AN LP1000 AED WHEN MANAGING A PEDIATRIC CARDIAC ARREST IN CHILDREN UNDER THE AGE OF 8. **USE OF THE LP15 IN CHILDREN UNDER THE AGE OF 8** CAN RESULT IN ELECTRICAL ARCING, SEVERE PATIENT BURNS, AND A SIGNIFICANT FIRE HAZARD.

- Consider vascular access for reversible causes
  - → D03: Vascular Access (in patients ≥ 12 years of age)

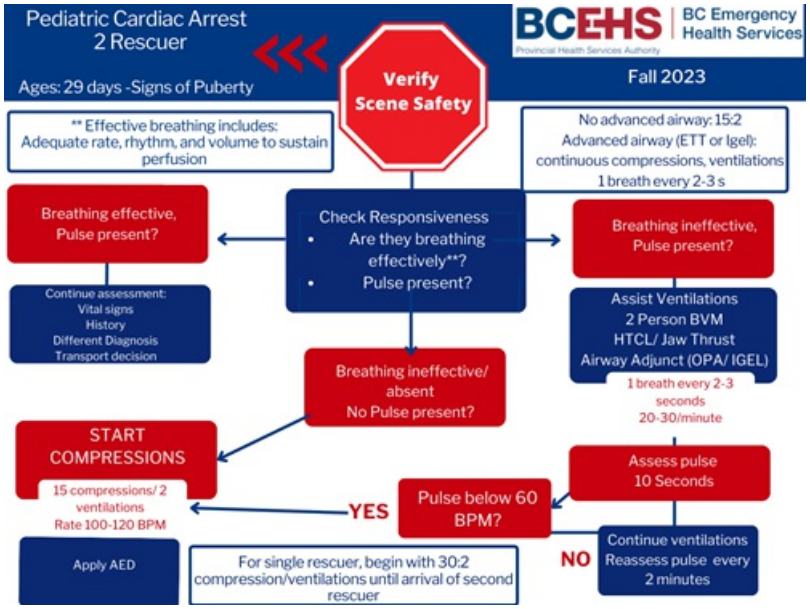
Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:

- Attach monitor and evaluate rhythm
- Establish vascular access
  - → D03: Vascular Access
  - → PR12: Intraosseous Cannulation
- Ventricular fibrillation or ventricular tachycardia
  - Defibrillate 2 J/kg, repeat at 4 J/kg
  - EPINEPHrine
  - Amiodarone
  - Lidocaine
- Pulseless electrical activity or asystole:
  - EPINEPHrine
  - Consider treatable causes
- Bradycardia:
  - Bradycardia with poor cardiac output requires chest compressions if the heart rate is < 60 and signs of poor perfusion are present; signs of poor perfusion include cyanosis, mottling, decreased level of consciousness, and lethargy
  - Consider normal saline bolus 20 mL/kg IV/IO
  - Consider EPINEPHrine
  - Consider pacing
    - → PR19: Transcutaneous Pacing
    - CliniCall consultation required prior to transcutaneous pacing.
- Hyperkalemia, Torsades de Pointes, or suspected acidosis:
  - Sodium bicarbonate
  - Magnesium sulfate
- Hypoglycemia
  - → E01: Hypoglycemia and Hyperglycemia
- Narcotic overdose:
  - → J12: Opioids
- Assess for pneumothorax
  - → PR21: Needle Thoracentesis

Critical Care Paramedic – All FR, EMR, PCP, and ACP interventions, plus:

- Aggressive fluid replacement including blood products for suspected hemorrhagic shock
- Aggressive re-warming if hypothermia present and suspected to be primary cause of presentation
- Ultranosonography to assess pneumothorax, tamponade, and cardiac contractility
- Post-return of spontaneous circulation care:
  - Advanced airway
  - Crystalloid bolus 20 ml/kg IV/IO
  - EPINEPHrine infusion

Algorithm



Evidence Based Practice

VF/VT-Pulseless (Shock Advised)

Supportive

- Biphasic Defibrillation

Neutral

- Antiarrhythmic - Class I (Na+ channel blockers)
- Antiarrhythmic - Class III (K+ channel blockers)

Against

Post-Cardiac Arrest Care

Supportive

Neutral

- Hypothermia
- Oxygen-titrated

Against

PEA / Asystole

Supportive

Neutral

- Anticholinergic

Against

General Cardiac Arrest Care

Supportive

- Bystander CPR
- Mechanical Intraosseous Insertion
- Pre-Arrival Instructions
- Standard CPR
- Termination Resuscitation
- CPR-Finger technique
- CPR-Thumb technique
- HEMS

Neutral

- Epinephrine
- One-handed CPR
- ACLS
- Compression-only CPR
- Manual Intraosseous Insertion
- NaHCO3
- Vasopressin

Against

- High Dose Epi.

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2. American Heart Association. Highlights of the 2020 American Heart Association Guidelines for CPR and ECC. 2020. [Link]
3. Heart & Stroke. 2019 Focused Updates to AHA Guidelines for CPR and ECC: Frequently Asked Questions. 2019. [Link]
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Practice Updates

- 2023-10-06: updated guideline to align with Pediatric Out-of-Hospital Cardiac Arrest educational program.
- 2023-05-24: changed AED with attenuated pads use threshold to < 8 years; above 8 years, LP15 use is permitted.

M07: Neonatal Seizures

Wes Bihlmayr

Updated: May 26, 2021
Reviewed: March 01, 2021

Introduction

- Identification of seizures in neonates and children can be difficult. Signs of seizures can include rhythmic lip smacking, blinking, or "bicycling" movement of the legs. Paramedics and EMRs/FRs should manage ongoing seizures while considering reversible causes.
- The primary concern in neonatal seizures is hypoglycemia, which should be identified and corrected with a 2 mL/kg D10W bolus until the blood glucose is > 2.6 mmol/L. If IV access is not within scope of practice or cannot be obtained, glucose gel can be given orally by rubbing on oral mucosa, or glucagon can be given intramuscularly (0.03 mg/kg).
- The preferred first line medication for control of a seizure lasting longer than five minutes, or multiple seizures without improving level of consciousness in between seizures, is a benzodiazepine. Midazolam can be administered via the intranasal (IN), intravenous (IV), or intramuscular (IM) route at dosages of:
  - IN 0.2 mg/kg
  - IV 0.15 mg/kg
  - IM 0.2 mg/kg

Additional Treatment Information

- If intractable seizure despite primary and secondary pharmacological treatment, critical care paramedics may consult with the transport advisor to consider:
  - A loading dose of midazolam 50 mcg/kg followed by an infusion beginning at 120 mcg/kg/hr and titrating to effect
  - A trial of Pyridoxine 50-100 mg over 1-2 minutes

General Information

- Patients requiring multiple sedatives or anti-convulsants have a high probability of requiring an advanced airway intervention and/or hemodynamic instability.

Interventions

First Responder

- Protect the patient from additional harm
- Prevent heat loss
- Provide supplemental oxygen as required
  - → A07: Oxygen Administration
- Manual airway maneuvers
  - → B01: Airway Management
  - Most pediatric airways can be effectively managed with proper positioning and an OPA/NPA (as per license level) and BVM without any requirements for further airway interventions. The gold standard for airway management is a self-maintained airway. Bag-valve mask is the preferred technique for airway management in pediatric resuscitation and is reasonable compared with advanced airway interventions (endotracheal intubation or supraglottic airway).

Emergency Medical Responder – All FR interventions, plus:

- Provide on-going care as per neonatal resuscitation guidelines
  - → M09: Neonatal Resuscitation
- Obtain blood glucose measurement; consider oral glucose

- Oral 40% Glucose Gel
- Convey urgently to closest facility; consider intercept with additional resources

Primary Care Paramedic – All FR and EMR interventions, plus:

- Consider use of supraglottic airway if unable to oxygenate or ventilate with bag-valve mask
  - → PR08: Supraglottic Airway
- Correct hypoglycemia
  - → E01: Hypoglycemia and Hyperglycemia
  - Glucagon

Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:

- Consider need for vascular access based on clinical scenario
  - → D03: Vascular Access
- Consider intraosseous access if patient meets weight based guidelines
  - → PR12: Intraosseous Cannulation
- Advanced airway intervention if unable to oxygenate or ventilate
- MIDAZOLam for seizure control

Critical Care Paramedic – All FR, EMR, PCP, and ACP interventions, plus:

- NIV/Invasive ventilation strategies
- Inotropic and vasopressors for hemodynamic instability
- Anti-convulsant agents for long acting effects
- Benzodiazepine infusion
- Vitamins for metabolic derangement
- Electrolyte replacement
- Antibiotic administration
- Central line and arterial line monitoring

Evidence Based Practice

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Pediatric Seizure

Supportive

- Diazepam-IV
- Diazepam-PR
- Lorazepam-IN
- Lorazepam-IV
- Lorazepam-PR
- Midazolam-Buccal
- Midazolam-IM
- Midazolam-IN
- Diazepam-IM
- Lorazepam-IM

Neutral

Against

- Midazolam-IV

- Point of Care Blood Glucose Monitoring

M08: Neonatal Thermoregulation

Wes Bihlmayr

Updated: May 25, 2021
Reviewed: March 01, 2021

Introduction

Neonates have a high body surface to weight ratio making them more prone to the four mechanisms of heat loss: convection; conduction; radiation; and evaporation. Paramedic and EMR/FR management of neonatal thermoregulation involves these four mechanisms.

- Convection: Decrease the wind or drafts in a room.
- Conduction: Heat is lost from a warm surface to a cooler surface.
- Radiation: Heat is lost to the environment when the environment is cooler than the body.
- Evaporation: Moisture on the body can accelerate the loss of heat from the other modes of heat loss.

Essentials

- In addition to preparing an area for resuscitation during the delivery of a neonate, it is important to think about preparing the environment for the neonate. Environmental preparation revolves around the four mechanisms of heat loss:
  - Convection: Warm the room, eliminate any cold drafts
  - Conduction: Warm towels and warm surface
  - Radiation: Warm the room
  - Evaporation: Dry the baby off and place a toque on the baby's head
- The ideal temperature range for a neonate is 36.3 - 37.2°C.
- Encouraging "kangaroo care" following delivery develops a strong bond between the neonate and mother, which promotes family centred care. Kangaroo care is performed by placing the neonate on the mother's chest, creating skin-to-skin contact, while maintaining the principles of heat loss. In the stable neonate, this can be performed while APGARs are attained and awaiting delivery of the placenta.

Additional Treatment Information

- Unless there are indicators of hypoglycemia, a blood sugar is not required until a few hours after birth.

Referral Information

Neonates with no system specific problem that are maintaining a normal temperature can be left in the care of a midwife or other health care professional. If no medical professional is on scene, the mother and neonate should be conveyed for an initial assessment.

Interventions

First Responder

- Promote skin-to-skin contact while maintaining the principles of heat loss

M09: Neonatal Resuscitation

Wes Bihlmayr

Updated: January 31, 2024
Reviewed: December 14, 2023

Introduction

Neonatal resuscitation focuses on the respiratory system and transitioning from fetal circulation to neonatal circulation. These two factors are interrelated; a functioning respiratory system is necessary to deliver oxygen to produce pulmonary vasodilation, thus lowering the pulmonary vascular resistance. When combined with increasing systemic vascular resistance, this allows the closure of fetal shunts and lung perfusion to progress.

Paramedic and EMR/FR management in the resuscitation of a neonate focuses on stabilizing the respiratory system in a systemic manner from least invasive to most invasive.

Essentials

- The Neonatal Resuscitation Program (NRP) has a clearly defined algorithm for all neonatal resuscitation events. Each step in the algorithm requires 30 seconds of effective intervention prior to moving on to the next step.
  - During the first 30 seconds, begin by assessing the neonate's tone; are they at term, breathing or crying?
    - Tone: a neonate should be active with flexed extremities. If the neonate is flaccid with extended extremities, resuscitation will be required.
    - Term: if the neonate is < 37 weeks gestation, they require an initial assessment as they are more likely to require assistance either immediately or soon after delivery.
    - Breathing or crying: a strong cry is a sign of a strong respiratory system. If the neonate is not crying, then a respiratory assessment for work of breathing is required and possible movement down the resuscitation chart.
  - In the next 30 seconds, dry and stimulate the neonate, keep the neonate warm, reassess the respiratory system, and attain a heart rate.
  - Following the first minute, a decision is required: does the neonate require respiratory support or assistance (positive pressure ventilation - PPV)?
  - If the patient requires PPV, then 30 seconds of effective ventilation on room air is initiated. Effective ventilation is described as adequate chest expansion with all breaths. If all breaths are not effective, then the acronym MR SOPA should be reviewed:
    - M – Mask: Ensure adequate seal
    - R – Reposition: reposition the head, consider shoulder roll
    - S – Suction: use a 10 fr suction catheter and suction the oropharynx
    - O – Open: open the neonate's mouth
    - P – Pressure: If possible, increase the pressure being delivered; initial pressure is 20 mmHg to 25 mmHg to 30 mmHg; this can be accomplished with a flow inflating bag or Neopuff
    - A – Alternate Airway: Consider intubation or supraglottic airway if licensed to do so
  - Continue down the PPV path until effective ventilation is maintained.
  - If the HR remains in the 60-100 range with effective ventilation, then PPV must be maintained. If the HR increases to > 100 then PPV can be discontinued.
  - If the HR drops to < 60 with effective ventilation, then chest compression must be initiated at a rate of 3 compressions to 1 ventilation. Provide PPV with 100% oxygen (FiO_2 100%).
  - If the HR remains < 60 EPINEPHrine should be administered. The dose is 20 mcg/kg.
  - If there is a clinical history of blood loss and signs of poor perfusion, a volume expander should be administered: either 10 ml/kg of normal saline or "O-negative" PRBC.

Additional Treatment Information

- Throughout a neonate resuscitation, it is important to keep the neonate warm. Once a neonate becomes hypothermic, they become more susceptible to increased pulmonary vascular resistance; this in turn adversely

affects the oxygenation and ventilation of the neonate and may reverse the transitioning back to fetal circulation, which is not compatible with life.

- EPINEPHrine can be administered via the endotracheal tube at a dose 10 times the IV dose - 200 mcg/kg.
- IV access can be via a peripheral IV or emergency UV.
- IO can be considered but is weight dependent.
- Uncuffed endotracheal tubes should be utilized to prevent the possibility of developing subglottic damage producing stenosis as the neonate grows.
- All pre-term neonates of ≤ 32 weeks gestation should be placed in a food grade polyethylene bag up to the neck to prevent insensible fluid loss and maintain thermoneutrality.
- A neonate delivered through thick meconium is at risk for developing increased work of breathing. If the child is vigorous, monitoring is suggested. If the neonate is not vigorous, then suctioning of the oropharynx is required, followed by movement down the treatment path. The past practice of suctioning below the vocal cords is no longer recommended.

Referral Information

All neonates requiring resuscitation should be conveyed to hospital for further work up.

General Information

- ECG monitoring should be performed during the resuscitation.
- SpO_2 monitoring must be via the pre-ductal right appendage for accurate measurements. A pre- and post-ductal (all other appendages) SpO_2 can be monitored to detect for the presence of shunts within the cardiovascular system.
- It is common for a neonate who experienced a precipitous delivery to develop increased work of breathing requiring respiratory support.

Interventions

First Responder

- Ongoing care as dictated by NRP; follow algorithm
  - Neonatal Resuscitation Algorithm
  - → A07: Oxygen Administration
  - → B01: Airway Management
  - Most pediatric airways can be effectively managed with proper positioning and an OPA/NPA (as per license level) and BVM without any requirements for further airway interventions. The gold standard for airway management is a self-maintained airway. Bag-valve mask is the preferred technique for airway management in pediatric resuscitation and is reasonable compared with advanced airway interventions (endotracheal intubation or supraglottic airway) in the management of pediatrics during a cardiac arrest in the out-of-hospital setting.
  - Resuscitation of neonates should take place with room air.

Emergency Medical Responder – All FR interventions, plus:

- Convey to the nearest hospital
- Consider intercept with additional resources

Primary Care Paramedic – All FR and EMR interventions, plus:

- iGEL insertion if unable to oxygenate or ventilate
  - → PR08: Supraglottic Airway

Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:

- Advanced airway intervention if unable to oxygenate or ventilate

- Consider obtaining vascular access and providing fluid for hemodynamic compromise
  - → D03: Vascular Access
- Obtain IO access if patient meets weight-based guidelines
  - → PR12: Intraosseous Cannulation
- EPINEPHrine

Critical Care Paramedic – All FR, EMR, PCP, and ACP interventions, plus:

- NIV/Invasive ventilation strategies
- Inotropic and vasopressor therapy for hemodynamic instability
- Central and arterial line monitoring
- Blood product administration
- UV access (needs to be added as a schedule 2)

Evidence Based Practice

Neonatal Resuscitation

Supportive

- BVM
- Chest Compressions
- Intubation
- LMA (without AW reflexes)
- Nasal Ventilation
- Resuscitation Attempts in Stillbirth
- Suction

Neutral

- Therapeutic hypothermia

Against

- Epinephrine

M10: Neonatal Respiratory

Wes Bihlmayr

Updated: May 25, 2021
Reviewed: March 01, 2021

Introduction

This practice guideline contains changes related to COVID-19.

Respiratory distress in the neonate is defined as an impairment of the lungs to exchange gas at the alveolar level. Multiple pathophysiologic processes can produce respiratory distress in the neonatal period and careful monitoring of the trend of disease progression can assist in identifying the cause.

Paramedic and EMR/FR management of the neonate in respiratory distress should focus on maintaining appropriate oxygenation and ventilation based on gestational age and days/hours of life. Differential diagnoses to consider in the newly born neonate differ than the differential diagnoses for a neonate on day of life 2 or more.

In neonates, the differential diagnoses can be:

- Respiratory distress syndrome (RDS): Primarily a surfactant deficiency that will progressively worsen until 72 hours of life and then slowly get better if no treatment is initiated. Normal in the preterm infant and higher risk in the neonate born to a mother with poorly controlled diabetes.
- Transient tachypnea of the newborn (TTN): Fluid retention in the lungs that will gradually resolve over 24-72 hours. Common in caesarean section and precipitous deliveries.
- Congenital pneumonia/sepsis: Similar physical presentation to RDS but with differing radiological evidence and can progress to sepsis quickly if not recognized.
- Pneumothorax: The neonate requires an opening pressure of up to 50 cmH_2O to push out the fluid filling the lung and can cause spontaneous pneumothoraxes.

The term neonate with an uncomplicated antenatal history that develops respiratory complications is unlikely to be RDS and is most likely to have an infection or undiagnosed congenital problems.

Essentials

- The Neonatal respiratory assessment consists of lung auscultation, evidence of nasal flaring, grunting of the neonate, accessory muscle use (begins in the subcostal and works up the chest as severity increases), and symmetry of the chest. A chest x-ray and blood gas analysis should be performed to gauge severity and initiate a baseline for trend monitoring.
- Establish ABCs and support ventilations if required.
- Support of the neonate's respirations follows a staged approach. The FiO_2 is titrated to maintain a pre-ductal SpO_2 of 88-95% in the preterm neonate and 92-95% in the term neonate. Escalation along the respiratory treatment pathway is based on clinical assessment, radiological evidence, and blood gas analysis.
- Pre-ductal SpO_2 is performed on the right hand and post-ductal on a lower appendage (right or left foot). A pre-ductal < 90% or a difference > 3% should prompt further investigations.
- Increased work of breathing with associated decreased air entry should be investigated for pneumothorax.

Additional Treatment Information

- Options for supporting neonatal respirations include:
  - Blow by oxygen: titrate to patient's SpO_2 if no increased work of breathing
  - High flow O_2: 2-3 lpm/kg of heated humidified gas; titrate FiO_2 to appropriate SpO_2
  - nCPAP: 5 cmH_2O - 8 cmH_2O; titrate FiO_2 to appropriate SpO_2
  - Intubation and mechanical ventilation
- Once a neonate is intubated, bLES should be considered. If the FiO_2 is > 30% and there is radiological evidence of surfactant deficiency, bLES is administered (5 ml/kg administered via a 6 fr OG tube down the ET tube).

- If patient is showing signs of tension pneumothorax – tracheal deviation, increased work of breathing, absent air entry, hemodynamic compromise – needle decompression should be performed while equipment is gathered for a chest tube insertion.
  - In a neonate a 26-gauge butterfly needle attached to a 3-way stop cock and 10 cc syringe is used to access the 2nd intercostal space mid-clavicular line, to aspirate air; in an older neonate, a 20-gauge needle connected to a 3-way stop cock and 10 cc syringe may be required
- Due to the rapid progression of sepsis in the neonatal period, all neonates with signs of respiratory distress will have a blood culture done and be started on antibiotics: Ampicillin (50 mg/Kg) and Gentamycin
  - Gentamycin:
    - DOL 0-7: < 30 weeks gestation 5 mg/kg
    - 30-34 weeks gestation 4 mg/kg q 36 hrs
    - > 35 weeks gestation 4 mg/kg q 24 hrs
    - DOL > 7: < 30 weeks gestation 5 mg/kg
    - > 30 weeks gestation 4 mg/kg q 24 hrs
- Common initial ventilation settings are: RR 50 Ti 0.4 TV 4-5.5 ml/kg FiO_2 as required, PEEP 5 cmH_2O. Neonates require I:E ratios approaching 1:1. The normal range of Ti is 0.35-0.5 with most patients requiring 0.35-0.4. If a large tube leak is detected, then PCV ventilation should be considered (starting settings may be 20/5 and then are titrated to effect).
- Neonates require an uncuffed ET tube due to the possibility of subglottic damage from an ET cuff and prolonged intubation, resulting in subglottic stenosis as the neonate grows.
- Sedation in the neonate should only be initiated if there are signs of pain or discomfort based on the BIIP scale as there is evidence of increased morbidity and mortality when sedation is given to neonates with no signs of pain or discomfort. If sedation is to be initiated, the preferred analgesics are:
  - Morphine: 50 mcg/kg bolus with an infusion of 10-20 mcg/kg/hr
  - Fentanyl: 1-2 mcg/kg bolus with an infusion of 0.5-2 mcg/kg/hr
  - Midazolam: 50 mcg/kg as a bolus for the labile neonate.
- Maintenance fluids for the first 24 hours should be D10W, and after 24 hours, D10W with NaCl (20 mmol/L)
  - DOL 0 – 60-80 ml/kg/day
  - DOL 1 – 80-100 ml/kg/day
  - DOL 2 – 100-120 ml/kg/day
  - DOL 3 – 120-140 ml/kg/day
  - DOL 4 – 140-150 ml/kg/day
  - DOL 5 – 150 ml/kg/day

General Information

- Neonates that have been in the community are at an increased risk of an infective origin to their increased work of breathing; these need to be considered during the differential diagnosis:
  - Bronchiolitis
  - Pneumonia
  - Croup
  - Pertussis

Interventions

First Responder

- Maintain thermal stability
- Provide supplemental oxygen as required. The maximum flow of a nasal cannula should be 5 L/min. The maximum flow of a partial or non-rebreathing mask should be 15 L/min. A nasal cannula may be placed under an NRB or BVM when flow rates above 5 L/min are required.
  - → A07: Oxygen Administration
- Positive pressure ventilation via bag-valve-mask. Provide a tight seal with the BVM using a 2-person technique where

possible. An inline viral filter should be used between the mask and the bag-valve device.

- → B01: Airway Management
- Most pediatric airways can be effectively managed with proper positioning and an OPA/NPA (as per license level) and BVM without any requirements for further airway interventions. The gold standard for airway management is a self-maintained airway. Bag-valve mask is the preferred technique for airway management in pediatric resuscitation and is reasonable compared with advanced airway interventions (endotracheal intubation or supraglottic airway).

Emergency Medical Responder – All FR interventions, plus:

- Provide supplemental oxygen to maintain $SpO_2 \geq 90\%$. The maximum flow of a nasal cannula should be 5 L/min. The maximum flow of a partial or non-rebreathing mask should be 15 L/min. A nasal cannula may be placed under an NRB or BVM when flow rates above 5 L/min are required.
  - → A07: Oxygen Administration
- Convey to closest facility with notification
- Consider intercept with additional resources

M11: Neonatal Cardiovascular

Wes Bihlmayr

Updated: June 02, 2021
Reviewed: March 01, 2021

Introduction

Neonatal cardiovascular conditions range from vascular problems to congenital cardiac problems. Neonatal vascular conditions can be separated into the pulmonary vasculature and systemic vasculature; congenital cardiac conditions can be further separated into structural problems (congenital heart disease, or CHD) and intrinsic (arrhythmia).

Paramedics and EMRs/FRs must diligently investigate complaints to isolate and identify the underlying problem, while at the same time providing appropriate supportive care. Differentiation between vascular and cardiac problems begins with the antenatal history.

The time of onset of symptoms varies with the severity of the lesion for cardiac and vascular conditions. Acute, non-cyanosis-producing conditions are usually associated with the complete closure of the ductus arteriosus, which normally occurs around day 2 or 3 of life, followed by a brief symptomatic period. These conditions either result in added strain on the myocardium, signs of congestive heart failure, or signs of inadequate tissue perfusion. Acute cyanotic lesions will usually develop soon after birth and can progressively deteriorate as the ductus arteriosus closes. Arrhythmias can be well tolerated by neonates and take days to months before they are noticed.

Increased pulmonary vascular resistance in the neonatal period is usually a result of an inadequate transition to extra-uterine life. It may begin immediately following birth, to a few hours after birth with varying intensity. Decreased systemic vascular resistance is usually a byproduct of sepsis.

The clinical picture of the cardiac problem varies from progressive deterioration with subtle signs, to the acute conditions with obvious signs. In order to determine the precipitating cause, a multisystem approach involving the respiratory and cardiovascular systems is required.

Essentials

- The cardiovascular system assessment entails assessing the patient's perfusion, four limb blood pressure, assessing the pulse pressure, heart sounds, signs of hepatomegaly, pre- and post-ductal SpO_2 measurements, and radiological testing (U/S and x-ray).
- Pre-ductal SpO_2 is performed on the right hand and post-ductal on a lower appendage (right or left foot). A pre-ductal SpO_2 < 90%, or a difference > 3%, should prompt more investigations.

Additional Treatment Information

- Cyanotic CHD presents as the classic "blue baby," that is tachypneic with at times no sign of an increased work of breathing. These patients may have an oxygen challenge to assist in determine a cardiac origin. These conditions can continually deteriorate until either pharmacological or surgical intervention is performed.
  - An oxygen challenge consists of either monitoring the SpO_2 on the right-hand during room air and then with 100% oxygen administration; a difference of > 10% is usually pulmonary in nature
- Non-cyanotic CHD presentation can vary from the asymptomatic neonate with a pre- and post-ductal SpO_2 difference > 3%, to an initially asymptomatic neonate that has an acute deterioration at around 3 days of life that begins with poor perfusion, and leads to cardiogenic shock and respiratory compromise. The asymptomatic neonate requires further investigation by a cardiologist. The symptomatic neonate may require pharmacological treatment to bridge the gap before surgical treatment.
  - Pharmacological treatment consists of administering Alprostadil which is a vasodilator (Prostaglandin E1) at an initial dose of 0.02 mcg/kg/hr, followed by gradual tailoring of the dose to 0.005-0.1 mcg/kg/hr (usually requires cardiac echo to tailor); consultation with BCCH PICU and/or BCCH cardiology required to increase dose
    - Side effects include: apnea; hypotension; bradycardia; hyperthermia; and cutaneous flushing
  - Bradycardia in a neonate is defined as a heart rate < 100. The asymptomatic patient requires monitoring and conveyance to the hospital. The symptomatic patient is defined as having poor perfusion (e.g., hypotension,

decreased mentation, signs of shock).
- If HR < 60 bpm with adequate oxygenation and ventilation, start CPR
- Medication: 0.01 mg/kg of epinephrine IV/IO
  - 0.02 mg/kg of atropine if increased vagal tone or primary AV block
- Consider transthoracic pacing

- Tachycardia in a neonate can be classified as either:
  - Narrow complex – rate > 220 with a QRS < 0.09 mm
  - Wide complex – variable rate (can be normal) with a QRS > 0.09 mm
- In the well perfused neonate with a tachyarrhythmia, paramedics have more time to investigate the cause while preparing a treatment plan. In the poorly perfused neonate (e.g., hypotension, altered mental state, signs of shock), initiate an emergent treatment plan while investigating causative factors.
- Treatment of tachyarrhythmias moves from lowest risk to highest risk to the patient.

Intervention	Narrow Complex Tachyarrhythmia	Wide Complex Tachyarrhythmia
Vagal Maneuvers	Bag of ice and water applied to the upper portion of the neonate's head, not to occlude the mouth and nose, for 20 seconds	Bag of ice and water applied to the upper portion of the neonate's head, not to occlude the mouth and nose, for 20 seconds
Medication	Adenosine: 0.1 mg/kg to a max dose of 6 mg. If no success, then 0.2 mg/kg to a max dose of 12 mg Amiodarone **or** Procainamide only after consultation with transport advisor. Amiodarone 5 mg/kg over 20-60 minutes Procainamide 15 mg/kg over 30-60 minutes	Adenosine: If WCT is thought to be due to an abnormal intraventricular conduction. 0.1 mg/kg to a max dose of 6 mg. If no success, then 0.2 mg/kg to a max dose of 12 mg Amiodarone **or** Procainamide only after consultation with transport advisor. Amiodarone 5 mg/kg over 20-60 minutes Procainamide 15 mg/kg over 30-60 minutes Magnesium for Torsades de pointes. 25-50 mg/kg administered over 60 minutes. Diluted to 10 mg/ml.
Synchronized cardioversion	Consult transport advisor. 0.5-1 J/Kg, may increase to 2 J/Kg if not successful Sedate before cardioversion	Consult transport advisor. 0.5-1 J/Kg, may increase to 2 J/Kg if not successful Sedate before cardioversion

- Increased pulmonary vascular resistance (PVR) or persistent pulmonary hypertension (PPHN) can result from a difficult transitional period from fetal to neonatal circulation. Oxygen is required to decrease the pulmonary vascular resistance in the first minutes of life allowing the PVR to drop below the systemic vascular resistance (SVR) closing the anatomical shunts of fetal circulation; supplemental oxygen is the first intervention required in these cases. If there is a delay in oxygenation or episode of poor oxygenation in the first hours of life, the PVR can increase, reverting neonatal circulation back to fetal circulation.
- The treatment of PPHN revolves around returning the circulation back to the PVR being lower than the SVR
  - Provide supplemental oxygen
  - Assess patient fluid status and provide fluid resuscitation if required (10 ml/kg boluses NS to a max of 30 ml/kg)
  - iNO – inhaled nitric oxide is a potent pulmonary vasodilator as this can assist in decreasing the PVR; the initial dose is 20 ppm
  - Increasing the SVR with inotropes and vasopressors:
    - Epinephrine: 0.05 - 1 mcg/kg/min (0.05-0.1 mcg primarily effect B1 and B2 receptors, so increased inotropy/chronotropy and vasodilation; doses > 0.1 mcg also stimulate alpha receptors, resulting in

vasoconstriction and increased SVR)
- Dobutamine: 2-20 mcg/kg/min (primarily B1 effects increasing myocardial contractility)
- Norepinephrine: 0.02-0.1 mcg/kg/min (strong alpha effects increasing SVR); normally only used as an addition to another inotrope in neonates
- Vasopressin: 0.1 milliunits/kg/min, increase by 0.1 milliunit every hour to a max of 1.2 milliunits (systemic vasopressor and pulmonary vasodilator at low doses)
- Dopamine: 5-20 mcg/kg/hr (5-10 mcg/kg/hr, primarily B1 effects and > 10 mcg/kg/hr alpha effects)

- While treating the cardiovascular condition, a respiratory distress condition may also be treated as a result of the cardiovascular condition. See Respiratory CPG for respiratory escalation of care.
- Treatable causes of bradycardia:
  - Hypoxia
  - H+ acidosis – Correct ventilation; in extreme metabolic acidosis, consider sodium bicarbonate (1 mmol/kg)
  - Hyperkalemia
  - Heart Block
  - Toxins – See cardiac arrest CPG
  - Trauma – Cushing's triad of increased ICP; 3% saline at 2.0-5 ml/kg over 10 minutes, or Mannitol at 0.25-1.0 gram/kg over 5 minutes
- Treatable causes of tachycardia
  - If potentially a sinus tachycardia (HR < 220, discernable P-waves, rate varies with stimulation, history):
    - Fluid bolus for the dehydrated patient (10 ml/kg NS)
    - Antipyretic for the febrile patient
      - Acetaminophen: 15 mg/kg PO or PR
      - Ibuprofen: 10 mg/kg PO
    - Analgesia for pain
      - Acetaminophen: 15 mg/kg PO or PR
      - Morphine: 0.05-0.1 mg/kg IV
      - Fentanyl: 1-2 mcg/kg IV/IN/IM
      - Ketamine: 0.5 mg/kg IV/IN
    - Electrolyte disturbances (due to the variability of disturbance, consult transport advisor for development of electrolyte correction timeframe)
      - Hyperkalemia
      - Hypocalcemia
      - Hypomagnesemia
    - Drug Toxicity – unlikely in the neonatal period but should be considered; examples include TCA, cocaine, and methamphetamines
  - Risk factors associated with PPHN:
    - Hypothermia
    - SSRI during pregnancy
    - Meconium Aspiration Syndrome
    - Congenital pulmonary hypoplasia, congenital diaphragmatic hernia
  - Patients with CVS emergencies are at risk of developing coagulopathies from profound metabolic/respiratory acidosis. CBC and Coags should be monitored to direct care with respect to blood product administration.
  - Refractory hypotension in the neonate may require a hydrocortisone challenge. Discuss with the transport advisor as to a hypotensive dose (1 mg/kg) or actual cortisol challenge (1-2 mg/kg).

General Information

Amiodarone may cause hypotension if administered too quickly. The risk to the patient must be considered when administering at a quicker rate.

Interventions

First Responder

- Maintain thermal stability
- Provide supplemental oxygen as required
  - → A07: Oxygen Administration
  - Manual airway maneuvers
- Positive pressure ventilation via bag-valve mask
  - → B01: Airway Management
  - Most pediatric airways can be effectively managed with proper positioning and an OPA/NPA (as per license level) and BVM without any requirements for further airway interventions. The gold standard for airway management is a self-maintained airway. Bag-valve mask is the preferred technique for airway management in pediatric resuscitation and is reasonable compared with advanced airway interventions (endotracheal intubation or supraglottic airway).

Emergency Medical Responder – All FR interventions, plus:

- Convey to closest facility with notification
- Consider intercept with additional resources

Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:

- Consider vascular access and fluid administration if hemodynamically unstable
  - → D03: Vascular Access
- Consider intraosseous access
  - → PR12: Intraosseous Cannulation
- For bradydysrhythmias, consider:
  - EPINEPHrine
  - → PR19: Transcutaneous Pacing
    - CliniCall consultation required prior to transcutaneous pacing.
- For tachydysrhythmias, consider:
  - CliniCall consultation required prior to initiating the below therapies.
  - Adenosine
  - Amiodarone
  - PR20: Synchronized Cardioversion

Critical Care Paramedic – All FR, EMR, PCP, and ACP interventions, plus:

- NIV/Invasive ventilation strategies
- Inotropic and vasopressors for hemodynamic instability
- Vitamins for metabolic derangement
- Electrolyte replacement
- Benzodiazepine infusion
- Antibiotic administration
- Inhaled vasodilator
- Point of care testing
- Blood product administration
- Central Line and Arterial Line monitoring
- Initiation of umbilical lines

M12: Neonatal Neurological

Wes Bihlmayr

Updated: May 25, 2021
Reviewed: March 01, 2021

Introduction

Neonatal neurological emergencies encompass a large variety of conditions including cerebral vascular accidents, developmental conditions, space-occupying lesions, and infectious encephalopathies. The majority of these conditions require advanced imaging to diagnose and will need long-term therapy.

Paramedic and EMR/FR management of the neonatal neurological emergency involves determining the time of onset and management of symptoms created by the condition. These include seizures, hypotonia, apnea, or variations in respiratory pattern, as well as absent or delayed primitive reflexes.

Essentials

- Neurological emergencies in the neonate generally present through altered mental status. This may be the result of:
  - Seizures
  - Hypoglycemia
  - Infection
  - Trauma
- Neonates may present with respiratory compromise from repeated seizures or central apnea.
- The primary treatment is management of symptoms and supportive care in accordance with the appropriate clinical practice guideline. In particular, seizures should be treated if paramedics and EMRs/FRs feel confident in their diagnosis, remembering that seizures can be subtle in neonates (e.g., lip smacking, blinking, and bicycle movement of the legs, are all common signs).

Additional Treatment Information

- The majority of neonates who experience respiratory compromise secondary to a neurological condition are treated as though they have an infectious encephalopathy until blood and cerebrospinal fluid cultures have been completed.
- Patients should be conveyed to a hospital with appropriate pediatric resources if there are multiple clinical pathways to choose from.
- Patients experiencing multiple apneic events may require placement of an advanced airway in order to oxygenation and ventilate effectively.

Interventions

First Responder

- Prevent heat loss
- Provide supplemental oxygen as required
  - → A07: Oxygen Administration
- Manual airway maneuvers
  - → B01: Airway Management
- Provide on-going care as per neonatal resuscitation guidelines
  - → M09: Neonatal Resuscitation

Emergency Medical Responder – All FR interventions, plus:

- Convey urgently to the closest facility
- Consider intercept with additional resources

Primary Care Paramedic – All FR and EMR interventions, plus:

- Consider use of supraglottic airway if unable to oxygenate or ventilate with bag-valve mask alone
  - → PR08: Supraglottic Airway
- Correct documented hypoglycemia
  - → E01: Hypoglycemia and Hyperglycemia

Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:

- Advanced airway intervention if unable to oxygenate or ventilate
- MIDAZOLam for seizure control
- Consider need for vascular access based on clinical scenario
  - → D03: Vascular Access
- Consider intraosseous access
  - → PR12: Intraosseous Cannulation

M13: Neonatal Fluid and Glucose Management

Wes Bihlmayr

Updated: November 28, 2023
Reviewed: March 01, 2021

Introduction

Neonatal fluid and glucose management may involve a wide range of requirements, from general maintenance all the way to complete electrolyte replacement. The neonatal renal system does not reliably regulate electrolytes until sometime after the first 24 hours of life. During that time, fluid maintenance is primarily based on glucose replacement to meet the high metabolic demands of the neonate.

Essentials

- Neonatal blood glucose levels can be corrected with feeding, oral glucose, intramuscular glucagon, or intravenous dextrose.
  - Attempt to correct blood glucose using oral glucose first; be cautious with volumes and protect the airway to the maximal extent possible; rub small amounts of glucose gel on oral mucosa
  - If the neonate is asymptomatic: a blood glucose > 2.6 mmol/L requires ad lib feeds; if the blood glucose is 1.8-2.6 mmol/L, then a prescribed volume of feed every 2 hours is required
  - If the neonate is symptomatic or has a blood glucose < 1.8 mmol/l, an IV is required and an infusion of dextrose initiated; the normal starting solution is D10W at a rate of 3 ml/kg/hr if asymptomatic and 4 ml/kg/hr if symptomatic, with an additional consideration of a 2 ml/Kg D10W bolus
  - Once a neonate maxes out on fluid/dextrose volumes, the next step is to administer glucagon, 0.5 mg IM/SC
- Maintenance fluids for the first 24 hours should be D10W and after 24 hours D10W with NaCl (20 mmol/L)
  - DOL 0 – 60-80 ml/kg/day
  - DOL 1 – 80-100 ml/kg/day
  - DOL 2 – 100-120 ml/kg/day
  - DOL 3 – 120-140 ml/kg/day
  - DOL 4 – 140-150 ml/kg/day
  - DOL 5 – 150 ml/kg/day

General Information

- Out-of-hospital fluid management of the neonate should focus on glucose intake. D10W should be the fluid of choice. The fluid to use in a poor perfusion state is D10W with slow boluses of normal saline (10 ml/Kg).
- In general, the out-of-hospital neonate should only receive intravenous fluid if there are signs of poor perfusion or a symptomatic blood glucose level.

Interventions

First Responder

- Provide reassurance to parent(s) / carer(s)
- Maintain thermal stability
- Provide supplemental oxygen as required
  - → A07: Oxygen Administration
  - Manual airway maneuvers
- Positive pressure ventilation via bag-valve mask
  - → B01: Airway Management
  - Most pediatric airways can be effectively managed with proper positioning and an OPA/NPA (as per license level) and BVM without any requirements for further airway interventions. The gold standard for airway management is a self-maintained airway. Bag-valve mask is the preferred technique for airway management in pediatric resuscitation and is reasonable compared with advanced airway interventions

(endotracheal intubation or supraglottic airway).

Emergency Medical Responder – All FR interventions, plus:

- Ongoing care as dictated by NRP
  - → M09: Neonatal Resuscitation
- Consider oral glucose
  - Oral 40% Glucose Gel
- Convey to the nearest hospital

Primary Care Paramedic – All FR and EMR interventions, plus:

- Correct documented hypoglycemia:
  - → E01: Hypoglycemia and Hyperglycemia
  - Glucagon

Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:

- Consider need for vascular access based on clinical scenario
  - → D03: Vascular Access
- Consider intraosseous access
  - → PR12: Intraosseous Cannulation

M03: Pediatrics - Respiratory Emergencies (superseded 2023-10-24)

Wes Bihlmayr

Updated: March 19, 2024
Reviewed: March 01, 2021

Introduction

This practice guideline contains changes related to COVID-19.

Respiratory conditions in children can be categorized into upper airway obstructions, lower airway obstructions, lower airway restrictive pathology, and disordered control of breathing.

Upper airway obstructions occur when there is an increased work of breathing due to an obstruction above the thorax. This can consist of a foreign body, tissue swelling, subglottic stenosis from previous intubation trauma, and the development of a tumour. Lower airway obstructions, by contrast, result from obstructive problems below the thorax: foreign bodies, and bronchial swelling or constriction.

Restrictions in the lower airways are a result of "stiffening" of lung tissue, caused by increased fluid accumulation from pulmonary edema, toxic exposure, allergic reactions, infiltration, and inflammation. Abdominal structures can also push on lung tissue, creating a restrictive condition.

Dysfunction within the respiratory center of the brain is responsible for the development of disordered breathing. These are more properly neurological problems with respiratory effects, and can include problems such as increased intracranial pressure, neuromuscular disease, and some poisonings and overdoses.

Essentials

- Upper airway obstruction can be an uncomfortable call to attend as many patients may look ill or unwell, but require purely comfort levels for treatment.
  - See → B04: Croup and Epiglottitis for additional information on the management of upper airway obstructions
- Lower airway obstruction results in an inability for the patient to get air out of the chest. This is usually due to excessive swelling or bronchospasm.
- Lower airway restrictive pathologies consist of numerous conditions that result in decreasing lung compliance or stiffening of the lung. The general management of these conditions concern correcting oxygenation and ventilation utilizing an escalation pathway of increasing FiO_2 via nasal cannula, face mask, heated HiFlow nasal cannula (2 L/min to a max of 60 L/min), NIV therapy, then intubation. Bronchospasm can be treated with a B_2 agonist.
- Disordered Control of Breathing are a series of conditions affecting the respiratory control center in the brain or neuromuscular diseases.

General Information

- Continuous salbutamol can decrease serum potassium.
- Ventilating the lower airway restrictive disease patient may require high peak inspired pressure of up to 32 cmH_2O and high PEEP of up to 10-15 cmH_2O. Diligent monitoring for the development of a pneumothorax is required.
- Succinylcholine should be avoided in the patient with neuromuscular disease due to the possibility of triggering hyperkalemia or malignant hyperthermia.

Interventions

First Responder

- Prevent heat loss but do not overheat the patient
- Provide supplemental oxygen as required
  - → A07: Oxygen Administration

- Manual airway maneuvers as required
  - → B01: Airway Management
  - Most pediatric airways can be effectively managed with proper positioning and an OPA/NPA (as per license level) and BVM without any requirements for further airway interventions. The gold standard for airway management is a self-maintained airway. Bag-valve mask is the preferred technique for airway management in pediatric respiratory emergencies and is reasonable compared with advanced airway interventions (endotracheal intubation or supraglottic airway).

Emergency Medical Responder – All FR interventions, plus:

- Provide supplemental oxygen to maintain SpO_2 ≥ 94%
  - → A07: Oxygen Administration
  - For bronchospasm, reactive airway disease, and asthma:
    - Salbutamol
    - ☐☐ **EMR: Requires completion of scope expansion education.**
- Convey with notification
- Consider intercept with additional resources

Primary Care Paramedic – All FR and EMR interventions, plus:

- Consider vascular access and fluid administration (in patients ≥ 12 years of age)
  - → D03: Vascular Access
- Consider supraglottic airway to maintain airway patency; an iGel with a viral filter pre-connected before insertion must be utilized
  - → PR08: Supraglottic Airway
- For bronchospasm, reactive airway disease, and asthma:
  - Salbutamol via MDI
  - Consider intramuscular EPINEPHrine; epinephrine via intramuscular injection should be considered for a patient with SpO2 < 90% and moderate to severe symptoms of asthma that are unresolved with the use of salbutamol administered by MDIs
  - See → B03: Asthma and Bronchospasm for additional information
- For croup and epiglottitis
  - Croup: consider nebulized EPINEPHrine (NOT for epiglottitis)
  - See → B04: Croup and Epiglottitis for additional information

Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:

- Consider addition of ipratropium to supplement salbutamol
- Consider magnesium sulfate for significant and protracted bronchospasm
- Consider intraosseous cannulation if peripheral access is unavailable
  - → PR12: Intraosseous Cannulation
- Consider procedural sedation to facilitate airway management. Where SGAs and/or bag-valve mask ventilation fail to provide adequate oxygenation, tracheal intubation may be permissible in cases where paramedics are otherwise unable to obtain and maintain a patent airway. To be clear, this is for actual or immediately impending failure of airway patency unable to be managed by any other means other than intubation. CliniCall consultation required prior to attempting intubation.
  - → PR17: Procedural Sedation
- Consider intubation in patients whose airways cannot be managed through less invasive means
  - → PR18: Anesthesia Induction
- Decompress suspected tension pneumothorax
  - Out-of-hospital needle thoracentesis should be considered AGMP. Although this is a low occurrence procedure, it does potentially expose the paramedic to an increased risk of exposure. If this procedure is needed, crews are directed to proceed with airborne PPE including face-shield, EHFR/N95 mask, gown, and gloves.
  - → PR21: Needle Thoracentesis

Critical Care Paramedic – All FR, EMR, PCP, and ACP interventions, plus:

- Mechanical ventilation (NIV and invasive)
- Chest tube maintenance
- Osmotic agents
- 3% Saline
- Infusion medication
- Antibiotic therapy
- Steroid therapy
- Nonselective adenosine receptor antagonist and phosphodiesterase inhibitor

Evidence Based Practice

Pediatric Wheeze/Bronchospasm

Supportive

- Anticholinergic
- Beta Agonist-MDI
- Beta Agonist-Nebulized
- Beta Agonist-Parenteral
- Epinephrine-Nebulized
- Epinephrine-Parenteral
- Hypertonic Saline-Nebulized
- Oxymetry Monitoring
- Steroids-Parenteral
- High flow nasal canula
- Ketamine

Neutral

- Magnesium Sulfate-IV
- Magnesium Sulfate-nebulized
- Oxygen-Humidified
- PEEP
- Steroids-Inhaled
- Steroids-Oral
- NiPPV
- ETCO2
- Temperature Monitoring

Against

Pediatric Stridor

Supportive

- Epinephrine-Nebulized
- Oxygen-Humidified
- Steroids-Oral

Neutral

Against