INFANT STABILIZATION

Newborn Fellowship 2025

NEWBORN CIRCULATION AFTER BIRTH

TRANSITION TO EXTRAUTERINE LIFE

Intrauterine	Extrauterine
Pulmonary blood vessels tightly constricted; high pulmonary vascular resistance	Pulmonary blood vessels relax; low pulmonary vascular resistance
Lungs are filled with fluid & not expanded	Lungs expand with air & fluid is absorbed from alveoli as baby takes deep breaths and cries
Oxygen is supplied from mother's blood and CO2 is removed from fetal blood by diffusion across placenta due low vascular resistance from placenta	Blood flows to lungs reaches alveoli, where O2 is absorbed and CO2 is removed
Oxygenated blood is transferred through the umbilical vein to the fetus, bypassing the lungs	Oxygenated blood from the lungs returns to left side of heart
Blood flows through the foramen ovale or ductus arteriosus (right to left shunt) to allow the most highly oxygenated blood to flow directly to the fetal brain and heart	Oxygenated blood fills the heart, ensuring adequate perfusion to brain and heart after clamping of umbilical cord
	Umbilical cord clamping increases systemic vascular resistance, facilitating closure of foramen ovale, left to right shunting & closure of ductus arteriosus in first few day of life

(AAP, 2021; DAVIDSON ET AL., 2020)

INFANT STABILIZATION AFTER BIRTH

Most newborns transition to extrauterine life without intervention

Resuscitation is usually respiratory related

Respiratory failure interferes with O_2 and CO_2 exchange in utero or after birth

- Early respiratory failure = tactile stimulation may be sufficient to initiate spontaneous breathing
- Late respiratory failure = assisted ventilation necessary to recover

Interruption or failure to transition to extrauterine life results in acid accumulation in tissues and constriction of blood vessels in intestines, kidneys, muscles, skin

If inadequate gas exchange continues, heart begins to fail and blood flow to all organs stops

STABILIZATION PREPARATION

01

Have supplies ready

02

Know risk factors

03

Ask the four pre-birth questions

(AAP, 2021)

SUGGESTED SUPPLIES

Warm	Preheated warmer, warm towels or blankets, temp sensor and sensor cover, hat, plastic bag or wrap (<32 weeks gestation), thermal mattress (<32 weeks gestation)
Clear Airway	Bulb syringe, 10F or 12F suction catheter attached to wall suction – set at 80-100 mmHg, tracheal aspirator
Auscultate	Stethoscope
Ventilate	Flowmeter set to 10L/min, oxygen blender set to 21% (21-30% if <35 weeks gestation), PPV device, term and preterm sized masks, 8F orogastric tube and 20 ml syringe, laryngeal mask (size 1) and 5ml syringe (if needed for inflation), 5F or 6F orogastric tube if insertion port is present on laryngeal mask, cardiac monitor and leads
Oxygenate	Equipment to give free flow oxygen, pulse oximeter with sensor and cover, target oxygen saturation table

(ADAPTED FROM AAP, 2021, NRP 8TH ED, P. 14)

SUGGESTED SUPPLIES

Intubate	Laryngoscope with size 0 and 1 straight blades (size 00 optional), stylet (optional), endotracheal tubes (sizes 2.5, 3.0, 3.5), CO2 detector, measuring tape and/or endotracheal tube insertion depth table, waterproof tape or tube securing device, scissors
Medicate	Access to epinephrine (0.1mg/ml=1mg/10ml), normal saline (100ml or 250ml bag or prefilled syringes), supplies for placing emergency umbilical venous catheter and administering medications, table of precalculated emergency mediation dosages for babies weighing 0.5-4 kg

(ADAPTED FROM AAP, 2021, NRP 8TH ED, P. 14)

POTENTIAL RISK FACTORS FOR RESUSCITATION

Antepartum Risk Factors	Intrapartum Risk Factors
Gestational age < 36 0/7 weeks	Emergency cesarean delivery
Gestational age ≥ 41 0/7 weeks	Forceps or vacuum assisted delivery
Preeclampsia or eclampsia	Breech or other abnormal presentation
Maternal hypertension	Category II or III FHR pattern
Multiple gestation	Maternal general anesthesia
Fetal anemia	Maternal magnesium therapy
Polyhydramnios	Placental abruption
Oligohydramnios	Intrapartum bleeding
Fetal hydrops	Chorioamnionitis
Fetal macrosomia	Opioids administered to mother within 4 hrs of delivery
IUGR	Shoulder dystocia
Signification fetal malformations or anomalies	Meconium stained amniotic fluid
No prenatal care	Prolapsed umbilical cord

(ADAPTED FROM AAP, 2021, NRP 8TH ED, P. 14)

4 PRE-BIRTH QUESTIONS

1. Gestational age?
2. Amniotic fluid clear?
3. Additional risk factors?
4. Umbilical cord management?
   - Delayed clamping may help neonate transition from fetal to neonatal circulation
   - Benefits
   - Cons
   - Timing = 30-60 seconds
   - Indicated for most vigorous term & preterm infants
   - Contraindicated: placental circulation not intact, multiple gestations, altered utero-placental perfusion or umbilical blood flow, non-vigorous newborn

(AAP, 2021)

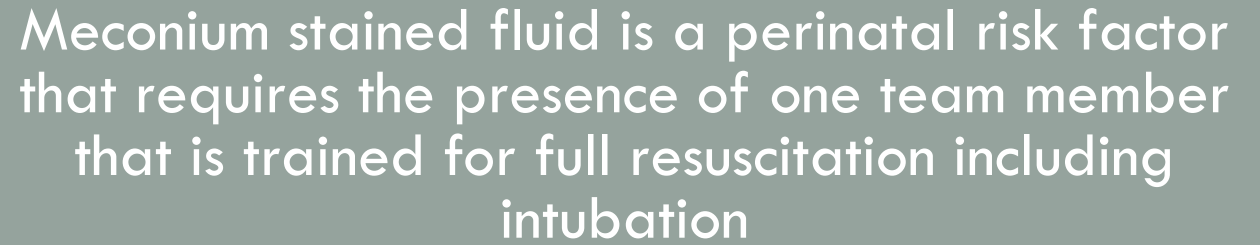
NEWBORN CARE IMMEDIATELY AFTER BIRTH

- Skin to skin
- NRP rapid evaluation- 3 questions
- Delayed cord clamping
- Provide and maintain warmth
- Dry and stimulate
- Provide respiratory support – maternal position, neonatal position, clear secretions, suction PRN

https://www.aboutkidshealth.ca/Article?contentid=422&language=English

(DAVIDSON ET AL., 2020; AAP, 2021)

SIDE NOTE:



Initial steps may be performed at the radiant warmer if indicated

EVALUATION OF INITIAL STEPS

Time frame

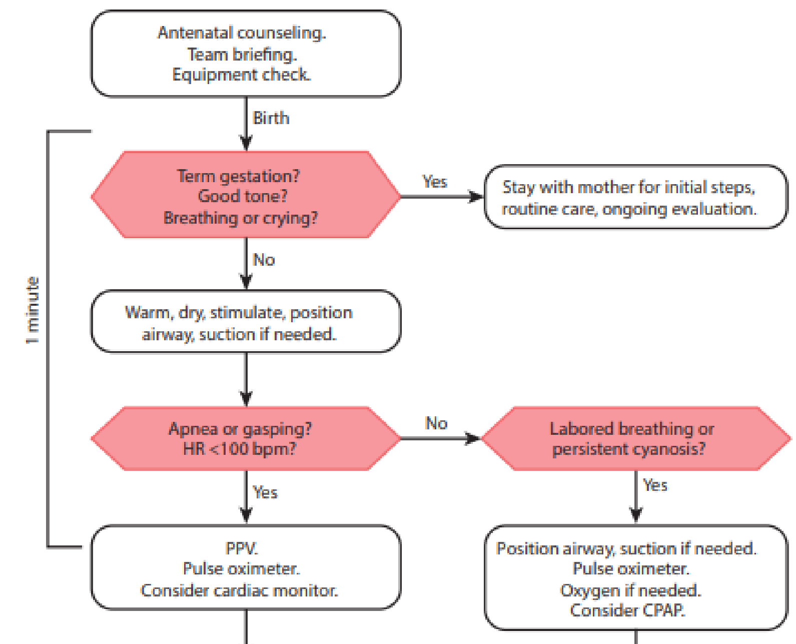
- To complete initial steps
- To assess neonate response to initial steps

Is the baby crying or breathing?

Apneic or gasping

- Start PPV
- Call for help

If the baby is breathing effectively, complete initial assessments including heartrate, temperature, APGAR score



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CLINICAL FINDINGS OF ABNORMAL TRANSITION

Respirations	Irregular breathing, apnea, tachypnea, respiratory distress
Heart Rate	Bradycardia or tachycardia
Muscle Tone	Decreased
Color	Pallor or cyanosis
Oxygen Saturation	Decreased
Blood Pressure	Decreased

(ADAPTED FROM AAP, 2021, P. 7)

ASSESSMENT OF THE HEART RATE

- Should be at least 100 bpm if breathing effectively
- If heart rate < 100 bpm, start PPV even if the baby is breathing
- Listen with stethoscope
- Tap out the heartbeat on the bed
- Number of beats in 6 seconds x 10
- If unable to auscultate HR, ask another team member to quickly connect pulse oximeter or cardiac monitor
- If an alternate airway becomes necessary, a cardiac monitor is recommended for the most accurate assessment of heartrate

RESPIRATORY DISTRESS

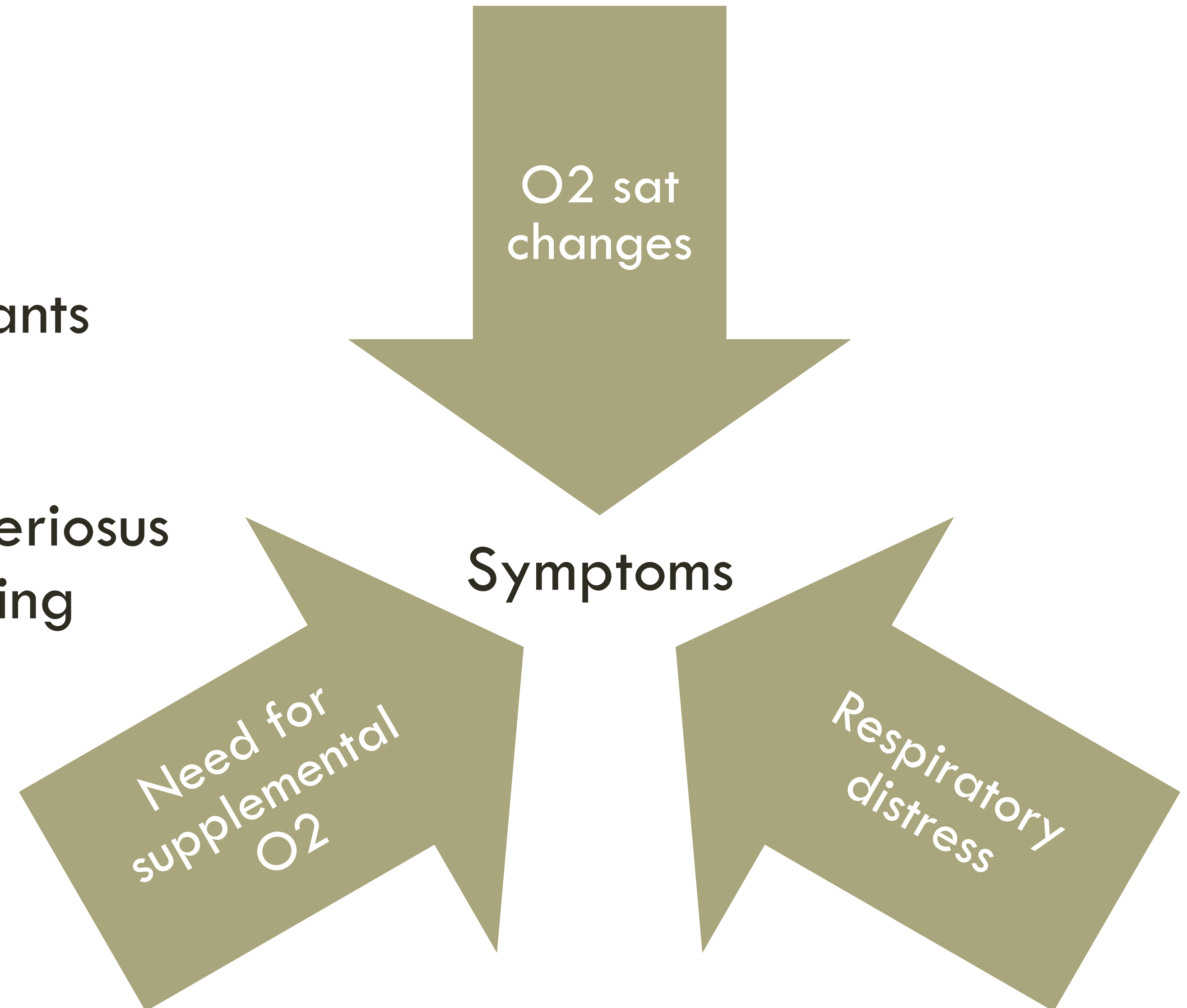
- Labored breathing
  - Grunting
  - Retractions
  - Nasal flaring
- Cyanosis
  - Acrocyanosis
  - Central cyanosis
  - Healthy babies may have central cyanosis for several minutes after birth
- Hypoxemia

Target Pre-ductal SpO2 After Birth	
1 min	60-65%
2 min	65-70%
3 min	70-75%
4 min	75-80%
5 min	80-85%
10 min	85-95%

(AAP, 2021)

DELAYED TRANSITION

- Not specific to late-preterm infants
- Lung changes
- Persistence of patent ductus arteriosus with right to left shunting persisting
- Resolves first few hours of life



TRANSIENT TACHYPNEA OF THE NEWBORN (TTN)

- Onset of respiratory distress often 1-2 hours after birth
- Resolves within 48-72 hours
- RR up to 100 breaths/min
- Intermittent grunting, nasal flaring, mild retractions
- Supplemental O2 may be needed

PREVENTION/INTERVENTIONS

- NRP
- Maintain thermoneutral
- Prevent hypoglycemia
- Supplemental O2
- CPAP
- Consider transfer to level III NICU
- Diagnostics
- Consider other causes

STABILIZATION INTERVENTIONS

Supplemental oxygen
CPAP
PPV

SUPPLEMENTAL OXYGEN

- Indicated when pulse oximeter reading remains below target range in a spontaneously breathing infant
- Methods:
  - Oxygen tubing
  - Flow inflating bag
  - T-piece resuscitator
  - Tail of self inflating bag, NOT with the mask
- Free flow may begin with 30% oxygen using a blender, titrate as needed to target range
- Flowmeter set to 10L/min
- If an oxygen blender is not available free flow oxygen may be delivered using 100% oxygen from the wall or portable source
- Prolonged oxygen should be heated and humified

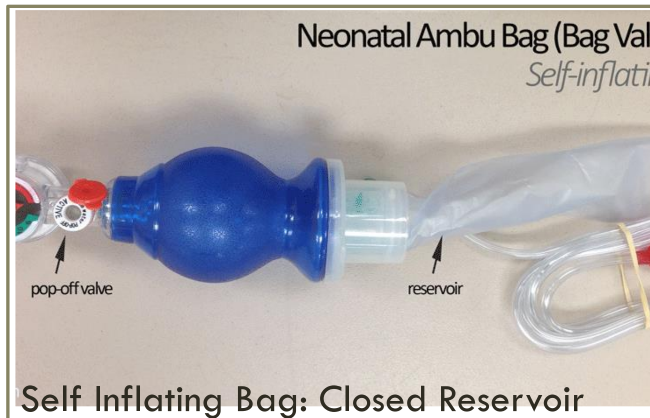
(AAP, 2021)

EQUIPMENT FOR SUPPLEMENTAL O2 ADMINISTRATION

Oxygen Tubing

Flow Inflating Bag

T Piece Resuscitator



Self Inflating Bag: Closed Reservoir

Self Inflating Bag: Open Tail Reservoir

SUPPLEMENTAL O2

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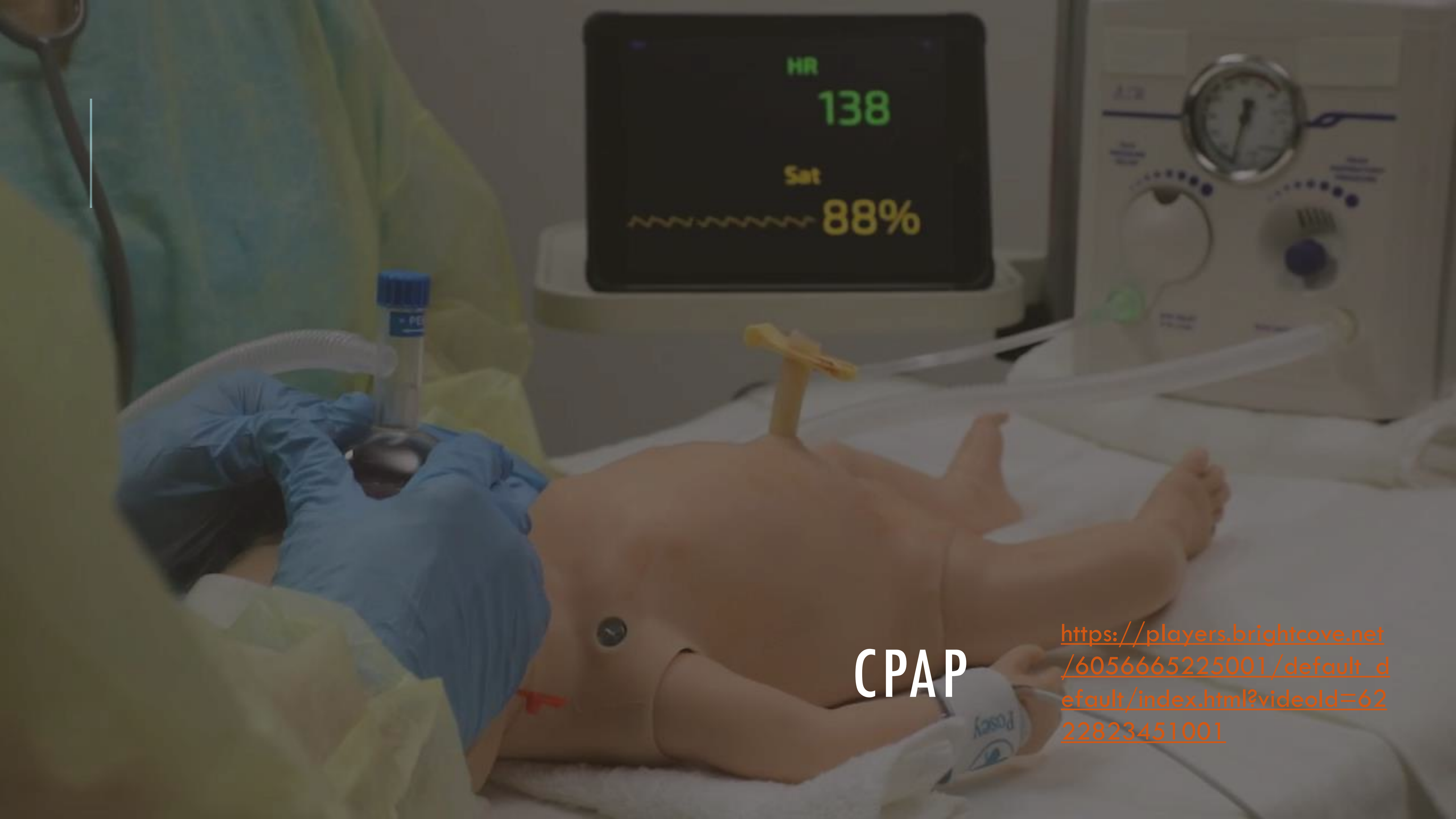
CPAP

- Indicated for newborns with labored breathing or those unable to maintain oxygen saturations with 100% oxygen, consider CPAP
- NOT appropriate if infant is apneic, gasping, or <100 bpm
- Methods:
  - T-piece resuscitator – do not occlude cap
  - Flow inflating bag – do not squeeze bag
  - CANNOT be given using self inflating bag
- PEEP set at 5-6 cm H2O pressure and tested before applying to infant
- If heartrate cannot be maintained at $\geq$ 100 bpm, give PPV instead
- Consider placing orogastric tube if CPAP or PPV administered longer than several minutes

(AAP, 2021)



CPAP

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POSITIVE PRESSURE VENTILATION (PPV)

Indications:

- Apnea
- Gasping
- Appears to be breathing but heart rate less than 100 bmp

Initial oxygen concentration:

- Newborns greater than 35 weeks is 21% oxygen
- Newborns less than 35 weeks is 21-30% oxygen

Set flowmeter to 10L/min

Ventilation rate 40-60 breaths per minute

Initial ventilation pressure (PIP) 20-25 cm H2O

PPV of a preterm newborn should be administered with a device that can give PEEP

(AAP, 2021)

WHAT IS THE MOST IMPORTANT INDICATION OF EFFECTIVE PPV?

A rising heartrate

MR SOPA

M –

R –

S –

O –

P –

A –

MR SOPA

M – Adjust the mask

R – Reposition neck and/or mask

S – Suction nose and mouth

O – Open mouth while ventilating

P – Increase pressure if no chest rise

A – Consider alternate airway (intubate or LMA)

CO2 DETECTOR

- Helps identify when the lungs are effectively ventilated and gas exchange is occurring
- Purple ➔ Yellow
- If the detector remains purple after the first 5 steps of MR SOPA, it is another sign that an alternate airway is needed

PPV

HR	Action
If HR greater than or equal to 100 bpm	Continue PPV at a rate of 40-60 breaths/minute
If HR 60-99 bpm	Continue PPV is HR is improving If HR is not improving, reassess ventilation, preform corrective measures
If HR less than 60 bpm	Reassess ventilation, preform corrective measures, adjust oxygen concentration, insert alternative airway (ETT/LMA)
If no improvement in HR (remains <60) but chest is moving	Increase to 100% oxygen and begin chest compressions

RESUSCITATION CONSIDERATIONS FOR PRETERM INFANTS

- Increase room temperature in the room the newborn will receive initial care to 74 - 77 degrees
- For newborns less than 32 weeks
  - Cover the newborn in food-grade plastic wrap or bag. Use a hat and thermal mattress
  - Use cardiac monitor
  - If newborn is breathing, consider using CPAP immediately after birth as alternative to intubation and surfactant administration

Apgar Score

Sign	0	1	2
Color	Blue or Pale	Acrocyanotic	Completely Pink
Heart rate	Absent	<100 minute	>100 minute
Reflex irritability	No Response	Grimace	Cry or Active Withdrawal
Muscle tone	Limp	Some Flexion	Active Motion
Respiration	Absent	Weak Cry; Hypoventilation	Good, Crying

WHAT IS AN APGAR SCORE?

- Assessment of physiologic state of neonate at birth and response to resuscitation
- Five categories for scoring:
  - Heart rate
  - Respiratory effort
  - Muscle tone
  - Reflex irritability
  - Color
- Helpful indicator of infant response to resuscitation

(AAP & ACOG, 2017)

REFERENCES

American Academy of Pediatrics. (2021). *Neonatal resuscitation* (8th ed.). American Academy of Pediatrics.

American Academy of Pediatrics & American College of Obstetricians and Gynecologists. (2017). *Guidelines for perinatal care* (8th ed.). American College of Obstetricians.

Association of Women's Health, Obstetric and Neonatal Nurses. (2020). Sudden unexpected postnatal collapse in healthy term newborns: AWHONN practice brief number 8. Journal of Obstetric, Gynecologic, & Neonatal Nursing, 49(4), 388-390. https://doi.org/10.1016/j.jogn.2020.05.002

Davidson, M., London, M., & Ladewig, P. (2020). *Olds' maternal-newborn nursing & women's health across the lifespan* (11th ed.). Pearson Education, Inc.

Feldman-Winter, L., Goldsmith, J. P., Committee on Fetus and Newborn, & Task Force on Sudden Infant Death Syndrome. (2016). Safe sleep and skin-to-skin care in the neonatal period for healthy term newborns. Pediatrics, 138(3), e20161889. https://doi.org/10.1542/peds.2016-1889

Lowdermilk, D. L., Cashion, K., Alden, K. R., Olshansky, E. F., & Perry, S. E. (2024). *Maternity & womens's health care* (13th ed.). Elsevier.