Neonatal Emergencies

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COI

- I have no conflicts of interest to declare

Case 1

- 24 y.o. G1P0 at 30.3 weeks gestation has arrived at the hospital and with worsening abdominal pain and leaking fluid
- Baby is crowning and about to deliver
- You are assigned to assist with resuscitation of the baby

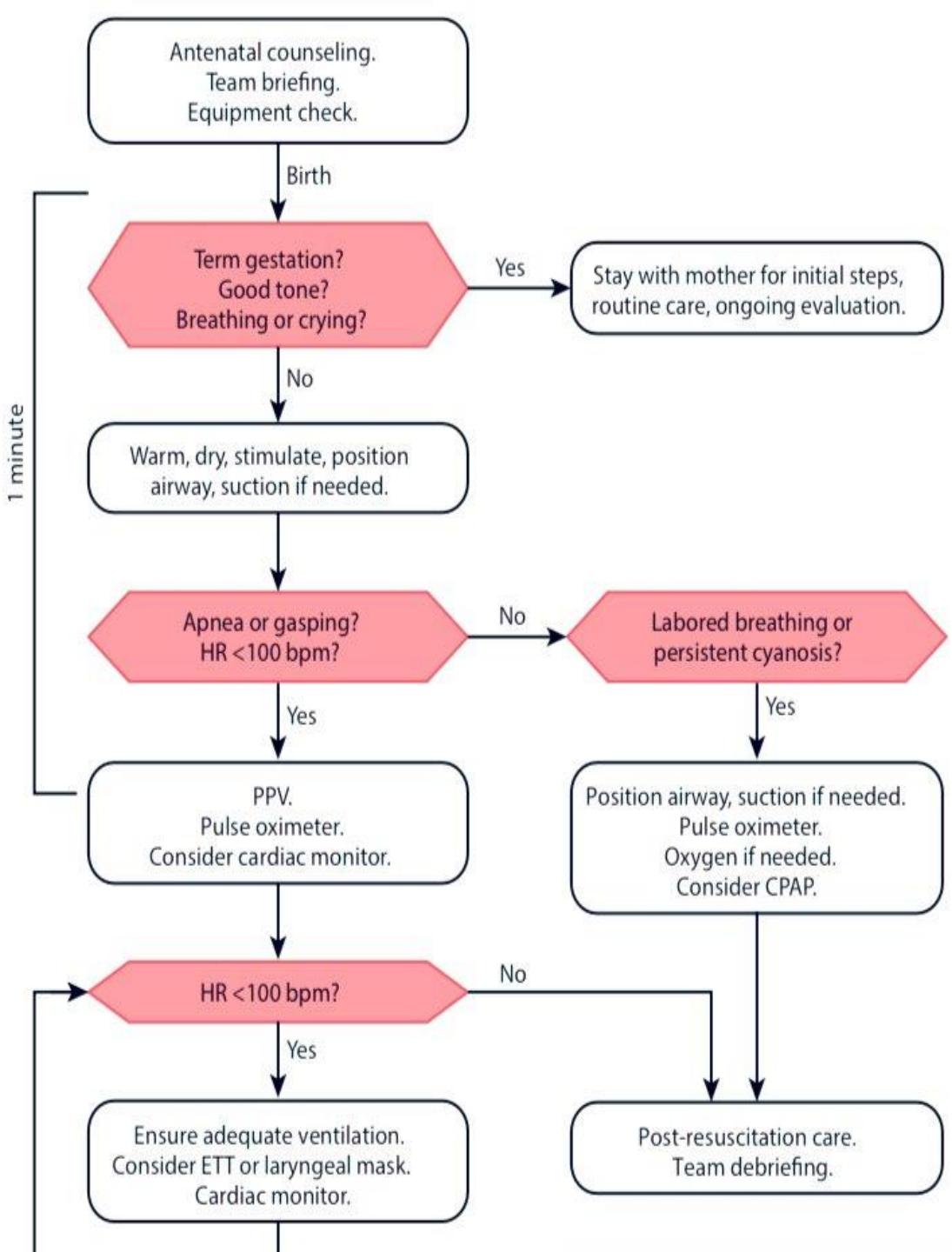
Goals in the Delivery Room

1) Ventilation

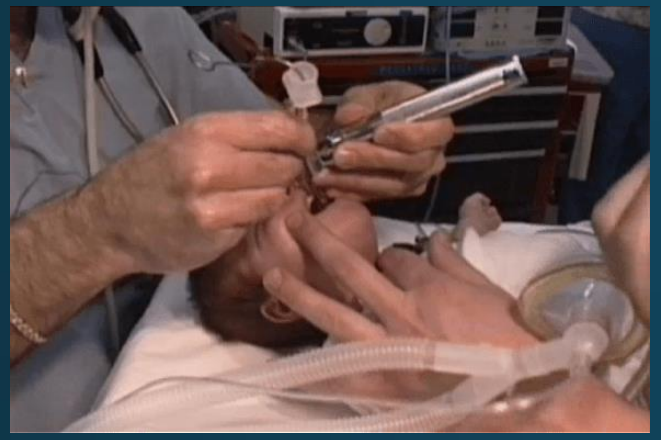
2)Thermoregulation

3)Delayed Cord Clamping

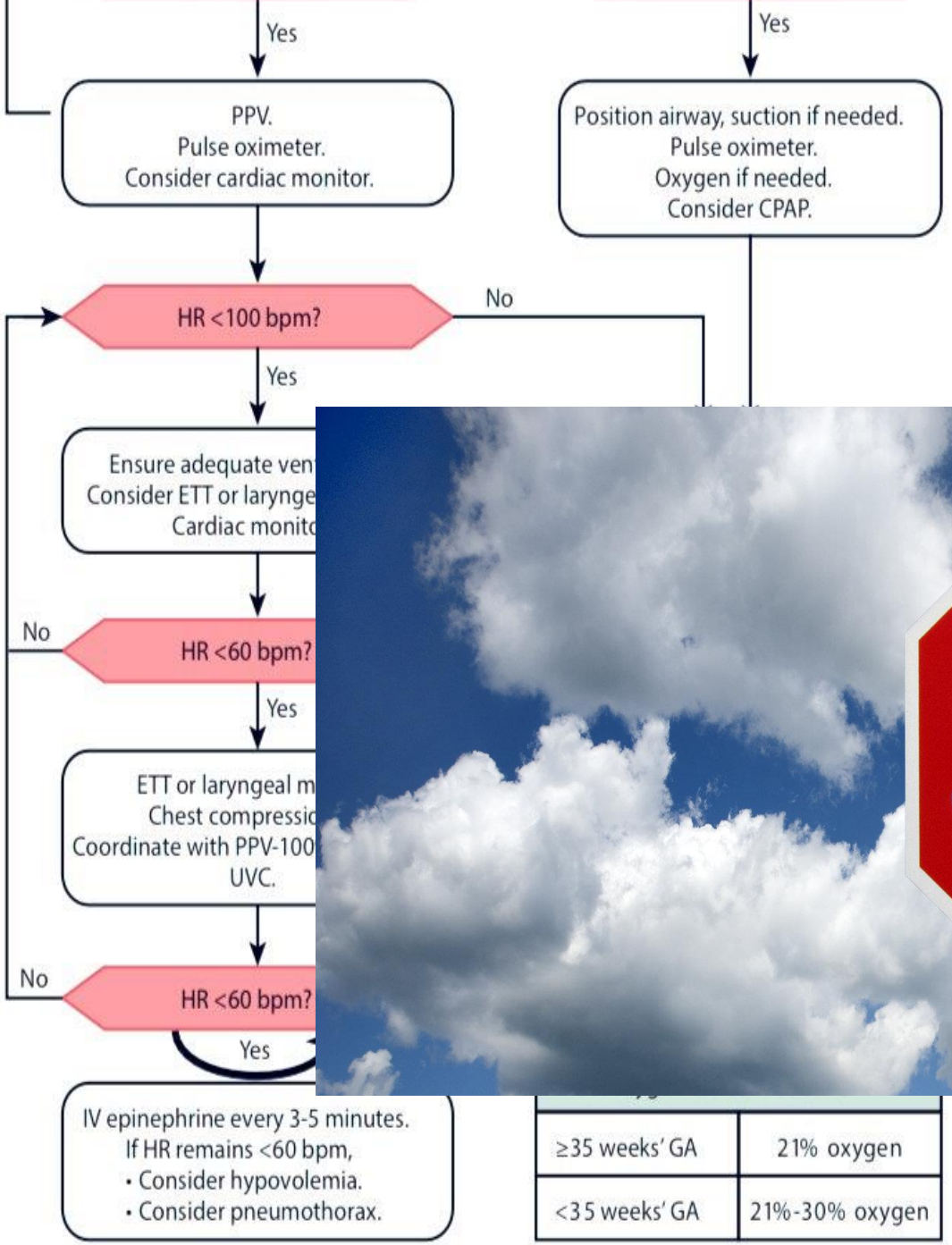
Ventilation


Antenatal counseling.
Team briefing.
Equipment check.
Birth
Term gestation?
Good tone?
Breathing or crying?
Yes
Stay with mother for initial steps, routine care, ongoing evaluation.
No
1 minute
Warm, dry, stimulate, position airway, suction if needed.
Apnea or gasping?
HR <100 bpm?
No
Labored breathing or persistent cyanosis?
Yes
Yes
PPV.
Pulse oximeter.
Consider cardiac monitor.
Position airway, suction if needed.
Pulse oximeter.
Oxygen if needed.
Consider CPAP.
HR <100 bpm?
No
Yes
Ensure adequate ventilation.
Consider ETT or laryngeal mask.
Cardiac monitor.
Post-resuscitation care.
Team debriefing.

Ventilatory Corrective Steps



MRSOPA



≥35 weeks' GA	21% oxygen
<35 weeks' GA	21%-30% oxygen

Primacy of Ventilation

40-60 b/min

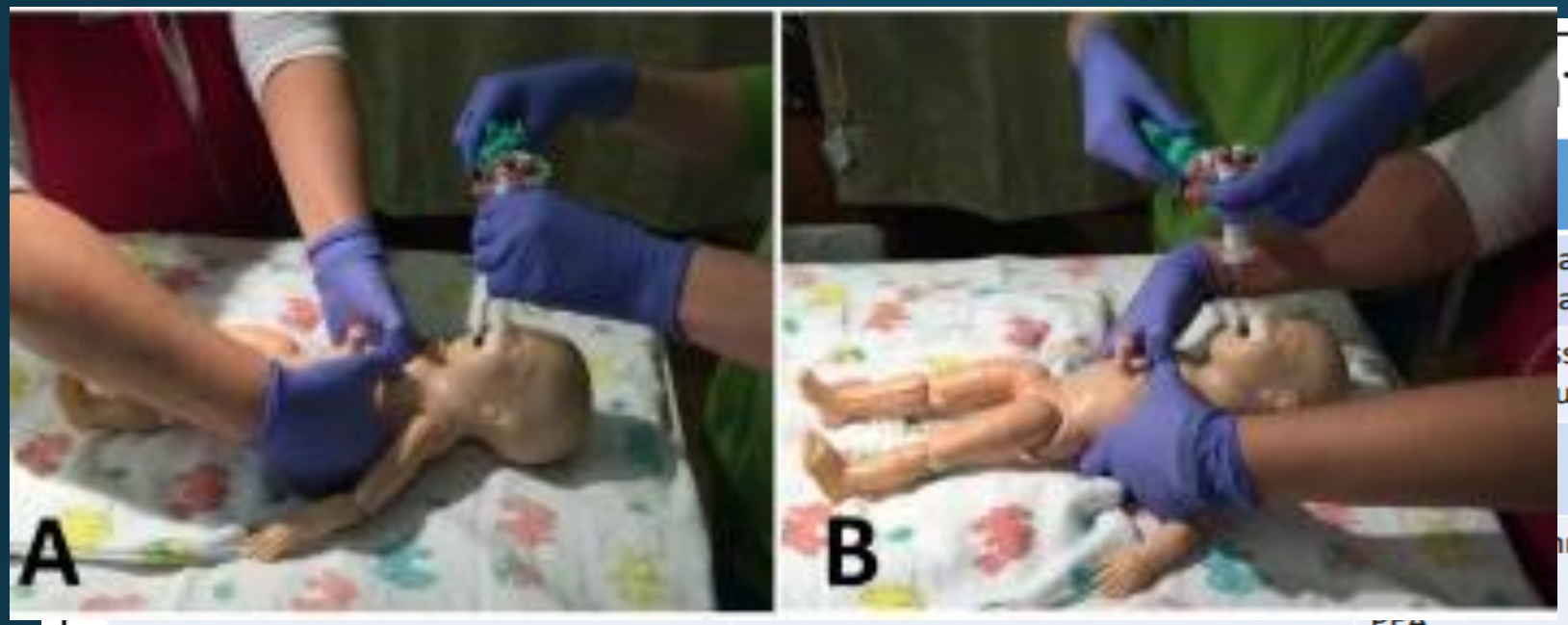
120 x 1/4 = 30 b/min

H elp

MRSOPA lternative Airway

L eads

O xygen 100%



fant CPR

		ated (single rescuer) ated (2 rescuer)
		ssions/min and 8-10 ute, not coordinated
		mia/Tachyarrhythmia
		PEA V-Fib/p
Access	Resuscitation UVC	IV IO
Medications	Epinepherine	Adenos calciu lidocai sulfate

Adapted from T Sawyer et al. Infant resuscitation
care fellowship programs: NRP or PALS? Results

Thermoregulation

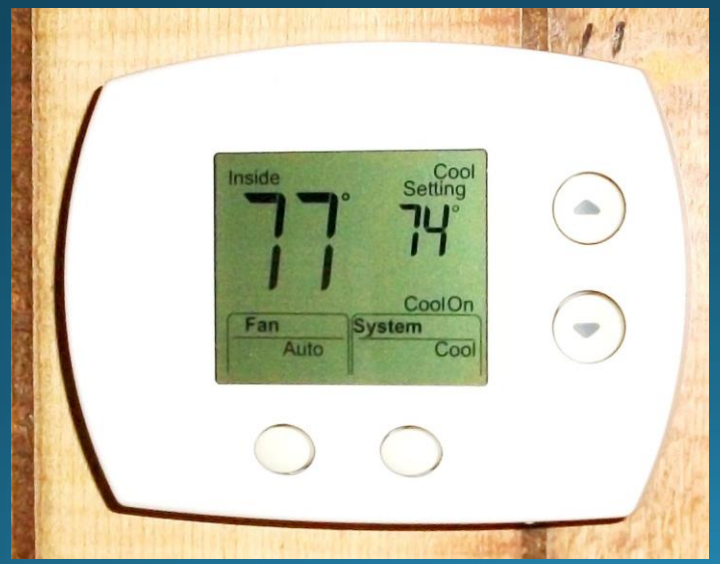
Prone to Hypothermia

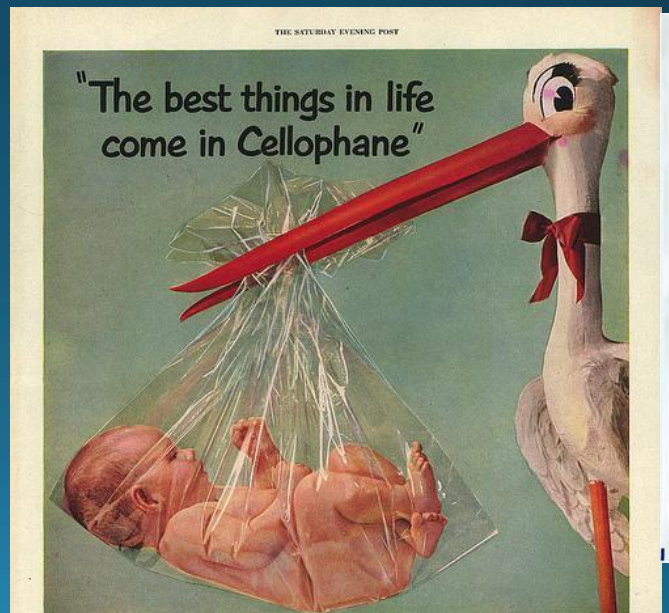
- Body surface area: mass ratio
- Subcutaneous Fat
- Thin skin
- Decreased metabolic response

Measures for Euthermia

<32 weeks

36.5-37.5 C



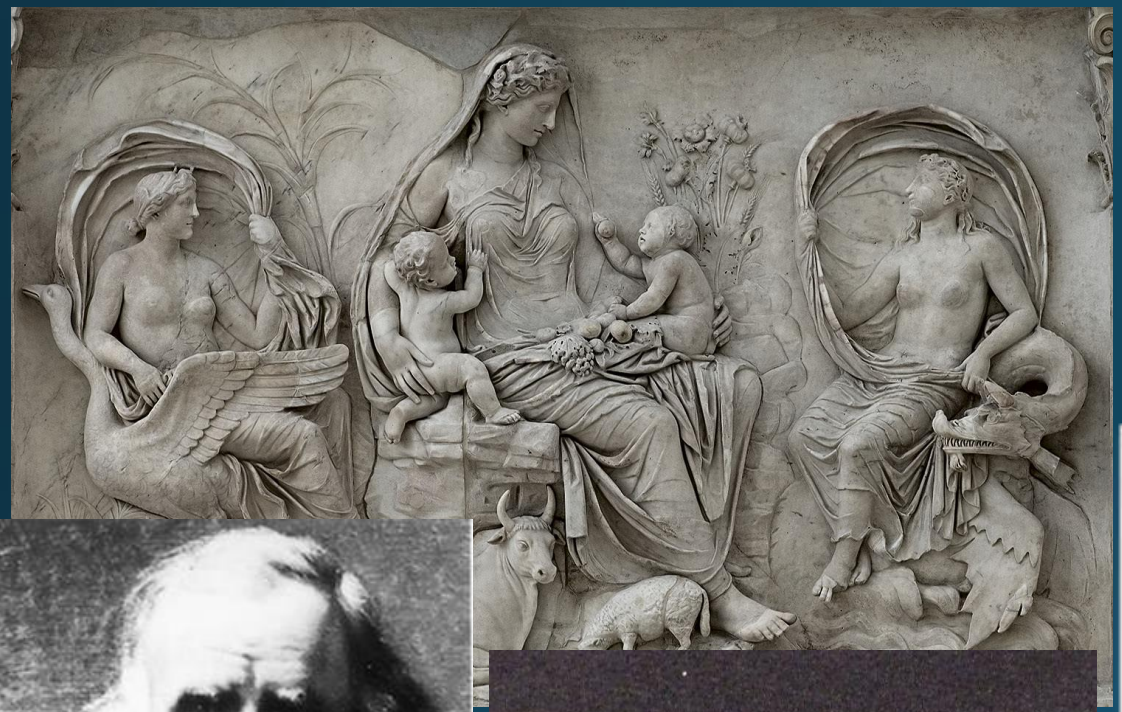


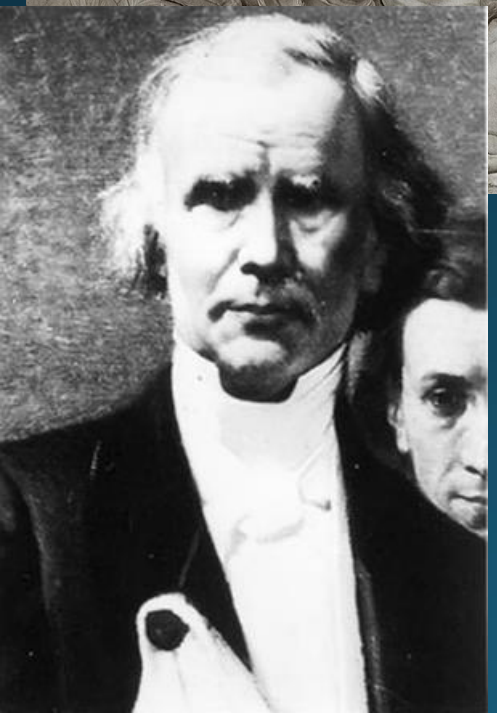
Consequences of Hypothermia

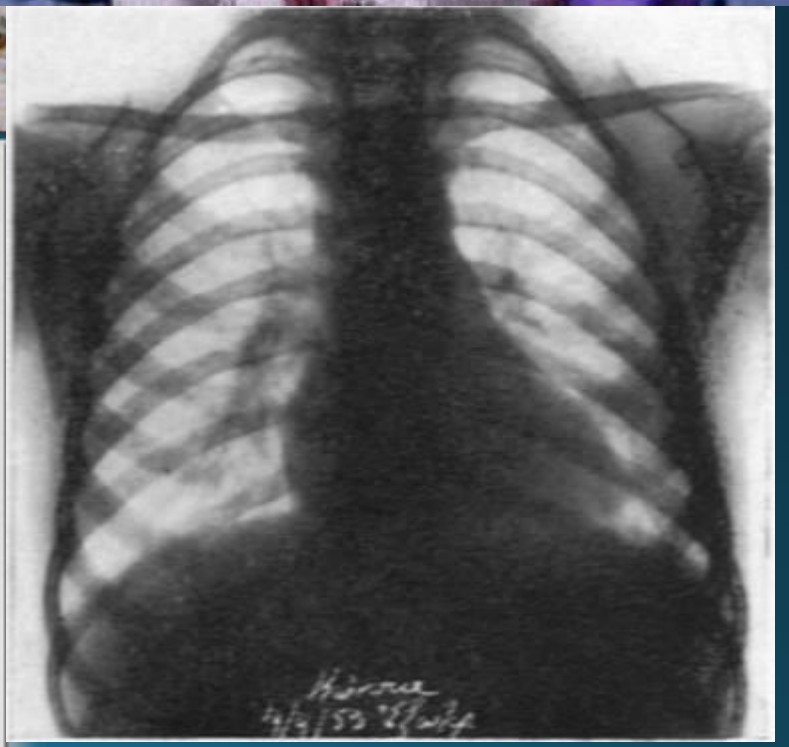
(Lyu 2015)

Delayed Cord Clamping

Historical Clamping







(Niermeyer 2015, Safarulla 2016,Hutchon 2015, McAdams 2018, Mandy 2016, Niermeyer 2013)

Recent Policy Statements

- ILCOR: delay if immediate resuscitation is not required
- AAP/ACOG : "at least 30-60 seconds for most vigorous term and preterm infants"
- ACNM: delay for term and preterm infants for 2-5 minutes
- WHO: Delay 1-3 minutes
- HBB addresses ventilation prior to cord clamping

(Ersdal 2015, Niermeyer 2015, ACOG Committee Opinion 2017,)

Current Practice

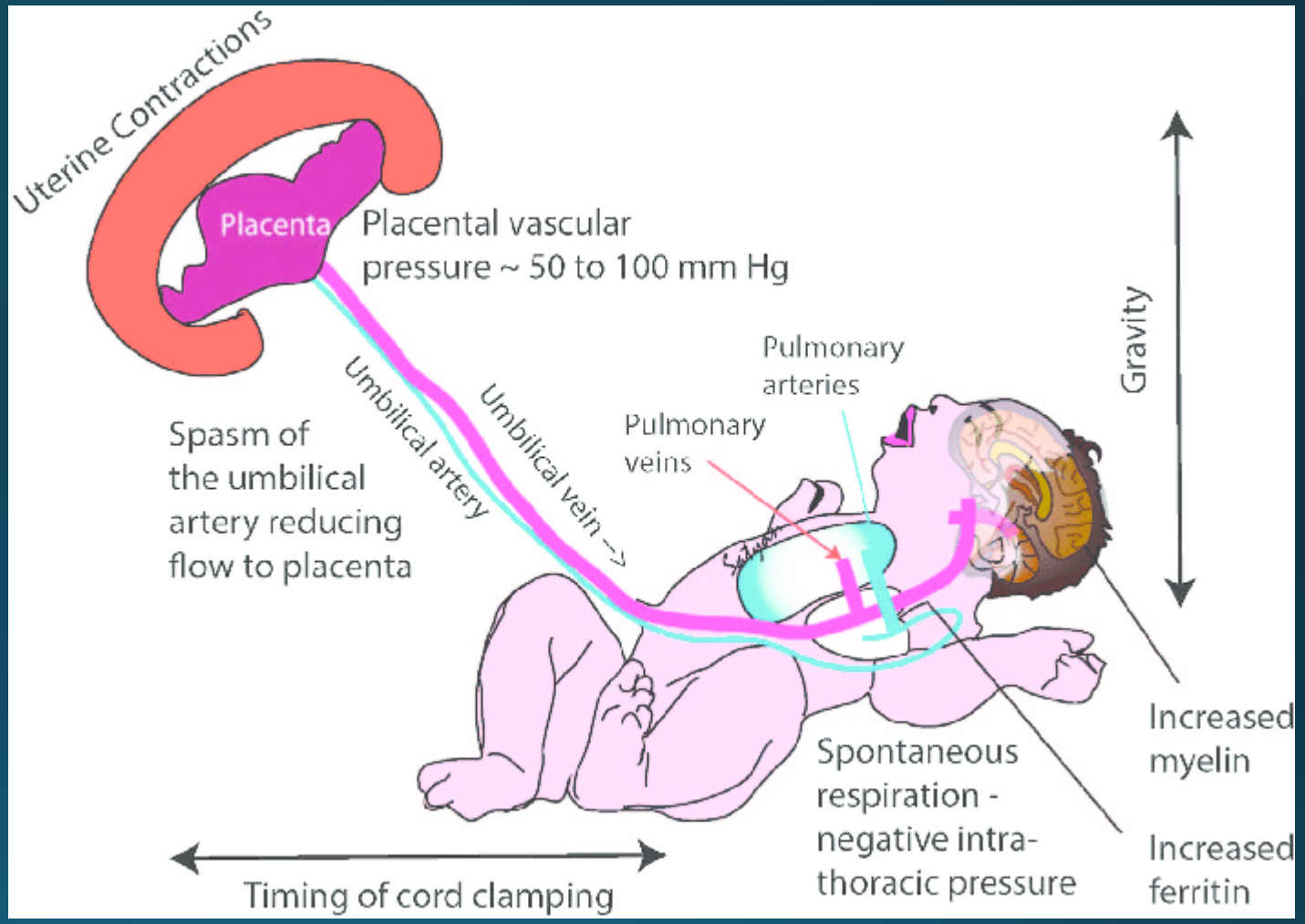
- 12% of medical centers have a DCC policy
- Obstetricians report increasing DCC compliance
- Observed: With less than 35 week infants, DCC attempted 49% of the time
- Similar to compliance in several DCC trials

(Leslie 2017, Jelin 2014, Jelin 2015)

DCC Physiology

- DCC until ventilation improves CV function at birth in lambs

- With onset of respirations, the pulmonary circuit must fill with placental blood to provide preload to the LV
- Immediate clamping decreases preload and increases afterload for the LV, leading to lower CO

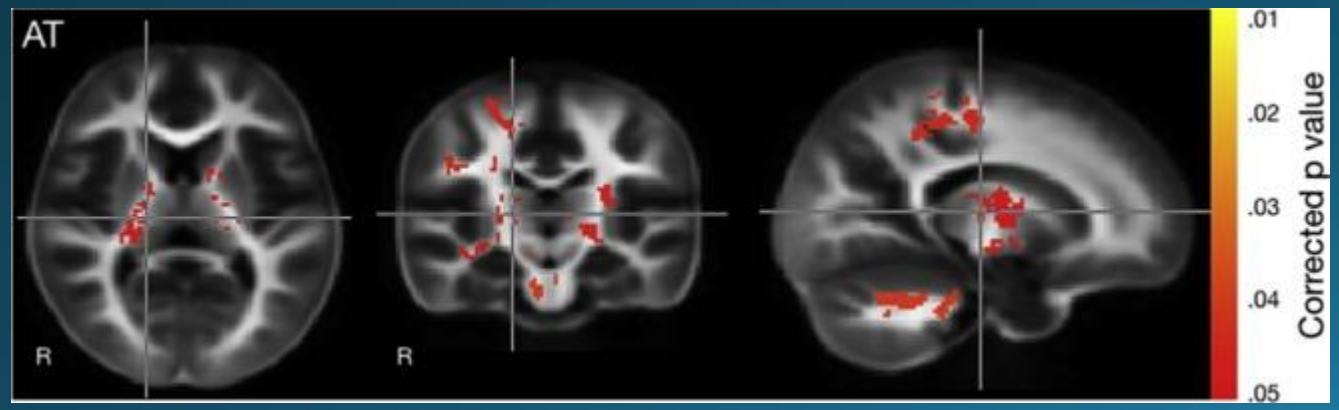


(Bhatt 2013, Niermeyer 2013, McAdams 2018)

Term Infants

DCC benefits

- Higher hemoglobin concentrations
- Less iron deficiency anemia
- Improved exclusive breastfeeding at discharge
- No increased polycythemia or overall jaundice
- Longer term NDOs have shown benefit in some trials



(Andersson 2015, ACOG Committee Opinion 2017, Mercer 2018, Niermeyer 2015)

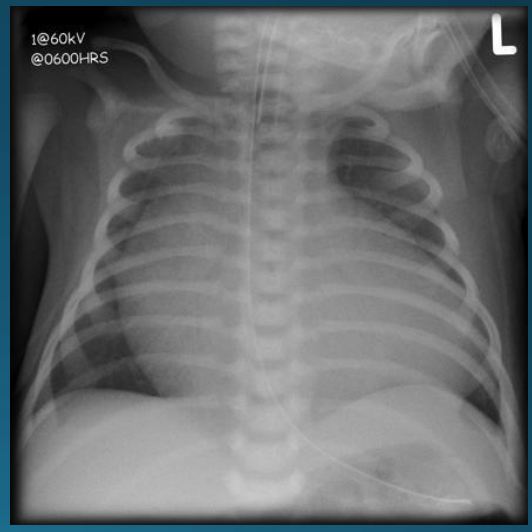
Preterm Infants

- Potentially more serious benefits than term infant
- Decreases delivery room intervention
- Decreases long-term morbidities IVH and NEC
- Metaananlysis in 2017: DCC reduced hospital mortality

(Rabe 2012, Mercer 2016, Niermeyer 2015, Fogarty 2017, Garg 2019)

Relative Contraindications?

- Hydrops
- IUGR
- CDH
- CHD
- General Anesthesia
- Cord Blood banking



(Backes 2015, Lefevvre 2017, Wang 2018, Pratesi 2017)

DCC in Non-vigorous infants

- Largely excluded from clinical trials
- Potential benefit to maintaining constant cerebral and myocardial perfusion
- Myocardial contractility is compromised
- Baby DUCC
- Stabilizing cardiac output to reduce cerebrovascular injury in asphyxiated near-term lambs

(Blank 2018, McAdams 2018, Niermeyer 2015, Polglase 2018)

Safety Concerns and Contraindications

- No increase in clinically significant polycythemia or jaundice in preterm infants
- Protective against low 1 minute APGAR scores and hypothermia
- No increase in postpartum hemorrhage
- True Contraindications

(Niermeyer 2013, Fogarty 2017, Niermeyer 2015, Polglase 2018)

Multiples

Twins

- ACOG and AAP give no recommendation for or against…yet
- Multiples are 10x more likely to be premature
- Safety of DCC in multiple pregnancies demonstrated in multiple studies
- No differences in maternal bleeding
- Concerns related to monochorionicity are theoretical

- Verbeek study: 600 babies ½ MC, ½ DC, showed twin B dichorionic twins delivered vaginally also had higher hb levels at birth compared to twin A

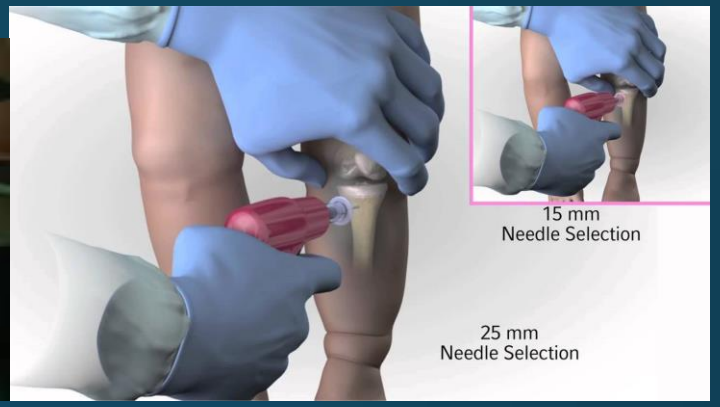
(Ruangkit 2014 Ruangkit 2018, Chiruvolu 2018, Ruangkit 2018, Verbeek 2018)

Umbilical Cord Milking

- Details make this challenging to study: how long to clamp? Where to position baby? Thermal challenges?
- Standardized format
- Benefits over UCM?- unclear
- Concerns with UCM: IVH

If you get in trouble:

- Hypovolemic Shock?



- Obstructive Shock?

In trouble?

- Ventilation Issues?

- Therapeutic Hypothermia?

Case 2

-9 day old term infant
-born by vaginal delivery to a 29 y.o. G3P1 mother
-prenatal labs: A+, antibody negative, RI, HIV negative, RPR NR, HepBsAg negative, GC/CT negative, GBS negative, and UDS negative
-Pregnancy was complicated by tobacco abuse and pregestational T2DM
-Labor was complicated by intrapartum fever to 39 C, maternal tachycardia, and fetal tachycardia
-ROM occurred 22 hours prior to delivery.
-Pt has developed poor feeding, tachycardia, and grunting.

Differential Diagnosis

- Sepsis
- Sepsis
- Sepsis
- CHD
- IEM

Neonatal Sepsis Introduction

- Incidence
- Terminology
- Neonatal sepsis: clinical syndrome in an infant 28 days of life or younger, manifested by systemic signs of infection
- Early vs Late

Pathogenesis

- Early vs Late infection
- 2 major maternal risk factors
- Other risk factors

Infectious Agents

- Bacteria:

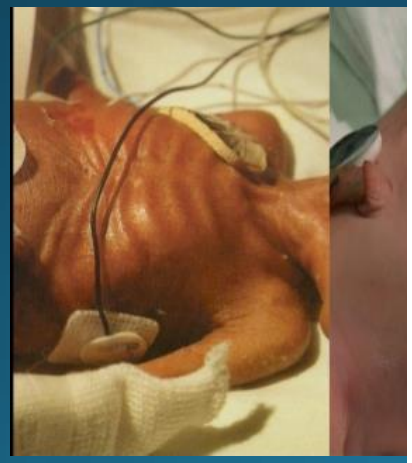
2 most common

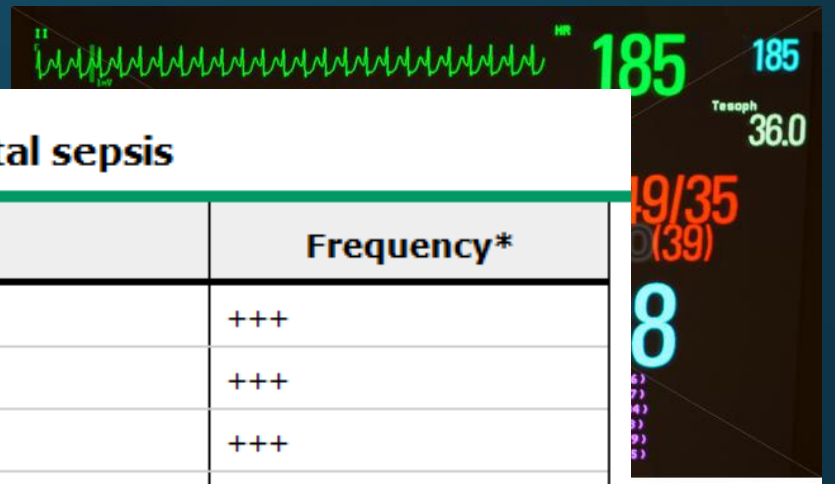
- Other bacterial agents
- Viruses

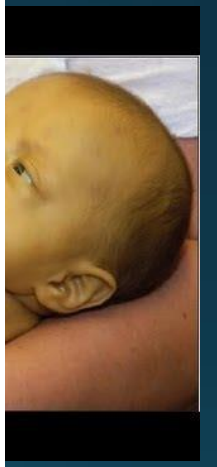
Maternal Risk Factors

- Chorioamnionitis
- Maternal fever
- Maternal GBS colonization
- Delivery at <37 weeks gestation
- Membrane rupture

Clinical Findings







Clinical findings in neonatal sepsis

Finding	Frequency*
Hyperthermia	+++
Respiratory distress	+++
Tachycardia	+++
Lethargy	++
Poor feeding	++
Apnea	++
Bradycardia	++
Poor perfusion/hypotension	++
Vomiting	++
Jaundice	++
Hepatomegaly	++
Cyanosis	+
Hypothermia	+
Irritability	+
Seizures	+
Abdominal distension	+
Diarrhea	+

* +++: commonly associated (≥50 percent of cases); ++: frequently

NRP 8 Upcoming Changes

Table 1: Overview of NRP 8th Edition Practice Changes

Change	NRP 7th Edition	NRP 8th Edition
Umbilical cord management plan added to 4 pre-birth questions, replacing "How many babies?"	The 4 pre-birth questions: (1) Gestational age? (2) Amniotic fluid clear? (3) How many babies? (4) Additional risk factors?	The 4 pre-birth questions: (1) Gestational age? (2) Amniotic fluid clear? (3) Additional risk factors? (4) Umbilical cord management plan?
Initial steps reordered to better reflect common practice.	Initial steps: Warm and maintain normal temperature, position airway, clear secretions if needed, dry, stimulate.	Initial steps: Warm, dry, stimulate, position airway, suction if needed.
An electronic cardiac monitor is recommended earlier in the algorithm	An electronic cardiac monitor is the preferred method for assessing heart rate during cardiac compressions.	When an alternative airway becomes necessary, a cardiac monitor is recommended for the most accurate assessment of the baby's heart rate.
Epinephrine intravenous/intraosseous (IV/IO) flush volume increased.	Flush IV/IO epinephrine with 0.5 to 1 mL normal saline	Flush IV/IO epinephrine with 3 mL normal saline (applies to all weights and gestational ages)
Epinephrine IV/IO and endotracheal doses have been simplified for educational efficiency. The dosage range is unchanged. The simplified doses (IV/IO and ET) do not represent an endorsement of any particular dose within the recommended dosing range. Additional research is needed.	Range for IV or IO dose = 0.01 - 0.03 mg/kg (equal to 0.1 - 0.3 mL/kg) Range for endotracheal dose = 0.05 - 0.1 mg/kg (equal to 0.5 – 1 mL/kg)	The suggested initial IV or IO dose = 0.02 mg/kg (equal to 0.2 mL/kg) The suggested endotracheal dose (while establishing vascular access) = 0.1 mg/kg (equal to 1 mL/kg)
Expanded timeframe for cessation of resuscitative efforts	If there is a confirmed absence of heart rate after 10 minutes of resuscitation, it is reasonable to stop resuscitative efforts; however, the decision to continue or discontinue should be individualized.	If confirmed absence of HR after all appropriate steps performed, consider cessation of resuscitation efforts around 20 minutes after birth (decision individualized on patient and contextual factors).

Neonatal Outreach

Thank you!

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