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Newborn Thermoregulation

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Objectives

- Describe the importance of neonatal thermoregulation
- Identify ways to prevent neonatal hypothermia
- Name the benefits of skin-to-skin contact in the first hour
- Describe common risk factors associated with Sudden Unexpected Postnatal Collapse (SUPCN)
- Identify neonates at risk for developing HIE
- Explain how neonatal HIE occurs and the benefits of therapeutic cooling measures

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What is thermoregulation?

- **Thermoregulation** is the ability of a neonate to regulate its own body temperature without using excess oxygen or glucose expenditures.
- Neonates are at risk for rapid heat loss due to:
  - Large body surface areas
  - Exposure of wet skin to air
  - Limited subcutaneous fat
  - Dependence on their brown fat (Brown Adipose Tissue) for heat-generating cellular metabolism

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What is Brown Adipose Tissue (BAT)?

- BAT begins to develop in the fetus about halfway through their gestation and continues to develop until birth
- Volume, location, type influenced by maternal nutrition
- Kidneys, thoracic inlet, spinal column, interscapular + axilla regions
- In a hypothermic (cold) neonate, it can increase heat production by 100%!
- Keep in mind that premature infants will not have adequate BAT
- Metabolizing BAT for heat needs requires O2

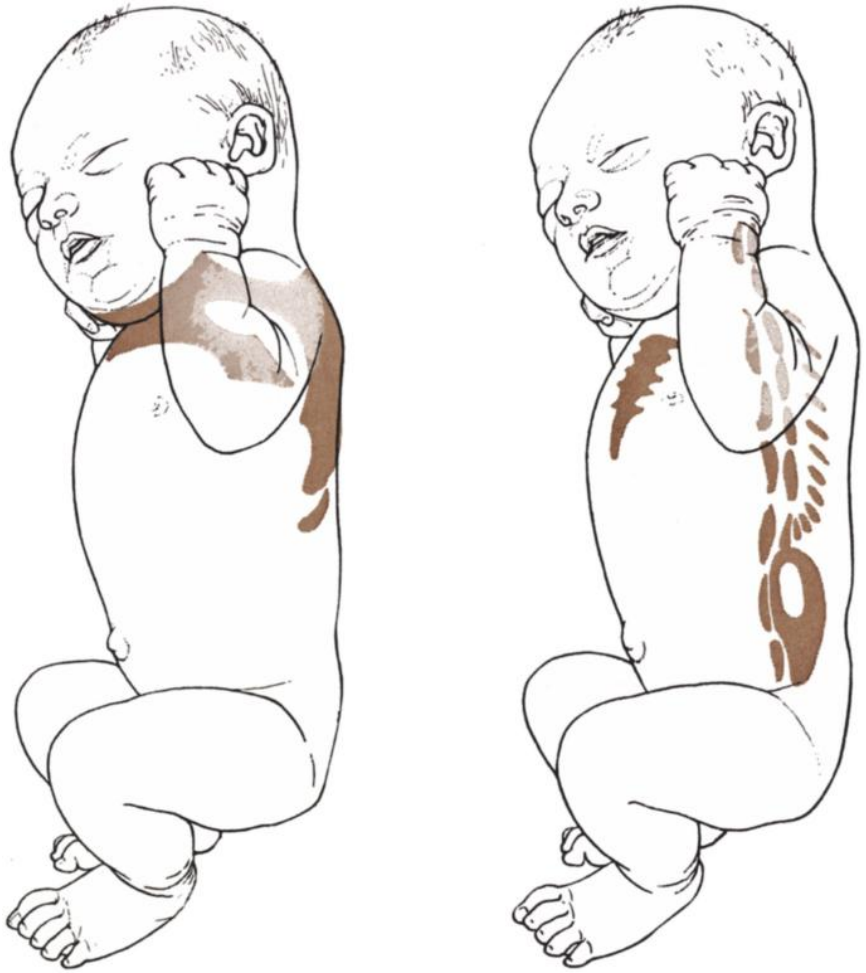

Photo source: SpringerLink Health

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Hypothermia, Hypoxia, and Hypoglycemia

- Respiratory distress and hypoglycemia can be the result and cause of hypothermia during neonatal transition
- O2 supplies ⇓
- Pulmonary blood flow ⇓
- Vasoconstriction ⇑
- Hypoxic event=increased risk for hypothermia

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Hypothermia, Hypoxia, and Hypoglycemia

- Energy demand ↑
- Glucose metabolism ↑
- Glucose stores ↓
- Surfactant production ↓
- Respiratory distress ↑

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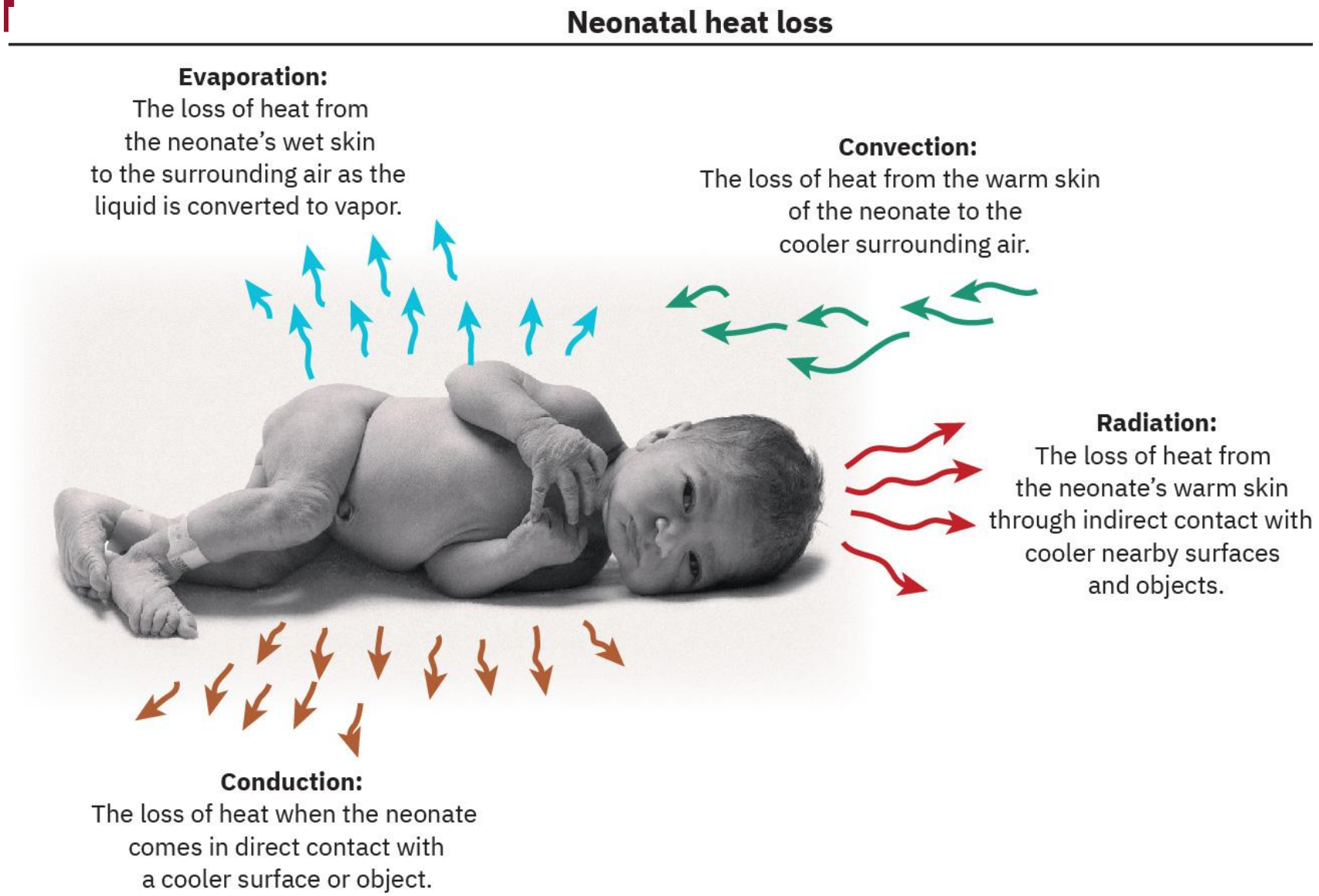
Types of Heat Loss



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Prevention/Nursing Intervention

- Neutral heat environment in rooms (77-82 F) if possible
- Neonates should not be uncovered near drafts (open doors/air vents)
- Prewarming the radiant warmer or isolette before birth
- Dry infant thoroughly and discard wet blankets
- Place warm blanket over infant during skin to skin
- Place warm blanket on birthing person's chest

Photo source: SpringerLink Health

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According to AWHONN, all stable neonates should have immediate skin to skin contact following birth through the first hour of life

-Supports thermoregulation
-Infants require fewer cardiopulmonary interventions

Skin-to-Skin: Baby's first hug!

- Dry/stimulate
- Immediately place prone on birthing person's bare chest
- Initial assessment and vitals done on chest
- Sudden Unexpected Infant Collapse (SUIC) can occur during skin to skin…assess infant frequently
- HOB elevated 35 degrees
- Nares unobstructed
- Legs flexed
- Neutral neck position

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80.5% water +
10.3% lipds +
9.1% proteins =
Vernix caseosa

Vernix="To varnish", caseous="cheesy nature"

Vernix

- Softer, healthier fetal skin
- Antimicrobial
- May help with thermoregulation

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DON’T FORGET! FOB or support person can do skin to skin too!

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Source: Hypnobabies Hypnobirthing

Skin-to-skin in the OR

If birthing person is stable and infant is stable, skin-to-skin should be initiated ASAP

Continuous attendance by staff

Delay routine infant care

Prioritize safety and thermoregulation

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Delayed Bathing

Stability	• Cardiorespiratory and thermal stability must be achieved prior to bathing
Timing	• Between 6 and 24 hours of age • Delaying improves glucose stability and thermoregulation
Method	• Preventing rapid heat loss • Immersion/under warmer
Conclusion	• Infants should immediately be dried and placed skin to skin • Clothes, hat, swaddle • Recheck temps

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Normal Temps/Rewarming

- 36.5 C-37.5 C
- Immediate skin to skin contact
- Radiant warmer: Servo control **every time** (set to no greater than 37 C)
- Infant should have a diaper on only
- Infant supine → attach probe to abdomen→monitor skin temp q 15-30 mins
- Place infant back to skin to skin, or in clothes and swaddle
- Placing infant in a cap can help reduce heat loss, however it should be done in conjunction with other interventions!

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Sudden Unexpected Postnatal Collapse (SUPC/SUIC)

- Can occur anywhere in the hospital setting
- Research has pointed to the first 2 hours of life as a high-risk time
- Risk Factors:
  - Prone positioning
  - Asphyxiating position
  - Maternal fatigue
  - Parental distraction (smartphone use)
  - Mother receiving narcotics
  - Lack of bedside attendance by clinical staff during the initial 2 hour recovery period

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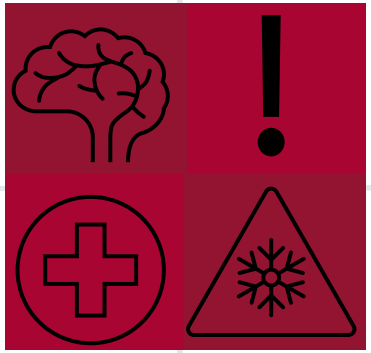
Hypoxic Ischemic Encephalopathy (HIE)

WHAT IS IT?

- Occurs after a disruption in the cerebral blood flow + O2 delivery to the fetal brain
- S/T insufficient placental blood flow and impaired gas exchange



RISK FACTORS

- Maternal diabetes
- Morbid obesity
- Chorioamnionitis
- Placental abruption
- Prolapsed cord
- Uterine rupture
- Tight nuchal

NOT "ONE SIZE FITS ALL"

- Progression and degree of injury is dependent on the timing, duration, and severity of the brain insult
- Outcomes vary

MANAGEMENT

- Therapeutic hypothermia (whole body or selective head cooling)
  - Reduces death and disability for moderate to severe HIE
  - Initiated within 6 HOL
  - Late preterm and term infants

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Recognizing HIE

- Any infant 35 weeks or greater with a history of sentinel event with one of the follow should be referred to NICU:
  - Apgar less than or equal to 5 at 10 minutes of life
  - Assisted ventilation require at 10 minutes of life
- Infants regardless of perinatal history with a cord blood gas obtained within 1 hour of life:
  - pH of 7 or less
  - Base Deficit of negative 16 mEq or greater

SARNAT SCORING TOOL

Sarnat Level		
Category	**Moderate**	**Severe**
Level of consciousness	Lethargic	Stupor/coma
Spontaneous activity	Decreased activity	No activity
Posture	Distal flexion, full extension	Decerebrate
Tone	Hypotonia (focal, general)	Flaccid
Primitive reflexes: Suck Moro	 Weak Incomplete	 Absent Absent
Autonomic system: Pupils Heart rate Respirations	 Constricted Bradycardia Periodic breathing	 Skewed deviation/dilated/nonreactive Variable heart rate Apnea

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Phases of HIE

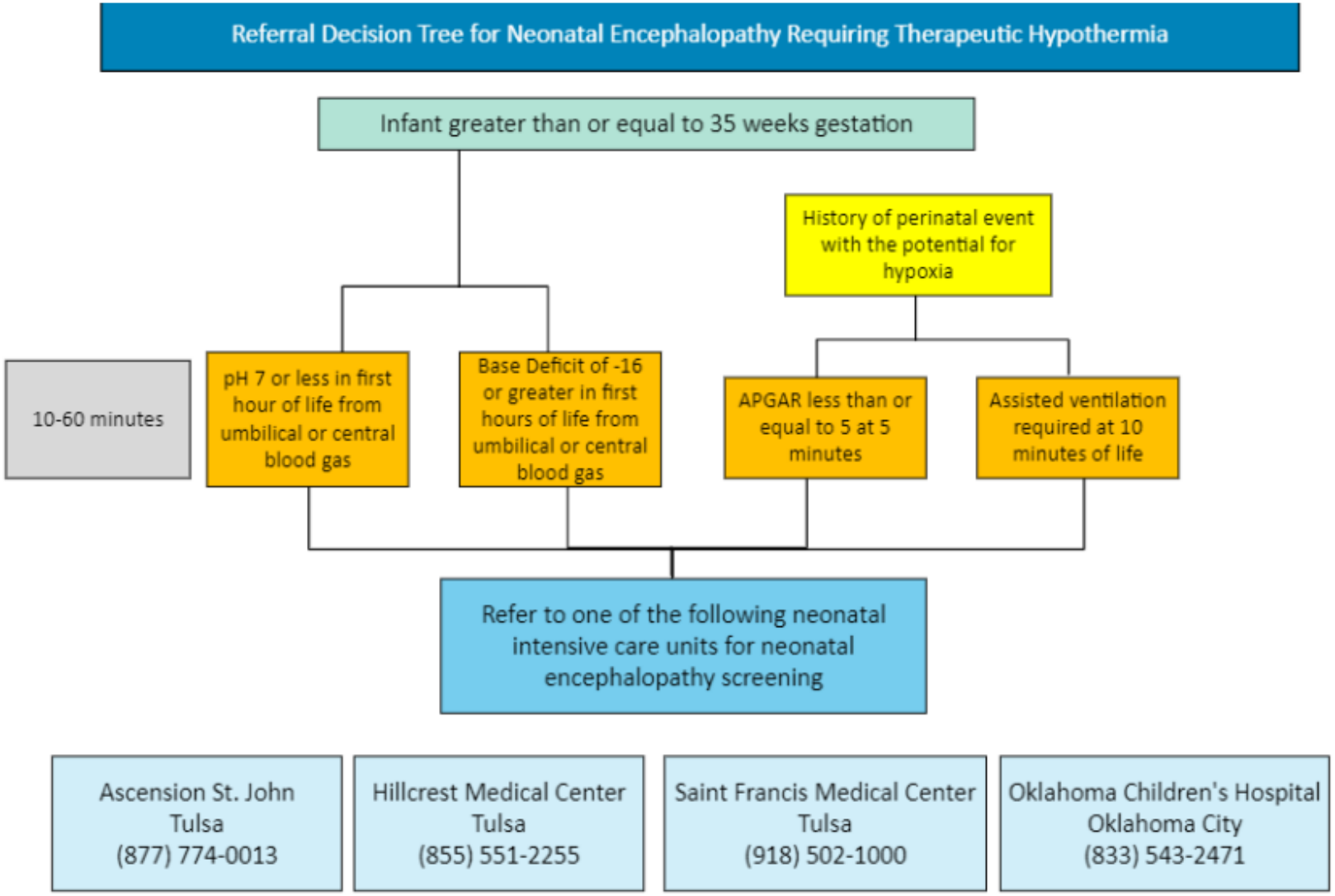
- Primary
  - Decreased cerebral blood flow, initial insult of cell swelling and necrosis
  - Occurs prior to hypothermia therapy

  Secondary
  - Reperfusion of the brain, Apoptosis-d/t lack of oxygen in the brain
  - Can be impacted with hypothermia

  Latency Phase
  - Period between these two phases that allows for a therapeutic window

  Phases can occur utero

Oklahoma HIE Task Force



How Does Hypothermia Therapy Work?

Babies with hypoxic-ischemic encephalopathy (HIE) undergo cooling . But what does the process look like, and how does it help stop the spread of brain damage?

THE PROCESS

Using a cooling cap or blanket, a newborn's body temperature is lowered to 33.5 degrees Celsius.

The newborn's body temperature is lowered for 72 hours.

Decreased body temperature slows the baby's metabolic rate.

Cells are able to recover, preventing the spread, severity and permanence of brain damage.

Sources

Bamalan OA, Moore MJ, Menezes RG. Vernix Caseosa. [Updated 2023 Jul 4]. In: StatPearls, National Institutes of Health (NIH) [Internet]. Treasure Island (FL): StatPearls Publishing; 2025

Bedwell, Susan, and Holtzclaw, Barbara J. *Early Interventions to Achieve Thermal Balance in Term Neonates.* Nursing for Women's Health, Volume 26, Issue 5,2022, Pages 389-396.

Oklahoma Perinatal Quality Improvement Collaborative. Oklahoma HIE Task Force (2023). Retrieved from https://opqic.org/therapeutic-hypothermia

Simpson, Kathleen Rice, et al. AWHONN's Perinatal Nursing. 5th ed., Philadelphia, Wolters Kluwer, 2020.

Simpson, Kathleen Rice PhD, RNC, CNS-BC, FAAN. Sudden Unexpected Postnatal Collapse and Sudden Unexpected Infant Death. MCN, The American Journal of Maternal/Child Nursing 42(6):p 368, November/December 2017.