Neonatal Hypothermia

Hypothermia is defined as core body temperatures **below 36.5°C**, however the consequences of hypothermia may occur at higher temperatures.
Neonates have a limited ability to thermoregulate, which increases the risk of hypothermia. Hypothermia in the neonatal population may have deleterious effects on **organ function.**

RISK FACTORS

Metabolic and endocrine dysfunction:
- Hypothyroidism
- Inborn errors of metabolism
- Hypoglycemia
- Addison's disease

Structural:
- Intracranial hemorrhage
- Gastroschisis
- Neural tube defects

Infection or sepsis

Birth in resource-poor environments:
- Higher rates of preterm and low-birthweight infants
- Inadequate delivery room environments
- Decreased thermoregulation during transport

Other:
- Premature birth
- Post-resuscitation
- Cold exposure

PATHOPHYSIOLOGY

There are 4 mechanisms through which a neonate loses heat:
- **Radiation**: infant is born into a setting containing cooler materials without direct contact, creating a gradient for temperature loss
- **Evaporation**: amniotic fluid evaporation
- **Conduction**: inadequately wrapped infant directly in contact with a cooler object
- **Convection**: surrounding cold air causes removal of heat from the infant

ADAPTATION TO COLD STRESS

Neonates adapt to the cold stress by:
- Increasing **heat production** by the heart, liver, and brain
- **Muscle flexion** to generate heat from voluntary movement and to minimize surface area
- **Peripheral vasoconstriction**
- Norephinephrine-directed **lipolysis of brown adipose** to create local heat reactions carried through the bloodstream to warm the body. This can be problematic as this causes a rapid increase in the overall metabolic rate, which can lead to hypoxia and hypoglycemia. **Premature infants may not have this capacity** as their bodies contain less brown adipose and overall fat stores.

Clinical Presentation

- Cold temperature
- Acrocyanosis
- Irritability/lethargy
- Hypotonia
- Poor feeding
- Hypoglycemia

Categories of Hypothermia	Temp
Cold Stress	36-36.4°C
Moderate Hypothermia	32-35.9°C
Severe Hypothermia	< 32°C

It is crucial to recognize hypothermia to prevent the following consequences:

- Hypoglycemia
- Intraventricular hemorrhage
- Bradycardia
- Coagulation dysfunction
- Metabolic acidosis
- Hypoxia
- Apnea
- Sclerema neonatorum
- Mortality

THERAPEUTIC HYPOTHERMIA

Therapeutic hypothermia or total body cooling is the treatment of choice for neonates who meet criteria for hypoxic-ischemic encephalopathy. Hypothermia (33-35°C) is maintained for 72 hours until rewarming. This treatment is the only proven neuroprotective therapy for treatment of neonatal encephalopathy.

PREVENTION

- **Warm delivery atmosphere**
- **Swaddling** and **drying** or **skin-to-skin** contact
- **Hats** to prevent heat loss from the scalp
- Continuous temperature regulation between **36.5-37.5°C**
- Thermoregulation during **transfers** and **procedures**
- Special considerations for preterm infants:
  - **Increase temperature** of delivery room (25-26°C)
  - **Polyethylene wrap** for pre-term infants <29 weeks
  - Preheat **radiant warmer**

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Morgan Gregg (Medical Student, University of Alberta), Dr. Nicole Anderson (Neonatal-Perinatal Fellow, University of Alberta) for www.pedscases.com