THERMOREGULATION

Newborn Fellowship 2025

WHAT IS THERMOREGULATION?

A maintenance of balance between heat loss, heat gain, and heat production

Newborns attempt to stabilize their core body temperature within a narrow range

First 12 hours after birth are critical in adjusting to extra-uterine life

HYPOTHERMIA

Who is at increased risk?

- Preterm
- Low birth weight / SGA
- Prolonged resuscitation
- Some defects (gastroschisis, omphalocele, neural tube defects)
- Decreased activity or hypotonia from sedatives

WHY IS THERMOREGULATION SO IMPORTANT?

- Reduces the effects of cold stress on the infant
  - Cold stress increases morbidity and mortality
- Hypothermic infants experience increased metabolic rate and oxygen consumption
- Hypothermia is preventable!

NEUTRAL THERMAL ENVIRONMENT (NTE)

- Newborn body temperature depends on the heat transfer between the infant and external environment
- Goal of care is to provide a neutral thermal environment
- NTE: The ideal environmental temperature that allows the infant to maintain a normal body temperature to minimize oxygen and glucose consumption.
- Heat loss must be controlled and minimized to ensure positive neonatal outcomes

MECHANISMS OF HEAT PRODUCTION

Metabolic processes

Voluntary muscle activity

Non-shivering thermogenesis

*If these responses to cold stress are unsuccessful → increased metabolic rate and increased O2 consumption

BROWN FAT METABOLISM

Located around kidneys, adrenal glands, mediastinum, subscapular, axillary and nape of neck

Brown fat cells generate more energy than any other cell in the body

Accumulated in the last part of the 3rd trimester (amount increases w/gestation)

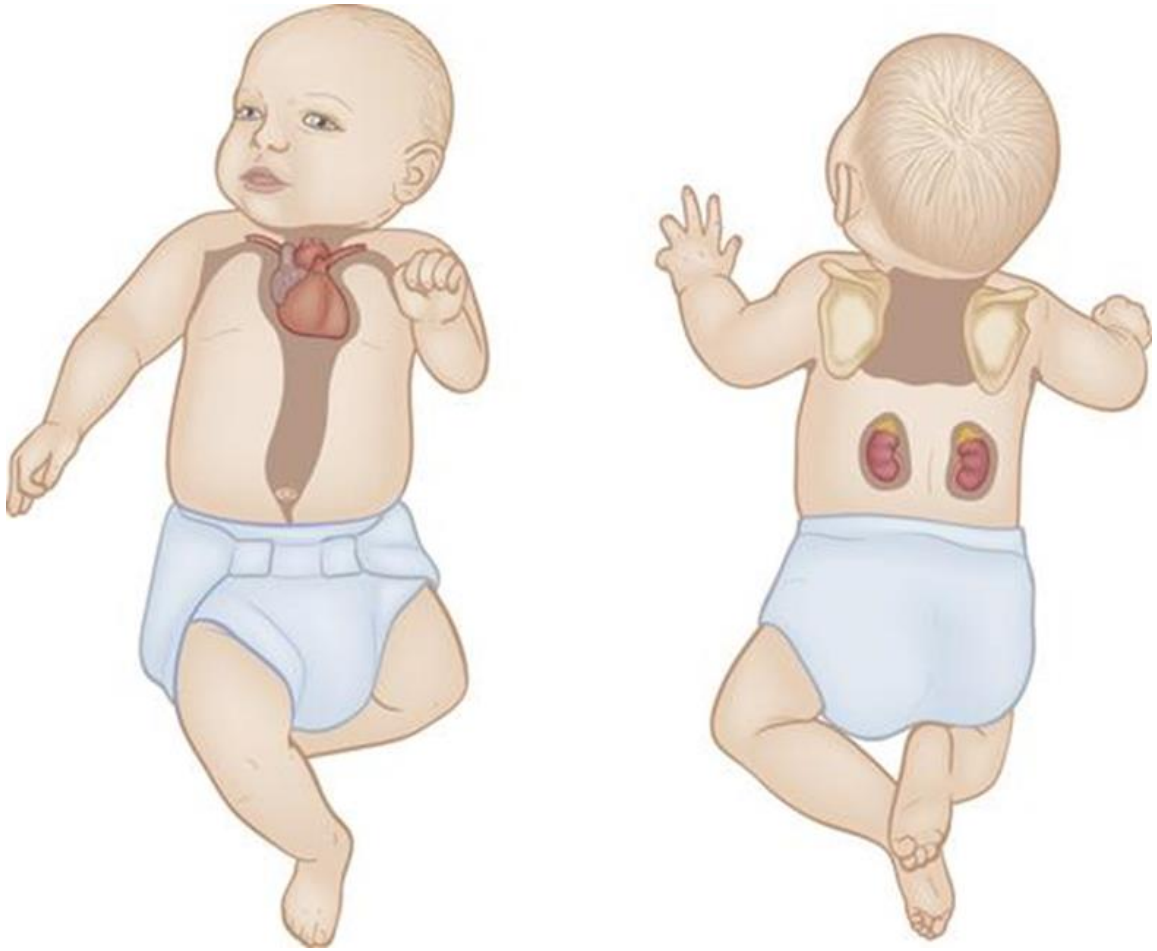
Brown fat accounts for 2-7% of term infant's TBW

Produces heat in core regions of the body

Reserves are rapidly depleted with cold stress

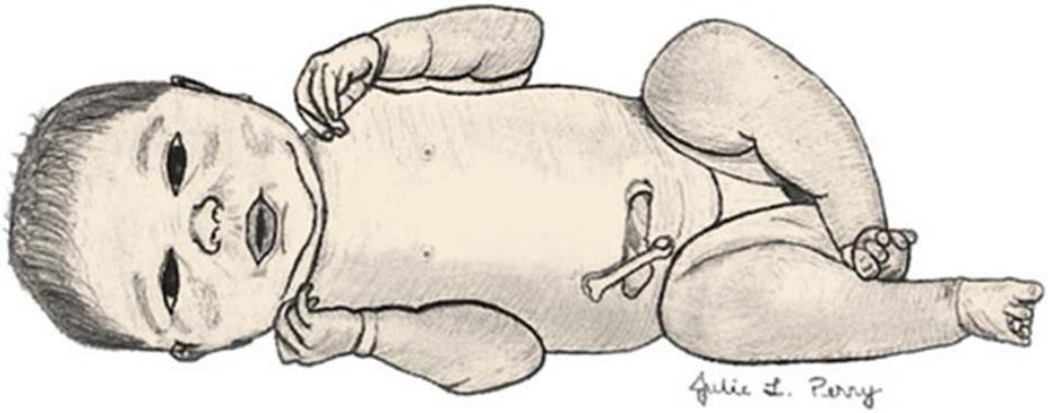
Once used, brown fat stores are not replaced

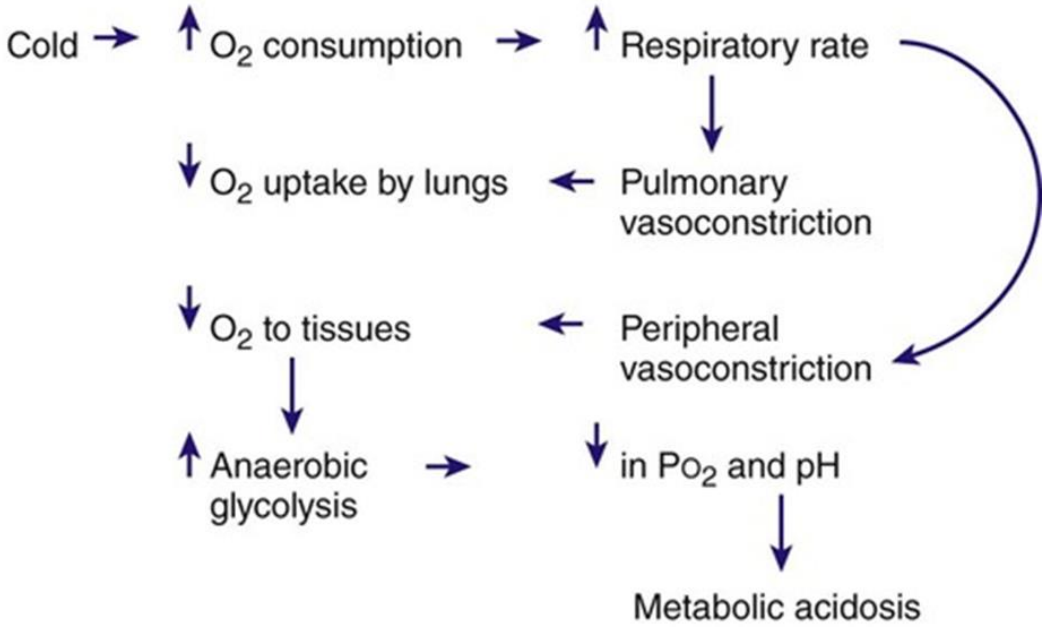
Gestational age dependent. Premature babies have less brown fat compared to term infants. Puts them at an increased risk for hypothermia.



COLD STRESS

- Imposes metabolic and physiologic demands on infant
- O2 consumption and energy diverted from maintaining normal brain function, cardiac function, and growth to thermogenesis for survival
- Can prompt a transient respiratory distress or aggravate existing RDS
- Increases risk of hyperbilirubinemia and hypoglycemia



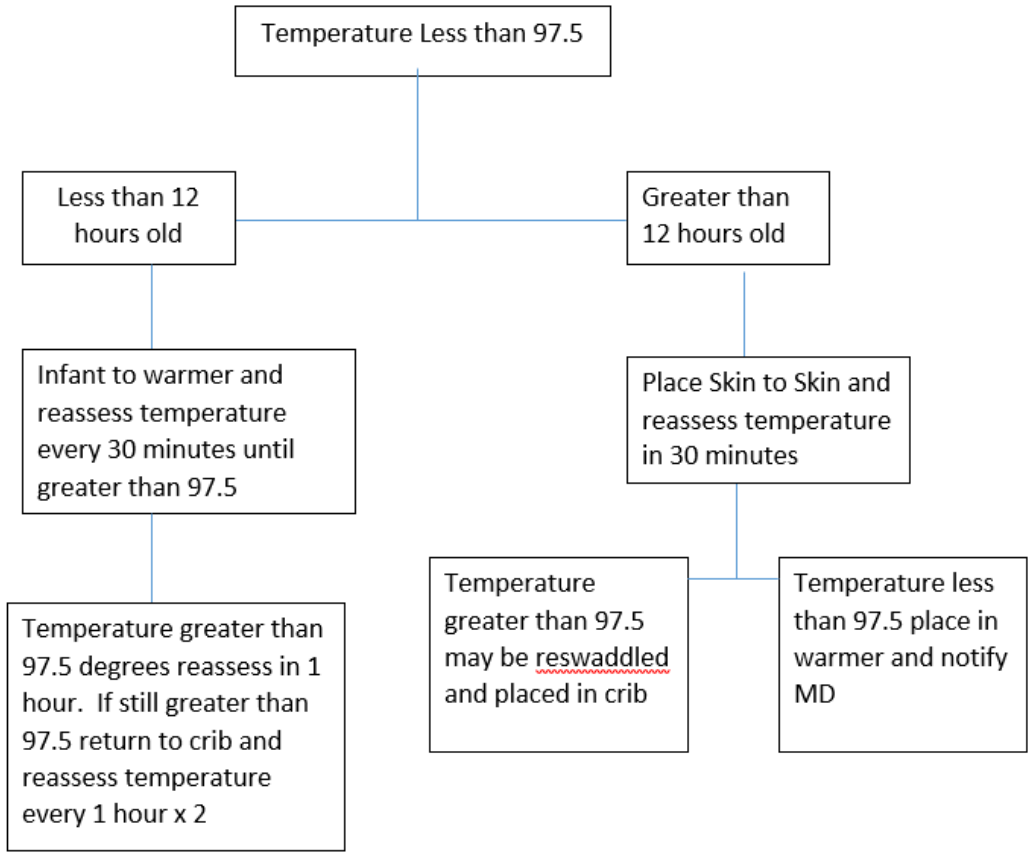


SIGNS AND SYMPTOMS OF HYPOTHERMIA

- A/B's
- hypoglycemia
- hypotonia
- hypoxemia
- feeding intolerance
- increased metabolic rate
- metabolic acidosis
- poor weight gain
- pulmonary vasoconstriction (PPHN)
- respiratory distress
- weak cry or suck

LATE PRETERM HYPOTHERMIA ALGORITHM

See resources section

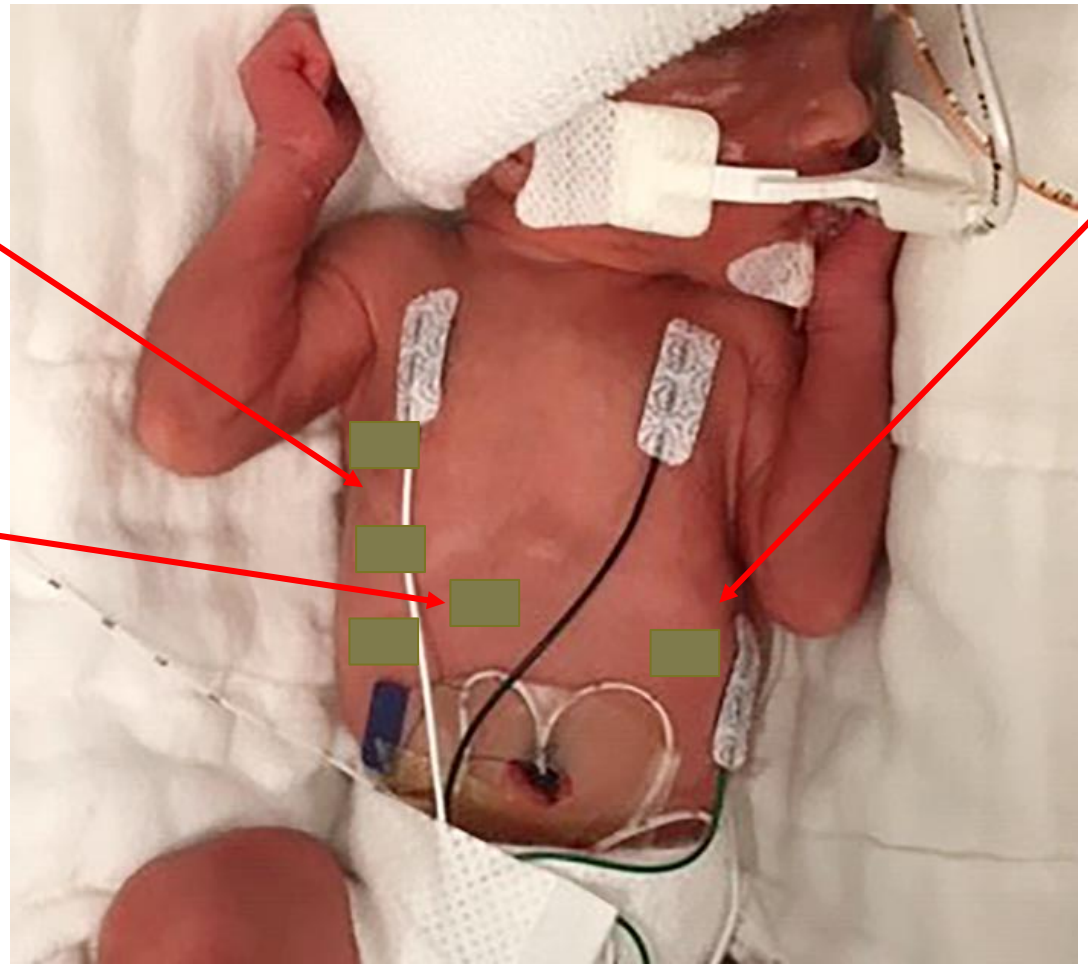


- If newborn has a second low temperature after being in the warmer, provider should be notified and at WH a consult with NICU should be ordered.


Panda
98.9
Heater Power
90%
Mode
Manual
Baby

TEMP PROBE PLACEMENT

- Nipple line, on the side of chest –
  - NOT in axilla – avoid any skin folds or wrinkles
- Over liver



Either side of the abdomen

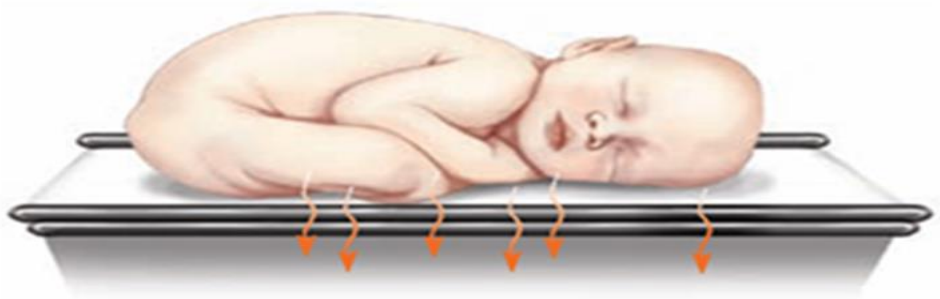
Avoid positioning on probe

Use reflective cover

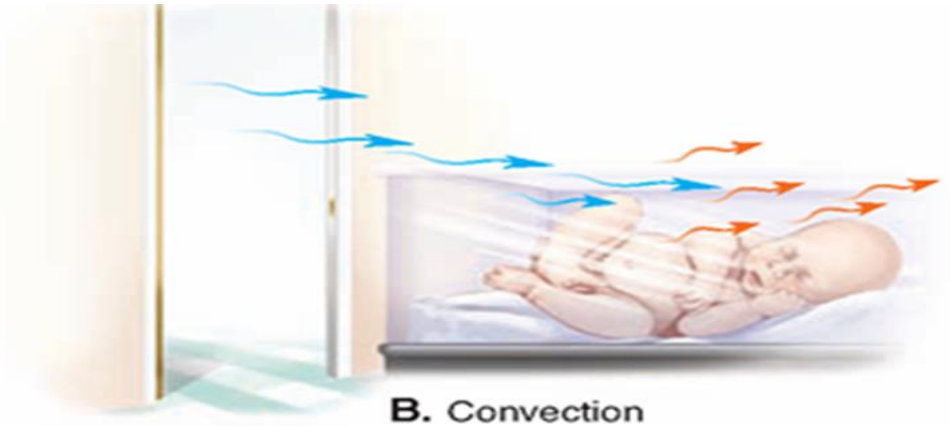
Change when soiled or no longer sticking

If placed on side of chest – take temperature on same side

METHODS OF HEAT LOSS



A. Conduction



B. Convection

C. Evaporation

D. Radiation

INTERVENTIONS TO PREVENT HEAT LOSS

Conduction: From infant to another object	**Convection:** From infant to surrounding air
Evaporation: By water evaporation	**Radiation:** From infant to colder nearby object

INTERVENTIONS TO PREVENT HEAT LOSS

Conduction:

- Skin to skin
- Initial assessment – place infant on pre-warmed bed in warmer
- Cover scales or x-ray plate with warm blanket or pillowcase
- Pre-warm positioners

Convection:

- Room temperature maintained at approximately 75.2 degrees
- Infant swaddled in open bassinet
- Cap applied to decrease heat loss from head (in M/B or when holding in NICU)
- Keep portholes closed

Evaporation:

- Thoroughly drying the infant after birth
- Quickly drying infant after bath
- Delayed bath

Radiation:

- Place bassinets, scales, etc. away from outside windows and doors
- Avoid air drafts
- Cover incubator
- Use double walled incubator
- Skin to skin

REFERENCES

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