



## **Chapter 19**

### **NEWBORN THERMOREGULATION**

*Thermoregulation is a very important aspect of neonatal care. Those least able to tolerate hypothermia include the preterm and/or growth restricted infant and the infant with asphyxia or respiratory difficulties.*

#### **Mechanisms of Heat Loss and Preventive Measures**

##### **1. Evaporation**

- Loss of heat when water evaporates from the skin and respiratory tract
- Highest immediately after birth and with bathing
- Dry baby quickly and remove wet towels/blankets
- Humidify O<sub>2</sub>

##### **2. Convection**

- Heat lost to surrounding moving air
- Depends on difference in air temperature, speed of movement of the air, and amount of skin exposure
- Cover baby's head
- Dress baby
- Keep out of drafts
- Warm O<sub>2</sub>
- Raise surrounding (ambient) temperature

##### **3. Radiation**

- Heat lost to surrounding colder solid objects (not in direct contact) independent of air temperature
- Keep incubator, warmer, cot away from outside walls and windows
- Dress baby
- Use double walled incubator or plexiglass heat shield in the incubator
- For infants with temperature control problems, cover three sides of the incubator with aluminum foil (shiny side in)

#### 4. **Conduction**

- Heat loss to cold solid objects in direct contact
- Baby will gain heat if placed on warm surface
- Prewarm incubator/radiant warmer to ensure warm mattress
- Cover x-ray plates and scales
- Prewarm hands, stethoscopes, blankets and other equipment

### **Defences Against Cold Stress**

#### 1. **Flexed Position of Healthy Term Infant**

- The flaccid/exposed position of the ill/premature baby promotes heat loss

#### 2. **Brown Adipose Tissue**

- Deposited after 28 weeks principally around scapulae, kidneys, adrenals, neck and axilla
- Lipolysis leads to release of heat to the perfusing blood
- Major means of heat production

#### 3. **Peripheral Vasoconstriction**

*\* Core temperature drops only when the baby's effort to maintain temperature production has failed; therefore, normal infant temperature does not rule out cold stress.*

### **Consequences of Cold Stress**

#### **Increased Metabolic Use of Calories**

- Failure to gain weight or weight loss

#### **Increased Oxygen Consumption**

- May lead to hypoxia, acidosis and respiratory distress

#### **Rapid Depletion of Glycogen**

- Resulting in hypoglycemia

If allowed to continue the baby may develop shock and disseminated intravascular coagulation (DIC) leading ultimately to death.

### **Prevention of Cold Stress**

1. Birthing room (operating room for Caesarean birth) and nursery kept at 24-26°C (75-80°F).
2. Quickly dry baby after birth and wrap in prewarmed blankets. Placing the healthy naked term infant against mother's naked body

and covering both with prewarmed blankets will also prevent heat loss.

3. Cover the newborn's relatively large head with wool or stockinette hat.
4. Withhold the initial bath until the baby's temperature has stabilized at 36.3-37.2°C.
5. Tub bath rather than sponge bath.
6. Assess well newborn temperature per axilla with an electronic thermometer hourly until stable, once per shift for the first day, and then daily until discharge.

### **Signs of Cold Stress**

- Lethargy
- Feeding intolerance
- Respiratory depression
- Acidosis
- Deceptive bright red colour

### **Management of Cold Injury**

1. **Rewarm Slowly**
  - To avoid hypotension
  - Set incubator temperature/radiant warmer 1-1.5°C warmer than baby and adjust every 15-30 minutes
2. **Undress Baby**
  - A cold baby or any baby on a radiant warmer should be naked
  - A warm baby in an incubator may be dressed
3. **NPO**
  - Intravenous 10% dextrose/water at 80 ml/kg/day
  - Monitor blood sugar
4. **Supplemental O<sub>2</sub> May Be Necessary**
  - Monitor colour and blood gases as necessary

\* *The infant should be rewarmed to 36.3 – 37.2°C prior to transport*

## Equipment

1. Routine use of incubators/radiant warmers for the well baby is discouraged. This equipment is used for the baby who is ill, likely to become ill, small, or requiring phototherapy.
2. An optimal thermal environment chart is kept in the nursery to guide the nurse in manually adjusting incubator temperatures.
3. The labour/birth area/nursery should contain an incubator prewarmed to 35°C.
4. The use of humidified incubators is strongly recommended for VLBW preterm infants and other infants where you are having difficulty with temperature regulation. The risks and benefits of this practice must be weighed carefully against the type/age of incubator and recommended infection control practices (ie. risk of pseudomonas).
5. **When using an incubator, the incubator and baby's temperatures should be recorded hourly for the first four hours and at least every four hours thereafter.**
6. If a radiant warmer is used, a skin (ISC) probe should be used to control baby's temperature. The probe is placed on the infant's abdomen or back covered with a reflective disk and the temperature control set at 36.6°C. The baby must not lie on the probe. Care should also be taken that the probe does not fall off. The baby's temperature is assessed hourly.
7. If a radiant warmer is used without a Servo Control heat regulator the baby's temperature must be taken and recorded every 10 minutes.
8. Skin (ISC) probes may mask temperature instability; therefore, heater output (temperature) should be recorded when radiant warmers are used.
9. Radiant warmers cause high insensible water loss and promote evaporative heat loss (*encourage use of isolettes, especially for VLBW infants*). The infant's fluid requirements will need to be individualized and sometimes increased to more than 200 ml/kg/day. Urine osmolality and specific gravity are observed (keeping the latter below 1.012).
10. When caring for the baby on a radiant warmer, do not lean over the baby, thus preventing radiant heat from reaching him/her.
11. **Radiant warmers reheat infants by radiant heat! Therefore, do not cover a baby under radiant unit with blankets, etc.**

12. Ill babies transported from the operating room to the nursery following Caesarean birth should be moved in a heated transport incubator.

### **Suggested Reading**

1. The ACoRN Editorial Board, *ACoRN, Acute Care of At-Risk Newborns*, Vancouver, BC, 2005.
2. Health Canada, *Family-Centred Maternity and Newborn Care: National Guidelines*, Minister of Public Works and Government Services, Ottawa, 2000.