Neonatal Thermoregulation
Julia Petty
Neonatal Physiology

- Neonatal physiology predisposes to poor thermal control
- Wet skin at birth and high surface area to body ratio – lost heat via skin surface.
- Immature hypothalamus
- Lack of subcutaneous fat (term) and/or adipose tissue or brown fat (preterm)
- Poor energy stores and limited brown fat = limited thermogenesis (heat production)
Neutral thermal environment (NTE)

- NTE – is the optimum environmental temperature to ensure the lowest oxygen and energy expenditure (Merenstein & Gardner, 2006)
- The neonate may have to cope with either of two extremes – ‘THERMAL STRESS’
- Excessive HEAT LOSS or excessive HEAT GAIN, both of which are stressors.

- Sherman et al, 2006; Bissinger & Annibale, 2010
Methods of heat loss

- EVAPORATION – heat loss through wet skin
- CONVECTION – heat loss from cooler air circulating around warmer skin particularly when exposed
- CONDUCTION – heat loss through direct contact with a cold surface (e.g. scales, unwarmed mattress)
- RADIATION – heat loss from heat radiating towards a cooler surface (e.g. a cold window, wall or incubator wall)
This baby will lose heat by evaporation through a wet skin after birth. Drying and wrapping OR skin to skin contact plus a hat is required.
This baby is exposed so may lost heat via conductive air currents particularly if the room is cool
This baby may lose heat by both convection and conduction via direct contact with cool scales.
The Metabolic triangle (Aylott, 2005 a&b)

- There is an important relationship between maintaining adequate oxygenation, temperature and blood glucose levels. A change in one affects the other.
Effects of Cold

- Decreased Surfactant efficiency
- Increased oxygen consumption – respiratory distress
- Increased utilisation of calorie reserves - hypoglycaemia
- Increased postnatal weight loss
Thermal care

- Monitor temperature & observe for instability
- Methods to keep baby warm / prevent heat loss – skin-to-skin contact, cover/wrap, hats, plastic wrapping for preterm neonates in delivery suite and then humidification
- Maintain the neutral thermal environment
- Incubator / Babytherm / Cot?
  - Sinclair et al, 2009; Allen, 2011
### Prevention of hypothermia

<table>
<thead>
<tr>
<th>Sources of heat loss</th>
<th>Preventive measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conduction</td>
<td>Warming blanket</td>
</tr>
<tr>
<td></td>
<td>Drapes or blankets</td>
</tr>
<tr>
<td></td>
<td>Head covering</td>
</tr>
<tr>
<td></td>
<td>Warmed solutions</td>
</tr>
<tr>
<td>Convection</td>
<td>Room temperature to 26.6°C (80°F)</td>
</tr>
<tr>
<td></td>
<td>Incubator</td>
</tr>
<tr>
<td></td>
<td>Keep neonate covered</td>
</tr>
<tr>
<td>Radiation</td>
<td>Radiant warmer</td>
</tr>
<tr>
<td></td>
<td>Wrap neonate</td>
</tr>
<tr>
<td></td>
<td>Warm room</td>
</tr>
<tr>
<td>Evaporation</td>
<td>Heated, humidified inspired gases AND body humidification</td>
</tr>
<tr>
<td></td>
<td>Plastic bags / wrap for preterm (&lt;28-30 weeks)- (Resus Council 2010)</td>
</tr>
</tbody>
</table>
Wearing a hat is important as significant heat may be lost through the head

Image Source: © Darren Brode (Photographer) | Dreamstime.com
Skin to skin contact so that baby can gain conductive heat from the mother. Early breast feeding can also commence.
Pre-warm the incubator, if required, to the optimum NTE temperature. Humidity can be added for preterm neonates.
Neonates born preterm are placed into plastic wrapping / bag at delivery until they are placed into a humidified incubator.
If attention is required at delivery, the radiant warmer on the resuscitaire should be pre-warmed.
Further reading

- Aylott, M. (2006b) The Neonatal energy triangle part 2; Thermoregulatory and respiratory adaptation *Paediatric Nursing*. 18, 7, 38-43
Continued…


