**Warmth**

Prevent Hypothermia
- Labour ward and theatre must be kept at 24 - 26°C
- Dry babies immediately after birth with a soft towelling towel and wrap in a second warm, dry towel
- Ensure that there is a good overhead heater in the infant resuscitation area
- Keep incubators and resuscitators warm, even when not in use
- Keep the baby with the mother in the kangaroo position (KMC)
- Nurse babies less than 1.5kg in an incubator or in KMC, continue KMC even after discharge
- Keep the room (nurseries, post natal wards) warm i.e. at 24 - 26 C, but not higher

Temperature settings for closed incubators

<table>
<thead>
<tr>
<th>Birth weight</th>
<th>Days after delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 1000 g</td>
<td>0.5</td>
</tr>
<tr>
<td>1000 g - 1500 g</td>
<td>35.5</td>
</tr>
<tr>
<td>1500 g - 2000 g</td>
<td>35.0</td>
</tr>
<tr>
<td>2000 g - 2500 g</td>
<td>34.0</td>
</tr>
<tr>
<td>2500 g - 3000 g</td>
<td>33.5</td>
</tr>
<tr>
<td>&gt; 3000 g</td>
<td>33.0</td>
</tr>
</tbody>
</table>

**Food**

How Much to Give

<table>
<thead>
<tr>
<th>Total fluids (ml/kg/day)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td>60</td>
</tr>
<tr>
<td>Day 2</td>
<td>90</td>
</tr>
<tr>
<td>Day 3</td>
<td>120</td>
</tr>
<tr>
<td>Day 4</td>
<td>150</td>
</tr>
<tr>
<td>Day 5</td>
<td>150</td>
</tr>
<tr>
<td>Day 6</td>
<td>150</td>
</tr>
<tr>
<td>Day 7</td>
<td>150</td>
</tr>
</tbody>
</table>

What to Give

Feed all babies within 30 minutes of birth (unless contraindicated e.g. severe respiratory distress)

If the baby is able to suckle
- Babies more than 24 weeks gestation are usually able to suckle
- Initiate breastfeeding within 30 minutes of birth
- Allow mothers to breastfeed on demand (at least 8 a day) and practice rooming in

If the baby should not be fed yet (6GT or airway problems)
- Commence IV nutrition fluids (if oral intake is impossible)
- Oral feeds can be continued slow for a maximum of 3 days. Thereafter, if still unable to feed, arrange for transfer

**Infection**

Prevent
- Screen for syphilis antenatally
- Ensure the PMTCT protocol is followed exactly
- Take maternal pyrexic, P/PROM seriously
- Wash your hands between every baby
- Staff your nursery properly, and with a clearly identified sister in charge at all times
- Do not overcrowd
- Ensure adequate spacing between babies
- Have dedicated nursery equipment
- Ensure sterile preparation of ALL feeds

Suspect
- Regard all preterm babies as at risk
- Take non-specific signs (lethargy, poor feeding, hypoglycaemia, respiratory distress) seriously

Find and Identify
- If bacteremia is possible do:
  - Blood culture
  - Lumbar puncture
  - Urine dipstick

Treat
- Maintain and monitor temperature, blood sugar and O2 saturation
- Use:
  - 1. Ampicillin 50mg/kg/dose 12 hourly IV and 2. Gentamicin 5mg/kg/dose 24 hourly
NEONATAL RESUSCITATION

Do it right now

ASSESS BREATHING, COLOUR AND HEART RATE every 30 seconds during the resuscitation. If the baby is improving then the intervention can be stopped. If the baby is not responding or getting worse then further intervention is needed.

The HEART RATE is the best marker of progress, in either direction.

A: Airway

- Remove meconium or blood, if present, before stimulation (by wiping face, nose and mouth and suctioning the mouth then nose)
- Warm, position, clear airway, dry and stimulate
- Assess HEART RATE, BREATHING and COLOUR
- If blue, but breathing and HR > 100 per minute administer oxygen

B: Breathe

If blue, HR < 100 per minute and/or inadequate or absent breathing

- Ventilate with bag and Laerdal® neonatal mask (round, clear, silicone): squeeze bag firmly at a rate of 60 breaths (counting “bag, 2,3” for the correct rate). DON'T use a “Sampson Pump”
- Most babies will be successfully resuscitated by bag and mask only
- Ventilate for 30 seconds then reassess
- Assess HEART RATE, BREATHING, and COLOUR

Intubate if the heart rate stays < 60 per minute, or respiratory effort is poor

C: Chest Compressions

If heart rate < 60 per minute

- Begin chest compressions, using the hand encircling technique, if two people are available, otherwise the two finger or single hand encircling technique. Give the compressions at the lower third of the baby’s sternum and compress to 1/3 the depth of the baby’s chest. Squeeze the blood out of baby’s heart
- Give three compressions followed by one breath, in a 2 second cycle (counting “1,2,3 bag” for the correct rate)
- Compress for 30 seconds then reassess
- Assess HEART RATE, BREATHING, and COLOUR

If HR is less than 60 per minute, intubate and give drugs

D: Drugs

- Give ADRENALINE 1:10 000 (1ml 1:1000 + 9ml normal saline in a 10ml syringe) in dose of 0.1ml/kg IV or via ETT every 3-5 minutes as required to get HR > 100 per minute
- Administer “adult” NALOXONE 0.1mg/kg (=0.25ml/kg of naloxone 0.4mg/ml) IM/SC/ETT only if mother received pethidine or morphine within 4 hours of delivery (DO NOT use “neonatal narcan”)

E: Exit (i.e. when to stop)

- No heartbeat for 15 minutes
- Spontaneous breathing not established in 20-30 minutes

When making the difficult decision to stop resuscitation, make the decision jointly with a colleague, even if this is over the telephone while your assistant continues ventilation

Make sure you have a copy of the Neonatal Resuscitation Poster in your Labour ward, Theatre and Nursery
**Neonatal Resuscitation**

**IS BABY...**
1. Breathing adequately?
2. Heart rate above 100?
3. Centrally pink?

**YES**

**AIRWAY**
Remove MECONIUM or BLOOD if present, before stimulating.

**Assess**
BREATHE, COLOR and HEART RATE

**Breathing, blue, HR > 100 ADMINISTER OXYGEN**

NO

**BREATHE**
May and may not breathe at birth.

**Assess**
BREATHE, COLOR and HEART RATE

**HR < 60**

**CHEST COMPRESSIONS**
10 compressions /1 minute

**HR > 60**

**DRUGS**
Correct all correctable problems

**EXIT**
- Asystole > 15 minutes
- TSR > 20 minutes

**ETT size**
Small baby: 2.5
Normal baby: 3.0
Big baby: 3.5

**ETT length (oral)**
1kg: 7cm
2kg: 8cm
3kg: 9cm
(add 1 cm for nasal intubation)

**Drug & Dose**
<table>
<thead>
<tr>
<th>Drug &amp; Dose</th>
<th>Points to note</th>
<th>Give</th>
<th>Route</th>
</tr>
</thead>
<tbody>
<tr>
<td>Naloxone (0.1 mg/kg)</td>
<td>-Use &quot;adult&quot; naloxone ampoules - 0.1 mg = 0.25 ml</td>
<td>1 kg = 0.25 ml</td>
<td>IV/IM SC/ETT</td>
</tr>
<tr>
<td>Ringers Lactate or Normal Saline (10 ml/kg)</td>
<td>-Normal saline = 0.9% saline - For volume expansion</td>
<td>1 kg = 10 ml</td>
<td>IV</td>
</tr>
<tr>
<td>Adrenaline (0.3 ml/kg 1:1000)</td>
<td>-Dilute 1 ml 1:1000 adrenaline with 9 ml normal saline for a 1:10 000 solution</td>
<td>1 kg = 0.3 ml</td>
<td>IV/ETT</td>
</tr>
<tr>
<td>Sodium Bicarbonate (2.0 ml/kg 2.25%)</td>
<td>-Dilute 8.5% NaHCO₃ with equal volume of water or use 4.25% - Do not give via ETT</td>
<td>1 kg = 2 ml</td>
<td>Slow IV push</td>
</tr>
<tr>
<td>Glucose (20 ml/kg 10%)</td>
<td>-10% dextrose (neonatal is 10%) - Use to correct hypoglycaemia</td>
<td>1 kg = 2 ml</td>
<td>IV or oral</td>
</tr>
</tbody>
</table>

**Anticipate**

**Communicate**

**Aspirate**

**Stimulate**

**Inflate**

**Circulate**

**Medicate**

**Investigate**

**Accommodate**

**Perambulate**

**Educate**

**Do it right now...**

**Anticipate**

**Communicate**

**Aspirate**

**Stimulate**

**Inflate**

**Circulate**

**Medicate**

**Investigate**

**Accommodate**

**Perambulate**

**Educate**

**Find the risk factors that predict neonatal problems:**
- Maternal
- Foetal
- Intrapartum

**When called to resuscitate a baby you must know about:**
- Gestation
- Meconium stained liquor
- Maternal drugs, esp opiates
- Foetal distress
- Indication for assisted delivery (including caesarean)

**If there is meconium present, you must get rid of it using a proper SUCTION catheter of adequate SIZE (FG10)**
- Suction the mouth & nose before delivering the shoulders
- On resuscitation surface, suction under direct vision

**The best way to stimulate babies is to dry them with a pre-warmed towel**

**Use an ambu bag**

**Compress 1/3 of chest diameter**

**There is no point compressing the heart, if the preceding resuscitation steps have not been followed**

**Naloxone, if indicated, should be given early**

**Adrenaline, if indicated, should be given stat**

**Bicarbonate, if indicated, should be given only if adequate ventilation has been achieved**

**Always ask the birth attendant (doctor or midwife) for a loop of cord, when foetal distress has been present, for acid-base investigation (if available), within ½ hour of birth**

**ALL hospitals should have acid-base analysis capacity**

**Always record time to spontaneous respiration (TSR), and propose**

**Decide timely where baby will go after resuscitation, so that plans can be made to accommodate her/him in the nursery if necessary**

**If baby needs to go to the nursery, for ongoing care, use a warmed transport incubator with an adequate oxygen supply**

**Explain to baby’s parents what has happened (good and bad)**

**Document your resuscitations, and reflect on whether or not everything was “done right now”**
At medical school we are taught that good clinical methodology requires for each patient a history, examination, assessment and plan. After medical school, history taking seems to fall by the wayside, nowhere more so than for neonates. This is to remind you that history taking is just as important for neonates as for any other category of patient, and to provide a structure for history taking and clerking.

Write the DATE and TIME, and PRINT your name, every time you see the patient

State the reason for admission: The main problems (# list)

Background
Father:
Name, age, occupation, health status

Mother:
Name, age, occupation
Past Medical History: HIV, medical, surgical, smoking, alcohol
Past Obstetric History: gravida, parity, problems (a history of a perinatal death in a previous pregnancy is one of the most important predictors of problems in this pregnancy)

Current
1) Pregnancy
Booking date, LMP, EDD (by dates/palpation/ultrasound)
HIV (including CD4 & ARV’s, feeding choice), VDRL, Blood group
ANC attendance and problems (maternal/foetal)
2) Labour
Onset and duration, reason for onset
Rupture of membranes (mode and duration)
Problems (maternal and foetal)
Nevirapine
3) Delivery
Mode and reason, presentation, liquor, problems
4) Resuscitation
Interventions and response, apgars
Doctors and nurses present, by name
5) Examination
Weight and estimated gestational age, nevirapine, feeding choice
Full neonatal examination (use the checklist on page 2 of the "Infant Care Record")
6) Assessment:
The problem list (this is why you do a history and examination, and the baby needs you to construct a clear and complete problem list)
7) Plans
For each listed problem, separately

Continuation
Review active problems as required using the problem specific approach (Subjective; Objective; Assessment; Plan). Think about each problem every day until it is resolved or there is a long term plan. Never allow a problem to fall off the list by default. Never overlook a newly identified problem.

Medico-legal
PRINT your surname at least on the first occasion that you write notes for each baby.
The procurement process requires that you may not stipulate a specific company.
Where a company has been selected below it is following extensive sampling and the decision has been made on quality, cost effectiveness and reliability.
When ordering state that the item has been previously ordered from that company to guide the awards committee.
Effective use of standard complaint forms can also help in eliminating those items that are of poor quality. We do not have to accept poor quality products at the expense of our patients just because we are in the state health system.

<table>
<thead>
<tr>
<th>ITEM</th>
<th>SIZE</th>
<th>CODE</th>
<th>COMPANY</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AIRWAY MAINTENANCE</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suction tubes</td>
<td>6</td>
<td>520.25 / 100/105/025</td>
<td>Vygon OR Portex</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>520.30 / 100/105/030</td>
<td>Vygon OR Portex</td>
</tr>
<tr>
<td>ET tubes (neonatal: soft, non-rigid, straight, non-cuffed, non-shouldered)</td>
<td>2.5</td>
<td>520.35 / 100/105/035</td>
<td>Vygon OR Portex</td>
</tr>
<tr>
<td></td>
<td>3.0</td>
<td>520.35 / 100/105/035</td>
<td>Vygon OR Portex</td>
</tr>
<tr>
<td></td>
<td>3.5</td>
<td>520.35 / 100/105/035</td>
<td>Vygon OR Portex</td>
</tr>
<tr>
<td>Oropharyngeal airway</td>
<td>000</td>
<td>Pega 92000</td>
<td>Trigate</td>
</tr>
<tr>
<td></td>
<td>00</td>
<td>Pega 9200</td>
<td>Trigate</td>
</tr>
<tr>
<td>Nasal prongs</td>
<td>Small - premature</td>
<td>1611 050 70040</td>
<td>Ibuki (Newco Medical) OR Hiline medical</td>
</tr>
<tr>
<td>Face mask (Transparent Infant Round Silicon)</td>
<td>0</td>
<td>15000</td>
<td>C.J. Healthcare</td>
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<tr>
<td>Replagle suction catheter</td>
<td>10CH</td>
<td>8888-256503</td>
<td>Sherwood</td>
</tr>
</tbody>
</table>

NB: 02 blender and a SATS monitor essential

<table>
<thead>
<tr>
<th>ITEM</th>
<th>SIZE</th>
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<th>COMPANY</th>
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</thead>
<tbody>
<tr>
<td><strong>IV ACCESS</strong></td>
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<tr>
<td>IV cannula</td>
<td>22G</td>
<td>Jelco</td>
<td></td>
</tr>
<tr>
<td></td>
<td>24G</td>
<td>Jelco</td>
<td></td>
</tr>
<tr>
<td>Umbilical catheter</td>
<td>5F</td>
<td>ACL 7158307</td>
<td>Vygon</td>
</tr>
<tr>
<td>Rate minder (Flow rate controller)</td>
<td>05010</td>
<td>Axel Medical</td>
<td></td>
</tr>
<tr>
<td>3-way Stopcock</td>
<td>4310022</td>
<td>Eastern Medikit</td>
<td></td>
</tr>
<tr>
<td>60 dropper giving set (or dedicated giving set for infusion pump, depending on infusion pump)</td>
<td>Various (Sabac)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mini volume extension set (Y-connector)</td>
<td>2C5681</td>
<td>Baxter (and various)</td>
<td></td>
</tr>
<tr>
<td>Paediatric low volume syringe pump set</td>
<td>+/-150 cm</td>
<td>Various depending on pump</td>
<td></td>
</tr>
<tr>
<td>Blood giving set</td>
<td></td>
<td>Sabac</td>
<td></td>
</tr>
<tr>
<td>Syringe (for use with syringe pump)</td>
<td>50ml</td>
<td>8728810F</td>
<td>Various eg BD, terumo, OPS</td>
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<tr>
<td>Buretrol</td>
<td></td>
<td>AFC 2421</td>
<td>various</td>
</tr>
<tr>
<td>Neonalyte /neolyte</td>
<td></td>
<td>FSN 000200</td>
<td>various</td>
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</table>

<table>
<thead>
<tr>
<th>ITEM</th>
<th>SIZE</th>
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<tbody>
<tr>
<td><strong>STRAPPING</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Zinc oxide strapping</td>
<td>75cm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Micropor (for IV strapping)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neonatal transparent dressing</td>
<td>4.4cm x 4.4cm</td>
<td>1622w 3m</td>
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</tr>
<tr>
<td>(tegadem)</td>
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<td></td>
</tr>
<tr>
<td>TBCO (for skin prep)</td>
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</table>

<table>
<thead>
<tr>
<th>ITEM</th>
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<tbody>
<tr>
<td><strong>ELIMINATION</strong></td>
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<td></td>
</tr>
<tr>
<td>Nappies</td>
<td></td>
<td>&quot;Little Miracle&quot; SA Preemies ASC</td>
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<tr>
<td>Nappies</td>
<td>Small</td>
<td></td>
<td>Logan medical / Kimberly Clark</td>
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<tr>
<td>Paediatric urine collector (bag)</td>
<td>100 ml</td>
<td></td>
<td>Various</td>
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<tr>
<td>Urine catheter silicon (no bulb)</td>
<td>5FG</td>
<td>SIUDC 5.0</td>
<td>Arrow</td>
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<tr>
<td>Urine catheter with bulb and introducer</td>
<td>6FG</td>
<td></td>
<td>Various</td>
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<tr>
<td>Neonatal urine catheter bag</td>
<td>5156</td>
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<td>Convatec</td>
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<td>ITEM</td>
<td>SIZE</td>
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<tr>
<td>------------------------------</td>
<td>------</td>
<td>----------</td>
<td>-----------------</td>
</tr>
<tr>
<td>GIT FEEDING / DRAINAGE</td>
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<tr>
<td>Litmus paper</td>
<td>6</td>
<td>136</td>
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<tr>
<td>Feeding tubes (with depth marking)</td>
<td>8</td>
<td>136</td>
<td>Various</td>
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<tr>
<td>BP cuffs (soft)</td>
<td>2</td>
<td>5202</td>
<td>Various</td>
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<tr>
<td></td>
<td>3</td>
<td>5203</td>
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</tr>
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<td></td>
<td>4</td>
<td>5204</td>
<td></td>
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<tr>
<td>Phototherapy eye shields</td>
<td>Micro, prem, regular</td>
<td>900644,900643, 900642</td>
<td>Brittan Healthcare</td>
</tr>
<tr>
<td>Sheath grip for attaching SATS probes (normally used for pals tubing)</td>
<td></td>
<td></td>
<td>Various</td>
</tr>
<tr>
<td>Tubigrip (for baby caps)</td>
<td>Prem</td>
<td>900644</td>
<td>Brittan Healthcare</td>
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<tr>
<td></td>
<td>Term</td>
<td>900643</td>
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</tr>
<tr>
<td></td>
<td>E</td>
<td>900642</td>
<td>Brittan Healthcare</td>
</tr>
<tr>
<td></td>
<td>H</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INTER-COSTAL DRAINS</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Chest drain (troc)</td>
<td>8</td>
<td>Ch 8888560805</td>
<td>TYCO</td>
</tr>
<tr>
<td>Blood giving sets (cut off to use as drainage tubes)</td>
<td>10</td>
<td>Ch 8888561019</td>
<td>Sherwood</td>
</tr>
<tr>
<td>Urine specimen container (for underwater bottle)</td>
<td></td>
<td></td>
<td>Provincial Laboratory</td>
</tr>
<tr>
<td>Transparent dressing (to secure chest drain to chest)</td>
<td>10cm x 12cm</td>
<td>4630</td>
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<tr>
<td>MEDICATION AND BLOODS</td>
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<tr>
<td>Disposable syringe (tuberculin)</td>
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<tr>
<td>Heparinised syringe</td>
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</tr>
<tr>
<td>Paediatric blood tubes</td>
<td>Various</td>
<td></td>
<td>Provincial Laboratory</td>
</tr>
<tr>
<td>23G needle</td>
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<tr>
<td>25G needle</td>
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<td>Various</td>
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<tr>
<td>PACKS</td>
<td>QUANTITY</td>
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<tr>
<td>Neonatal Procedure</td>
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</tr>
<tr>
<td>(packed in dressing towel)</td>
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<td></td>
</tr>
<tr>
<td>Keyhole drape</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gown</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gauze</td>
<td>10</td>
<td></td>
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</tr>
<tr>
<td>Galley pot</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mosquito forceps</td>
<td>2</td>
<td></td>
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</tr>
<tr>
<td>Iris dilating forceps</td>
<td>- toothed</td>
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<td></td>
</tr>
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<td></td>
<td>- untoothed</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>General Procedure</td>
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<tr>
<td>(packed in dressing towel)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Keyhole drape</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gown</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Galley pot</td>
<td>2</td>
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</tr>
<tr>
<td>Gauze</td>
<td>10</td>
<td></td>
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</tbody>
</table>
REFERRAL CRITERIA FOR SICK NEONATES

It is National Health Policy that ALL babies should have EQUAL and APPROPRIATE access to ALL levels of care. When decisions need to be made about where sick babies should best be cared for, it is necessary to be guided by region-specific admission and exclusion criteria, so that, for each baby, APPROPRIATE care plans can be devised. These criteria, and the final decisions that are made for individual babies, are based both on resources available and on the individual baby’s prognosis.

Admission Criteria
If any of the following conditions exist or are suspected contact your referral centre to discuss possible transfer of your patient for further care:

| Gestation and Weight | | |
|---------------------|------------------|
| Preterm infants > 28 weeks or birth weight > 1 kg |

| Respiratory System | | |
|--------------------|------------------|
| Respiratory distress from any cause which requires > 60% head box oxygen to maintain oxygen saturation above 85% |
| Congenital abnormalities |

| Cardiovascular System | | |
|-----------------------|------------------|
| Congenital cyanotic heart disease |
| Cardiac failure unresponsive to treatment |

| Central Nervous System | | |
|------------------------|------------------|
| Status epilepticus |
| Convulsions with inadequate facilities to investigate |

| Gastrointestinal Tract | | |
|------------------------|------------------|
| Congenital abnormalities including abdominal wall defects, intestinal obstructions and anorectal malformations |
| Necrotising enterocolitis |
| Persistent GIT bleeding |

| Genitourinary System | | |
|----------------------|------------------|
| Severe congenital abnormalities of kidney, bladder or genitalia |
| Renal failure |

| Haematological | | |
|----------------|------------------|
| Severe or persistent bleeding |

| Metabolic | | |
|-----------|------------------|
| Neonatal Jaundice: |
| □ onset within first 24 hours of life |
| □ if associated with positive Coomb’s test |
| □ if approaching exchange levels |
| Persistent or recurrent hypoglycaemia |
| Inborn errors of metabolism (acidosis / hypoglycaemia / neurological signs) |

Not meeting these designated inclusion criteria does not imply the meeting of exclusion criteria.
Exclusion Criteria

Babies with the following conditions are not suitable for ventilation or more sophisticated care and are unlikely to be admitted to a referral centre.

If you are uncertain please discuss individual babies with your referral unit (See guideline: "Transferring Neonates to a Higher Level of Care").

Gestation and Weight

- Babies < 1000 grams or 28 weeks gestation
- Between 900 and 1000 grams, IPPV may be considered in special circumstances, following discussion with a Paediatrician

Perinatal Hypoxia / Birth Asphyxia

Babies exposed to perinatal hypoxia, which have the following problems:

- no heartbeat at 15 minutes
- time to spontaneous respiration > 20 minutes
- 10 minute apgar < 6 AND cord arterial blood base excess < -10 AND / OR pH < 7.1
- Grade III / severe Hypoxic Ischaemic Encephalopathy

Major Congenital Abnormalities

- Babies with major congenital abnormalities where involvement of one or more organ systems is deemed incompatible with life

Intra / Periventricular Haemorrhage

- Grade IV
- Grade III, with other complications / other organ involvement
- Severe periventricular leukomalacia

HIV / AIDS / MTCT

- Babies known to be HIV-exposed who are severely ill at birth, with multi-organ involvement
- Babies who are sick at birth, and whose mothers have advanced, symptomatic AIDS

Not meeting these designated exclusion criteria does not imply the meeting of inclusion criteria

Appropriate management must be provided for babies not eligible for admission to an ICU. This must focus on providing warmth, oxygen, fluids and nutrition.
PROCEDURE FOR TRANSFERRING NEONATES TO THE PIETERMARITZBURG METROPOLITAN HOSPITALS COMPLEX

The movement of sick newborn babies is frequently hazardous and has the potential to compromise the wellbeing of the baby.

1) There are therefore a number of different ways to support healthcare workers and newborn babies in district hospitals:
   - A telephonic consultation
   - During a monthly consultant visit to the district hospital
   - Transfer to a referral centre for an out patient consultation or admission

Grey’s Hospital functions as a single entry point for all children in the Western half of KwaZulu-Natal into the paediatric and child health services in Pietermaritzburg. If you need to refer a newborn baby for admission to this service please proceed as follows.

2) To access support from the Pietermaritzburg Metropolitan Hospitals Complex the referring MO needs to:
   - Phone the appropriate person listed below to discuss the patient:

<table>
<thead>
<tr>
<th>Time</th>
<th>Ask for...</th>
<th>NICU registrar</th>
<th>Phone number</th>
</tr>
</thead>
<tbody>
<tr>
<td>08h00 – 16h00</td>
<td>Ask for...</td>
<td>NICU registrar</td>
<td>033-8973783</td>
</tr>
<tr>
<td></td>
<td>If no response</td>
<td>Dr Graham Ducasse</td>
<td>083-325-7569</td>
</tr>
<tr>
<td>After hours &amp; weekends</td>
<td>Ask for...</td>
<td>Nursery MO on-call</td>
<td>033-8973783 / 3363</td>
</tr>
</tbody>
</table>

If no response at any time, ask Grey’s switchboard to contact the paediatric consultant on call.

- Provide details of the patient and an easily contactable telephone number (preferably a cell number and NOT a switchboard number) for the Grey’s doctor to contact you
- The Grey’s Hospital doctor will either provide telephonic advice or will identify a bed in Pietermaritzburg and notify the referring MO of the relevant details
- The referring MO then needs to arrange transport with Emergency Medical Rescue Service

3) In all instances it is essential that:
   - Telegraphic discussions occur to access support and to prevent or arrange for the transfer of the baby
   - The mother/caregiver must ALWAYS accompany the baby (if this absolutely not possible, it is the responsibility of the referring MO to arrange for tracing and transporting a caregiver)
   - Detailed documentation must accompany the baby with full antenatal, intrapartum and postnatal records of both the mother and the baby, either in a letter or as copies of the original records

For all paediatric and neonatal transfers, use the “Monitoring Sheet for Neonatal Transfers” (Form Paed/31) to monitor the condition of the child and track transfer plans.

Any problems with the above process need to be reported to Dr N McKerrow, Chief Specialist and Head of Department at 033-8973264.
TRANSPORTING NEONATES

Transporting small or sick newborn babies always poses the risk of aggravating their clinical condition. It is therefore essential that the transfer of a small or ill baby is done in a manner that will minimize potential harm and ensure arrival at the referral hospital in as optimal a state as possible.

Communication

- Contact referral centre telephonically:
  - initially to ensure acceptance of the patient and to obtain advice on interim management
  - at departure to give time of departure, and estimated time of arrival
- A referral letter with full antenatal, intrapartum and postnatal details must accompany the baby. You can also photocopy the Newborn Care Record to send with the baby.

Stabilization Phase

- Fluid resuscitation:
  - ensure IV access
  - ringers lactate, plasma or blood, whichever is appropriate, in 10 to 20ml/kg boluses, repeated twice to achieve capillary filling time of < 3 seconds and/or adequate blood pressure
- Check for hypoglycaemia, and correct if blood glucose is < 2.5mmol/l
- Ensure adequate airway and oxygen saturation
- Ensure adequate warmth
- Insert nasogastric tube with open drainage to decompress the bowel

Transportation Phase

- Ensure stabilization phase is complete and baby stable

DO NOT TRANSPORT AN UNSTABLE BABY

- Ensure adequate and appropriate personnel, equipment and supply of consumables (drugs, fluids, oxygen, etc) for the trip
- Maintain warmth by transporting in a transport incubator, or with kangaroo mother care if stable enough
- Monitoring:
  - monitor pulse and oxygen saturation of all ill neonates. Aim for oxygen saturation of 88-93%
  - monitor capillary refill time and blood glucose (especially for trips > 1 hour)
  - if feasible, also monitor blood pressure and aim for a mean arterial pressure of 35mmHg

FOR ALL TRANSFERS USE THE “MONITORING SHEET FOR NEONATAL TRANSFERS” (Form Paed/31)
Apnoea in the neonatal period is a potentially life-threatening or brain-threatening condition. Apnoea of immaturity MUST be prevented. In others, the underlying cause must be treated.

**Definition**

Apnoea is the cessation of breathing for long enough (usually > 20 seconds) to cause bradycardia together with cyanosis and/or pallor.

Apnoea should be distinguished from periodic breathing, which usually occurs in babies less than 34 weeks gestation. Babies with periodic breathing stop breathing for a shorter duration, do not develop cyanosis or bradycardia, and spontaneously resume breathing without stimulation.

Who is at risk?
The commonest cause is apnoea of immaturity due to an immature respiratory centre, usually in preterm infants < 34 weeks gestation. Apnoea of immaturity is uncommon in the first 4 days, or in a baby who has been apnoea-free.

**Those at risk who catch us out...**

Apnoea may be the first or only manifestation of:

1) **Convulsions**: if you treat the convulsions the apnoea often goes away (see Convulsions guideline)
2) **Sepsis neonatorum**: (See Sepsis neonatorum guideline)
3) Anatomical or exogenous (including mucous) **obstruction of the respiratory tract** (nose to alveolae): remove or bypass the obstruction
4) **Hypothermia** and **hypoglycaemia** (see specific guidelines)
5) **Acidosis**

**Investigations**

- Check blood sugar and temperature immediately
- Other investigations, guided by clinical examination, include CXR, FBC and differential, U&E, calcium, glucose, septic screen (blood culture, LP, urine MCS)

**Management**

- It’s not apnoea of immaturity, assess and manage the underlying cause

**OTHERWISE...**

Prophylactic Aminophylline/Theophylline/Caffeine must to be given to all preterm babies < 34 weeks. *(Caffeine is better)* Give it as soon after birth as possible.

Toxicity warning signs: tachycardia, feed intolerance, seizures

- Prevent apnoea of immaturity through pharmacological stimulation of the respiratory centre. **Prescribe at birth:**
  - AMINOPHYLLINE IV slowly or THEOPHYLLINE PO: loading dose 5mg/kg. Maintenance 1-2mg/kg/dose, 12 H. Continue to +/- 34 weeks.
  - OR...
  - CAFFEINE PO loading dose: 20mg/kg. Maintenance 5mg/kg 24H PO. Continue to +/- 34 weeks

- Monitor (apnoea monitor, pulse oximeter, cardiac monitor) and give O₂ if required to keep sats between 85 – 95%

It is dangerous to give oxygen to infants with apnoea of immaturity if they do not need it

- Manual stimulation when needed

Infants with repeated apnoea, in spite of theophylline, should be referred to a specialist hospital for investigation and nasal CPAP/ventilatory support if required. They may need mask and bag ventilation before being transported
Instructions for doing it properly

Obtain a gestational age score on all babies weighing less than 2000g, within 24 hours of delivery. This assists in making appropriate care plans, especially at the limits of viability. It is preferable to wait until baby is "settled" before scoring, but sometimes an early score (soon after delivery) is essential.

Score for both neuromuscular and external/physical features. Add each to give a final score, and then give a maturity rating (in weeks) by referring to the conversion table. Complete the process by plotting baby’s weight and length on the neonatal growth chart, and documenting whether baby is appropriate, under- or overweight for gestational age.

Neuromuscular Maturity

Assess all six features with baby lying supine (spine on bed), and awake but not crying. Refer to the chart while assessing. Accuracy is improved if you assess both sides of the body, and use the average score.

1) Posture:
Observe the posture. Handling the infant may improve the assessment.

2) Square Window:
Flex the hand at the wrist. Exert pressure sufficient to get as much flexion as possible. The angle between the hypothenar eminence and the anterior aspect of the forearm is measured and scored.

3) Arm Recoil:
Fully flex the forearms with the hands at the shoulders for 5 seconds, then fully extend by pulling the hands. Release as soon as the elbows are fully extended, and observe the recoil (degree of flexion at the elbows). Random movements do not count.

4) Popliteal Angle:
With the pelvis flat on the examining surface, use one hand to bring the knee onto the abdomen. With the other hand, gently push behind the ankle to bring the foot towards the face.

5) Scarf Sign:
Take the infant's hand and draw it across the neck and as far across the opposite shoulder as possible, like a scarf. Assistance to the elbow is permissible by lifting it across the body. Score according to the location of the elbow.

6) Heel to Ear:
Hold the infant’s foot with one hand and move it as near to the head as possible without forcing it. The knee may slide down the side of the abdomen. Keep the pelvis flat on the examining surface.

Physical Maturity

The six features examined are self explanatory in the table below.

<table>
<thead>
<tr>
<th>Sign</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin</td>
<td>Sticky, friable, transparent</td>
<td>Gelatinous, red, translucent</td>
<td>Smooth, pink, visible veins</td>
<td>Superficial peeling and/or rash, few veins</td>
<td>Cracking, pale areas, rare veins</td>
<td>Parchment, deep cracking, no vessels</td>
<td>Leatherly, cracked, wrinkled</td>
</tr>
<tr>
<td>Lanugo</td>
<td>None</td>
<td>Sparse</td>
<td>Abundant</td>
<td>Thinning</td>
<td>Bald areas</td>
<td>Mostly bald</td>
<td></td>
</tr>
<tr>
<td>Plantar Creases</td>
<td>Heel-toe 40-50 mm = -1, Heel-toe &gt;50 mm, no creases</td>
<td>Flat red marks</td>
<td>Anterior transverse crease only</td>
<td>Creases over anterior 1/3</td>
<td>Creases over entire sole</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breast</td>
<td>Imperceptible</td>
<td>Barely perceptible</td>
<td>Flat areola, no bud</td>
<td>Stippled areola, 1-2 mm bud</td>
<td>Raised areola, 3-4 mm bud</td>
<td>Full areola, 5-10 mm bud</td>
<td></td>
</tr>
<tr>
<td>Eye &amp; Ear</td>
<td>Lids fused, loosely = -1, tightly = -2</td>
<td>Lids open, pinna flat, stays folded</td>
<td>Slightly curved pinna, soft with slow recoil</td>
<td>Well-curved pinna, soft but ready recoil</td>
<td>Formed and firm, with instant recoil</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Genitals, male</td>
<td>Scrotum flat, smooth</td>
<td>Scrotum empty, faint rugae</td>
<td>Testses in upper canalis, rare rugae</td>
<td>Testses descending, few rugae</td>
<td>Testses down, good rugae</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Genitals, female</td>
<td>Clitoris prominent, labia flat</td>
<td>Prominent clitoris, small labia minora</td>
<td>Prominent clitoris, enlarging minora</td>
<td>Majora and minora equally prominent</td>
<td>Majora large, minora small</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Maturity Rating

Add up the individual Neuromuscular and Physical Maturity scores for the twelve categories, then obtain the estimated gestational age from the table below.

<table>
<thead>
<tr>
<th>Total Score</th>
<th>-10</th>
<th>-5</th>
<th>0</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>20</th>
<th>25</th>
<th>30</th>
<th>35</th>
<th>40</th>
<th>45</th>
<th>50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gestational Age (in weeks)</td>
<td>20</td>
<td>22</td>
<td>24</td>
<td>26</td>
<td>28</td>
<td>30</td>
<td>32</td>
<td>34</td>
<td>36</td>
<td>38</td>
<td>40</td>
<td>42</td>
<td>44</td>
</tr>
</tbody>
</table>

Use a scoring sheet with weight chart (Form Paed/02). Write the score in the designated space on page 1 of the Infant Care Record (Form Paed/01).
**Neonatal Convulsions**

Often a manifestation of an underlying serious problem

Most neonatal seizures will not persist into infancy and there is no evidence that treatment of clinical seizures with anticonvulsants improves outcomes. However, there is consensus that neonatal clinical seizures should be treated, particularly if they are frequent, prolonged or have adverse effects on cardiorespiratory function.

**Diagnosis**

Neonatal convulsions may be overt and obvious, they may be subtle and look like “something else” (like apnoea), or they may be subclinical and detected only on EEG (where available!). The following table describes neonatal seizures.

<table>
<thead>
<tr>
<th>Seizure type</th>
<th>Incidence</th>
<th>Physical characteristics</th>
</tr>
</thead>
</table>
| Subtle       | Most common i.e. 50 – 75% | Orofacial: mouthing, chewing, lip smacking, blinking, eye deviation, fixed open stare  
Limb movements: e.g. pedalling, boxing  
Autonomic: unstable blood pressure, tachycardia, central apnoea |
| Clonic       | 23 – 40%  | Repetitive jerking that cannot be suppressed if limb is held  
Focal or generalised  
Differentiate from jittering |
| Tonic        | 2 – 23%   | Stiffening, sustained posturing of the limbs or trunk or deviation of eyes  
Generalised or Focal (less common) |
| Myoclonic    | 8 – 18%   | Tend to occur in flexor muscle groups, rapid isolated jerks  
Focal, multifocal or generalised  
Differentiate from benign sleep myoclonus |

**Things that can look like convulsions**

1) **Jitteriness** (usually a sign of ill health: e.g. hypoglycaemia, meningitis)
   - no associated eye movements or autonomic phenomena
   - induced by stimulus or spontaneous
   - suppressed by holding the limb

2) **Benign neonatal sleep myoclonus** (usually a sign of good health and contentment)
   - occurs during REM/active sleep
   - not stimulus sensitive

**Causes of neonatal seizures**

In our setting, the main causes are:

1) **Hypoxic-ischaemic encephalopathy** (HIE)
2) Intracranial haemorrhage (IVH/PVH)
3) Intracranial infection: meningitis > encephalitis
4) Electrolyte disturbances: hypoglycaemia, hypocalcaemia, hypomagnesaemia, hyper- and hypo-natraemia
5) Kernicteris

N.B. Babies with HIE are best managed in their district hospital. Neither babies with severe (grade III) HIE nor secondary apnoea are candidates for ventilation.
Management

1) Immediate
   - Evaluation of airway, ventilation and perfusion with **resuscitation** to commence immediately if needed
   - Hypoglycaemia should be looked for and treated promptly
   - History: pregnancy, labour, delivery, resuscitation and a detailed description of the seizure should be documented

2) Stop the convulsion...
   - Indication for treatment of clinical seizures
     - Prolonged > 3 min
     - Recurrent > 3 convulsions in 1 hour
     - Associated with cardiorespiratory compromise
   - LORAZEPAM 0.3mg/kg/dose IV works quickly and has enduring anticonvulsant activity. Refractory cases may need MIDAZOLAM load 0.1-0.3mg/kg + infusion 3mg/kg in 50ml D5W at 1-4 ml/hour. 1ml/hour = 1mcg/kg/min

**Intravenous phenobarbitone is variably available in South Africa**

3) Investigations
   - Blood glucose level
   - Electrolytes: Na⁺, Ca²⁺, Mg²⁺
   - Full blood count
   - Cranial ultrasound may be indicated to exclude gross CNS pathology, but is not effective at detecting subdural and epidural bleeds or identifying parenchymal injury

Further investigations will be dependent on underlying aetiology.
   - Acid-base status
   - Blood culture
   - Lumbar puncture: in our setting HIE and meningitis sometimes occur concurrently, because both are common

4) Treat the underlying cause when known
   - Refer to the relevant guidelines
   - Hypocalcaemia: CALCIUM GLUCONATE 10% (0.22 mmol calcium/ml). If symptomatic, give 0.5 - 1ml/kg (0.11-0.22mmol/kg) IV over 10 minutes stat. Then give 2 - 4 ml of 10% solution/kg/day (0.44 - 0.88 mmol/kg/day) as a continuous infusion IV (this can be added to the neonatalyte)
   - Hypomagnesaemia: MgSO₄ 50% solution (2 mmol/ml). Give 0.1-0.2ml/kg/dose (0.2-0.4 mmol/kg/dose) 12H IV or IM

5) Maintenance anticonvulsant
   - If baby is going to need ongoing anticonvulsant, use PHENOBARBITONE PO: load 20mg/kg, then 5mg/kg/dose 24H
   - In most cases, anticonvulsant can be stopped prior to discharge (do this a few days before discharge)

When to refer
Babies with seizures should be referred:
   - if not contra-indicated by generic exclusion criteria (especially severe HIE)
   - if the seizures are intractable
   - if a cause cannot be identified

Follow up
Follow up needs are determined by underlying cause and residual or anticipated neurological deficit
PERINATAL HYPOXIA ("BIRTH ASPHYXIA") AND HYPOXIC ISCHAEMIC ENCEPHALOPATHY

The commonest avoidable cause of perinatal mortality and morbidity in term babies in South Africa

Definition
Hypoxic ischaemic encephalopathy is a clinical condition that presents with neurological signs in term infants, during the early neonatal period.

Although the focus is on the brain, it is a multi-organ disease, with all organs having been exposed to severe perinatal hypoxia.

 Cause
It is caused by severe perinatal hypoxia together with secondary cerebral ischaemia. A severe re-perfusion injury occurs maximally at about 72 hours.

Diagnosis
Do not jump to the diagnosis of HIE in any baby with encephalopathy. ALWAYS consider the three other COMMON causes – MENINGITIS, HYPOGLYCAEMIA AND ELECTROLYTE ABNORMALITIES – in babies with neonatal encephalopathy.

Take a good labour, delivery and resuscitation history and document the use of and findings on the PARTOGRAM. Also document time to spontaneous respiration.

Clinical signs and severity assessment
Lethargy with poor sucking, increased or decreased tone and poor Moro reflex, irritability, fisting, convulsions, full fontanelle and apnoea.

Severity score
Use the HIE score to measure the severity of the clinical signs on a daily basis. Anyone can do this.

<table>
<thead>
<tr>
<th>HIE Scoring Chart</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>0</strong></td>
</tr>
<tr>
<td>Level of consciousness</td>
</tr>
<tr>
<td>Tone</td>
</tr>
<tr>
<td>Seizures</td>
</tr>
<tr>
<td>Posture</td>
</tr>
<tr>
<td>Moro</td>
</tr>
<tr>
<td>Grasp</td>
</tr>
<tr>
<td>Suck</td>
</tr>
<tr>
<td>Respiration</td>
</tr>
<tr>
<td>Fontanelle</td>
</tr>
</tbody>
</table>

Score babies daily using this chart. Use the HIE Scoring sheet (Form Paed/05). The score will usually increase a little up until the 4th day and then decrease.

Severity grading
A grading system is also used, but you need to have some experience in looking after neonates, and EEG parameters should be used.

Grade 1: mild encephalopathy with infant hyper-alert, irritable, and over-sensitive to stimulation. There is evidence of sympathetic over-stimulation with tachycardia, dilated pupils and jitteriness. The EEG is normal and there are no seizures.

Grade 2: moderate encephalopathy with the infant displaying lethargy, truncal hypotonia, proximal weakness, and partially depressed primitive reflexes. There is parasympathetic over-stimulation with low resting heart rate, small pupils, and copious secretions. The EEG is abnormal and 70% of infants will have seizures.

Grade 3: severe encephalopathy with a stuporous, flaccid infant, absent reflexes, and drooling of saliva due to poor swallow and gag. The infant may have seizures and has an abnormal EEG with decreased background activity and/or voltage suppression.
Management

NO specific interventions have been shown to alter the outcome for babies with HIE. But you still have to get the basic principles of neonatal care right, to optimise the outcome of those babies who will not die.

Prevention
- Reduce perinatal hypoxia with good antenatal and labour ward care

Resuscitation
- Do not over-oxygenate baby. If the lungs are normal, use air or 60% O₂ (leave the reservoir off the ambubag)
- Prevent postpartum hypoxia by competently resuscitating the baby. Give oxygen ONLY if needed to keep the O₂ saturation between 85-90%
- DO NOT give naloxone unless maternal opiates were given within 4 hours of delivery

Convulsions
- DO NOT USE "prophylactic phenobarbitone" (sedation masks neurological signs and has no benefits)
- LORAZEPAM 0.3mg/kg/dose IV works quickly and has enduring anticonvulsant activity. Refractory cases may need midazolam infusion (use MIDAZOLAM 3mg/kg in 50ml D₅W at 1-4ml/hr: 1ml/hr = 1mcg/kg/min). Consider referral.

Intake
- Initiate IV fluids and keep nil per os for 24 hours (lessens risk of Necrotizing Enterocolitis) and then gradually commence nasogastric feeds and breastfeeding when the baby can suck and swallow
- Restrict fluid intake to ¾ maintenance requirements on days 1-3

Observation
- Monitor the HR, RR, temperature, saturation, BP, intake and output 3 hourly, and respond accordingly
- Prevent hyperthermia by making sure that the incubator temperature is not set too high
- Watch out for hypoxic injury to other organs
  - Lungs: ARDS
  - Heart: hypoxic myocardopathy
  - Liver: hypoglycaemia
  - Kidneys: ATN
  - Marrow: thrombocytopenia
  - GIT: necrotising enterocolitis

Follow up
- Follow up at 6 weeks and 4 months for neuro-developmental assessment and refer to physiotherapy if required.

Referral criteria
- Babies with HIE need to be managed in their district hospital. It is important to pay attention to supportive care so as to prevent further deterioration.
- A baby with a high HIE score is not a candidate for referral for ventilation, neither is a baby who fails to breathe spontaneously by 20 minutes post-delivery, despite full resuscitation.

Prognosis
- A baby who scores a maximum of 10 or less and is normal by day 7 will usually have a normal outcome. A baby whose score peaks higher than 15 or who remains abnormal after day 7 must have a guarded prognosis. This must be communicated to the family.
- Babies may be discharged once they are feeding well and stable.
PREVENTING MOTHER TO CHILD TRANSMISSION OF HIV
(PMTCT)

Why is it important?

Prevention is better, there is no cure

1 in 3 babies born to HIV-infected mothers will be infected with HIV during pregnancy, delivery and via breast milk, without intervention. Nevirapine given correctly to mothers and babies almost halves the risk of HIV transmission. (More complex ARV regimens can reduce transmission to less than 2%.)

- The BEST practice is to reduce the mother’s viral load to as low a level as possible prior to delivery
- Most transmission occurs during delivery so good obstetric management is vital, apart from ARVs
- Don’t forget the father – prevention and/or treatment of HIV infection, and planning for future parenthood

Determine the mother’s HIV status

- Ask every pregnant woman if she knows her status at the time of confirmation of pregnancy (check this for private sector patients as well)
- If YES, ask if she has ever taken / is taking ARVs
- If NO, recommend VCT as soon as possible

ALL mothers should be offered voluntary counselling and testing for HIV during antenatal care

Plan for the HIV-infected mother

During pregnancy

- Regular, careful antenatal care (especially if mother’s CD4 < 200)
- It is very important to discuss feeding choice with the mother, either:
  - exclusive breast for 4-6 months, OR
  - exclusive replacement/formula feeding, if mother has access to clean water and is able to sterilise bottles etc

The CD4 level is important:

<table>
<thead>
<tr>
<th>CD4 level</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 200 cells/mm³</td>
<td>mother should be started on HAART</td>
</tr>
<tr>
<td>&gt; 200 cells/mm³</td>
<td>mother should receive PMTCT according to provincial protocol</td>
</tr>
</tbody>
</table>

NEVIRAPINE (NVP) for mother:

Nevirapine 200mg PO stat at onset of labour, OR when membranes rupture, OR prior to Caesarean section. NVP must be taken between 72 and 2 hours before the birth

REMEMBER to give the nevirapine to the mother when she is 34 weeks pregnant

During delivery

- Do an elective C/S if the viral load high at 37 weeks AND before the onset of labour
- Do not artificially rupture membranes
- Do not do invasive procedures (eg scalp pH monitoring of baby)
- Avoid episiotomy, if possible

Post partum

- REMEMBER to implement the feeding choice the mother made antenatally
- Ongoing HIV care for mother including ARVs, prophylaxis for opportunistic infections and contraception

EXCLUSIVE FEEDING is essential – either breast (i.e. nothing else, not even water) OR formula.

When WEANING, make the switch from breast to formula as quickly as possible, to minimise the period of mixed feeding (i.e. breast AND formula), which is the most risky for HIV transmission.
Plan for the HIV-exposed infant

Antiretrovirals

- Determine what ARVs mother received
  - if single dose nevirapine was given between 2 hours before birth and 72 hours after birth, give a single dose of nevirapine to baby between 12-72 hours after birth
  - if single dose nevirapine was given to mother < 2 hours before birth or > 72 hrs after birth: give immediate dose nevirapine to baby (within 6 hours of birth) and a repeat dose 12-72 hours after birth

<table>
<thead>
<tr>
<th>NEVIRAPINE (NVP) for baby:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth weight &gt; 2kg, give 0.6ml PO stat</td>
</tr>
<tr>
<td>Birth weight &lt; 2kg, give 0.2ml/kg PO stat</td>
</tr>
</tbody>
</table>

- if baby’s mother is on the HAART regimen, baby will need 2 drug therapy (AZT + 3TC for 4 weeks) – DISCUSS with consultant

Feeding choice

- This must be an informed choice based on the specific social circumstances of each individual woman, and ideally with the full support of her family
- The choice should best be made antenatally (see “Plan for the HIV-infected mother”)
- Document the feeding choice clearly on the neonatal record (Form Paed/01)

Follow up

- Document all HIV information and plans in all designated places on the “Newborn Care Record” (Form Paed/01)
- Regular monthly clinic visits are essential for:
  - growth monitoring
  - feeding support
  - treatment of intercurrent illnesses
- COTRIMOXAZOLE prophylaxis should be started from 6 weeks (single daily dose of 2,5 ml given Monday - Friday)
- Immunisation should be given according to SA EPI schedule, unless baby has signs suggestive of AIDS
- HIV testing
  - PCR must be done for definitive diagnosis at 6 weeks
  - ELISA from 18 months, and at least 3 months after cessation of breast feeding

Pregnancy is often the first time when women become aware of their HIV status – maximise this opportunity for education, care, support and good medical treatment
NEONATAL HYPOGLYCAEMIA
A common AND serious neonatal problem

Feed ALL babies within half an hour of birth (with breast milk unless mother has chosen to formula feed)

Start this protocol as soon as baby has a glucose reading of 2.5 mmol/l or less
A glucometer reading below 2.5 mmol/l means that the baby is at risk of BRAIN DAMAGE

Who is at risk?
All babies who are small, sick, cold and/or not fed, and those born to mothers with diabetes.
  - Monitor the blood glucose of small and/or sick babies every 3 hours for the first 24 hours and continue until the level is normal for 24 hours
  - Check the blood glucose of infants of diabetic mothers hourly, for the first 6 hours
  - If milk feeds are contraindicated, start intravenous fluids (neonatolyte) immediately
  - Keep the baby warm

What are the clinical signs?
Often there are no symptoms or signs. There may be jitteriness or lethargy, apnoea, convulsions, or hypothermia. Remember the vicious cycle:

![Vicious Cycle Diagram]

Oral management: mild hypoglycaemia (glucose 1.8-2.5 mmol/l)
1) When the glucometer reads 1.8-2.5 mmol/l, give 10 ml/kg breast milk (or artificial feed if indicated) IN ADDITION TO SCHEDULED FEEDS
2) Repeat the glucometer 15 minutes after COMPLETION of the feed
3) If glucometer reads more than 2.5 mmol/l, continue with normal feeds and monitor glucose level three hourly
4) If glucometer again reads under 2.5 mmol/l, oral management has FAILED. Proceed to intravenous management

Intravenous management: severe hypoglycaemia (glucose <1.8 mmol/l)
1) If glucometer reading is less than 1.8 mmol/l, OR oral management has failed, start an IV infusion with neonatolyte (10% dextrose + electrolytes) IMMEDIATELY, at the appropriate rate for weight, gestation and age
2) When you have finished strapping and splinting the cannula give a 3ml/kg bolus
3) Repeat the glucometer reading after 15 minutes
4) If the glucometer reads more than 2.5 mmol/l, continue with normal feeds and monitor glucose level three hourly
5) If the glucometer again reads less than 2.5 mmol/l, change infusion to a 15% dextrose infusion (180ml neonatolyte + 20ml 50% dextrose). At the start give a 2ml/kg bolus, then continue at required rate for age
6) Repeat the glucometer reading 15 minutes after changing to 15% solution
7) If glucose remains low, give GLUCAGON 0.2mg/kg IV or IM, and arrange transfer to a regional or tertiary hospital

Record all readings and actions on “Hypoglycaemia Management Chart” (Form Paed/19)
Neonatal Hypothermia

A common AND serious neonatal problem

Who is at risk?
- Wet infants (after delivery or bathing)
- Low birth weight infants
- Infants requiring resuscitation
- Sick infants, particularly if there is infection
- Infants who are in a cold room
- Infants who are not fed
- Hypoglycaemic infants
- Infants undergoing medical procedures

Prevention is the cornerstone of management
- Dry the infant well after birth and wrap in a second warm and dry towel
- Keep the baby with the mother in the kangaroo position (KMC)
- Nurse babies less than 1.8kg in KMC or in an incubator (at appropriate temp)
- Feed all babies within 30 minutes after birth (unless contra-indicated e.g. severe respiratory distress)
- Ensure that there is a good overhead heater in the infant resuscitation area
- Keep the room warm i.e. at 25-26°C, but not higher
- Dress babies in incubators in a vest, nappy, booties and a woollen cap. Do not wrap in a blanket
- Keep the baby away from windows and draughts
- Keep incubators and resuscitaires warm, even when not in use

Temperature settings for closed incubators

Check the temperature of manual incubators every hour and keep them at the following temperatures according to the baby’s weight and age. Record the temperature on the incubator, using the “Basic Neonatal Care Nursing Observations” chart.

<table>
<thead>
<tr>
<th>Birth weight</th>
<th>Days after delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td>&lt; 1000g – 1500g</td>
<td>35.5</td>
</tr>
<tr>
<td>1500g – 2000g</td>
<td>35.0</td>
</tr>
<tr>
<td>2000g – 2500g</td>
<td>34.0</td>
</tr>
<tr>
<td>2500g – 3000g</td>
<td>33.5</td>
</tr>
<tr>
<td>&gt; 3000g</td>
<td>33.0</td>
</tr>
</tbody>
</table>

Note: These settings are a guide. They must be increased or decreased according to baby’s temperature. Never increase more than 1°C higher than the baby’s temperature at a time.

Clinical signs of hypothermia

Initially there may be no signs. You and the mother may think that the baby is asleep.

Cold, lethargy, apnoea, peripheral oedema, sclerema.
In severe cases, bleeding and pulmonary haemorrhage may occur.

Treatment of hypothermia

1) Give oxygen until the baby’s temperature is normal (longer if indicated by respiratory problem)
2) Ensure an adequate glucose level:
   - monitor and record the blood glucose levels
   - feed the baby with breastmilk, milk or IVF
   - if temperature is less than 35°C, start IVF (neonatolyte)
3) Warm up as quickly as possible
   - place baby in the KMC position
   - in an incubator, set the temperature to 1°C higher than the baby’s temperature, and increase as baby warms up. Cover baby with a plastic sheet to protect radiant heat loss. Do not cover with blankets or tin foil
   - check the temperature ½ hourly until it is normal
   - you will need to decrease the incubator temperature as baby’s temperature returns to normal (use the table as a guide)
4) Identify and treat the underlying cause
"Sepsis Neonatorum"
A deadly and difficult clinical problem

Why is it important?
8% of preterm babies with respiratory distress are infected, 25% of NICU admissions are due to or develop infections, and 30% of preterm babies with "bacteraemia" will have meningitis.

There is very little scientific evidence to guide treatment for or prophylaxis of neonatal bacterial infections. Babies get bacteria from their mothers perinatally, or from healthworkers postnatally. It is important to identify:
- babies at risk for acquiring an infection
- babies already with an infection
- the extent of the infection (i.e. does the infection include meningitis, is the Systemic Inflammatory Response Syndrome / SIRS already established?)

If you put a baby onto antibiotics, then you think that the baby is at risk for and has already acquired a bacterium. And therefore you must manage accordingly.

What causes sepsis neonatorum?
Host
Babies have immature, undeveloped defences, and with decreasing gestational age defence systems become even weaker.

Organisms
a. Primary
Group B streptococcus, E.coli, listeria, staphylococcus aureus, other streptococci, haemophilis, anaerobes etc.
b. Nosocomial
Staphylococcus epidermidis, klebsiella, pseudomonas, MRSA, etc.

Carriers
If a baby is born without a bacterium, and later acquires one, it has been transmitted via hands. Organisms on mother’s hands are usually important for normal colonisation of baby (unless she’s picked it up in the hospital). Organisms on healthworkers hands are lethal.

WASH YOUR HANDS

How to suspect SN?
You must know the risk factors…
Maternal risk factors
In order of importance:
1) Group B streptococcus (GBS) colonisation
2) Chorioamnionitis
3) P(P)ROM
4) Maternal pyrexia (> 38.0º C) during labour

It is rare in state hospitals to know whether or not the mother is colonised with GBS

If mother received antibiotics ≥ 4 hours prior to delivery, this is considered pretreated.

Neonatal risk factors
Preterm (< 34/40), low birth weight (< 2kg)

And you must know the clinical features…
When it’s obvious, it’s easy…
"Collapse", shock, purpura, coma etc

When it’s subtle, it’s not…
"Handles poorly", apnoea, lethargy, O₂ requirement, respiratory distress, not feeding so well, a little abdominal distension, low birthweight, etc.
What then?

1) Confirm the “sepsis” diagnosis
   Do a septic workup

2) Start intravenous antibiotics
   GENTAMICIN 5mg/kg/dose 24H and BENZYL PENICILLIN (Penicillin G) 50 000 units/kg/dose 12H or AMPICILLIN 50mg/kg/dose 12H

3) Assess how sick the baby is
   Clinical, FBC, ABG

What is a “septic workup”?  
1) Blood culture
   Finds the organism

2) CSF analysis
   Determines duration of antibiotics, and long term follow up.

   If baby is too sick or unstable, the LP can be delayed. However, for managing the “sepsis neonatorum” problem, the earlier it’s done the better.

3) Urine analysis
   Bag and dipstix is an unreliable screen, especially in the first 24 hours. A negative dipstix for white cells and nitrates does not exclude a UTI. A positive dipstix for WC’s and/or nitrates should be followed by a suprapubic aspirate for formal M, C&S.

What about the FBC?

No parameter in the full blood count is a good predictor of the presence of infections in babies, especially in the first 24 hours.
Sensitivity for the absolute WCC picking up infection is only 44%.

The full blood count is useful for determining how sick baby is. If the WC (< 5) and/or platelet (< 50) counts are low, and infection is present, then the infection is likely to be advanced.

What about the CSF?

The risk for having meningitis starts climbing when the total CSF white cell count starts climbing from 8. Most neonatologists use a “cut-off” of 20, above which meningitis is extremely likely.

A CSF white cell count below 20 does not exclude meningitis

If CSF suggests meningitis, change antibiotics to CEFOTAXIME 100mg/kg/dose 12H (and AMPICILLIN 100mg/kg/dose 12H). Treat for 14 days for gram positive organisms, and for 21 days for gram negative organisms.

What are the markers of severity?

It is important not only to determine the presence or absence of infection, but also to assess how sick baby is, and this will assist with deciding on the appropriate place of management.

The following clinical markers indicate severity:

Immaturity: the more preterm the more at risk - refer according to “Referral Criteria for Sick Neonates” guideline

Apnoea: refer if apnoea persists after standard apnoea prophylaxis and treatment (“Neonatal Apnoea” guideline)

Respiratory failure (any cause): refer according to “Respiratory Distress” guideline

Necrotising enterocolitis (NEC): refer all cases once baby’s condition is stabilised

The following laboratory markers indicate severity:

Acidosis (as indicated by a low bicarbonate on a standard U&E printout, or on a formal Acid-Base assay) There are three big causes of acidosis in babies:

1) Hypoxia (peri and post natal)
2) Shock
3) Dead tissue (typically NEC)

Hypoxia and shock must always be corrected prior to transfer.

Neutropaenia, thrombocytopaenia (see above)

By getting the basics right, and picking up and managing “Sepsis Neonatorum” early, you will make this common neonatal problem less difficult for you to handle, and less deadly for the babies you look after.
**NEONATAL JAUNDICE: UNCONJUGATED HYPERBILIRUBINAEAMIA**

A lighter touch, a righter touch

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The neurotoxic sequelae of a high unconjugated bilirubin are unpredictable, potentially devastating, and totally preventable. The occurrence of kernicteris in KZN is alarmingly high.

**RATHER OVER-REFER THAN UNDER-REFER**

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**What is jaundice?**

Jaundice is the yellow discoloration caused by the presence of bilirubin in the soft tissues.

**What causes jaundice**

ALL babies develop an elevated bilirubin in the first week of life. This, on the bilirubin pathway, is due to the NORMAL:

1. **Increased production** = accelerated red cell breakdown
2. **Decreased removal** = reduced liver bilirubin handling capacity
3. **Increased reabsorption** = increased enterohepatic recirculation

When jaundice becomes severe enough to treat, the cause is related to an exaggeration of one or more of these factors

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1. **Increased production:**
   - Haemolysis (especially rhesus disease and ABO incompatibility), bruising, haematoma, polycythaemia, immaturity, sepsis

2. **Decreased removal:**
   - Immaturity, hepatitis, (pathological enzyme deficiencies are very rare)

3. **Increased reabsorption**
   - Delayed passage of meconium, breast feeding

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**If you find a baby who is, or may be, or may become jaundiced/yellow...**

1. **Anticipate jaundice**
   - Rhesus negative mother: do cord TSB and repeat at six hours
   - Immaturity: do TSB with first bloods, then 12-24 hourly
   - Sick babies: do a TSB with first bloods, then 12-24 hourly

2. **If baby is yellow, do a TSB stat**

   TSB may be done as a capillary (heel prick) or venous sample and should be available (bilirubinometer or laboratory) in **less than one hour**

3. **Start phototherapy while awaiting the result if baby is preterm or markedly jaundiced**

4. **The result must be plotted on a Phototherapy Guideline Chart (Form Paed/34) according to TSB level (micromoles/L), baby's age (in hours NOT days) and weight/gestational age, and acted on immediately**

5. **All babies whose TSB is high enough for phototherapy should have:**
   - mother's blood group
   - baby’s blood group
   - baby’s Coomb’s

**Getting these tests off early assists management planning and may prevent exchange transfusions**

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6. **Well babies should receive phototherapy if their TSB is on/over the phototherapy line for age and weight. Sick babies should go under lights at TSB levels of 30 micromoles/L lower than the line (see both charts overleaf).**

7. **Repeat TSB for babies under phototherapy must be done 12-24hrly**

8. **Phototherapy should continue until TSB is 50micm/L less than photo level. TSB must be checked 24hrs after cessation of lights**

9. **Note the pattern or TSB tracking on the phototherapy chart. Note departure from "physiological" pattern e.g. early TSB rise suggesting haemolysis, or raised TSB after 10 days when phototherapy is no longer indicated (but further investigation may be indicated)**

10. **If rate of rise of TSB is high, send a blood specimen for conjugated bilirubin, FBC/PCV, and blood culture**

11. **Check TSB level against Exchange Transfusion chart indicating potential need for exchange transfusion (ETF)**

12. **Anticipate the need for an exchange transfusion early and consult referral hospital**
PHOTOTHERAPY

In presence of risk factors use one line lower (the gestation below) until <1000g.

If gestational age is accurate, rather use gestational age (weeks) instead of body weight.

Start intensive phototherapy when the TSB is ≥ the line according to gestation or weight.

Infants under phototherapy:
- Check the TSB 12–24 hly but if TSB >30 μmol/L above the line, check TSB 4–6hly.

STOP phototherapy:
- If TSB > 50 μmol/L below the line. Recheck TSB in 12–24hr.

Phototherapy
- The distance from the light source to mattress must be as close as possible
- Use correct phototherapy bulb – 400 to 850 nm wavelength
- Use adequate light intensity: log of hours “on”. Bulbs must be changed every 1000 hrs of use. Intensity on lightmeter must be > 8 microwatts/cm²/nm
- Baby must be optimally exposed (no clothes, no nappy)

The baby under phototherapy
- Hydration: give an extra 20ml/kg/day of fluids, unless competently demand breast feeding
- Eyes must be shielded
- Breast feeding: give EBM via NGT when TSB is rapidly rising or when close to exchange levels so that baby is not removed from the phototherapy
- Monitor temperature, dextrostix and urine output 3 hourly

Exchange transfusion

There is increased risk of kernicteris when:
- preterm baby
- rapidly rising bilirubin (> 17micm/l/hr)
- low levels serum albumin (ALBUSOL® 20% 5ml/kg slowly IV is protective)
- concomitant illness (e.g. sepsis, acidosis)

Exchange transfuse to prevent or lessen kernicteris:
- use the graph to decide on whether to transfuse
- the decision on when to exchange is based on both the absolute level and rate of rise of TSB
- in babies who are ABO or Rhesus incompatible, and Coomb’s positive, POLYGAM® 1g/kg IV over 3 hours, with LASIX 1mg/kg stat, may prevent an exchange transfusion
- Note: 1. Infants who present with TSB above threshold should have Exchange done if the TSB is not expected to be below the threshold after 6 hrs of intensive phototherapy.
- 2. Immediate Exchange is recommended if signs of bilirubin encephalopathy and usually also if TSB is >30 μmol/L above threshold at presentation
- 3. Exchange if TSB continues to rise >17 μmol/L/hour with intensive phototherapy

Photocopy the “Jaundice Poster” and put it up in your nursery and use individual charts for each patient

Babies with prolonged NNJ (TSB > 150 on day 15) should be investigated. Start with urine dipstix for UTI, TFT’s for hypothyroidism, and urine reducing substances for galactosaemia, then consider breastfeeding jaundice.

Babies with conjugated hyperbilirubinaemia must be referred
**Guidelines for interventions in babies with jaundice**

Unconjugated hyperbilirubinemia only

South African Neonatal Academic Hospital guidelines: 2006

**PHOTOTHERAPY**

- In presence of risk factors use one line lower (the gestation below) until <1000g.
- If gestational age is accurate, rather use gestational age (weeks) instead of body weight

Infants > 12 hours old with TSB level below threshold, repeat TSB level as follows:

1. 1-20 μmol/L below line: repeat TSB in 6hrs or start phototherapy and repeat TSB in 12-24hrs,
2. 21-50 μmol/L below line: repeat TSB in 12-24hrs,
3. >50 μmol/L below line: repeat TSB until it is falling and/or until jaundice is clinically resolving

Infants under phototherapy:
- Check the TSB 12-24 hly but if TSB >30 μmol/L above the line, check TSB 4-6hly.
- Start intensive phototherapy when the TSB is ≥ the line according to gestation or weight.

**EXCHANGE TRANSFUSION**

- In presence of sepsis, haemolysis, acidosis, or asphyxia, use one line lower (gestation below) until <1000g.
- If gestational age is accurate, rather use gestational age (weeks) than body weight

Note: 1. Infants who present with TSB above threshold should have Exchange done if the TSB is not expected to be below the threshold after 6 hrs of intensive phototherapy.
2. Immediate Exchange is recommended if signs of bilirubin encephalopathy and usually also if TSB is >65 μmol/L above threshold at presentation
3. Exchange if TSB continues to rise >17 μmol/L/hour with intensive phototherapy
KANGAROO MOTHER CARE (KMC)

Let nature do the nurturing

The common problems of small babies – hypothermia, hypoglycaemia, and hypoxia - are alleviated, if not cured, by a common solution: kangaroo mother care (KMC)

ALL facilities with maternity services SHOULD implement KMC as ROUTINE practice

What is KMC?

Kangaroo mother care consists of skin-to-skin care of babies (usually low birth weight or very low birth weight). KMC also promotes early and exclusive breastfeeding, but may be used even when babies are formula fed.

What are the cornerstones of KMC?

1) Kangaroo Position

Dress the baby in a nappy and cap and place in an upright position against the mother’s bare chest, between her breasts and inside her blouse. One may use a special garment, or one can tuck the mother’s blouse under the baby or into her waistband. Cover both mother and baby with a blanket or jacket if it is cold. Many hospitals have designed their own wraps (for example, out of old theatre drapes), or have involved community based organisations in the making of wraps. You too can be innovative.

2) Kangaroo Nutrition

Babies who are unable to suckle should be fed expressed breast milk via a nasogastric tube or cup if they can swallow. Keep babies in the KMC position whilst being tube fed. Allow them to try to suckle during the tube feed.

In the KMC position, babies will declare themselves ready to suckle, as their rooting and suckling reflexes become manifest. Once the baby is able to suckle, allow the baby to breast feed on demand but at least every three hours.

3) Kangaroo Support

It is very important to explain and demonstrate to the mother until she is motivated and confident to try the kangaroo position. In Kwazulu-Natal the word “Ukugona” (to hug or embrace) is used. Assist the mother with positioning and feeding, and give emotional support. The concept should be explained to other family members (especially the maternal grandmother), and they can also practise KMC (especially the father).

4) Kangaroo Discharge

Use the KMC score chart (Form Paed/26) to evaluate readiness for discharge. Discharge when the baby has a sustained weight gain and has a KMC score of 19 or more. Bring the baby back for follow up in the next few days to ensure that baby is well and growing. It is good practice to follow up KMC babies in a designated place near the KMC ward.

When do we start KMC?

Intermittent KMC can be practised while the baby is still in the nursery. It is possible even with babies on oxygen and IV therapy. Frequency is determined by how stable baby is. A common sense approach is best. Aim for a minimum of 3 times a day.

Continuous KMC can be instituted once the baby is stable, suckling well, preferably > 1500g (but at any weight if confidence and competence has been established) and needs no additional care. The baby can then be transferred to an adjoining KMC ward. Smaller babies may be able to go onto continuous KMC if they are stable and do not require oxygen.

Where do we do continuous KMC?

The KMC ward should be in close proximity to the Neonatal unit and under the supervision of the neonatal staff, with 24 hour nursing coverage. The ward should be comfortable, homely and warm but not heated. There should be no cribs.
What is the daily routine of a KMC Ward?

1) Monitoring
   - Babies should be weighed daily, and feeds adjusted according to weight gain. If not yet breastfeeding on demand, they should receive 175ml/kg/day, in 8 feeds 3 hourly.
   - Babies on oxygen should have their oxygen saturation monitored 3 hourly.
   - The Basic Neonatal Nursing Observation chart can be used.

2) Record Keeping
   - For babies who are “just growing”, use only the KMC Daily Score (Form Paed/26) sheet. If babies have any other problems (like oxygen dependency) carry on using the normal continuation sheet.

3) Medication
   - From two weeks of age, use VIDAYLIN® 0.6ml/dose 24H and VITAMIN D 400U/dose 24H. Add FERRODROPS® 0.3ml/dose 24H at 6 weeks. All preterm babies should be on THEOPHYLLINE 1-2mg/kg/dose 12H until they weigh about 1800g.

4) Immunisation
   - Give the BCG and Polio vaccines when baby weighs 1800g, or at discharge, whichever comes first.

5) Complications
   - It is important to watch out for:
     a. Anaemia of immaturity
        Transfuse preterm babies if their Hb is less than 9g%.
     b. Patent Ductus Arteriosus (PDA)
        Bounding pulses are the hallmark of PDA’s in small babies. Check pulses daily, and if they are bounding, listen for a murmur. Refer to a regional hospital if a PDA is present, and reduce intake to 120ml/kg/day
     c. Sepsis Neonatorum
        Babies in KMC are less likely to acquire infections, but they are still at risk. At any sign of infection, fully and carefully assess baby, and manage according to the "Sepsis Neonatorum” guideline.

KMC discharge
   - Use the KMC scoring sheet to decide when to discharge.
   - Discharge on medications as above (usually it is appropriate to stop the vitamin D at discharge). Iron and multivitamins should be continued for the first year of life.
   - Try and develop the follow up clinic as part of the neonatal/nursery service. Don’t make KMC babies go and sit in an outpatient queue.
   - Do use the same scale to weigh them when they come for follow up.
Definitions

- Large for Gestational Age (LGA): a baby with a birth weight > 90th percentile for gestational age. In term babies, this amounts to a birthweight > 4000g.
- Macrosomia: a baby which has a large body and increased body mass.

**LGA and macrosomia are synonymous terms, and include infants of Diabetic Mothers (IDM's)**

Causes

- Maternal diabetes
- Genetics: “big parents - big baby”
- Excessive maternal weight: “fat mother - fat baby”
- Rare genetic disorders e.g. Beckwith-Wiedemann Syndrome

Complications and Risks

- Antenatal and Intrapartum risks:
  - Increased stillbirth rate (6x in IDM’s)
  - Obstructed labour and shoulder dystocia
  - Foetal distress
- Neonatal:
  - Birth trauma (fractures of clavicle/humerus; brachial plexus injury; hypoxic-ischaemic damage)
  - Hypoglycaemia (in all, but especially in IDM’s)
- In addition, in IDM’s:
  - Immature lungs with RDS
  - Polycythaemia
  - Neonatal Jaundice
  - Cardiac defects
    - Asymmetrical ventricular septal hypertrophy with left and/or right HOCM
    - VSD
  - Rare: sacral agenesis; microcolon
  - Long-term: increased risk of type I and type II diabetes in baby

**IDM’s are BIG but IMMATURE**

Management

1) Delivery is high risk: expect and manage complications

2) Examine for:
   - Birth trauma
   - Dysmorphia
   - Macrosomia
   - Plethora
   - Cardiac murmurs
   - RDS
3) Look for and manage hypoglycaemia, with reference to the "Neonatal Hypoglycaemia" guideline

**Record all readings and actions on "Hypoglycaemia Management Chart" (Form Paed/19)**

- Feed within 30 minutes of birth (unless severe RDS or intrapartum hypoxia)
  - breast; or
  - formula 10 ml/kg (only if medically indicated). Try NOT to give formula to a breast feeding baby, unless no alternative exists

**Low blood sugar readings on a glucometer MUST be confirmed by a laboratory test**

- Do a blood glucose 1 hr post-delivery:
  - if ≥ 2.5 mmol/l
    - continue frequent breast feeding 2-3hrly (or formula, according to “Feeding and Fluid Management” guideline)
    - continue 3hrly blood glucose tests for 24 hours
  - if 1.8 - 2.5 mmol/l
    - feed as above and check blood glucose again after 30 minutes. Repeat until ≥ 2.5 mmol/l
  - if < 1.8 mmol/l
    - insert drip
    - take blood for lab serum glucose and FBC from cannula before connecting drip
    - give bolus 3ml/kg Neolyte (10% dextrose) and then run drip as follows:
      - If breast feeding: continue drip at 30ml/kg day and continue breast 2-3hrly. Wean drip slowly if blood sugar is maintained > 2.5mmol/l. If hypoglycaemic, increase drip rate to 60-80mls/kg/day and continue breast feeding.
      - If formula feeding: calculate formula feeds at 60ml/kg/day and divide 2-3hrly feeds, while running drip at 2ml/hr. Wean off drip if blood sugar is maintained > 2.5mmol/l.
  - if persistently < 1.8 mmol
    - give GLUCAGON 0.2mg/kg and change drip to 15% dextrose *
    - if still < 1.8mmol/l, take blood for insulin, cortisol, growth hormone and TFT, then start HYDROCORTISONE 5mg/kg stat, then 10mg/kg/dose 6H IV

* To make a 15% IVI solution: add 20ml 50% dextrose to a 200ml bag of Neolyte
FEEDING AND FLUID MANAGEMENT

Ensure that babies are fed within an hour of birth, preferably within the first 30 minutes

Feeding (refer also to your “Cornerstones of Neonatal Care” poster)

If the infant is able to suck
(Babies who are more than 34 weeks gestation are usually able to suck, unless they are ill)
- Breast feed and encourage EXCLUSIVE breast feeding
- Initiate breast feeding within the first 30 minutes of birth
- Allow mothers to breast feed on demand and room-in

If the baby is unable to suck or the mother and baby are separated
- Give Expressed Breast Milk (via NGT or cup)
- Use formula only if EBM is not available
  - < 1.5 kg – pre-term formula
  - > 1.5 kg – normal formula

If the baby is not able to feed
(The infant may be < 1.5 kg or ill e.g. severe respiratory distress or septicaemia)
- Commence IV maintenance fluids (neonatolyte) at the appropriate rate
- Keep on IV fluids only
- Gradually add feeds from Day 2 (refer to the table below as a guide)
- Increase the feeds if there is no vomiting, apnoea or abdominal distension
- If the baby is unable to tolerate feeds at all, IV fluids can be continued alone for a maximum of 3 days. Thereafter, if still unable to feed, arrange for transfer.

Frequency and method of feeding
- Allow breastfed babies to feed on demand – at least 8 times in 24 hours
- Feed other babies 3 hourly or on demand
- VLBW babies may need 2 hourly or even 1 hourly feeding
- If the baby is not breastfeeding then feed with a cup
- If the baby is unable to swallow or is on head box oxygen then feed by nasogastric tube (never remove a baby from oxygen to feed)

Fluid requirements

The following daily fluid requirements are recommended:

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<tr>
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<th>&lt; 1000g</th>
<th>1 – 1.5kg</th>
<th>&gt; 1.5kg</th>
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<tr>
<td></td>
<td>Total fluids (ml/kg)</td>
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<td>Day 1</td>
<td>90*</td>
<td>75*</td>
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<td>Day 2</td>
<td>115</td>
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<td>Day 7</td>
<td>150-180</td>
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* Very low birth weight babies may require more than 60ml/kg on Day 1
** Feeds can be increased more quickly if well tolerated or more slowly if not
- To calculate the drip rate: wt x volume/kg/24 = ml/hour
- If using a 60 drop/ml intravenous infusion administration set, then ml/hour = drops/min
- Always use an infusion controller, buretrol or dial-a-flow when administering fluids to neonates
- To calculate 3 hourly feeding: wt x volume/kg/8 = ml/feed

You MUST calculate and prescribe the correct intake, feed and fluid for every baby, every day including on weekends. Use the front page of the "Newborn Care Record" (Form Paed/01). Document intake and output on Form Paed/21 (IV and orals) or 22 (orals only)
THE PPIP MORTALITY REVIEW PROCESS

Making perinatal mortality review meaningful

It is the structured clinical audit of all perinatal deaths (stillbirths, neonatal deaths, maternal deaths) that enables a thorough assessment of the quality of care that mothers and babies receive in the health system.

For a clinical audit / mortality review to be successfully implemented there are two vital requirements:
1) dedicated individuals willing to spend time and effort to make the process happen
2) a carefully structured system where roles and responsibilities are well-defined

Thus the system for a mortality review process in a maternity unit consists of two main activities:
A. data collection
B. the actual mortality review process

A. Data collection
To conduct a mortality review, two data sources are needed:
1) the labour ward admissions, discharges and deaths register
2) the individual clinical records of the mothers and their stillbirths and neonatal deaths

Keep a separate register of stillbirths and neonatal deaths so that their medical records can be traced. Deliveries and deaths by birth weight are captured on Total Births data sheets. Detailed information on each death is captured on the Perinatal Death data sheet. (see also the “PPIP” guideline)

To organise and keep track of the data it is helpful to compile a lever arch file, clearly labelled PPIP. The file can be divided into two sections, one for perinatal data and the other for maternal data. It is helpful to order the contents in each section as follows:
1) Laminated copies of code lists (Cause of death and Avoidable factors)
2) Monthly dividers for each month followed by a Total Births data sheet for that month as well as a Perinatal Death data sheet completed for every stillbirth and neonatal death that occurred during that month
3) Spare data capture forms

B. The mortality review process
Efficiency and effectiveness depends on your following the four components of the mortality review process:

<table>
<thead>
<tr>
<th>Component</th>
<th>When</th>
<th>Who</th>
<th>Purpose</th>
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<tbody>
<tr>
<td>1. 24 hour review</td>
<td>Each stillbirth/neonatal death should be reviewed and summarised within 24 hours</td>
<td>The attending doctor or nurse at the time of the death</td>
<td>Ensure all necessary information is captured at a time when information is available</td>
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</table>
| 2. Preparatory meeting | Before the Perinatal Mortality Review Meeting | The doctor and nurse in charge of the labour ward and neonatal unit | A detailed analysis of all deaths, with case selection for presentation at the Mortality Review Meeting  
Compilation of monthly statistics for presentation at the meeting |
| 3. Mortality review / PPIP meeting (see below) | Weekly to monthly depending on load | The whole perinatal care team (doctors and nurses) as well as antenatal clinic staff | Presentation of statistics, case discussions and task reviews  
Assign new tasks based on each meeting’s discussion  
Ensure all data capture sheets have been completely completed |
| 4. Epidemiology & Analysis | 6 monthly/annually | Managers and clinical personnel | Broader problem identification with trend assessment, and with proposed solutions/recommendations |

1. The 24 hour review
Every single stillbirth/neonatal/maternal death occurring in your hospital should be summarised using the PPIP Perinatal or Maternal Death data sheet at the time of death. The person best placed to do this is either the birth attendant (doctor or midwife) for stillbirths, or the on duty doctor (or by way of handover the daytime nursery team) for neonatal and maternal deaths. The death summary should be regarded as no more burdensome, and no less important, than the discharge summary for other babies and mothers leaving the unit.

It is still best to have a single person in the labour ward and nursery making sure that this process happens. This can be a doctor or a nurse.
2. The preparatory meeting

This meeting is crucial. All data capture sheets must be completely completed, to the stage of readiness for entry onto the computer. This means that all fields must be filled in, and codes must be entered where required. This makes data entry onto the computer efficient and accurate, and allows for any category of employee to enter data.

Careful selection of cases for presentation will enhance learning opportunities and facilitate problem identification and task definition and allocation.

The preparatory meeting is the responsibility of the most senior doctor and most senior nurse in the labour ward and nursery.

3. The mortality review meeting

Mortality meetings must be well organised and managed by the nurse and doctor responsible for perinatal care.

1) Meetings should be held weekly to monthly depending on the number of deaths.
2) A suitable time and venue is needed.
3) All staff involved with perinatal care should be invited (nurses, doctors and administrators). Staff must understand that mortality meetings are very important. It is especially helpful to invite staff from referring clinics.
4) Case presentations should be concise and professional. Discussion is encouraged if the presenter does not provide the cause of death and avoidable factors. This is best done by the group.
5) The meeting should by consensus establish the obstetric and neonatal (for babies born alive) causes of death and then look carefully for avoidable factors. The meeting must never become a "witch hunt", and should be confidential.
6) All decisions (causes and avoidable factors) made must be recorded/revised on the mortality sheets (Perinatal Death data sheets) for entry later onto a computer.
7) Problems with the process of providing perinatal care in the hospital, the referring clinics and in communities must be identified and prioritised, and plans should be made and documented for addressing each problem.
8) Tasks arising out of discussions around cases should be assigned to team members, and minuted. Progress with the tasks should be reviewed at the start of the next meeting.

The meeting agenda

A typical mortality review agenda is as follows:

1) Welcome and introductions, and identification of a minute taker
2) Review of tasks set at last meeting
3) Summary of last meeting’s statistics
4) Summary of this meeting’s statistics
5) Case presentations
6) Task identification and allocation
7) Closure and date of next meeting

4. Epidemiology and Analysis

The power of PPIP lies in its ability to provide instant feedback on perinatal death and quality of care information to labour ward and neonatal staff. By simply initiating this systematic review process, change will happen.

It is however important both for the identification of broader system problems and for monitoring change that 6 monthly or annual reviews are performed.

These reviews should be compiled into reports, which document both findings and recommendations arising out of the findings. This is the point at which the power of PPIP can be used for communicating problems to managers. Once the process of mortality review is established in your site, the report will also look at success of implementation, and of response to, previous recommendations.

Making change happen

When making recommendations, it is important to link each recommendation clearly to specific information arising out of your PPIP review process. It is then useful to clearly define its requirements for implementation at each of the following levels:

1) Policy
2) Administration
3) Clinical practice
4) Education

Finally, responsibility for implementation at each level should be assigned, so that at the next review, implementation (or lack thereof) can be accounted for (as an example of this, see “Saving Children 2005”).

By conducting mortality reviews in this systematic way, we will both save lives and improve quality of care, through death auditing.

(Adapted from Philpott and Voce: “4 Key Components of a Successful Perinatal Audit Process”, Kwikskwiz #29, 2001)
PERINATAL PROBLEM IDENTIFICATION PROGRAM (PPIP)

Perinatal Mortality Auditing Made Simple

PPIP is a mother and baby healthcare audit system, which uses the perinatal mortality review process to assess quality of care. It seeks to determine the size and nature of perinatal problems, with a view to creating implementable solutions directed at improving the quality of care and decreasing morbidity and mortality.

Keep a large lever arch file in your Labour Ward for all PPIP documentation. (see “PPIP Mortality Review” guideline)

PPIP Deaths Register (overleaf)

Apart from the Maternity Register, if doing PPIP, it is extremely useful to have a PPIP Deaths Register (see overleaf):
1) Keep a PPIP Deaths Register in Labour Ward, under the responsibility of a named professional nurse (usually the PN/Midwife in charge of Labour Ward)
2) Enter all stillbirths occurring in any of the obstetric/gynaecology/maternity units, preferably at the time of death, or as soon as possible thereafter (you must record the birth weight)
3) Include babies born and dying before arrival
4) All neonatal deaths occurring in any of the neonatal units/paediatric wards should be entered into this register, preferably at the time of death, or as soon as possible thereafter (you must record the birth weight)

Total Deliveries (PPIP printout)

Use the PPIP Total Deliveries monthly tally form for this. The information is taken from the Maternity Register. Make sure that your Maternity Register collects all the required information.

EVERYBODY must make sure that the birth weight is recorded in the birth register

1) The PN in charge of Labour Ward should fill in the form “Total Deliveries” for each month
2) Total deliveries includes all live and still births weighing 500 grams or more
3) Totals should be filled in on the form for each weight category
4) The number to be filled in for multiple pregnancies is the actual number of babies or foetuses delivered (NOT the number of pregnancies) i.e. triplets are counted as 3, not 1

Perinatal Deaths (PPIP printout)

It is useful to identify mothers’ folders by stillbirth or by nursery admission (if baby is actually admitted). This makes tracking and tracing folders easier after mother has been discharged.

Stillbirths
1) A red sticker can be attached to “Stillbirth Folders” (get them from radiology or your pharmacy). Write “PPIP” on the sticker
2) One “Perinatal Death” form should be completed for each stillbirth weighing 500 grams or more
3) For each STILLBIRTH the attendant midwife should complete the details “mother’s IP number, delivery date, date of death, birth mass, syphilis and HIV serology and single or multiple pregnancy” (Note: the AT ADMISSION serology status should be recorded). It is useful to write the mother’s surname in the top left corner (but remember confidentiality)
4) It is VERY HELPFUL for the birth attendant (midwife or doctor) to write a case summary on the back of the form
5) The form should be filed in the Labour Ward PPIP file immediately
6) At mother’s discharge, the mother’s folder should be kept in Labour Ward in a PPIP folders box. Keep this box and the lever arch file together

Neonatal Deaths
1) If mother is discharged before baby then her folder should go to the baby’s bed in the nursery (this should apply to all neonatal admissions)
2) When/if a neonatal death occurs, a red sticker should be attached to baby’s folder and the mother’s folder. Write “PPIP” on the sticker
3) One “Perinatal Death” form should be completed for each neonatal death weighing 500 grams or more
4) For each NEONATAL DEATH, the PN in charge of the nursery should complete the details “mother’s IP number, delivery date, date of death, birth mass, syphilis and HIV serology and single or multiple pregnancy” (Note: the AT ADMISSION serology status should be recorded). Write the surname in the top left corner. Mother’s folder should be obtained if not with baby’s folder
5) It is VERY HELPFUL for the doctor on duty at the time of the death to write a case summary on the back of the form
6) The form and the folder should then be placed in the Labour Ward PPIP File and Box

The “Cause of death” and “Avoidable factors” sections to be completed at the PPIP meetings

Maternal Deaths

It is wise, and beneficial, to use PPIP for Maternal Deaths, remembering that the Confidential Enquiry process MUST still be followed
# PPIP Deaths Register

Unit: __________  Month: ____________  Year: _____________

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<thead>
<tr>
<th>Consecutive number</th>
<th>Date of Birth</th>
<th>Date of Death</th>
<th>Name</th>
<th>Mother's folder number</th>
<th>Baby's folder number</th>
<th>Birth weight</th>
<th>Folder in box</th>
<th>PPIP form filled</th>
<th>PPIP entered</th>
<th>Folder returned to</th>
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Last modified: 14 June 2007  For review: 2009
Respiratory Distress

Respiratory distress is an extremely common neonatal problem, with a limited number of common causes. The cornerstone of management is oxygen, not forgetting the other basics of warmth, food/glucose, and infection prevention/management.

Definition

Respiratory distress is marked by one or more of the following signs (listed in increasing severity):

- Respiratory rate > 60/minute (tachypnoea/fast breathing)
- Recession or indrawing of the chest
- Alar nae flaring
- Grunting
- Cyanosis
- Irregular breathing, then apnoea

Assessment of severity

- Mild: Respiratory rate > 60/minute with minimal (< 30%) oxygen requirements
- Moderate: Respiratory rate > 60/minute, recession, flaring, cyanosis (requiring up to 60% oxygen)
- Severe: Respiratory rate > 60/minute, grunting, cyanosis (requiring > 60% oxygen), irregular respiration (progressing to apnoea)

If oxygen requirements go above 60%, baby may need ventilatory support

Common causes

Pulmonary causes

- Hyaline membrane disease (HMD)
- Meconium aspiration syndrome
- Wet lung syndrome
- Pneumonia
- Pneumothorax

Extrapulmonary causes

- Congenital heart disease/heart failure
- Hypothermia
- Metabolic acidosis
- Anaemia and polycythaemia
- Diaphragmatic hernia
- Upper GIT anomalies (e.g. tracheoesophageal fistula)

Investigations

- Chest X-ray (wait 4-6 hours if hyaline membrane disease or transient tachypnoea of the newborn (TTN) are suspected)
- Gastric aspirate for a shake test and gram stain
- FBC, CRP and glucose
- Blood pressure
- Transilluminate the chest if a pneumothorax is suspected

Management

Oxygen

- Give enough oxygen to keep the oxygen saturation between 85 and 93%. If you do not have a pulse oximeter ensure that the baby's tongue is pink. You MUST get one in your nursery FOR THE BABIES
- If it is not possible to keep the infant pink in oxygen then continuous positive pressure (CPAP) via nasal prongs or endotracheal tube should be given – discuss referring your patient
- Monitor oxygen saturation and oxygen requirement using the "Oxygen Monitoring Sheet (Form Paed/18"

Supportive Care

- Keep the infant warm in an incubator
- If the respiratory distress is mild, do intermittent KMC provided that he/she maintains oxygen saturation (85-93%) on nasal cannula oxygen
- Keep nil per mouth for the first 24 hours
- Give appropriate volumes of neonatolyte
- Observe the RR, saturation, BP, HR hourly, and check the blood glucose 3 hourly

Criteria for referral

- If patient is not maintaining oxygen saturation despite 50% oxygen, or the baby develops apnoea, the baby should be referred to a hospital that has the ability to provide CPAP or IPPV
- PDA that does not respond to treatment
- Severe HMD – discuss early referral to a hospital that may have surfactant
- Possible cyanotic CHD, diaphragmatic hernia, tracheoesophageal fistula