Management of the Late Preterm Infant

Dr. Mark A. Bailey
Department of Child and Adolescent Health

Mater Dei Hospital, Malta

Written by: Dr. Mark A. Bailey

Checked by: Dr. Paul Soler
          Dr. Ryan Farrugia

Issued: 16 05 15

Review: 16 05 17
This guideline is intended to assist clinicians in decision-making and is not intended to replace clinical judgment or to establish an exclusive protocol for the care of all infants.

The guidance does not override the individual responsibility of healthcare professionals to make decisions appropriate to the circumstances of the individual patient.

This guideline applies to all paediatric and midwifery/nursing staff within Mater Dei Hospital providing care to late preterm infants at birth and in the postnatal period. It is not applicable to those infants that need neonatal intensive care.
Infants born at 34\(^0\) through 36\(^6\) weeks’ gestation, or “late-preterm” infants, are often the size and weight of some term infants. Because of this fact, late-preterm infants may be treated by parents, caregivers, and health care professionals as though they are developmentally mature and at low risk of morbidity. They are often managed in newborn level 1 (basic) nurseries or remain with their mother after birth. Late-preterm infants are physiologically and metabolically immature. As a consequence they are at higher risk than are term infants of developing medical complications that result in higher rates of mortality and morbidity after birth. In addition, late-preterm infants have higher rates of hospital readmission during the neonatal period than do term infants.

Late-preterm births account for up to 70% of all preterm births and the number is increasing. This increase has been attributed to a number of factors including increased obstetric surveillance and intervention as well as multiple pregnancies.

Late-preterm infants have not been studied frequently, and understanding of the developmental biology and mechanisms of disease experienced by these infants is largely incomplete. Management is therefore based on general principles, clinical experience, and extrapolation from knowledge of very preterm and term infants.

After birth late-preterm infants are more likely than are term infants to be diagnosed with temperature instability, hypoglycaemia, respiratory distress, apnoea, jaundice and feeding difficulties.

Paediatric primary care providers, midwives, neonatal and pediatric nurses should know the risks associated with late preterm birth. During the birth hospitalisation, the late-preterm infant should have frequent assessments for respiratory compromise, hyperbilirubinaemia, poor feeding, temperature instability and infection. This close monitoring should not automatically require admission to the NICU unless the infant is experiencing symptoms. However, standard well-baby nursery care may not be appropriate. Some hospitals have proposed late-preterm initiatives that include education of all medical team members in the well-baby nursery and parents on the morbidities of late-preterm infants as well as having special markings or tags on the late-preterm infant’s cribs as a reminder of the need for these extended assessments. These initiatives could help prevent late-preterm infant morbidities through early recognition of symptoms.
**Temperature Instability**

Late preterm infants are more susceptible than full-term infants to cold stress because of underdeveloped glycogen stores, an immature epidermal barrier, a higher surface to body mass ratio together with decreased levels of subcutaneous and brown fat. They have a high metabolic rate but a decreased ability to generate heat. The immature epidermal barrier results in an increased transepidermal water loss. Hypothermia increases metabolic and oxygen demands increasing the risk of hypoglycaemia and respiratory distress.

The late preterm infant's body temperature should be maintained between 36.5 °C and 37.5 °C

**Signs and symptoms of Cold Stress**

- Baby feels cool to touch
- Poor feeding, increased gastric residual or vomiting
- Bradycardia or tachycardia
- Hypoglycemia
- Tachypnoea, restlessness, shallow or irregular breathing
- Mottling, Apnea, central cyanosis
- Lethargy, feeble cry, hypotonia
- Metabolic acidosis
- Increased oxygen requirements
- Increased capillary refill time

**Complications of Cold Stress in Low Birth Weight Babies**

- Increased metabolic rate and oxygen consumption
- Clotting disorders
- Shock
- Intraventricular Hemorrhage
- Persistent Fetal circulation
- Decreased surfactant production
- Hypoglycaemia
- Increased neonatal mortality
Prevention of Hypothermia

In the Resuscitation Room

- Ensure adequate delivery room temperature, including the operating theatre during Caesarian Sections (24°C)
- Avoid draughts
- Carry out resuscitation under an overhead radiant heater
- Dry head and cover with a hat
- If the infant is well and mature enough, dry with warm towels, encourage skin to skin care as much as possible, covering mother and baby with a warm blanket
- If skin-to-skin is not possible the infant should be placed under a radiant heater or in an incubator. A table of appropriate initial temperature settings can be found as an appendix.
- The baby must not be washed or bathed for the first 24 hours and thereafter bathing should be introduced only when a normal temperature can be maintained.
- Any equipment or supplies that will come into contact with the infant should be warmed to avoid losing heat from conduction
- Newborn examination that includes removal of clothing should be performed under a radiant heater

In the Nursery

- The baby’s temperature should be recorded within 30 minutes of delivery
• Temperature should be taken in the axilla using a digital thermometer. Rectal temperatures are not recommended because of the risk of injury whilst tympanic temperatures are unreliable in a newborn.

• The axillary temperature should be taken 3-4 hourly and recorded.

• Monitoring may stop when the attending medical staff are confident the infant can maintain a normal temperature.

• Any baby being nursed under a radiant heater or in a closed incubator should also have 3 hourly axillary temperature recording. This should continue following removal of the heat source to ensure baby can maintain temperature.

• If the temperature is outside the normal range, readings should be taken every 30-60 minutes. This should be continued until temperature has normalized.

**Management of Hypothermia**

• Slow rewarming is preferred to minimize oxygen utilisation. Re-warm at 1°C per hour.

• Skin-to-skin is a very effective method for slow rewarming.

• Dress in a hat, swaddle, and use extra blankets.

• Adjust incubator temperature if infant is nursed in one.

• Any baby in the process of rewarming must have 30 minute temperature checks.

• It is very important that hyperthermia is avoided.

• If the temperature does not rise, the baby should have a medical review. Inability to maintain an appropriate temperature may indicate a serious illness such as sepsis.

• The baby must be able to maintain this temperature in a cot prior to discharge.
Signs and symptoms of Hyperthermia

- Warm to touch with a very pink/red appearance
- Sweating
- Tachypnoea or apnoea
- Tachycardia
- Hypotonia
- Irritability or lethargy
- Poor feeding

Causes of Hyperthermia:

- Overswaddling
- Incubator/room temperature too high
- Phototherapy or direct sunlight
- A combination of the above

Management of Hyperthermia

- Decrease temperature by removing extra clothing and blankets
- Decrease incubator temperature
- If the above are remedied and the temperature falls within an hour no further action is required
- If the baby looks unwell or the pyrexia persists for over an hour consider:
  1. Infection
  2. Dehydration fever
  3. Brain injury
- A medical assessment must be performed.
Respiratory Distress

The late preterm infant is at high risk for respiratory distress within the first few hours of birth. Multiple studies have found that late-preterm infants are at increased risk for respiratory distress syndrome (RDS), transient tachypnoea of the newborn (TTN), pneumonia, and air leaks (pneumothorax and pneumomediastinum) requiring respiratory support with the rate of respiratory complications steadily decreasing with each increasing week in gestational age. Many late preterm infants are delivered by Caesarean section, which also increases the risk. Antepartum steroids have been found to decrease the risk of RDS in infants born by Caesarian section up to 39 weeks gestation.

- The infant should be observed during this time for nasal flaring, tachypnoea, grunting, sternal recessions and cyanosis

- Parameters, including respiratory rate, heart rate and temperature should be documented every 3 hours for the first 12 hours at least

- A respiratory rate persistently more than 60/min is abnormal

Oxygen saturations should be measured if the infant has any signs of respiratory distress and a medical assessment performed. Normal saturation levels are over 94 to 100% in air (after 15 minutes of life). A level of less than 92 requires oxygen therapy and medical review. Satuations must be measured from the right upper limb (preductal) using an appropriate (new) oxygen probe and monitor with the probe shielded from ambient light.

- Infants who develop persistent respiratory distress (e.g. tachypnoea, grunting or a persistent requirement for supplemental oxygen) should be transferred to NPICU for further management

- Respiratory distress can be the result of other conditions such as hypoglycaemia

- Any infant showing respiratory distress should not be allowed to feed orally. If feeds are ordered they should be via a nasal gastric tube
Hypoglycaemia

Glucose levels in infants after birth are approximately 70% that of maternal blood glucose.

Low blood glucose is much more common in late preterm babies in comparison to term babies.

The late preterm infant is at high risk for hypoglycemia because of decreased glycogen and fat stores, decreased ability to produce glucose and immature glucose-regulated insulin secretion. Also vigorous ketogenesis does not occur so that these babies are unable to respond to low blood glucose levels adequately. Finally the lower metabolic rate of late preterm infants makes them more susceptible to hypoglycemia after birth.

The level among preterm infants typically decrease to a nadir 1 to 2 hours after birth and remain low until metabolic pathways can compensate or exogenous sources of glucose are provided.

Clinical Manifestations of Possible Hypoglycaemia

- Irritability, tremors, jitteriness
- Exaggerated Moro reflex
- High-pitched cry
- Seizures or myoclonic jerks
- Lethargy, listlessness, limpness, hypotonia
- Coma
- Cyanosis
- Apnoea or irregular breathing
- Tachypnoea
- Hypothermia; temperature instability
- Vasomotor instability
- Poor suck or refusal to feed
Prevention of Hypoglycaemia

- Breastfeeding after birth is possible in many late preterm infants

- Breastfeeding should be initiated as soon as the baby shows signs of readiness and certainly within the first hour. Initiation of breast feeding is facilitated by skin to skin contact between the mother and her infant immediately after birth for at least the first hour of life and longer if possible. Such practices will maintain normal infant body temperature and reduce energy expenditure (thus enabling maintenance of normal blood glucose) while stimulating suckling and milk production.

- Feeds should be frequent, at least 10–12 times per 24 hours in the first few days after birth.

- Formula fed babies should also be fed within one hour of birth. If mother and baby are still at Central Delivery Suite at one hour a feed should be given there.

- Routine supplementation with water, glucose water, or formula is unnecessary and may interfere with the establishment of normal breast feeding and normal metabolic compensatory mechanisms.

- Blood glucose monitoring should commence with the 2nd feed i.e. not so soon after birth that the physiologic fall in blood glucose level causes confusion and overtreatment (but before if there are signs suggestive of hypoglycaemia).

- Monitoring should continue until acceptable, prefeed levels are consistently obtained, meaning until the infant has had at least two consecutive satisfactory measurements. A reasonable (although arbitrary) goal is to maintain plasma glucose concentrations > 2.6mmol/L.

- In the event of a low blood glucose reading management will depend on whether the infant is symptomatic or not. Refer to the hypoglycaemia guideline.

- Bedside glucose screening tests MUST be confirmed by formal laboratory testing, although treatment should begin immediately in infants with clinical signs.
Sepsis

The late preterm infant is at greater risk for infection than the full-term newborn because maternal antibodies are not fully transferred prior to the 37th week of pregnancy. Infections commonly induce preterm labour and must be considered as a possible cause for the preterm labour. Additionally, a positive maternal group B streptococcal status places the infant at risk for neonatal sepsis.

Risk Factors for Infection

- Pre-labour rupture of membranes (> 18 hours).
- Preterm birth (<37 weeks), especially with pre-labour rupture of membranes.
- Confirmed or suspected chorioamnionitis (e.g. intrapartum fever).
- Invasive group B streptococcal (GBS) infection in a previous baby.
- Antibiotic treatment given to mother for confirmed or suspected invasive bacterial infection 24 hr before, during, or post labour.

Clinical Indicators Suggestive of Infection

- Altered behaviour or responsiveness
- Altered muscle tone
- Feeding difficulties (e.g. feed refusal)
- Feed intolerance (e.g. abdominal distension, vomiting)
- Altered heart rate
- Signs of respiratory distress
- Oxygen desaturation
- Apnoea
- Signs of perinatal asphyxia or hypoxic ischaemia
- Seizures
- Need for mechanical ventilation (especially term baby)
- PPHN
- Temperature abnormality not explained by environment
- Signs of shock
- Unexplained bleeding disorder (e.g. thrombocytopenia, INR >2)
- Oliguria
- Hypo/hyperglycaemia
- Metabolic acidosis (BE ≥10)
- Local signs of infection e.g. skin, eyes
• Confirmed or suspected sepsis in a co-twin

Red flag signs suggestive of neonatal infection

• Systemic antibiotics given to mother for suspected bacterial infection within 24 hr of birth
• Seizures
• Signs of shock
• Need for mechanical ventilation in a term baby
• Suspected or confirmed infection in a co-twin

Management

• Any red flags or no red flags but ≥2 risk factors or clinical indicators:
  - perform investigations, including blood cultures, and start antibiotics

• No red flag or clinical indicators but one risk factor or no red flag or risk factors but 1 clinical indicator:
  - use clinical judgement and consider withholding antibiotics. Monitor baby for clinical indicators of possible infection, including vital signs.
  - Monitor for at least 12 hr from birth (at 1 hr, 2 hr and then 2-hrly for 10 hr)

• If further clinical concerns, perform investigations including blood cultures and start antibiotics

• If decision made to give antibiotics, aim to start within 30 minutes and always within 1 hr of decision

Feeding

Feeding difficulties is probably the most common problem with late preterm infants, even when they appear vigorous.

Decreased feeding stamina leads to less effective suckling and decreased transfer of milk whilst sub-optimal breast stimulation leads to poor milk supply.
The ability to co-ordinate suck, swallow and breathe is often inefficient in late preterms.

Poor muscle tone causes feeding fatigue, latch difficulty and suboptimal feeding.

Both late preterms and SGA babies have fewer awake, alert periods thus are less likely to initiate feeding and more likely to end the feed prematurely.

Poor feeding further increases the risk of hypoglycaemia, hyperbilirubinaemia, increased weight loss and readmission to hospital.

**Management**

Late-preterm infants may not be able to handle a flexible feeding schedule because they may not "make-up" the intake volume after sleeping for three to five hours and fall behind in the required daily intake for growth. The late preterm infant will need to be on a set feeding schedule or may require nasogastric feedings if the infant becomes fatigued and is unable to take adequate feeds.

Active feeding management plans are designed to prevent adverse outcomes, ensure adequate milk intake, and establish milk supply in the breastfeeding mother.

Active management of feeding during the first 72 hours does appear to establish feeding faster and prevent morbidity secondary to poor feeding.

An individualised feeding plan should be introduced to every late preterm and SGA baby admitted for routine postnatal care. This plan will need to be adapted on a daily basis for the first 3 days of life and beyond if feeding is slow to establish.

Late preterms and SGA babies will lose weight as does any newborn. It is important to advise the mothers of this so they do not worry unnecessarily.

Infants are usually discharged when the weight reaches 2000g. Infants who weigh less than 2200g at birth may subsequently lose enough weight to go below the discharge weight. The parents should be informed of this on admission so the mother can prepare for a longer hospital stay.
Although these babies have unique nutritional needs there is no documented evidence on what these needs are and how best to provide them.

In the absence of any guidance from the literature the following strategies are recommended.

Frequent weight checks are important if the primary care provider is concerned about inadequate intake.

Management Plan Details

Breast Feeding

- If the infant weighs less than 2200g consider the use of a nasogastric (NG) tube to give supplements for the first 24-48 hours. Although early feeds are often taken well within a day or two it is common for feeding to falter. Supplement feeding with a NG tube permits the baby to use less energy for feeding early on and this seems to permit the establishment better feeding by 72 hours.

- Mothers should be taught feeding cues so that feeds can be initiated before crying

- The maximum interval between feedings should be no more than 3 hours

- A feed should be completed within 30 minutes.

- Supplements:  
  - First 24 hours: 5-10mls per feed
  - 24-48 hours: 10-15mls per feed
  - 48 hours and beyond: 20-30mls per feed

- After 48 hours supplementing should be reviewed. If the baby is feeding well supplement alternate feeds and stop supplements on day four unless feeding is considered to be inadequate

- Breastfeed for approximately 20 minutes before supplementing if the baby is able to feed that long, otherwise give the supplement when the babies’ efforts are slowing
• Good positioning is essential to prevent any airway obstruction from excessive flexion of the head and trunk

• Express following each feed, ideally within 6 hours of birth, to stimulate milk production and to obtain colostrum to give with next feed

• Finger feeding or a nursing supplementer may be used to give the supplement

• If using a NG tube introduce the supplement after 15 minutes or earlier if babies feeding efforts decrease

• It must be considered that these quantities are based on supplementing breastfeeding. If the baby does not latch onto the breast at any one feed the amount of milk should be increased to give a full feed

• If breastfeeding is still difficult after milk production has started a small sized nipple shield can be introduced as this can make feeding easier for these babies

**Bottle Feeding**

• Work out the exact feed volume according to weight.

• During the first 48 hours try and avoid giving above this to ensure baby has frequent smaller feeds. The aim is to establish effective regular feeding, NOT to increase weight rapidly.

• Rapid weight gain in late preterms and especially SGA babies has a very strong link with childhood obesity and obesity related morbidity.

• In babies below 2200g it still may be beneficial to use a NG tube at first.

• In the first 24 hours half of the feed may be given orally and the rest by NG tube for example.

• Feeding time by 24-48 hours should be 15-20 minutes, if baby has not finished the feed by 20 minutes complete the feed using the NG tube.
• After 48 hours increase feeding time to maximum of 30 minutes. By 72 hours if baby is demanding more than prescribed amount of milk, quantities or frequency can be increased.

**Jaundice**

Several studies have found an increased risk of hyperbilirubinemia in late-preterm infants. Rehospitalisation for jaundice occurs more frequently in late-preterm infants than in term infants.

Late-preterm infants have an immature hepatic system with limited ability to conjugate bilirubin. When combined with the risk of inadequate fluid intake and dehydration, decreased excretion of bilirubin and increased enterohepatic circulation of bilirubin occurs. The risk of extremely high levels of bilirubin leading to kernicterus also exists.

Thus late preterm infants, particularly those who are breastfed, are at higher risk of developing hyperbilirubinaemia and require closer surveillance and monitoring.

Research on the ability of nurses who care for newborns to determine the infants' progression to jaundice through a cephalocaudal assessment compared with laboratory evaluation revealed that the nursing assessment strategy often failed to identify jaundiced infants; this finding was especially true for late preterm infants.

Therefore cutaneous bilirubin screening and/or a serum bilirubin determination may be indicated based on clinical findings.

The differential diagnosis of hyperbilirubinemia should be considered.

If the conclusion of the differential diagnosis is lack of milk, then primary treatment of hyperbilirubinemia is to increase the amount of milk fed to the infant, ideally through improved breastfeeding techniques or via expressed breast milk.

Institution of phototherapy for breastfeeding jaundice may actually interfere with the primary treatment of getting increased quantities of milk to the baby.
Management will depend on the bilirubin level according to gestation. See the appropriate guideline (NICE)

**Recommended Minimum Criteria for Discharge of Late-Preterm Infants**

Because late-preterm infants are at greater risk of neonatal morbidity and mortality than are term infants, parents of late-preterm infants may need special instruction and guidance before hospital discharge and closer follow-up after discharge.

Late-preterm infants who have risk factors, such as those who are breastfed or are first born, are most vulnerable. It is especially important to educate first-time mothers of late-preterm infants how to evaluate feeding success and what signs to look for to detect dehydration and hyperbilirubinaemia. In some circumstances, this education may require a longer birth hospitalisation.

Suggested discharge criteria for late-preterm infants are as follows:

1. Timing of discharge is individualized and based on feeding competency, thermoregulation, and absence of medical illness and social risk factors (see below).

2. A follow-up visit arranged for 24 to 48 hours after hospital discharge. Additional visits may be indicated until adequate weight gain has been demonstrated.

3. Vital signs should be documented as being within reference ranges and stable for the 12 hours preceding discharge, including a respiratory rate of less than 60 breaths per minute, a heart rate of 100 to 160 beats per minute and axillary temperature of 36.5 to 37.5°C (97.7–99.5°F) measured in a cot with appropriate clothing.

4. Twenty-four hours of successful feeding, either at the breast or with a bottle, and the ability to coordinate sucking, swallowing, and breathing while feeding has been demonstrated. Any infant with a weight loss of more than 2% to 3% of birth weight per day or a maximum of 7% of birth weight during the birth hospitalization should be assessed for evidence of dehydration before discharge.
5. A formal evaluation of breastfeeding, including observation of position, latch, and milk transfer, has been undertaken and documented in the chart by trained caregivers at least twice daily after birth.

6. A feeding plan has been developed and is understood by the family.

7. A risk assessment for the development of severe hyperbilirubinaemia has been performed and appropriate follow-up has been arranged.

8. Physical examinations of the infant reveal no abnormalities that require continued hospitalization.

9. Family, environmental, and social risk factors have been assessed. When risk factors are identified, the discharge should be delayed until they are resolved or a plan to safeguard the infant is in place. Such risk factors may include but are not limited to:

   (a) untreated parental substance use or positive toxicology test results in the mother or newborn infant

   (b) history of child abuse or neglect

   (c) mental illness in a parent in the home

   (d) lack of social support, particularly for single, first time mothers

   (e) ongoing or established risk of domestic violence

   (f) adolescent mother, particularly if other risk factors are present

10. The mother and caregivers have received information or training or have demonstrated competency in the following:

   (a) infant’s hospital course and current condition

   (b) expected pattern of urine and stool frequency for the breastfeeding or formula-fed neonate (verbal and written instruction is recommended)

   (c) umbilical cord, skin, and newborn genital care
(d) hand hygiene, especially as a means to reduce the risk of infection

(e) use of a thermometer to assess an infant’s axillary temperature

(f) assessment and provision of appropriate layers of clothing

(g) identification of common signs and symptoms of illness, such as hyperbilirubinaemia, sepsis, and dehydration

(h) assessment for jaundice

(i) provision of a safe sleep environment, including positioning the infant on his or her back during sleep

(j) newborn safety issues including car safety seat use, need for smoke/fire alarms, and hazards of second hand tobacco smoke and environmental pollutants

(k) appropriate responses to a complication or an emergency

(l) sibling interactions and appropriate inclusion in care responsibilities

References

"Late-Preterm" Infants: A Population at Risk: William A. Engle, Kay M. Tomashek and Carol Wallman: Pediatrics 2007;120;1390

Evidence-based Care Management of the Late Preterm Infant: Ana Souto, MS, PNP, Miriam Pudel, MS, PNP, Donna Hallas, PhD, PNP-BC, CPNP: J Pediatr Health Care. 2011;25(11):44-49

Health Risks Associated With Late-Preterm Infants - Implications for Newborn Primary: Care Erica Saleski Forsythe, MSN, RN, Patricia Jackson Allen, MS, RN, PNP-BC, FAAN: Pediatr Nurs. 2013;39(4):197-201

Neonatal Thermoregulation and Parameters Guideline 2011: M Bailey S Agius