The Late Preterm Infant: Nursing Care and Management

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Objectives

- Provide an overview of the clinical significance of even mild prematurity
- Demonstrate understanding of the unique needs of the Late Preterm Infant (LPI)
- Review guidelines to promote evidence based care for this population
Which image do you think of first when you think of premature babies?
This One?

Or This One?
What about these ones?
“Near Term”

- According to National Institute of Child Health and Human Development (NICHD)
  - “Near Term” can be misleading
  - Suggests that these babies are more like term infants
  - Can result in underestimation of risk

- “Near Term” be treated as developmentally mature and at low risk of morbidity
  - Physiologically and metabolically immature
  - Higher risk of developing medical complications
  - Higher rates of mortality, morbidity, hospital readmission
Late Preterm Infant defined

- Late Preterm Infant (LPI) is one born between 34 0/7 weeks and 36 6/7 weeks

- 36 6/7 weeks established previously as upper limit of gestational age for prematurity

- LPI often the size and weight of a term infant (>37wks GA)
“Late Preterm”

- According to National Institute of Child Health and Human Development…
  
  - No such thing as a “normal” preterm infant
  
  - “Late preterm” conveys sense of vulnerability
Round Down

- Optimizing Care and Outcomes for Late Preterm Infants panel suggests:
  - Gestational age should be rounded off to the nearest completed week
  - Therefore a baby at 35 5/7 weeks is 35 weeks, not 36 weeks
Distribution of gestational age categories
United States, 2012

Late preterm births
United States, 2014-2016

https://www.cdc.gov/nchs/data/nvsr/nvsr64/nvsr64_12.pdf
Late preterm births by race/ethnicity
United States, 2011-2013 Average

All race categories exclude Hispanics. Late preterm is between 34 and 36 weeks gestation.
Multiple deliveries include twin, triplet and higher order deliveries. Late preterm is between 34 and 36 weeks gestation.

The Surge of Late Preterm Births in the 1990’s

- Maternal Factors
  - Induction: Increased from 9.5% to 20.6% (25% elective induction in 2003)
  - Stimulation/Augmentation: ↑59% to 16.7% of births in 2003
  - Multifetal pregnancies: ↑ from 2.4% of live births in 1992 to 3.2% in 2002


Risk Factors for Late Preterm Delivery

- Late or no prenatal care
- Elective induction, augmentation, cesarean
- Premature Rupture of Membranes
- Short inter-pregnancy intervals
- Preeclampsia

- Urinary tract or vaginal infections
- Pre-existing Medical Conditions
  - Hypertension
  - Diabetes
  - Clotting disorders
Risk Factors for Late Preterm Delivery

- **Lifestyle Factors**:
  - Use of tobacco, alcohol or drugs
  - Domestic violence
  - Lack of social support
  - High levels of stress
  - Working long hours, upright
  - Low income
“Don't rush your baby's birth day”
Characteristics of the LPI

- Low Body Fat
- Low Birth Weight
- Jaundice
  - Delay in bilirubin metabolism
- Feeding difficulties
  - Immature suck and swallow
- Immature immune system
- Failure to thrive
  - Respiratory distress
  - Low tone
- Poor state regulation
- Hypothermia
- Hypoglycemia
- Excessive weight loss
- Low glycogen stores
Clinical Outcomes: Full term vs. LPI

Outline

- Hypothermia
- Hypoglycemia
- Respiratory Distress
- Hyperbilirubinemia
- Sepsis
- Excessive Weight Loss
- Failure to thrive
- Feeding Difficulties
Temperature Instability

Full Term

Late Preterm
~10-30% of late preterm infants have persistent temp instability beyond initial transition (ideal 36.5-37.5)

- Increased heat loss potential
- Impaired ability to produce heat
Various Modes of Heat Loss

- **Radiation**: transfer of heat to cooler objects (windows)

- **Convection**: heat transferred to the air surrounding infant

- **Evaporation**: wet surfaces exposed to air, then dries (amniotic fluid drying on infant, loss of heat occurs)

- **Conduction**: direct contact with cooler object
Do you know…???

A naked newborn exposed to an environmental temperature of $23^\circ C$ ($73.4^\circ F$) suffers the same heat loss as a naked adult in $0^\circ C$ ($32^\circ F$)
Temperature Instability

- **Interventions**
  - Delay interventions at birth that increase heat loss
  - Skin to skin care with mother immediately after birth and as frequently as medical condition allows
  - Dress infant with hat, double blankets if necessary
  - Use servo-control and temp. probe while in warmer/incubator
Temperature Instability

- **Interventions**
  - Document ambient temperature/clothing necessary to maintain optimal body temp
  - Assess carefully for cause of changes in temperature
    - Primary thermo-regulation vs. sepsis, respiratory issues, hypoglycemia
    - Warm consistently: incubator, servo-control, monitor NTE, slow transition to OC, additional clothing when in open crib
  - Notify provider of episodes of hypothermia
Temperature Instability

- **Parent Education**
  - Importance of temperature regulation
  - Avoid over or under dressing infant
  - When to call healthcare provider:
    - Temp instability with changes in infant (poor feeding, irritability, lethargy)
Skin to Skin Safely
Skin to skin benefits

- Temperature stability (thermal synchrony)
- Higher oxygen saturation
- Improved breastfeeding & milk production
- Increased attachment and bonding
- More mature sleep organization
- Better autonomic regulation
- Effective as pain control
- Increased weight gain
- Shorter hospital stay
- Enhances immune system
- Stimulates digestion


Outline

- Hypothermia
- Hypoglycemia
- Respiratory Distress
- Hyperbilirubinemia
- Sepsis
- Excessive Weight Loss
- Failure to thrive
- Feeding Difficulties
Hypoglycemia
Hypoglycemia

- **Definition/Impact**
  - Serum glucose levels of <45mg/dl* in the first 24 hours
  - LPI are up to three times more likely to have episodes of hypoglycemia as term infants
  - Legal implications
Hypoglycemia

**Etiology**
- Inadequate Glycogen Stores
- Increased Glucose Utilization
- Impaired ability to take in adequate nutrition
Hypoglycemia

- **May Cause:**
  - Repeated lab testing or screening
  - Alterations in normal feeding patterns and choices including:
    - Exposure to artificial baby milk (foreign proteins, change in gut pH/permeability)
    - Impaired milk production and transfer
  - Increased risk of separation and admission to NICU
UCSF NC² Asymptomatic Infants-at-risk

1st HOL
- Initial Feed within 1 hour → Screen glucose 30 mins after initiation of 1st feed
  - <25: Oral glucose gel → Feed
  - ≥25: Routine Care

2nd HOL
- Screen glucose at 2 HOL (before feed)
  - <39: Oral glucose gel → Feed → Re-check glucose in 1 hour
  - ≥40: Routine Care

3rd HOL
- Glucose Re-check at ~3 HOL (before feed)
  - <25: IV treatment
  - 25-39: Oral glucose gel → Feed → Re-check glucose in 1 hour
  - ≥40: Routine Care

MAXIMUM of THREE doses of oral glucose before proceeding to IV treatment.

Consider IV treatment prior to third dose of oral glucose gel if infant is not having sequentially rising glucose in response to oral therapy.
UCSF NC² Symptomatic Infants

Screening and Management of Neonatal Hypoglycemia in SYMPTOMATIC infants >= 34 Weeks Gestational Age

"CONCERNING" symptoms:
- Seizure
- Lethargy/decreased responsiveness
- Hypotonia
- Apnea
- Cyanosis

Target glucose >= 45 prior to routine feeds

"Concering" Symptoms: check glucose

Glucose <45
- IV treatment
- Recheck glucose 15 mins after IV glucose complete.
  - <45
  - >=45

Glucose >=45
- Evaluate for other causes of symptoms

"POSSIBLE" symptoms:
- Jitteriness/tremors
- Irritability
- Exaggerated Moro reflex
- High Pitched cry
- Excessive sleepiness/drowsiness

"Possible" Symptoms: check glucose

Glucose <45
- Oral glucose gel
- Feed
- Recheck glucose in 1 hour

Glucose >=45
- Evaluate for other causes of symptoms

Glucose <35
- IV Treatment
- Oral glucose gel
- Feed
- Recheck glucose in 1 hour
  - <45
  - >=45

Glucose 35-44
- Continue glucose monitoring, evaluate for underlying cause.

Glucose >=45
- Continue glucose monitoring, evaluate for underlying cause.

It is reasonable to trial oral glucose gel (in small aliquots, 0.5mL at a time) in babies with concerning symptoms while attempting to obtain IV access.
# UCSF Neonatal Hypoglycemia in the Critical and Transitional Care Setting

<table>
<thead>
<tr>
<th>Patient Population</th>
<th>Blood Glucose mg/dL</th>
<th>Symptomatic</th>
<th>Asymptomatic</th>
<th>Intervention</th>
</tr>
</thead>
</table>
| All (Including NICN) | <25 mg/dL | ✓ | ✓ | Notify MD/NNP  
Place IV  
Obtain order for:  
• D<sub>10</sub>W bolus – 2 mL/kg  
• D<sub>10</sub>W @ 80 mL/kg/day |
| NICN Patients with:  
  - Encephalopathy  
    - HIE  
    - Perinatal stroke  
    - Seizures | <60 mg/dL | ✓ | ✓ | Notify MD/NNP  
Place IV  
Obtain order for:  
• D<sub>10</sub>W bolus – 2 mL/kg  
• D<sub>10</sub>W @ 80 mL/kg/day |
| All Infants Identified as “at Risk” (Except NICN) | <50 mg/dL | ✓ | | Notify MD/NNP  
IV Dextrose per order  
**AND/OR**  
Feeding per order |
| All Infants Identified as “at Risk” (Except NICN) | <50 mg/dL | ✓ | ✓ | Notify MD/NNP  
Feeding per order  
**AND/OR**  
IV Dextrose per order |
Blood Glucose testing tips

- For heel sticks:
  - Warm heels to improve circulation
  - Wipe away first drop
- Accuracy in low range depends on manufacturer
- Low or high hematocrit can effect value
- Confirm low levels with iSTAT or stat blood sample sent to laboratory
- Do not delay treatment
Hypoglycemia-Interventions

- Maximize energy intake
  - Encourage early, frequent, effective BF
  - Supplement as clinically indicated (not as routine) following evidence-based guidelines

Methods of supplementation to breastfeeding

Figure a: A 5- or 10-mL syringe containing expressed human milk and/or formula can be attached to a 5 Fr feeding tube, the end of which should be inserted along the infant’s palate after she/he has latched properly onto the breast. The syringe should be slowly pushed when the infant sucks.

Figure b: During “cup feeding,” the infant is supported in a slightly upright position. A small cup containing supplement is placed at the bottom lip to stimulate mouth opening. The cup is then tilted so that the baby can slowly sip.

Figure c: For “finger feeding,” supplement is drawn into a 5- or 10-mL syringe, which is then attached to a 5 Fr feeding tube. The end of the tube should be supported by a gloved finger when introduced into the infant’s mouth. As the infant sucks on the finger, the syringe plunger can be slowly pushed.
Outline

- Hypothermia
- Hypoglycemia
- Respiratory Distress
- Hyperbilirubinemia
- Sepsis
- Excessive Weight Loss
- Failure to thrive
- Feeding Difficulties
- Car seat safety & Discharge
Respiratory Distress
Respiratory Distress

Definition/Impact

• Respiratory distress requiring intervention is approximately 30% more common in LPI
• Rates are inversely proportional to gestational age
• Rates of any respiratory distress are increased by 4-20+ times

Respiratory Distress Syndrome (RDS) is not the same as Respiratory Distress
Respiratory Distress

- **Etiology**
  - Surfactant deficiency
  - Retained fetal lung fluid
  - Bacterial infection causing pneumonia
  - Inability to meet physiologic demands
  - Patent Ductus Arteriosus or Congenital Heart Disease

  **Respiratory distress is one of the most common indications for transfer to NICU or delayed discharge**
Frequency of RDS, Sepsis and Apnea at 34-36 Weeks

Respiratory Distress

- **Interventions**
  - Closely monitor for first hour of life
  - Minimize oxygen requirements or demands
  - **DELAY BATH**
  - Maintain NTE
  - Minimize procedures/hands-on; provide developmental support
  - Positioning, skin-to-skin
  - Supplemental oxygen if indicated
  - Evaluate need for continuous airway pressure
Respiratory Distress-Parent Education

- Provide anticipatory guidance and support for family regarding:
  - Teach recognition of respiratory distress and apnea
  - Potential interventions
  - Duration & length of stay
  - Risk of rehospitalization
Outline

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Hyperbilirubinemia - definition

- Hyperbilirubinemia is defined as an elevated serum total bilirubin (TB) level
  - > 10-12 mg/dl in term
  - > 4-5 mg/dl in preterm infants
    - Usually peaks around 5-7 days
    - Later peak in preterm infants

- Values vary depending on the infant’s age in hours, gestational age, and pathology
  - http://phototherapyguidelines.com/
Hyperbilirubinemia and the LPI

![Graph showing serum total bilirubin levels over days for term and near-term groups. The graph has two lines: one for the term group (n=219) and one for the near-term group (n=146). The y-axis represents serum total bilirubin (mg/dL) and the x-axis represents days.]
Incidence of Jaundice

- Jaundice as a cause for discharge delay
  - 16.3% at 35-36 weeks
  - 0.03% at term

- Bilirubin-induced brain injury
  - Late preterm infants represent a large fraction of infants in kernicterus registries
  - LPDs are twice as likely as term infants to be treated for jaundice
Recommendations for Prevention (AAP, 2004)

- Assess risk factors every shift:
  - Measure levels in all infants with jaundice in first 24 hours
  - Recognize that visual estimation is inaccurate
  - Promote & support BF
  - Establish protocols for identifying and evaluating
  - Perform thorough risk assessment
    - Race, cephalhematoma, blood type, etc
  - Interpret levels according to age in hours
  - Plan for repeat level if d/c’d before 72 hours
Phototherapy

Let me cut that for you.
Outline

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Sepsis
Sepsis

• Evaluation and treatment are inversely proportional to gestational age
• LPI are 3 times more likely to have sepsis evaluation
• LPI 30% more likely to be treated
• Most commonly sited organism of concern is Group B Strep (GBS)
• Most commonly noted site of infection in early sepsis is lungs (pneumonia)
Sepsis-Etiology

• Maternal infection or colonization (cold, flu, chorio, prolonged ROM)

• Cause of preterm delivery (PIH/HELLLP) may confuse or mask evaluation for sepsis

• LPI are more likely to have impaired immune response

• LPI are less likely to tolerate the physiologic stress of sepsis
Sepsis-Assessment and Screening

- Assess cause of PTL and delivery
- Consider placental examination
- Assess maternal GBS status and treatment in labor

**Early-onset sepsis** is defined as infection occurring $\leq 72$ hours of birth.

**Late-onset sepsis** is defined as infection occurring $> 72$ hours of birth.
Early-onset sepsis
Risk factors

- Maternal infection (e.g. chorioamnionitis/fever/antibiotics)
- Prolonged rupture of membranes (>24h)
- Maternal GBS colonisation or infection in current pregnancy/confirmed invasive GBS infection in a previous baby
- Spontaneous preterm labour
Late-onset sepsis >72 hours

- Babies become colonized after birth and then develop invasive infection
- Organisms are acquired after birth (‘nosocomial’ or ‘healthcare-acquired infection’ – so potentially avoidable)
Sepsis-Interventions

- Vigilance: any abnormal finding may indicate sepsis
- Careful assessment and full treatment of mother in labor with GBS, other infections or PROM
- Careful and prolonged clinical assessment for signs of sepsis
- Obtain Neonatology consultation
- Early intervention with broad spectrum antibiotics if indicated
- Follow blood culture and clinical signs
Rules of the “Rule Out”

▪ All preterm infants with the possible exception of a delivery after an induction for maternal reasons

▪ All infants with any respiratory symptoms, feeding intolerance or changes in neurologic status

▪ Any baby that just “doesn’t look quite right”
Baby W

- Baby boy born to a G3-P2 by scheduled C/S at 1100 @ 36 6/7 weeks
- GBS positive… but not ruptured… so not treated
- At 1 hour of life (1200) dusky spell during bath, blow by oxygen given then recovered
- 2nd episode of being “spitty” with another dusky spell
- Moved to nursery, placed on warmer, oxygen cannula placed
- Sepsis work up ordered (CBC and Blood Culture)
Baby W

- CBC sent, but unable to obtain blood culture
- Vital signs significant for temp 100.4, nurse replaced temp probe
- Pediatrician went home, left orders for lab draws
- Multiple pokes for lab draws, bruising noted at tourniquet sites
- MD called back in to place line for blood culture
- Umbilical line placed, culture sent
Baby W... the story continues

- PIV infiltrated during Ampicillin admin, Gent given through UAC
- MD went home, told RN to call at 0400 with blood gas results
- Respiratory distress with irritability during the night, more “spits”
- Emergent intubation required at 0500, baby critically ill, transferred to tertiary facility
- Blood culture positive at 20 hours of life for Streptococcus
Take Aways

- Babies show non-specific signs of sepsis, trust your instincts
- Do not normalize the abnormal
- Look at the whole picture
- Communicate your findings
- Give a thorough handoff

- Dusky spell
- Required blow by
- “spitty”
- 2nd dusky spell
- Increased oxygen need
- Temp instability
- Bruising
- Increased respiratory distress
- Irritability
- More “spits”
Early Identification... A New Approach: The Probability of Neonatal Early Onset Infection

- Based on the work by Drs Gabriel Escobar and Karen Puopolo, et al. (2014)

- Goal: To define a quantitative stratification algorithm for the risk of EOS in newborns greater than or equal to 34 weeks gestation

- The question: Is there a way to use maternal OBJECTIVE data with OBJECTIVE neonatal clinical findings to define more efficient strategies for the evaluation and treatment of EOS in term and late preterm infants?

- The potential result: Decreased antibiotic treatment in newborns
How?

▪ Escobar, Puopolo, et al. looked at over 600,000 live births with a gestational age greater than or equal to 34 weeks at 14 hospitals between the years of 1993 and 2007

▪ Identified ALL 350 EOS cases that occurred at less than 72 hours of age

▪ These cases were matched by birth year and birth hospital to 1063 controls

▪ The model uses 5 predictors to compute a potential risk of sepsis at birth

▪ The risk is then adjusted based on infant-specific data to guide evaluation and treatment decision (Bayesian approach)
“The Calculator” – Let’s try it!


▪ CASE: 39 1/7 week G3P1 presents with c/o labor. Contractions every 3 - 5 minutes. Cervical exam at 1.5 cm. BOW intact. Labors to complete in 1.5 hours. Ruptures 20 min prior to delivery. GBS negative, no antibiotics administered. Last temperature prior to delivery 98.9 degrees F.

▪ Based on the calculator, what is the baseline risk of EOS?

▪ What if the gestational is 35 1/7 weeks?
Equivocal Signs

- In the first 12 hours of life, the baby experiences either:
  - Two (2) of the following abnormalities that persist for 2 hours, or
  - One (1) abnormality that persists for 4 hours
- Heart rate ≥ 160
- Respiratory rate ≥ 60
- Temperature ≥ 100.4F or < 97.5F
- Respiratory distress (grunting, flaring or retracting)

(Escobar, et al. 2014)
Which baby gets antibiotics?

- 35 1/7 week
  - 101.6 F
  - ROM 14 hour
  - GBS pos w/abx

- 35 1/7 week
  - 102.1 F
  - ROM 19 hours
  - GBS pos w/abx
### Which baby gets antibiotics?

<table>
<thead>
<tr>
<th>Risk per 1000/births</th>
<th>EOS Risk @ Birth</th>
<th>0.30</th>
</tr>
</thead>
<tbody>
<tr>
<td>EOS Risk after Clinical Exam</td>
<td>Risk per 1000/births</td>
<td>Clinical Recommendation</td>
</tr>
<tr>
<td>Well Appearing</td>
<td>0.12</td>
<td>No culture, no antibiotics</td>
</tr>
<tr>
<td>Equivocal</td>
<td>1.49</td>
<td>Blood culture</td>
</tr>
<tr>
<td>Clinical Illness</td>
<td>6.29</td>
<td>Empiric antibiotics</td>
</tr>
</tbody>
</table>
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Feeding Issues
Feeding Issues

Definition/Impact

• Up to 25% of LPI have delayed discharge due to feeding difficulties
• Excess weight loss (>3% first 24 hours, >7% at 72 hours)
• Physiologic changes during feedings (desaturations)
• Inability to take adequate nutrition by mouth,
• Feeding difficulties can lead to sepsis evaluations, separation of mother and infant, admission to NICU
Feeding Issues - Etiology

- Difficulty coordinating suck, swallow and breathing
- Easily exhausted
- Increased need for calories
- Mild hypotonia
- Less alert awake periods
- GI tract less mature
I can’t even...
Interventions

▪ Identify maternal risk factors that may affect successful feeding

▪ Ensure adequate feeding frequency

▪ Facilitate immediate, uninterrupted, and extended skin-to-skin for stable infants until after the first breastfeeding
UCSF Breastfeeding Policy for LPI

- Skin to skin as much & as early as possible
- Early colostrum expression
- Formal lactation consult within 24 hours
- Pumping initiated 24 hours for 10-20 mins after feeding LPI
- Weight loss >3% in first 24 hours or >7% at 72 hours of life requires further eval and monitoring
- Prevent thermal stress during breastfeeding
- Do not supplement unless medically indicated, ordered and consented to by mother
Support for Breastfeeding (N2 consortium)

- Skin to skin
- Lactation Consultation
  - Should be offered to ALL mothers of late preterm
- Milk Expression/Hand expression
  - Initiate within 4 hours from birth
- Assessment of Breast Milk Transfer
  - LATCH scoring
  - Consider weighing after DOL 3
- Assessment of hydration status
  - daily weights, weighing/counting diapers
- Duration of Supplementation
  - Until infant can feed effectively
Supplementing

- Supplement with, expressed breast milk, donor breast milk, hydrolyzed formula, formula

- Supplement no more than recommended volumes
  - First 24 hours- 2-10mL per feed
  - 24-48 hours- 5-15mL per feed
  - 48-72 hours- 15-30mL per feed
  - 72-96 hours- 30-60mL per feed

- Do not supplement unless medically indicated, ordered and consented to by mother
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Car Seat Safety

- We’re no longer doing Car Seat Testing!!
Late Preterm Infants are not just smaller versions of term infants

- Increased risk of:
  - Morbidity and mortality
  - Resuscitation
  - Jaundice
  - Hypoglycemia
  - Temperature instability
  - Apnea
  - Respiratory distress
  - IV fluid administration
  - Ventilatory support
  - Length of stay
  - Rehospitalization

Born in a critical developmental time period
Bibliography/Resources


- AWONN Late Preterm Infant Initiative (2005-2006): What Parents of Late Preterm (Near-Term) Infants Need to Know

- AWONN Late Preterm Infant Initiative (2005-2006): Questions Parents of Late Preterm (Near-Term) Infants Should Ask


- CPQCC Care and Management of the Late Preterm Infant Toolkit: Concept, Care Planning, Gestational Age Assessment, Physiologic Monitoring, Education and Evaluation (Zlotnik, P. MD), 4/9/07
Bibliography/Resources

- CPQCC Care and Management of the Late Preterm Infant Toolkit: At Risk for Sepsis (Powers, R. MD), 4/9/07


