Optimizing the Care of the Late Preterm Infant

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DISCLOSURE STATEMENT

Speaker: Eustratia Hubbard, M.D.
Dr. Hubbard has documented that she has nothing to disclose.

Objectives

1. Review definition and characteristics of LPI
2. Discuss the increased risk of negative outcomes for LPIs
3. Describe multidisciplinary management for the inpatient care of LPI
A Late Preterm Infant is NOT Term

LPI are a significant sup-group of newborns

LPI birth rate is lower since 2007, but LPIs now have higher mortality
LPI have higher mortality

- Mortality rate is 3X that for term infants
  - Top cause: congenital malformations, SIDs, accidents, diseases of the circulatory system, intrauterine hypoxia, birth asphyxia
- By age at time of death compared to term infants:
  - Early neonatal mortality (< 7 DOL) 6-fold greater
  - Late neonatal mortality (7-27 DOL) 3-fold greater
  - Postneonatal mortality (>27 DOL) 2-fold greater
- Being SGA was an independent risk factor

Mortality risk is inversely proportionate to gestational age

<table>
<thead>
<tr>
<th>Weeks of Gestation</th>
<th>Neonatal Mortality per 1000 Live Births</th>
</tr>
</thead>
<tbody>
<tr>
<td>27</td>
<td>30.4</td>
</tr>
<tr>
<td>28</td>
<td>27.3</td>
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<tr>
<td>29</td>
<td>25.7</td>
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<tr>
<td>30</td>
<td>23.9</td>
</tr>
<tr>
<td>31</td>
<td>22.1</td>
</tr>
<tr>
<td>32</td>
<td>20.8</td>
</tr>
</tbody>
</table>

LPI have higher neonatal morbidity

- LPI are 7 times more likely to experience a serious morbidity: hospital stay > 5 nights + a potentially life-threatening morbidity, transfer to higher level medical facility, or death before discharge from birth hospitalization
- Morbidity decreases the closer an infant approaches term
- LPIs are 20, 10, & 5 times more likely to experience mortality at 34, 35, & 36 weeks, respectively, compared to 40 week infants
- Late preterm birth and maternal medical condition exposure were independent risk factors for morbidity during birth hospitalization
LPI medical problems during birth hospitalization

<table>
<thead>
<tr>
<th>Problem</th>
<th>Near-term</th>
<th>Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature instability</td>
<td>15%</td>
<td>0%</td>
</tr>
<tr>
<td>Hypoglycemia</td>
<td>15.6%</td>
<td>5.3%</td>
</tr>
<tr>
<td>IV fluids</td>
<td>36.7%</td>
<td>5.3%</td>
</tr>
<tr>
<td>Respiratory distress</td>
<td>28.9%</td>
<td>4.2%</td>
</tr>
<tr>
<td>Clinical jaundice</td>
<td>54.4%</td>
<td>27.9%</td>
</tr>
<tr>
<td>Due to prematurity</td>
<td>39.7%</td>
<td>7.6%</td>
</tr>
<tr>
<td>Discharge delay</td>
<td>35%</td>
<td>7%</td>
</tr>
</tbody>
</table>


LPI have higher NICU admission rates

Biological determinants of preterm birth and LPI- a double whammy

- Retrospective cohort study using city-wide perinatal database in London-Middlesex, Canada
- All singleton live births, excluding multiple gestations and major malformations
- LPI are at increased risk for NICU triage/admission \([aRR=6.14]\) and neonatal respiratory morbidity \([aRR=6.16]\) compared to infants born at 39-41 weeks
- Infants exposed to pathological intrauterine environment AND late preterm birth have excessive morbidity
- Biological determinants of preterm birth: infection/inflammation (inc premature rupture of membranes), placental ischemia and other hypoxia (inc hypertensive conditions, abruption, bleeding), and other (diabetes, oligohydramnios, polyhydramnios)

References:
**LPI have longer hospitalizations, more readmissions**

- Longer LOS as GA decreases: 12.6 days for infants born at 34 weeks, 6.1 days for 35 weeks, 3.8 days for 36 weeks—Pulver, et al. CW Pediatrics 2010
- LPI are 2-3 times more likely to be readmitted compared to term (top reasons jaundice, suspected sepsis, feeding difficulties)—Engle WA, et al. Pediatrics 2007

**Risk factors for morbidity in LPI**

- Never in NICU
- SGA
- Breastfed
- Asian
- Male
- Firstborn
- Public insurance

**Why LPI are a vulnerable population**

<table>
<thead>
<tr>
<th>Maternal Factors</th>
<th>Infant Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>High risk pregnancies</td>
<td>Increased risk for delayed or insufficient milk production</td>
</tr>
<tr>
<td>Advanced maternal age</td>
<td>Obesity</td>
</tr>
<tr>
<td>Multiple births</td>
<td>Diabetes</td>
</tr>
<tr>
<td>Comorbid conditions</td>
<td>Preeclampsia</td>
</tr>
<tr>
<td>Increased rate of surgical delivery</td>
<td>Uteroplacental abnormality</td>
</tr>
<tr>
<td></td>
<td>Breast hypoplasia</td>
</tr>
<tr>
<td></td>
<td>Breast surgery</td>
</tr>
<tr>
<td></td>
<td>Induced labor or surgical delivery before fetus signals readiness</td>
</tr>
<tr>
<td></td>
<td>Smaller in size, less substrates</td>
</tr>
<tr>
<td></td>
<td>Immature organ systems due to exit from intrauterine environment</td>
</tr>
<tr>
<td></td>
<td>4-6 weeks early</td>
</tr>
<tr>
<td></td>
<td>Appear healthier than very preterm and more similar to term infants</td>
</tr>
</tbody>
</table>
Reducing LPI Morbidity & Mortality

- Identification of LPI by best obstetric estimate and/or postnatal gestational age assessment
- Educate providers and staff on characteristics of LPI and common morbidities
- Prepare parents for potential vulnerabilities and extra care needed to prevent negative outcomes
- Monitor vulnerabilities from delivery room to discharge to outpatient
- Consistent model of care utilizing an institution’s resources and processes and input from multiple disciplines
- Individualizing care plan to the needs of infant and family

Oh where, oh where should LPI go?

**NICU**

- Pros:
  - Continuous cardiorespiratory monitoring
  - Smaller nurse-to-patient ratio

- Cons:
  - Maternal-infant separation
  - Increased intervention,
  - More bottle/formula feeding
  - Increased length of stay
  - Increased cost

**COUPLEt CARE**

- Pros:
  - More access to skin-to-skin contact & breastfeeding
  - Parents learn infant cues & provide care

- Cons:
  - Share nurse with more patients (1:6 to 1:10 ratio)
  - Intermittent monitoring of vital signs & appearance
  - “Blend in” with term infants and receive same care

Commonly encountered problems in neonatal period

- Excessive sleepiness
- Immature self-regulation
- Hypotonia
- Airway instability
- Poor suck and swallow coordination
- Hypothermia
- Hypoglycemia
- Excessive weight loss
- Breastfeeding difficulties
- Poor nutrient intake
- Feeding intolerance
- Jaundice
- Respiratory distress
- Apnea and bradycardia
- Sepsis
LPI struggle with thermoregulation

**RISK FACTORS FOR HYPOTHERMIA**
- Low subcutaneous fat (for insulation & gluconeogenesis)
- Low brown adipose tissue (for non-shivering thermogenesis)
- High surface area to body mass
- Poor extremity flexion (to reduce exposed surface)
- Immature, non-keratinized thin skin (to limit evaporative heat loss)
- Diminished secretion of thermogenic hormones (Thyroxine & Norepinephrine) & serotonin due to immature hypothalamus
- High metabolic rate & poor substrate stores
- Experience more interventions (decrease skin-to-skin time & increase environmental cooling)

**CONSEQUENCES OF HYPOThERMIA**
- Apnea
- Respiratory distress
- Hypoglycemia
- Somnolence
- Poor feeding
- Slow weight gain

Hypothermia is one of the leading reasons for LPI admission to NICU

### Preventing cold stress
- Dry immediately with warmed blankets
- Skin-to-skin contact (S2S) with proper positioning & nursing observation or place on pre-warmed resuscitation bed
- Uninterrupted S2S until after 1st feeding is preferred. Assess on mother’s chest and delay measurements.
- After transfer, available from neck-to-toe = frat when not S2S
- Delay bathing until after 24 h. (unless mother is HIV positive)
- Educate parents on importance of keeping infant warm by increasing temperature in room, keeping S2S when parent awake, or covering body with clothing/blankets and head with hat
- Monitor temperature frequently in first 4 hours, then every 4-6 hours until at least 48 hOL
- Respond to hypothermia with addition of warm blankets/hat while S2S. If no improvement in 30 minutes, move to radiant warmer.
- If recurrent temperature instability, consider transfer to NICU, sepsis screen/treat, increase caloric intake, simplify feeding process (or NG), incubator

### COLD Baby Guidelines (for babies > 35 weeks and 2 kg)
- **Thermoregulation and Warming Recommendations**
- **Ensure adequate core temperature**
- **Monitor for skin color changes**
- **Warming interventions**
- **Observe and record vital signs**
- **Evaluate frequent temperature changes**
- **Parental education**
- **Assess for cold stress**
- **Implement warming strategies**
- **Maintain core temperature**
- **Monitor for complications**
- **Interventions for hypothermia**
- **Assess for infection**
- **Nutritional support**
- **Simplified feeding process**

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LPI are at risk for hypoglycemia

- Low glucose stores in liver & muscle (especially if SGA or IUGR)
- Low subcutaneous fat stores
- Immature gluconeogenic & glycolytic pathways
- Poor ketogenic response to hypoglycemia
- Prolonged feeding/intake due to:
  - Sleepiness
  - Immature suck
  - Ileus
- Delayed maternal milk
- Low glycogen stores in liver & muscle
- High glucose consumption (cold stress, hypoxia, respiratory distress, sepsis)

Preventing hypoglycemia
- Follow a Hypoglycemia Management Protocol that describes prevention, monitoring, and responses
- Prevent cold stress
- First feeding within 1-2 HOL
- Educate parents on importance of adequate feeding every 2-3 hours & signs of hypoglycemia
- Supplement with human milk or formula if recurrent hypoglycemia
- Begin IV dextrose if symptomatic, severe, or recurrent hypoglycemia despite supplementation (and glucose gel)
- Glucose monitoring beginning within 1-2 HOL and continue for 24 hours minimum
- Monitor for symptoms of hypoglycemia and poor feeding for 48 hours

LPI birth & effect on lungs

- Transition from saccular to alveolar phase when air-space wall thins out & surface area increases
- Surfactant pool surges at 35 weeks
- Lower expression of ENaCs needed for transepithelial fluid movement
- Increased compliance of upper airways and chest wall
- Immature brainstem
- May miss out on labor-associated surges in steroids & catecholamines
- Underdeveloped lungs

Preterm Respiratory complications of low gestational age (PCRA) 2010;51:149
Increased respiratory support & morbidities

- Incidence of respiratory problems increases with decreasing gestational age
- Risk is increased if Cesarean section without preceding labor
- Pregnancy complications leading to preterm birth compound the risk
- Respiratory disorders are one of the top reasons LPI are admitted to NICU
- Long-term outcomes studies have relied on data from a time when GA determination was based on LMP alone & neonatal care has changed tremendously

Hibbard JU et al. Consortium on safe labor, respiratory morbidity in late preterm births. JAMA. 2010;304:419

LPI may experience intermittent hypoxemia

- Prospective cohort observational study comparing 43 “healthy” LPI to 42 term infants
- Overnight pulse oximetry on DOL 2-3, term equivalent & 45 weeks PMA
- Frequency of hypoxemic events per hour (desaturation ≥ 10% below preceding baseline)
- LPI had more intermittent hypoxemic events at birth and term equivalent age compared to term, differences resolved by 45 weeks PMA
- Association to neurodevelopmental outcomes not investigated and continue to be unknown


Preventing serious respiratory morbidity

- Before birth:
  - Prevention with antenatal steroids administration? Ongoing large clinical trial investigating benefit after 34 weeks gestation
  - Instruct infant caregivers against influenza & Whooping cough

- Delivery room:
  - Communication between maternal providers and pediatric delivery team
  - Adequate personnel and preparation
  - If mother/baby stable, S2S for transition observing airway, respiratory effort, color

- Transition
  - Frequent vital signs & keep infant warm
  - Nursing observation during first feeding
  - Early response to distress with neonatal team consultation & transfer to higher level of care if persistent

- Couplet care/Postpartum room:
  - Educate parents about signs of distress & apnea and to pay special attention during feedings
  - Educate parents on safe sleep practices. Model these by always placing infant flat & supine what not S2S on an awake parent
  - Educate parents on increased risk of death for LPI while bed-sharing. Discourage co-sleeping with multiples
  - Vital signs and nursing assessment at least every 8 hours, preferably every 4 hours during first 24 HOL
  - Be aware that apnea may emerge after 24 HOL as transitional hormones decrease
  - Home apnea monitors are not recommended and have not been shown to decrease risk of SIDS

Immunize infant caregivers against Influenza & Whooping cough

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Institutional policy to assist with identification of at-risk infants and guide response/treatment

- Emphasize the immune benefits of breastmilk with parents
- Educate parents on possible signs of infection & when to seek care
- Encourage parents to use hand hygiene, avoid contact with sick persons & follow recommended immunization schedule (same as for term infants)
- Some infants <35 weeks with multiple risk factors may be eligible for RSV prophylaxis

Less circulating maternal IgG
Immature cellular immunity, cytokine response and complement system
Stratum corneum & acid mantle in development
Leaky gut
Suboptimal microbiome due to Cesarean section, maternal/infant antibiotic exposure, nutrient type

Increased risk for sepsis, pneumonia
Suspected sepsis is one of the top reasons for readmission
Nearly 2X admission rate in infancy for RSV

Example of Policy: Identification and Treatment of Sepsis

LPI birth during critical time of neurodevelopment

During the last 6 weeks of gestation:
- 1/3 of brain volume acquired
- White matter increases 5-fold
- 1/6 of cerebellar volume acquired
- Rapid increases in neuronal connectivity, dendritic arborization, synaptic junctions
- Neurochemical pathways mature
- Less antioxidant enzyme expression

Brain of 35 week infant

Neurological symptoms in neonatal period:
- Excessive sleepiness
- Immature sleep-wake pattern
- Immature self-regulation
- Hypotonia
- Airway instability
- Apnea
- Poor suck and swallow coordination

Brain of 40 week infant
Addressing risk for negative neurological outcomes

- Incidence of periventricular leukomalacia in LPI is not known.
- Increased risk for upper airway obstruction and positional asphyxia.
- Increased risk for developmental delay.
- Increased risk for poor school readiness and learning problems in kindergarten including retention.
- More special education enrollment.
- 2.3X risk for full-scale IQ <85.
- More behavioral problems inc. inattention.
- Routine head imaging is not recommended for well LPI.
- Consider if risks for asphyxia/hypoxia, major malformations, significant IUGR or concerning signs/symptoms.
- Educate parents on need to position safely during feeding/sleep, awaken for feeds, observe for readiness to feed/interact vs signs of stress/overstimulation.
- Administer car seat test before discharge.
- Consider referral to developmental follow up or early intervention program if multiple risk factors or abnormal neurological exam.
- Encourage parents to regularly discuss developmental progression and concerns with outpatient provider.
- Adjusted age is not typically used when assessing LPI population.

Preventing negative events from positional apnea

- Educate parents on proper use of car restraint including rear-facing position, strap placement & tightness, etc.
- Time in car seat should be limited to when infant is in a moving vehicle.
- Encourage parents to avoid using devices that place infant in upright position until after due date.
- Assure that car seat is appropriate for infant's size.
- As recommended by AAP, car seat testing before discharge of all infants <37 weeks gestation at birth.

Preferred features of car seat for LPI:
1) Weight limit below 5 pounds
2) Five-point harness
3) Multiple shoulder slots with lowest slot <10 inches from seat bottom
4) Multiple crotch slots with closest slot <5.5 inches from seat back.
5) Avoid convertible seats which rarely fit small babies properly
6) No after-market products

Car Seat Testing of LPI

- AAP recommends minimum 90-120 minutes or duration of car ride home.
- No current guidelines on what defines fail.
- Use infant's car seat.
- Position as if traveling in car.
- Observation by trained staff.
- Cardiorespiratory & oxygen saturation monitoring.
- At our institution, fails test if any of the following:
  - Apnea greater than 20 sec
  - Heart rate < 80 bpm for > 10 sec
  - Oxygen saturation < 90% for > 10 sec

When infant fails car seat testing:
- If fit was poor, consider repositioning or obtaining new seat.
- If infant has been unmonitored in couplet care, consider transfer to NICU for continuous monitoring.
- If only problem is upright car seat, infant must ride in car bed.
- Use car bed until ~9 lbs or re-tested.
- A car bed is not as safe as a car seat during a vehicle accident.

Preventing events from positional apnea

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GI and Hepatic immaturity contribute to vulnerabilities

- Intestinal villi less developed
- Digestive enzyme levels lower
- Peristalsis & gastric emptying immature
- Sphincter tone/ regulation immature
- Limited microbiome
- Hepatic enzymes less active
- Lower bile acid pools
- Nutrient absorption suboptimal
- Prolonged ileus
- Leakly gut

- Biliubin conjugation impaired
- Glucose metabolism pathways delayed
- Hyperbilirubinemia
- Hypoglycemia
- Poor weight gain

- Poor weight gain even with adequate volumes
- Feeding intolerance
- Reflux
- Necrotizing enterocolitis (rare)

- Nutrient absorption
- Suboptimal
- Prolonged ileus
- Leaky gut

- Hepatic enzymes less active
- Lower bile acid pools

GI and Hepatic immaturity contribute to vulnerabilities

Human milk is best for term and preterm infants

- Smaller components easier to digest
- Contains enzymes & growth factors which assist with digestion
- Possesses immunological properties: antibodies, live immune cells, probiotic bacteria
- Preterm infants who are breast fed have less:
  - Feeding intolerance
  - Necrotizing enterocolitis
  - Late-onset sepsis
  - Complications related to parenteral nutrition
  - NICU length of stay

- Breastfed LPI are at greater risk of hyperbilirubinemia, hospital readmissions and death

But breastfeeding is associated with increased morbidity in LPI

- Breastfeeding initiation for LPI is 60-70% & percent breastfeeding at >4-10 weeks is much lower than that for term AND moderately preterm infants
- LPI are at greater risk for feeding problems (even if bottle feeding)
  - 51% of 34 week infants, 34% of 35 weeks, & 22% of 36 weeks, compared with 2% of infants born at >38 weeks
  - More likely to need NG feeds with decreasing gestational age: 50% of 34 week infants, 27% of 35 week infants, & 7% of 36 week infants
- Breastfed LPI are at greater risk of hyperbilirubinemia, hospital readmissions and death
- Breastfed LPI were 2X more likely than breastfed term infants to be readmitted or require hospital-related care if discharged from hospital was less than 48 hours after delivery.
Breastfeeding challenges for LPI

- Insufficient stimulation & emptying of breasts
- Poor milk production
- Poor intake
- Weight loss
- Poor energy
- Hypothermia
- Hypoglycemia
- Sleepy
- Poor stamina
- Sensitive
- Weak suckling
- Uncoordinated
- Small mouth
- Poor tone
- Low energy stores
- Separation from mom

Risks for delayed lactogenesis:
- Advanced age
- Infertility/PCOS
- Pre-eclampsia
- KUPF/Sulf/Pitocin
- Diabetes/Obesity
- C/S without labor
- Hemorrhage

Helping LPI breastfeed: “Extra” care by healthcare team

- Educate mothers on benefits of human milk so she understands why extra work is worth it. Offer daily reassurance
- Keep mothers & infants together for as long as possible
- Early & continued assistance by trained staff (Nurse may need to help with every feed initially)
- Twice daily assessment of feeding readiness cues, breastfeeding latch & milk supply (breast exam, pumping volume & frequency)
- Daily lactation consultation to observe feeding and update feeding plan (posted in room and documented in medical record)
- Ensure sufficient intake by following daily weights & feeding schedule
- Daily assessment by provider that infant has adequate nutrition and parent understands and is capable of following feeding plan
- Consider Occupational Therapy consultation
- Nutrition consultation once 7 days old

Late Preterm Infant Care Plan

- My name is
- Help me stay warm by:
  - Keeping my hat on all times
  - Holding me skin-to-skin
  - Swaddling me in several dry blankets
  - Check my temperature before each feed

- My feeding plan:
  - Breastfeed me every 3-4 hours, 6-10 feedings in 24 hours!
  - My mom pumps after I eat.
  - Pump breast at the same time for min.
  - Also give me breast milk and for int, every hours.

  - Tube at breast and tube with finger
  - No pacifiers
  - Other

  - My mother prefers to bottle feed me.
  - Feed me int, every hours

Completed by date
Helping LPI breastfeed—“Extra” steps for mother
- Early, continuous & frequent skin-to-skin
- First feeding within 1 hour of life if stable
- Feed on demand, at least 8 times/day, 15 minutes each
- Teach mother how to provide chin support if infant has slips off breast due to low tone or has a weak suck
- Try nipple shield & other feeding methods if unable to sustain latch
- Initiate hand expression/pumping if separated from infant, insufficient suck, or supplementing; emphasize its importance to establish milk supply
- Supplementation with human milk or formula when needed
- Document feeding details, pumping & output in Log Book
- Teach parents feeding readiness cues, to awaken infant if time to feed, how to assess adequate intake (falling asleep at breast does not mean stomach full & breast emptied) as well as to limit feeding duration if infant is SGA/IUGR

Helping LPI breastfeed—“Extra” milk when indicated
Consider supplementation when:
- Less than 36 weeks
- Low reserves (SGR or SGA)
- Excessive weight loss (>15%/day, or >16% total)
- Poor suck or <15 mL at breasts 8 times a day
- Hypothermia
- Hypoglycemia
- Jaundice and/or low milk volume
- Low maternal colostrum/milk volumes

Small volumes every 3 hours with breastfeeding:
- DOL#1 5-10mL
- DOL#2 10-20mL
- DOL#3 20-30mL
- DOL#4 30-40mL
- DOL#5 40-50mL

Type: Expressed maternal milk or donor breastmilk preferred over formula
Method: via tube/syringe at breast if vigorous/efficient otherwise cup feeding or bottle
May be easier with nipple shield and/or specially designed nursing system
Pace with small boluses to encourage sucking
Reassure mother that exclusive breast feeding is in her future once milk is flowing and infant can empty breasts

LPTI feeding tools – BF log book

Breastfeeding Guide and Logbook

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Nutrition considerations at discharge for breastfeeding LPI

- Provide Vitamin D 400 IU daily while breastfeeding
- Iron 2.4 mg/kg/day until 12 months old or formula feeding
- Multivitamin with iron will supply both needs
- Fortification:
  - 35–36 week infants do not need it
  - Infants born at 34 weeks or those with severe IUGR that are struggling to gain weight (until ~due date)
    - 90 mL/kg day of 10 calorie preterm formula OR
    - 2-3 feeds/day of 22-24 calorie formula
- Referral to breastfeeding support group, In-home Lactation Consultation and/or clinic specializing in breastfeeding at-risk infants

Bottle Feeding LPI

- Poor coordination & stamina can prolong duration of feeds, expending energy and delaying weight gain
- May need chin support, pacing, change in nipple type, side-lying & swaddling
- Consider occupational therapist consultation
- Also consider bottle feeding breastmilk when limited time awake at breast, prolonged feeding sessions, > 5 days using tube/syringe at breast, failure to grow, maternal exhaustion, multiple gestation
- Can alternate with breastfeeding or use after 10-15 minutes of time at breast
- No bottle-proping, TV-watching, phone-talking while feeding LPI due to risk of aspiration and apnea

LPI have increased risk for jaundice

- Overrepresented in the US Pilot Kernicterus Registry
- One of the top reasons for admission to NICU
- Most common reason for readmission after birth hospitalization

- Impaired bilirubin excretion
- Later bilirubin peak (5-7 DOL) 6 to 8-fold higher risk of TSB ≥20
Preventing serious jaundice in LPI

Optimize feeding
- Early & regular feeding (every 2-3 hrs)
  increases meconium clearance
- Increasing intake volume increases stool volume
- If poor maternal milk production, & rapidly rising TB, consider supplementation
- If good feeding but no stooling, consider rectal temp or glycerin suppository

Assess risk
- Assess for risk factors
- Check bilirubin at 24-48 hrs & follow algorithm
- Daily TcB is another option
- Observation for peak bilirubin at 5-7 days (in hospital or clinic)
- Avoid early hospital discharge or discharge w/o available fu within 1-2 days
- Educate parents on increased risk for serious jaundice, signs of jaundice, when to seek medical care & the importance of adequate feeding to improve bilirubin excretion

Bilirubin management and follow up for LPI

Gestational age 35-37 weeks
- Predischarge TSB or TcB
- Assess bilirubin risk zone on nomogram
  - Low
  - Intermediate
  - High

Low
- + risk factors: Evaluate for phototherapy. TSB/TcB at 4-24 hrs
- No risk factors: If discharging <72 hours, follow up within 2 days

Intermediate
- + risk factors: Evaluate for phototherapy. TSB/TcB at 4-24 hrs
- No risk factors: If discharging <72 hours, follow up within 2-3 days

High
- + risk factors: Evaluate for phototherapy. TSB/TcB within 4-8 hours
- No risk factors: Evaluate for phototherapy. TSB/TcB within 4-24 hours

Bilirubin and Phototherapy reference tools for algorithm

Adapted from:

Managing Hyperbilirubinemia

- Start phototherapy at lower TSB than for term. Do not discharge home if initiation of phototherapy is indicated
- Keep mothers and infants together during treatment
- Use phototherapy device that allows for feeding on demand & sufficient S2S
- Check DB for infants with persistently high TB (we always check it with 2nd TSB)
- Wait for TSB to drop before stopping phototherapy
- Do not use decrease in risk zone on bilirubin nomogram once phototherapy started
- Continue phototherapy thru peak at 5-7 DOL
- Consider completing phototherapy at home if TB stable but without significant decrease over few days, infant otherwise medically ready for discharge, feeding well, stools transitioning, parents coping & f/u appt in 1 day
- Outpatient follow-up in 24-48 hrs for infants who had phototherapy

LPI is ready for discharge when...

- Greater than 48 hours old
- Feeding every 2-3 hours
- Good feeding for ≥ 24 hours; not being "force fed"
- Mother comfortable with feeding plan and other care
- Breast pump available if needed
- At least 2 visits by Lactation consultant
- No longer losing weight, preferably gaining, esp. if IUGR or <2 kg
- Normal temperature in open crib
- Normal vital signs for ≥12 hours
- Bilirubin assessment & plan for f/u
- Passing stools, preferably transitional & 3-4/day
- Passed car seat challenge
- Rx for Multi-vitamin with Iron
- Outpatient f/u arranged for 1-2 days
- Family readiness, coping and safety assessed
- Routine and LPI-specific parent education completed
- Routine newborn screenings/procedures completed

LPI in the Big World

- 1st appointment within 48 hours from discharge
- Weekly visits until > 40-42 weeks & thriving
- Should be gaining 30 grams/day
- Ongoing assessment of feeding, voiding & stooling
  - Feeding details: frequency, method, duration, nutrient types & percent contribution, pumping frequency/volumes
- Observation for jaundice & low threshold for TSB testing
- Maternal assessment: exhaustion, mood, sleep
- Home health and/or lactation specialist follow-up beneficial
Other resources

- CPQCC toolkit
  - https://www.cpqcc.org/toolkits/late-and-management-late-potterm-infant
- Academy of Breastfeeding medicine
  - https://www.acbmp.org/resources/late-preterm-infant
- AAP/ACOG toolkit (2018)
- SPIN Program UCSD (LPI) info and iEat feeding tables

Partners in developing LPI care plan at UC San Diego Health

- Lisa Stellwagen, M.D.
- Yvonne Vaucher, M.D.
- Eyle Boies, M.D.
- Alison Wolf, P.N.P.
- Lactation Service including Terri Lawson, Nancy White
- Women and Infants Services director, nurse managers, clinical nurse specialists, nurses, and ancillary staff since 2003
- Research Team: Michelle Loff MD, Jonathan Ries MD, Maria Hitraya-Low MD

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