CARE OF THE LATE PRETERM INFANT: PEARLS & PITFALLS

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DISCLOSURES

Relevant financial relationships

- Salaried professor at East Carolina University
- Director for the Center for Neonatal Nursing Education, LLC
- Co-Editor & contributing author of fetal/neonatal physiology text
- Associate Editor for Continuing Education, *Neonatal Network*
- Author of neonatal nurse practitioner test preparation text
- Receives honoraria for CE courses/seminars

LEARNING OUTCOME

Recognize the unique physiologic challenges imposed upon the late preterm (LPT) infant during the transition to extrauterine life in order to encourage nursing risk assessments, early identification of the at-risk infant, and timely intervention.

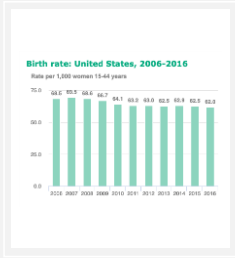
EPIDEMIOLOGY

Approximately 3.9 million births occur in the USA (per annum)

Birth = most common cause for hospitalization

Birth hospitalizations are SHORT (too short!)

- Vaginal birth = 24hrs (common), 36hrs (less common), or 48hrs (rare)
- Cesarean birth = 48hrs (common), 72hrs (less common), 96hrs (rare)



Source: National Center for Health Statistics, final natality data. US Census Bureau. Population estimates based on bridged race categories released by the National Center for Health Statistics. Retrieved September 2, 2018, from www.marchofdimes.org/peristats.

LATE PRETERM BIRTHS

LPT births = ~70% of all infants born prematurely

Hospital costs are 10x higher than for term infants

- Costs attributed to → **birth hospitalization & hospital readmission**

Early identification of the at-risk LPT infant is critical to reduce the risk for injury & avoid hospital readmission

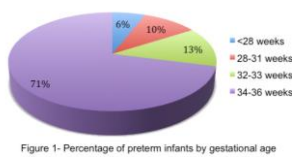
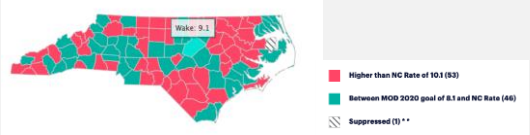


Figure 1- Percentage of preterm infants by gestational age

RISK FACTORS

IN AN AVERAGE WEEK IN NORTH CAROLINA

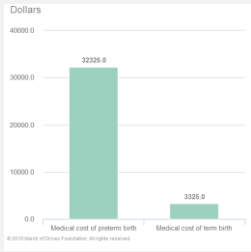
2,322	242	167	43
babies are born	babies are born preterm	babies are born late preterm	babies are born very preterm



COSTS

- Preterm birth = $26 billion (annually)
- Reasons: physiologic immaturity, temperature instability, respiratory disorders, feeding issues, hypoglycemia, & jaundice.

COST OF PRETERM BIRTH IN THE UNITED STATES (2005)



Source: Institute of Medicine. 2007. Preterm Birth: Causes, Consequences, and Prevention: National Academy Press, Washington, D.C. Published and unpublished analyses. Retrieved September 2, 2019, from www.marchofdimes.org/peristats.

UNINTENDED HOSPITAL READMISSIONS

- Key quality indicator in the USA
- Of interest to several agencies: Federal Gov't, Medicaid, and Children's Health Insurance Program Reauthorization

TABLE 2 Readmissions by Week, n (%)

	Week 1	Week 2	Week 3	Week 4
Total N = 5308 (%)	2558 (48)	946 (18)	966 (18)	1038 (20)
Feeding problem, n = 2170 (%)	1057 (49)	346 (16)	364 (17)	403 (18)
Jaundice, n = 1073 (%)	1004 (89)	116 (0)	53 (3)	40 (3)
Respiratory distress, n = 1750 (%)	367 (21)	446 (25)	480 (28)	480 (27)
Rule out sepsis, n = 1183 (%)	392 (33)	256 (21)	263 (22)	282 (24)
Infection, n = 1124 (%)	247 (22)	255 (23)	305 (27)	317 (28)

TABLE 3 Readmission Rates by Gestational Age Category

Gestational Age Category	n (%)	Readmission Rate per 1000
Late Preterm (34–36 wk)	19 361 (6.4)	54.8*
Early Term (37–38 wk)	94 178 (31.8)	20.8*
Term 39–42 wk	180 144 (60.8)	14.8
Total Births	296 114	17.9

* $P < .001$ compared with term readmission rate per 1000

UNINTENDED HOSPITAL READMISSIONS

LPT infants 2x more likely to be readmitted (compared to term babies)

Most common indications for readmission:

- feeding problems/hypoglycemia
- Jaundice

READMISSION RISK FACTORS

- First-born child
- Exclusive breastfeeding
- Postpartum complications
- Public insurance
- Length of stay

CONCEPTUAL MODEL OF HEALTHCARE UTILIZATION

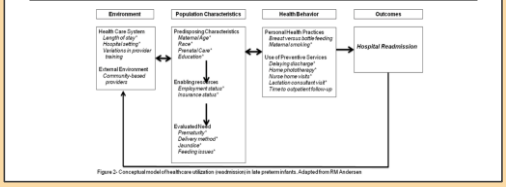


Figure 2- Conceptual model of healthcare utilization (readmission) in late preterm infants. Adapted from RM Andersen

LPT INFANTS ARE **NOT** HEALTHY NEWBORNS

- Majority of LPT infants are cared for in a healthy newborn setting
- LPT infants may not receive necessary scrutiny/monitoring for issues of prematurity when treated in a healthy newborn setting
- Issues?
  - Inadequate hydration/feeding
  - Jaundice
  - Readiness for discharge to home (currently remains qualitative)

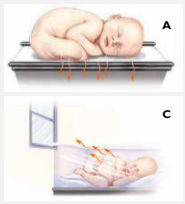
THE CLINICAL ASSESSMENT

What do we know now?

- LPT infants are the fastest growing subset of babies
- LPT infants are not healthy term newborns
- Mother-baby RNs must understand the physiologic challenges that LPT infants face
- Most IBCLCC's and Mother-Baby RNs do not receive accredited fetal/neonatal physiology coursework prior to engaging in direct patient care

Late preterm neonates have a higher risk for respiratory morbidities, hypoglycemia, temperature instability, hyperbilirubinemia, and feeding difficulties when compared to their term counterparts – Malley et al (2010)

MECHANISMS OF HEAT LOSS



Convection

Radiation

Evaporation

Conduction

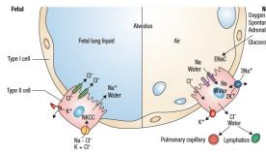
THERMOREGULATORY PROBLEMS: COLD STRESS

- Immature Epidermal Barrier
- Higher Skin Surface Area to BW
- Need for additional NRP (delay in skin-to-skin)
- Radiant losses (temperature of delivery room)
- Evaporative losses (wet skin)
- Conductive losses (when radiant warmer bed is not pre-warmed)
- Convective losses (unswaddled while family looking at baby & air blowing from A/C vent)

INCREASES THE RISK FOR HYPOGLYCEMIA!

PULMONARY PHYSIOLOGY

Water goes in



Water goes out

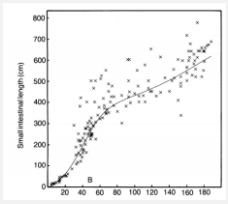
Step 1 → interstitium
Step 2 → to vasculature & lymphatics

Source: Jnah & Trembath, 2019

PULMONARY PROBLEMS

- Transient Tachypnea of the Newborn
- Respiratory Distress Syndrome
- Pulmonary Hypertension
- Respiratory Failure

GASTROINTESTINAL PHYSIOLOGY



Age (weeks gestational age)	Average Length (cm)
20	125
30	200
term	275
1 year postnatal	380
5 years	450
10 years	500
20 years	575

Weaver LT, Austin S & Cole TJ. (1991). Small intestinal length: a factor essential for gut adaptation. *Gut*, *32*,

GI PROBLEMS: FEEDING PROBLEMS & DEHYDRATION

- Immature suck/swallow reflex
- Reduced stamina
- Immature peristaltic function
- Immature sphincter control

METABOLIC/ENDOCRINE PHYSIOLOGY: GLUCOSE METABOLISM

POSTNATAL GLUCOSE METABOLISM

↑ Catecholamines → stimulates glucagon secretion → stimulates immediate glycogenolysis

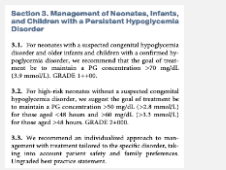
↑ Catecholamines → stimulates glucagon & FFA secretion → enzymes accumulate over next 4-6 hrs → onset of gluconeogenesis

TABLE 10.4 The Four Major Carbohydrate Metabolic Pathways

Metabolic Pathway	Major Function
Glycogenesis	Synthesis of glycogen
★ Glycogenolysis	Breakdown of glycogen → glucose
Glycolysis	Breakdown of glucose → pyruvate
★ Gluconeogenesis	Synthesis of non-carbohydrate sources (pyruvate, lactate, amino acids) → glucose

MET/ENDO PROBLEM: HYPOGLYCEMIA

Hypoglycemia: Clinical hypoglycemia is defined as a plasma glucose concentration low enough to cause symptoms and/or signs of impaired brain function. **LPT infants are 2-3x more likely to develop hypoglycemia!**

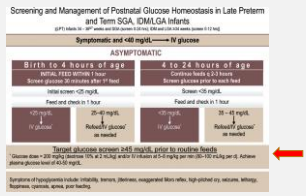

Section 3. Management of Neonates, Infants, and Children with a Persistent Hypoglycemia Disorder

3.1. For neonates with a suspected congenital hypoglycemia disorder and older infants and children with a confirmed hypoglycemia disorder, we recommend that the goal of treatment be to maintain a PG concentration >70 mg/dL (3.9 mmol/L). GRADE 1+⊕⊕.

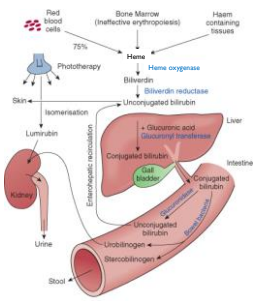
3.2. For high-risk neonates without a suspected congenital hypoglycemia disorder, we suggest the goal of treatment be to maintain a PG concentration >50 mg/dL (>2.8 mmol/L) for those aged <48 hours and >60 mg/dL (>3.3 mmol/L) for those aged >48 hours. GRADE 2+⊕⊕.

3.3. We recommend an individualized approach to management with treatment tailored to the specific disorder, taking into account parent safety and family preferences. Ungraded best practice statement.

https://www.pedsendo.org/education_training/healthcare_providers/consensus_statements/assets/PES_recommendation_hypoglycemia.pdf



HEMATOLOGIC PHYSIOLOGY: BILIRUBIN



HEME PROBLEM: HYPERBILIRUBINEMIA

- Decreased suck/swallow & breast feeding proficiency (**dehydration**)
- Decreased serum albumin levels
- Decreased BBB protection (neuronal protective mechanisms)
- Decreased serum bilirubin binding capacity

NURSING CARE GUIDELINES

THERMOREGULATION

Dry the baby

Hat & KC or Swaddle

If baby is cold… →

1. Check/fix ambient temperature
2. Ensure baby swaddled, wrap each blanket separately
3. If still cold after steps #1 and #2, rewarm under radiant heat & check glucose!

NURSING CARE GUIDELINES

RESPIRATORY FUNCTION

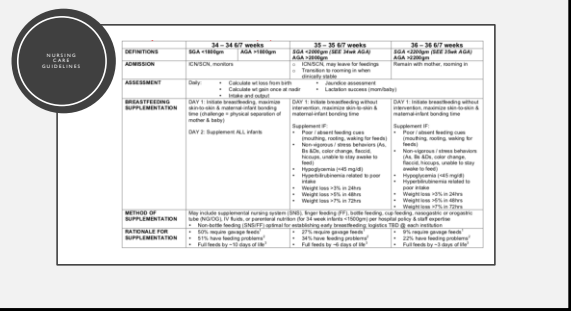
NURSING CARE GUIDELINES

FEEDING & GLUCOSE MONITORING

Supplementation of breast feeding is needed until:

- Onset of lactogenesis and maternal milk supply is abundant,
- LPT infant can feed effectively without tiring, **and** the
- LPT infant is maintaining/gaining weight

GA (weeks)	Kcal/kg/d	Protein/kg/d	Sample feeding volume q3 (34 weeks, 2kg)
34-36	120	3.1	30ml q3hrs
37-38	115	2.5	28ml q3hrs



	34 – 34 6/7 weeks SGA <1800gm AGA <1800gm	35 – 35 6/7 weeks SGA <2000gm (SGE Med AGA) AGA >2000gm	36 – 36 6/7 weeks SGA <2200gm (SGE 10wk AGA) AGA >2200gm
DEFINITIONS			
ADMISSION	ICN/SCN, monitors	ICN/SCN, may leave for feedings Transition to rooming in when clinically stable	Remain with mother, rooming in
ASSESSMENT	Daily: • Calculate wt loss from birth • Calculate wt gain once at nadir • Intake and output	• Jaundice assessment • Lactation success (mom/baby)	
BREASTFEEDING SUPPLEMENTATION	DAY 1: Initiate breastfeeding and minimize skin-to-skin & maternal-infant bonding time (challenge = physical separation of mother & baby) DAY 2: Supplement ALL infants	DAY 1: Initiate breastfeeding without intervention, maximize skin-to-skin & maternal-infant bonding time Supplement IF: • Poor / absent feeding cues (mouthing, rooting, waking for feeds) • Non-vigorous / stress behaviors (Ax, Bx &Ds, color change, flaccid, hiccups, unable to stay awake to feed) • Hypoglycemia (<45 mg/dl) • Hyperbilirubinemia related to poor intake • Weight loss >3% in 24hrs • Weight loss >5% in 48hrs • Weight loss >7% in 72hrs	DAY 1: Initiate breastfeeding without intervention, maximize skin-to-skin & maternal-infant bonding time Supplement IF: • Poor / absent feeding cues (mouthing, rooting, waking for feeds) • Non-vigorous / stress behaviors (Ax, Bx &Ds, color change, flaccid, hiccups, unable to stay awake to feed) • Hypoglycemia (<45 mg/dl) • Hyperbilirubinemia related to poor intake • Weight loss >3% in 24hrs • Weight loss >5% in 48hrs • Weight loss >7% in 72hrs
METHOD OF SUPPLEMENTATION	May include supplemental nursing system (SNS), finger feeding (FF), bottle-feeding, cup-feeding, lactogavage or orogastric tube (NG/OG), IV fluids, or parenteral nutrition (for 34 week infants <1500gm) per hospital policy & staff expertise • Non-bottle feeding (SNS/FF) optimal for establishing early breastfeeding; logistics TBD @ each institution		
RATIONALE FOR SUPPLEMENTATION	• 50% require gavage feeds[1] • 51% have feeding problems[2] • Full feeds by ~10 days of life[3]	• 27% require gavage feeds[1] • 34% have feeding problems[2] • Full feeds by ~6 days of life[3]	• 9% require gavage feeds[1] • 22% have feeding problems[2] • Full feeds by ~3 days of life[3]

NURSING CARE GUIDELINES

HYPERBILIRUBINEMIA MONITORING

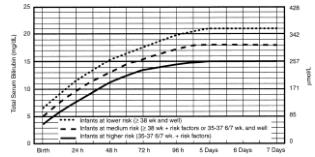
Step 1: Assign neurotoxicity risk

Risk factors = isoimmune hemolytic disease, G6PD deficiency, asphyxia, significant lethargy, temperature instability, sepsis, acidosis, or albumin <3g/dL

NURSING CARE GUIDELINES

HYPERBILIRUBINEMIA MONITORING

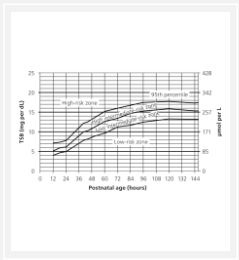
Step 2: Plot bilirubin result and assess for phototherapy requirement



NURSING CARE GUIDELINES

HYPERBILIRUBINEMIA MONITORING

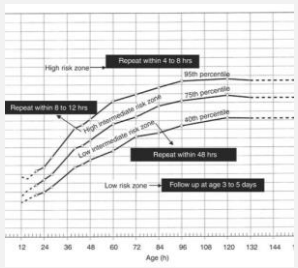
Step 3: Plot bilirubin result and assess hour-specific risk



NURSING CARE GUIDELINES

HYPERBILIRUBINEMIA MONITORING

Step 4: Determine timeframe for repeat (follow-up) bilirubin check



CONCLUDING THOUGHTS

What do we need in the future?

- Hospital-based continuing education led by an expert instructor with **population-specific** advanced practice education and training
- Nursing awareness and advocacy
- Judicious use of short-term supplementation for LPT infants (and term infants) with clinical risks/indicators of dehydration
- Benefits for treating LPT infants as PRETERM infants: early identification of jaundice, dehydration, poor growth, delayed transition, need for longer inpatient stay, reduced hospital readmission rate, reduced unintended morbidities (dehydration-induced hypoglycemia and jaundice, cognitive impairment; etc.)

QUESTIONS?

Contact me!

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