Nutritional Support of Very Low Birth Weight Newborns

Georgia Ditzenberger, NNP-BC, PhD[a,b]

KEYWORDS

- VLBW infant, newborn • Premature newborn
- Postnatal growth restriction

Nutritional support to promote optimal postnatal growth for very low birth weight (VLBW) newborns less than 1500 g at birth during the initial prolonged hospitalization is a significant issue. During the past 4 decades, improvements in such areas as thermoregulation, ventilatory support, and fluid and electrolyte management have made it possible for more VLBW newborns survive to discharge from neonatal intensive care units (NICUs). VLBW newborns spend 2 to 3 months in the NICU, maturing to 35 to 42 weeks of postmenstrual age (PMA) in preparation for discharge. The National Institute of Child Health and Human Development Neonatal Network reported that although intrauterine growth restriction was present in 22% of VLBW newborns at birth, 91% of newborns demonstrated postnatal growth restriction by 36 weeks of PMA.[1] Growth restriction, intrauterine and postnatal, is defined as body weight less than the 10th percentile on reference growth curves.

Conditions with potential confounding effects on postnatal growth include genetic conditions inhibiting growth; bronchopulmonary dysplasia* (BPD; oxygen requirement after 36 weeks of gestation); small for gestational age (SGA) status at birth; late-onset sepsis; neurologic conditions, including intraventricular hemorrhage (IVH), hydrocephaly, microcephaly, and periventricular leukomalacia (PVL); patent ductus arteriosus (PDA) requiring intervention; and gastrointestinal conditions, such as feeding intolerance, necrotizing enterocolitis (NEC), or short gut syndrome.[1,2]

The persistent growth deficit in VLBW newborns is associated with the inadequacy of protein and energy intake during the initial hospitalization when controlling for potential confounding effects.[1,3–9] Inadequate protein and energy intake may account for 45% to 50% of the postnatal growth restriction seen by the end of the initial

* Bronchopulmonary dysplasia is often used interchangeably with chronic lung disease. Current literature is favoring a return to the term *bronchopulmonary dysplasia* over *chronic lung disease* because of the confusion with chronic lung diseases of older adults not related to premature birth.

[a] Division of Neonatology, Department of Pediatrics, University of Wisconsin School of Medicine and Public Health, Madison, WI, USA
[b] Neonatal Advanced Practice Nursing and Research, Meriter Hospital, Inc., 202 S. Park Street, Madison, WI 53515-1596, USA
E-mail address: ditzeg@pediatrics.wisc.edu

Crit Care Nurs Clin N Am 21 (2009) 181–194
doi:10.1016/j.ccell.2009.01.005 **ccnursing.theclinics.com**
0899-5885/09/$ – see front matter

hospitalization, with the remainder attributable to effects from underlying conditions.[8,10] Recent changes in commercially prepared formulas and human milk fortifiers are associated with a reduction in postnatal growth restriction from 97% in 2001 to 91% in 2007.[1,11] Although this reduction in postnatal growth restriction in the past decade is significant, the problem clearly persists.

This article reviews the concepts involved in the nutritional support of VLBW newborns, including definitions and discussions of growth, optimal postnatal growth, body composition, initial weight loss of VLBW newborns, growth expectations, growth assessment tools used during the postnatal period, the relation between inadequate nutrition and neurodevelopment, the relation between protein intake and cognitive outcome, postnatal nutrition balance, the potential for programming of future adult-onset chronic conditions, a review of fetal nutritional intake, and current recommendations for nutritional support of VLBW newborns.

GROWTH

Growth is ''the progressive development of a living thing, especially the process by which the body reaches its point of complete physical development…from infancy to maturity involves great changes in body size and appearance…not a steady [process]; at some times growth occurs rapidly, at others slowly. Individual patterns of growth vary widely because of differences in heredity and environment.''[12] Fetal, neonatal, and infant periods of the human life cycle are such times of rapid growth. Heredity plays an important part in determining the potential for growth (eg, genetic potential), but environment, which supports access to adequate nutrients for growth, also is important to sustain growth to genetic potential.

OPTIMAL POSTNATAL GROWTH

Optimal growth for VLBW newborns during the postnatal period to 40 weeks of PMA is currently defined by the American Academy of Pediatrics as approximating ''the rate of growth and composition of weight gain for a normal fetus of the same postmenstrual age.''[13] Therefore, assessing VLBW newborn growth seems to be straightforward (ignoring, for the moment, the composition of weight gain); if one has access to a fetal growth chart, one can compare VLBW newborn measurements to determine the attainment of optimal growth.

Gestational age is determined by the ''best obstetric estimate,'' a combination of the first day of the last menstrual period; physical examination of the mother; prenatal ultrasonography; and history, if any, of assisted reproduction.[14] Newborns are typically measured soon after birth and determined to be appropriate for gestational age (AGA) if measurements of head circumference, length, and weight are within the 10th and 90th percentile curves for fetal growth, SGA if at or below the 10th percentile curve, or large for gestational age if at or above the 90th percentile curve.[15] Symmetric growth is determined when all measurements are within the same percentile curves; for example, symmetric SGA is when measurements for head circumference, length, and weight are of the 10th percentile curve or less. Asymmetric growth is defined when one or more measurements are in differing percentile curves.[16]

BODY COMPOSITION

The clinical assessment of the distribution of weight in fat mass and lean muscle mass, or body composition, may be a cursory visual assessment and not an accurate or objective summation of body composition. Adequate growth to genetic potential