

Very Low Birth Weight Infants Fail To Thrive During Their NICU Stay

Maksim Kirtsman MDCM¹ and Richard J Schanler MD.^{1,2}

¹Pediatrics/Neonatal-Perinatal Medicine, Cohen Children's Medical Center of New York at North Shore, Manhasset, NY;

²Pediatrics, Hofstra University School of Medicine, Hempstead, NY.

Abstract

- **Background:** It has been reported that very low birth weight (VLBW) infants experience growth faltering during their NICU stay. We investigated whether contemporary practices utilizing nutrition guidelines continue to result in a similar pattern of growth faltering.
- **Objective:** To determine the extent of growth faltering in the NICU.
- **Design/Methods:** We reviewed a 2007-2010 NICU database for newborn infants <33 weeks gestational age with birth weights of 500 to 1500 g, who survived to be discharged home before 45 weeks postmenstrual age. The major outcome was the change in body weight percentile from birth to discharge. We evaluated factors (morbidity, birth weight, gestational age, weight gain, weight percentile at birth, year, multiple gestation) potentially affecting this change. Morbidities assessed were chronic lung disease, severe intraventricular hemorrhage, periventricular leukomalacia, necrotizing enterocolitis, late-onset sepsis, and surgery for patent ductus arteriosus, retinopathy of prematurity, and/or abdominal catastrophes.
- **Results:** Of 613 infants, 88 (14%) and 265 (43%) were below the 10th percentile at birth and discharge, respectively. The mean change in percentile from birth to discharge was $-18 \pm 16\%$ [mean \pm SD, median = -15 %], $p < 0.001$. The change in percentiles was the same for infants with birth weights 1000 to 1500 g and 500 to 999 g. Significant factors affecting the change in percentiles were gestational age ($r = 0.39$), weight percentile at birth ($r = 0.43$), weight gain ($r = 0.39$), head circumference growth ($r = 0.43$), and morbidity ($r = 0.13$), but not birth weight ($r = -0.07$), year of discharge ($r = 0.01$), or multiple gestation ($r = -0.05$). Nearly 70% of the variance in the change in percentiles was due to weight percentile at birth ($p < 0.001$), gestational age ($p < 0.001$), and weight gain ($p < 0.001$).
- **Conclusions:** Despite contemporary nutrition practices, VLBW infants experience growth faltering during their NICU stay. We observe that growth faltering is less affected by morbidity and birth weight than by growth rate in the NICU. These data suggest that modifiable factors supporting improved weight gain and head growth in the NICU, such as advanced continuous nutrition support, may be most important in correcting this pattern of growth faltering.

Background

- Very low birth weight (VLBW) infants experience growth failure in the NICU.¹⁻³
- Attributable causes for growth failure include delayed initiation of nutrition, accrued energy and protein deficits, and clinical morbidity.⁴⁻⁵
- Suboptimal early nutrition negatively affects long-term growth and developmental outcomes of VLBW infants.⁵
- Few data are available to determine whether contemporary nutrition practices utilizing nutrition guidelines impact growth faltering in the NICU.

Objectives

- To determine the extent of growth faltering in the NICU
 - ❑ To determine the change in body weight percentile from birth to discharge
- To evaluate factors that affect growth faltering in the NICU

Hypothesis

- Despite contemporary nutrition practices, VLBW infants continue to experience growth faltering during their NICU stay.

Study Design

- Retrospective review of infants in two NICUs
- Inclusion criteria
 - ❑ Admission within 24 hours of birth
 - ❑ Birth weight = 500 to 1500 grams
 - ❑ Gestational age < 33 weeks
 - ❑ Survival to hospital discharge home
 - ❑ Discharged before 45 weeks of postmenstrual age
 - ❑ Discharged between 1/2007 and 9/2010
- Variables included in analyses
 - ❑ Birth weight
 - ❑ Gestational age
 - ❑ Weight and head growth rate
 - ❑ Weight percentile at birth
 - ❑ Head circumference percentile at birth
 - ❑ Discharge year
 - ❑ Multiple gestation
 - ❑ Morbidity
- Growth data from Fenton growth curves⁶
- Morbidity assessment:
 - ❑ Chronic lung disease
 - ❑ Intraventricular hemorrhage, Grades III-IV
 - ❑ Periventricular leukomalacia
 - ❑ Necrotizing enterocolitis
 - ❑ Late-onset sepsis
 - ❑ Surgery for patent ductus arteriosus
 - ❑ Surgery for retinopathy of prematurity
 - ❑ Surgery for necrotizing enterocolitis
 - ❑ Spontaneous bowel perforation

Table 1:
Infant Characteristics

n	613
Gestational age, wks (mean \pm SD, range)	28.5 \pm 2.2, 23 - 32
Multiple gestation, n	206 (34%)
Birth weight, g (mean \pm SD, range)	1095 \pm 248, 505 - 1500
Birth weight percentile (mean \pm SD, range)	37 \pm 24, 0 - 97
SGA, n	88 (14%)
Discharge weight, g (mean \pm SD, range)	2262 \pm 502, 1335 - 4950
DC weight percentile (mean \pm SD, range)	19 \pm 18, 0 - 84
Below 10th percentile at discharge, n	265 (43%)
Length of stay, days (mean \pm SD, range)	57 \pm 25, 17 - 140
PMA at discharge, wks (mean \pm SD, range)	36 \pm 2.3, 32 - 45

SGA = small for gestational age; DC = discharge; PMA = postmenstrual age

Figure 1:
Infants Below 10th Percentile

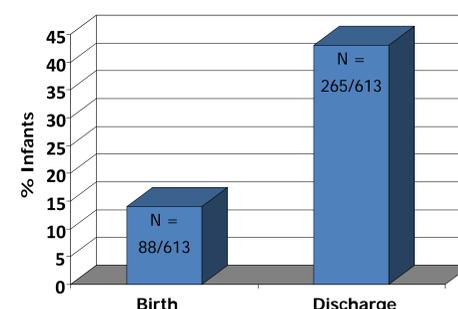


Figure 2:
Body Weight Percentile Change & Gestational Age

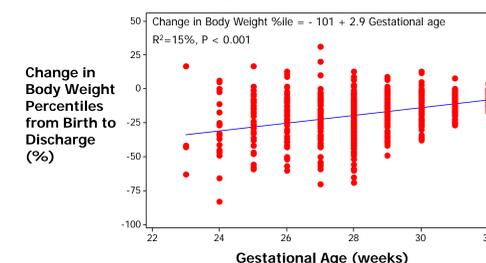


Figure 3:
Body Weight Percentile Change & Mean Daily Weight Gain

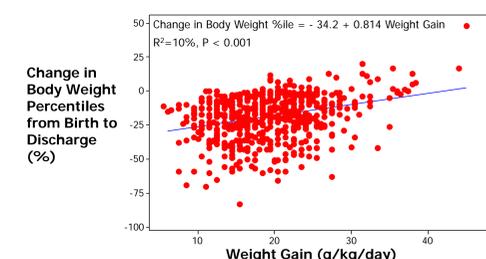
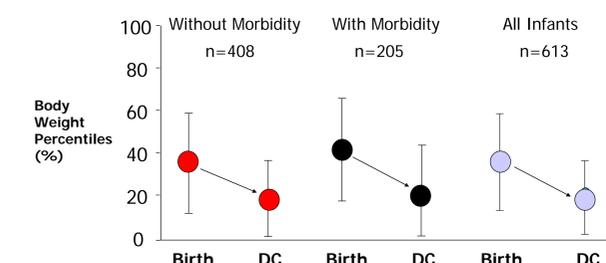


Table 2:
Significant Factors Associated With Change in Body Weight Percentile

- Gestational age ($r = 0.39$) ($p < 0.001$)
- Weight percentile at birth ($r = 0.43$) ($p < 0.001$)
- Weight gain ($r = 0.39$) ($p < 0.001$)
- Head circumference growth ($r = 0.43$) ($p < 0.001$)

Figure 4:
Body Weight Percentile Change and Morbidity



Significant differences from Birth to Discharge (DC) for all comparisons, $P < 0.001$

Results

- Out of 613 infants:
 - ❑ 88 (14%) below the 10th percentile at birth by weight
 - ❑ 265 (43%) below the 10th percentile at discharge by weight
- Overall, mean (\pm SD) percentile change = -18 ± 16 , $P < 0.001$
- Nearly 70% of the variance in the change accounted for by:
 - weight percentile at birth ($P < 0.001$)
 - gestational age ($P < 0.001$)
 - weight gain ($P < 0.001$)

Conclusions

- Despite contemporary nutrition practices VLBW infants experience growth faltering during their NICU stay.
- Growth faltering is less affected by morbidity and birth weight than by growth rate in the NICU.
- Modifiable factors supporting improved growth in the NICU may be most important in correcting this pattern of growth faltering.

References

- Embleton NE, Pang N, Cooke RJ. Postnatal malnutrition and growth retardation: an inevitable consequence of current recommendations in preterm infants? *Pediatrics* 2001;107:270-273
- Cooke RJ, Ainsworth SB, Fenton AC. Postnatal growth retardation: a universal problem in preterm infants. *Arch Dis Child Fetal Neonatal Ed* 2004;89:F428-F430
- Hay WW, Jr, Lucas A, Heird WC, et al. Workshop summary: nutrition of the extremely low birth weight infant. *Pediatrics*. 1999;104:1360-1368
- Ehrenkranz RA, Younes N, Lemons JA, et al. Longitudinal growth of hospitalized very low birth weight infants. *Pediatrics* 1999; 104: 280-289
- Ehrenkranz RA, Dusick AM, Vohr BR, et al. Growth in the neonatal intensive care unit influences neurodevelopmental and growth outcomes of extremely low birth weight infants. *Pediatrics*. 2006;117(4):1253-1261
- Fenton TR. A new growth chart for preterm babies: Babson and Brenda's chart updated with recent data and new format. *BMC Pediatrics* 2003;3:13