Assessing Extrauterine Growth Retardation in VLBW Infants: Static VS longitudinal EUGR

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Abstract

Background: Extrauterine growth retardation (EUGR) has been recognized as one of the common outcomes and a poor predictor for very low birth weight (VLBW) infant outcomes. The definition of EUGR has been debated. Static EUGR refers to weight at a given time that is below the 10th percentile, while longitudinal EUGR indicates weight loss from birth at a given time that is greater than 1 standard deviation. This study aimed to compare the incidence and risk factors of EUGR using different diagnostic criteria. **Material and Methods**: This was a retrospective study. Data were retrieved from the hospital's very low birth weight (VLBW) registry. Exclusion criteria included death, discharge, or referral before 36 weeks of gestation. Growth status at discharge was assessed and classified based on the Fenton growth chart. Correlations, incidence, and risk factors for both definitions of EUGR were evaluated. **Results:** There were 148 infants in the registry during the study period. Of these, 41 were excluded, resulting in 107 infants enrolled in the study. Static EUGR was identified in 55 infants (51.4%), while longitudinal EUGR was found in 35 infants (32.7%). The median (IQR) birthweight was 1180 g (950,1348 g), and the gestational age was 29.5 weeks (28.4,32.7 weeks). Nearly half (49.5%) of the infants were male. SGA and delayed full feeding were the independent risk factors of static EUGR. Whereas delayed full feeding was the only independent risk factor of longitudinal EUGR, *p-value* < 0.05. The kappa's correlation coefficient of both definitions was 0.185, *p-value*=0.019. **Discussion:** The incidence of EUGR was higher in static cases. Static EUGR was primarily influenced by birth growth, whereas longitudinal EUGR was more affected by hospital conditions. **Conclusion:** The definition of EUGR should be used judiciously

Introduction

Extrauterine growth retardation (EUGR) is one of the most common problems in preterm infants. It has been used as the indicator of hospital care in very low birth weight (VLBW) or very preterm infants. However, the definition of EUGR has been debated. Cross-sectional weight at discharge is widely used to diagnose EUGR, bur correlation with the long-term outcome is questioned. Weight z-score change between birth and discharge or 36 weeks gestation is proposed to replace cross-section weight at discharge for EUGR diagnosis as it correlates more to later neurodevelopmental outcomes.

This study aimed to evaluate the incidence of EUGR at discharge from both definitions and the correlation coefficient between both definitions.

Methods

This study was a retrospective single-center cohort study. Data were retrieved from the hospital's very low birth weight registry during 2020-2023. Parents had consented upon entry to the registry. Infants were eligible for the registry if their birth weight was less than or equal to 1500 g, had no multiple congenital anomalies, had no chromosomal abnormalities, or were compatible with any syndromic features. Exclusion criteria included death, discharge, or referral before 36 weeks of gestation. Mothers' age, gestational age, underlying or comorbid conditions associated with pregnancy, serology, and mode of delivery were recorded. Infants' data included birth weight, Apgar scores, resuscitation during birth, respiratory support, degree of RDS, days to reach full feeding, ventilator days, and infants' morbidity such as BPD, PDA were recorded.

Definition

Static EUGR was defined as body weight at discharge being less than the 10th percentile of the Fenton growth curve.

Longitudinal EUGR was defined as a decrease in body weight z-scores from birth to discharge > 1. Body weight Z-score was calculated using Peditools Fenton 2013 growth calculator for preterm infants (https://peditools.org/fenton2013/)

Delayed full feeding meant infants needs more than 10 days after birth to reach enteral feeding of 120 ml/kg/day

Sample size calculation and statistical analysis

Based on the previous study, a minimum of 38 infants was needed to achieve statistical significance at a 0.05 level and 80% power. However, we included all infants in the registry during the study period. Incidences of EUGR were described in percent, normally distributed continuous variables were described in mean±SD, and non-normally distributed variables were described in median (IQR). The correlation between the 2 definitions was estimated by the Kappa coefficient. Univariate analysis was used to identify risk factors associated with EUGR. The multiple logistic regression model included all possible risk factors to identify independent risk factors.

Results

There were 148 infants eligible for the study, 23 of whom died, and 18 were either referred or discharged before reaching 36 weeks of gestation. Of the 107 infants enrolled in the study, **55 (51.4%) had static EUGR, and 35 (32.7%) had longitudinal EUGR.** The mean maternal age was 30.6±6.47 years, and 63 (58.9%) infants were the first child. Most of them were singletons (81 infants, 75.7%). Infants' baseline characteristics were described in Table 1.

Table 1. Infant's baseline characteristics

Variables	N=107
GA (weeks)*	29.5 (28.4,32.7)
BW (g)*	1180 (950,1348)
Male (n, %)	53 (49.53)
SGA (n, %)	32 (29.91)
RDS requires surfactant therapy (n, %)	38 (35.5)
Ventilator days (day)*	1 (0,15)
BPD (n, %)	67 (62.6)
NEC (n, %)	15 (14)
Delay full feeding (>10 days) (n, %)	61 (57.01)
PDA (n, %)	45 (42.45)

Fig. 1 Multivariable analysis of factors associated with static EUGR

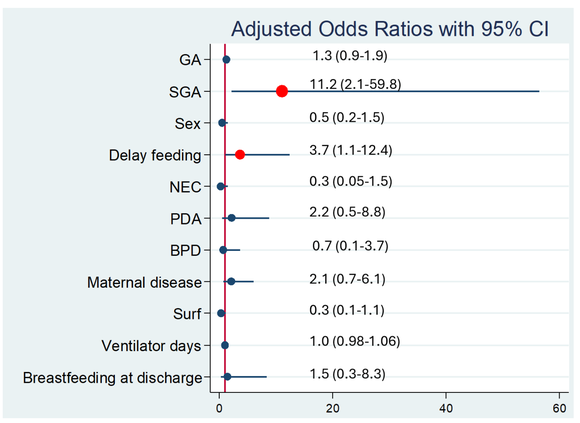
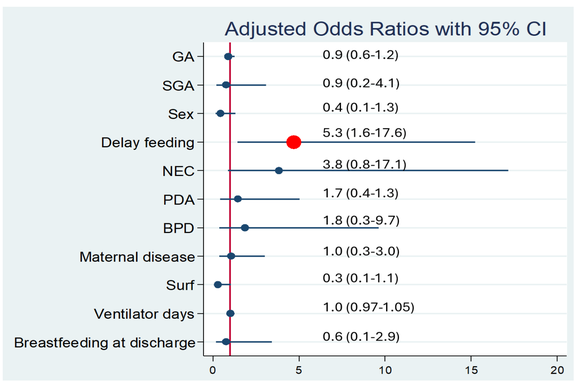


Fig. 2 Multivariable analysis of factors associated with longitudinal EUGR



Discussion

In this study we found 51.4% of static EUGr and 32.7% of longitudinal EUGR. Agreement between to definitions were quite weak with Cohen' kappa coefficient of 0.186. Factors associated with EUGR were different from both definitions.

SGA was the strong predictor of static EUGR, where it is not associated with longitudinal EUGR. Delayed full feeding was the significant associated factors in both static and longitudinal EUGR.

Infants in static EUGR group had higher GA, more proportion of SGA and less RDS and BPD from univariable analysis. However, only SGA was significant after controlling for other factors. It implied that pre-birth conditions was more significant for static EUGR than conditions during hospitalization.

Contrary to longitudinal EUGR, Infants in EUGR group has lower GA, birthweight, longer ventilators day, more PDA and BPD as shown in univariable analysis. SGA was not different between groups. It means that condition during hospitalization has more effect on longitudinal growth more than static growth.

Delay full feeding was a significant associated factors in both definitions. It convinced us that feeding or nutritional intakes during early life was important to growth outcomes. In this study, we defined a delay of full feeding as infants can tolerate full enteral feeding of 120 ml/kg/day because if the individual infant was step feeding as our standard feeding protocol. They should reach full enteral feeding within 10 days.

There were several limitations of this study. Our data were retrieved from the hospital registry so some of the specific data that might be associated with EUGR was not recorded. This was a data from our hospital only, even we have some standard practice guideline, however it might not represent other hospital settings. From our result, we suggest that longitudinal growth might be the better outcome to measure quality of care during hospitalization.

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