Crown-Rump Length Measured in the Early First Trimester as a Predictor of Low Birth Weight

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The aim of this study is to assess the association between crown-rump length (CRL) measured before the 10th gestational week and birth weight. Results from 316 transvaginal ultrasonography scans at the 46th, 53rd, 60th, 67th, and 74th days of pregnancy were compared in low birth weight (LBW) versus normal birth weight groups. A positive correlation between CRL and birth weight was observed when CRL was measured at days 60, 67, and 74. CRL measured on the 67th day of pregnancy was significantly smaller in the LBW group than in the normal birth weight group. A cut-off value of CRL=26.5 mm measured at day 67 has the highest power to predict LBW.

Key Words: Crown-rump length, low birth weight, ultrasonography
A positive correlation between CRL and birth weight was observed when CRL was measured at gestational days 60, 67, and 74 (Table 1). This positive correlation was repeated at the same gestational days when only term pregnancies were analyzed (Table 2). No association was observed between CRL and gestational age on any other dates of CRL measurement (Table 1). CRL measured at day 67 differed significantly between LBW and normal birth weight groups. The difference was not significant when CRL was measured on other days (Table 3).

In the ROC curve, days 60, 67, and 74 exhibited larger areas under the curve than days 46 and 54. The cut off value of 26.5 mm measured at day 67 had the highest power to predict LBW (sensitivity: 83.3% and specificity: 73.7%) (Fig. 1).

The main results of this study are that the CRL measured in the early first trimester of pregnancy is closely associated with birth weight, and that the accuracy of birth weight prediction is particularly high at day 67 (9+3 week) of pregnancy. This is the first report to demonstrate the CRL cut-off value that optimally predicts LBW.

Smith, et al. observed that a CRL discrepancy of 2-6 days smaller than expected is related to an increased risk of LBW (OR 1.7), but is not associated with perinatal death. In pregnancies conceived by controlled ovarian hyperstimulation, a strong association has been observed between fetal growth during the first trimester and birth weight, suggesting that impairment of fetal growth starts in the first trimester. In that study, a CRL discrepancy of 2-6 days is associated with an increased risk of SGA (OR 1.1), intrauterine growth restriction (OR 2.8), and preterm delivery before 32 weeks (OR 2.0). Another study observed a correlation between the

**Table 1. Analysis of Correlations between CRL and Birth Weight and CRL and Gestational Age on Each Day of Ultrasonography**

|          | Day 46 | Day 53 | Day 60 | Day 67 | Day 74 |
|----------|--------|--------|--------|--------|--------|
| Weight   |        |        |        |        |        |
| Pearson correlation | 0.228 | 0.218 | 0.377 | 0.277 | 0.350 |
| Sig. (2-tailed)     | 0.070 | 0.100 | 0.002* | 0.028* | 0.004* |
| Gestational age     |        |        |        |        |        |
| Pearson correlation | 0.126 | 0.067 | 0.309 | 0.193 | 0.128 |
| Sig. (2-tailed)     | 0.323 | 0.617 | 0.053 | 0.129 | 0.304 |

CRL, crown-rump length.
*Statistically significant.

**Table 2. Analysis of Correlations between CRL and Birth Weight of Babies Delivered at Term**

|          | Day 46 | Day 53 | Day 60 | Day 67 | Day 74 |
|----------|--------|--------|--------|--------|--------|
| Weight   |        |        |        |        |        |
| Pearson correlation | 0.203 | 0.177 | 0.341 | 0.362 | 0.325 |
| Sig. (2-tailed)     | 0.147 | 0.285 | 0.012* | 0.008* | 0.016* |

CRL, crown-rump length.
*Statistically significant.
CRL before 10th Week of Pregnancy and Birth Weight

Table 3. Difference of CRL between Low and Normal Birth Weight Groups on Each Day of Ultrasonography

| Day  | Birth weight (g) | n  | Mean (mm) | Std. error | Mean rank | Sig.  |
|------|------------------|----|-----------|------------|-----------|-------|
| 46   | <2500            | 7  | 7.56      | 0.33       | 37.71     | 0.431 |
|      | ≥2500            | 57 | 7.23      | 0.16       | 31.86     |       |
| 53   | <2500            | 9  | 10.89     | 0.42       | 25.72     | 0.465 |
|      | ≥2500            | 49 | 11.28     | 0.22       | 30.19     |       |
| 60   | <2500            | 7  | 18.43     | 1.21       | 25.14     | 0.265 |
|      | ≥2500            | 57 | 19.64     | 0.34       | 33.40     |       |
| 67   | <2500            | 6  | 25        | 2.07       | 16.33     | 0.027*|
|      | ≥2500            | 57 | 28.73     | 0.46       | 33.65     |       |
| 74   | <2500            | 5  | 32.2      | 1.69       | 20.20     | 0.099 |
|      | ≥2500            | 62 | 35.34     | 0.49       | 35.11     |       |

CRL, crown-rump length.
*Statistically significant.

*Fig. 1. ROC curve for prediction of low birth weight (<2500 g) for each ultrasonography date. Gestational days 60, 67 and 74 have larger areas under the curve than other days. ROC, receiver operating characteristic.*

Table 3 shows the difference of CRL between low and normal birth weight groups on each day of ultrasonography. The data indicate that the relationship between CRL and birth weight is significant from day 60 (8+3 week) of pregnancy. Contrary to other studies, our data failed to demonstrate a relationship between CRL and duration of pregnancy.

An advantage of this study is that their dates of ovulation are clearly documented because the subjects were conceived by in vitro fertilization only. Most previous studies that calculated gestational age relied on menstrual history or included women who had conceived by intrauterine insemination. As ovulation occurs between 8 and 40 h after the luteinizing hormone peak, the timing of ovulation cannot be precisely documented even in the intrauterine insemination cycle.9,10 The other advantage is setting the cut-off value. Previous studies used CRL or Z-score discrepancies as an independent variable. Even though a cut-off value is more clinically relevant than CRL or Z-score discrepancies, this study can only suggest the timing of the measurement at day 67 (9+3 week) of pregnancy. A larger scale study assessing the cut-off value of the other days of early pregnancy may give rise to more practical information.

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