Should We Use Customized Fetal Growth Percentiles in Urban Canada?

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Abstract

An increasingly common challenge in antenatal care of the small for gestational age (SGA) fetus is the distinction between the constitutionally (physiologically) small fetus and the fetus affected by pathological intrauterine growth restriction (IUGR). We discuss here the rationale and the evidence for the use of customized growth percentiles for the purpose of distinguishing between the fetus with true IUGR and the fetus with constitutional SGA. We also provide estimates of the potential effects of adopting ethnicity-specific birth weight curves on the rates of SGA and large for gestational age status in multi-ethnic metropolitan cities in North America and Europe, such as the City of Toronto. Using customized growth percentiles would result in a considerable decline in the rate of a false-positive diagnosis of SGA among visible minorities, and improve the detection rate of true large for gestational age fetuses among these groups.

Résumé

La distinction entre les fœtus constitutionnellement (physiologiquement) petits et les fœtus affectés par un retard de croissance intra-utérin pathologique (RCIU) constitue un défi de plus en plus commun dans le cadre des soins prénataux prodigués aux fœtus présentant une hypotrophie fœtale (HF). Nous discutons ici de la logique et des données soutenant l'utilisation de percentiles de croissance adaptés aux fins de la distinction entre les fœtus présentant un réel RCIU et les fœtus présentant une HF constitutionnelle. Nous offrons également des estimations des effets potentiels de l'adoption de courbes de poids de naissance propres à une origine ethnique particulière sur les taux de fœtus présentant une HF et les taux de fœtus présentant une hypertrophie fœtale au sein de villes métropolitaines multiethniques d'Amérique du Nord et d'Europe (comme la ville de Toronto). L'utilisation de percentiles de croissance adaptés se traduirait en une baisse considérable du taux de diagnostic faux positif d'HF chez les minorités visibles, ainsi qu'en une amélioration du taux de détection des fœtus présentant une réelle hypertrophie fœtale chez ces groupes.

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THE NATURE OF THE PROBLEM

A 32-year-old nulliparous woman of South Asian origin is seen by her obstetrician at 33 weeks of gestation. Her pregnancy has been uncomplicated to date, but her physician is concerned that the fetus is small, on the basis of a symphysis-fundal height equivalent to a pregnancy of 31 weeks' GA. An ultrasound examination is performed, and the EFW is at the fifth percentile for GA. The woman's height is 152 cm and her weight is 60 kg. The current pregnancy was accurately dated by a first trimester ultrasound.

One week later, a repeat ultrasound examination reveals a normal biophysical profile score, a normal amniotic fluid index, and normal umbilical artery Doppler waveforms. Her obstetrician feels that this is most likely a healthy, constitutionally SGA fetus, but agrees to continue weekly fetal monitoring thereafter as a precaution. At 37 weeks, the EFW is at the third percentile for GA, while the biophysical score, amniotic fluid index, and Doppler waveforms remain normal. However, her obstetrician expresses discomfort with further expectant management, and recommends delivery. Two days later, after failed induction of labour, the woman undergoes Caesarean section. Although the Apgar scores are normal, the newborn is admitted to the NICU for five days following respiratory difficulties attributed to transient tachypnea of the newborn and delayed adaptation to extrauterine life.

This case illustrates that a diagnosis of SGA in the fetus may result in cautionary behaviour on the part of the clinician (which may inadvertently heighten maternal

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and infant surveillance) and interventions that may in turn result in "iatrogenic" morbidity. This case also suggests that better tools are needed to aid the clinician in distinguishing between two forms of fetal SGA.[1] The first is the constitutionally small fetus, defined as a fetus with an estimated weight or birth weight below the 10th percentile for gestational age, but whose "smallness" is merely attributed to genetic growth potential, without related negative effects on health. The second form of SGA arises from fetal IUGR, wherein physiologically regulated growth is impeded by one or more pathologic factors, such as placental dysfunction.[2] Although pathological IUGR is commonly suspected when the estimated fetal weight is below the 10th percentile for gestational age, IUGR can be present even when the fetal weight is above the 10th percentile for gestational age.[3,4] In contrast to constitutional SGA, pathological IUGR is associated with an increased risk of adverse outcomes, including stillbirth, neonatal mortality and morbidity, and long-term adverse outcomes.[5–7]

Current tools used to distinguish between constitutional SGA and pathological IUGR include the biophysical profile score, amniotic fluid volume, and umbilical artery Doppler studies.[8] However, the sensitivity of these standard tools may be limited, especially in cases of late-onset IUGR.[9] Doppler studies of the fetal middle cerebral artery[9] and uterine artery[10] may identify the at-risk SGA fetus near term, in whom induction of labour or Caesarean section might be justified to avoid stillbirth. However, these methods require ultrasound expertise, adding further to the costs of antenatal care, with no proven high-level evidence of benefit.

Another approach to distinguish between pathological IUGR and constitutional SGA is through the use of customized fetal growth percentiles. Such customized measures account for factors that affect normal physiologic variation in fetal growth and weight, and therefore may be of special importance in Canadian communities with high ethnic diversity among whom there may be differences in normal fetal growth.

ABBREVIATIONS

EFW	estimated fetal weight
GA	gestational age
IUGR	intrauterine growth restriction
LGA	large for gestational age
SGA	small for gestational age

CUSTOMIZED PERCENTILES: THE CONCEPT

The concept of customized growth percentiles was articulated by Gardosi et al. in 1992.[11] These authors suggested that intrauterine fetal growth (i.e., fetal growth potential) is affected by multiple physiological (rather than pathological) factors that contribute to normal variation in birth weight. Thus, it is unreasonable to judge the growth of all fetuses according to uniform population-based curves, although this practice is all too common in most clinical settings, including in Canada. Customization (i.e., personalization) allows the clinician to better evaluate each pregnancy for the presence of reduced fetal growth by judging each fetus against its own predicted growth potential.

Using multivariate analysis of birth weight data from uncomplicated pregnancies, Gardosi and colleagues identified several factors that consistently predicted fetal growth, including maternal ethnicity, parity, pre-pregnancy height and weight, and fetal sex.[12,13] They calculated adjustment coefficients for each of these factors (per population studied) and then developed a software tool to determine the individual customized optimal birth weight at 40 weeks' gestation for an individual fetus on the basis of the aforementioned variables. Next, Gardosi developed a "proportionality equation," derived from the work of Hadlock et al.,[14] and determined the proportion of the fetal weight at 40 weeks' gestation that is achieved at any given prior gestational age, assuming that these proportions are constant for all fetuses. By combining the individual term optimal weight at 40 weeks with the proportionality equation, Gardosi generated fetal growth curves specifically reflecting the growth potential of the individual non-pathologically affected fetus throughout pregnancy.[12] Nevertheless, it should be emphasized that this approach was based on several assumptions that remain to be proven, including:

1. all fetuses grow in utero according to the same pattern (i.e., meeting the proportionality equation);
2. the effects of the various maternal and fetal predictors of fetal weight on the optimal weight, as well as the variation in optimal weight, are similar at different gestational ages; and
3. most of the variation in optimal weight is explained by gestational age and fetal sex.

CUSTOMIZED PERCENTILES: THE EVIDENCE

Since the introduction by Gardosi et al.[12] of the customized fetal growth concept, other researchers have generated population-specific adjustment coefficients and validated