Soft Tissue Assessment for Fetal Growth Disorders Mini-commentary on BJOG-20-0076.R1

Wesley Lee[1]

[1]Baylor College of Medicine

April 28, 2020

Mini-commentary on BJOG-20-0076.R1: Differences in fetal fractional limb volume changes in normal and gestational diabetic pregnancies: an exploratory observational study

Soft Tissue Assessment for Fetal Growth Disorders

Wesley Lee

Baylor College of Medicine, Texas Children's Pavilion for Women, Houston, TX USA

Email: wesley.lee@bcm.edu

In a preliminary study, Akiba and colleagues report novel observations about fetal limb soft tissue changes in Japanese women with gestational diabetes as compared to gravidas with normal glucose tolerance (BJOG 2020 xxxx). No significant differences in fractional arm volume (AVol) were found between groups until after 32 weeks gestation although corresponding differences did not occur with fractional thigh volume (TVol).

Three-dimensional ultrasonography now makes it feasible to evaluate fetal soft tissue development in ways that were not previously possible when based on 2D size parameters alone. For example, this technology allows creation of standardized imaging planes for reliable extraction of 2D soft tissue measurements (e.g. mid-thigh circumference or subcutaneous fat thickness). Fractional limb volume, based on 50% of long bone diaphysis length, can also be obtained (Lee W, et al. *Ultrasound Obstet Gynecol* 2009;33:427-40). These 3D volume parameters demonstrate a linear relationship to menstrual age during early pregnancy, from 18 weeks until approximately 28-29 weeks gestation. Limb soft tissue accretion exponentially increases thereafter. Akiba et al. have identified differences in this growth process between AVol and TVol measurements at a time of accelerated soft tissue deposition among diabetic gravidas.

Obstetricians traditionally rely on estimated fetal weight (EFW) as a proxy for birth weight and as a key marker of neonatal nutritional status. One should recognize that there are many different ways that EFW could be calculated. Unfortunately, the vast majority of fetal weight prediction models rely on 2D size parameters such as biparietal diameter, abdominal circumference, and femur diaphysis length. Too much emphasis is currently placed on skeletal structures that may not accurately reflect body composition changes in malnourished fetuses. Inclusion of limb soft tissue parameters with 2D size parameters now adds a key nutritional component to the weight estimation process. This capability offers new ways for characterizing changes in fetal body composition associated with fetal growth disorders and neonatal growth outcomes (Lee W, et al. *Ultrasound Obstet Gynecol* 2013; 41:198–203, Simcox LE, et al. *Am J Obstet Gynecol*2017;217:453.e1–453.e12, Roelants JA, et al. *Pediatr Obes*2017;12:65-71).

Newer sonographic approaches for evaluating fetal body composition are often hampered by practical barriers for successful implementation into clinical practice. Efficient methods for the noninvasive evaluation of soft tissue development are required for fetal growth assessment. Future technological advances could focus on the application of machine learning and/or artificial intelligence methods for more rapid fractional limb volume results without the need for manual tracing of soft tissue borders. As grayscale imaging improves over time, these improvements may help us to separate fetal soft tissue components (e.g. fat, muscle, and bone) for further insight into body composition changes in diabetic pregnancies. Robust characterization of prenatal soft tissue development and its relationship to childhood obesity and health during adult life raises many possibilities to be explored. Additional studies could examine the level of maternal glucose control and fetal body composition in different study populations. This line of investigation may eventually lead to a new paradigm shift for how we could evaluate fetal growth disorders going forward.

Disclosure of Interest: There are no conflicts of interest. A completed disclosure of interest form is available to view online as supporting information.