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ISUOG Practice Guidelines: ultrasound assessment of fetal biometry and growth

Clinical Standards Committee

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INTRODUCTION

These Guidelines aim to describe appropriate assessment of fetal biometry and diagnosis of fetal growth disorders. These disorders consist mainly of fetal growth restriction (FGR), also referred to as intrauterine growth restriction (IUGR) and often associated with small-for-gestational age (SGA), and large-for-gestational age (LGA), which may lead to fetal macrosomia; both have been associated with a variety of adverse maternal and perinatal outcomes. Screening for, and adequate management of, fetal growth abnormalities are essential components of antenatal care, and fetal ultrasound plays a key role in assessment of these conditions.

The fetal biometric parameters measured most commonly are biparietal diameter (BPD), head circumference (HC), abdominal circumference (AC) and femur diaphysis length (FL). These biometric measurements can be used to estimate fetal weight (EFW) using various different formulae[1]. It is important to differentiate between the concept of fetal size at a given timepoint and fetal growth, the latter being a dynamic process, the assessment of which requires at least two ultrasound scans separated in time. Maternal history and symptoms, amniotic fluid assessment and Doppler velocimetry can provide additional information that may be used to identify fetuses at risk of adverse pregnancy outcome.

Accurate estimation of gestational age is a prerequisite for determining whether fetal size is appropriate-for-gestational age (AGA). Except for pregnancies arising from assisted reproductive technology, the date of conception cannot be determined precisely. Clinically, most pregnancies are dated by the last menstrual period, though this may sometimes be uncertain or unreliable. Therefore, dating pregnancies by early ultrasound examination at 8–14 weeks, based on measurement of the fetal crown–rump length (CRL), appears to be the most reliable method to establish gestational age. Once the CRL exceeds 84 mm, HC should be used for pregnancy dating[2–4]. HC, with or without FL, can be used for estimation of gestational age from the mid-trimester if a first-trimester scan is not available and the menstrual history is unreliable. When the expected delivery date has been established by an accurate early scan, subsequent scans should not be used to recalculate the gestational age[1]. Serial scans can be used to determine if interval growth has been normal.

In these Guidelines, we assume that the gestational age is known and has been determined as described above, the pregnancy is singleton and the fetal anatomy is normal. Details of the grades of recommendation used in these Guidelines are given in Appendix 1. Reporting of levels of evidence is not applicable to these Guidelines.

GUIDELINES

An AGA fetus is one whose size is within the normal range for its gestational age. AGA fetuses typically have individual biometric parameters and/or EFW between the 10^{th} and 90^{th} percentiles.

A SGA fetus is one whose size is below a predefined threshold for its gestational age. SGA fetuses typically have EFW or AC below the 10th percentile, although 5th centile, 3rd centile, −2SD and *Z*-score deviation have also been used as cut-offs in the literature.

A FGR or IUGR fetus is one that has not achieved its growth potential. The difficulty in determining growth potential means that it is difficult to reach a consensus regarding a clinically useful definition[5]. This condition can be associated with adverse perinatal and neurodevelopmental outcomes. It has been classified into early-onset (detected before 32 weeks' gestation) and late-onset (detected after 32 weeks' gestation) types[5,6]. Fetuses with suspected FGR will not necessarily be SGA at delivery, and a fetus may fail to achieve its growth potential despite not being SGA at birth. Similarly, not all SGA fetuses are growth-restricted; most are likely to be 'constitutionally' small[7]. Traditionally, the symmetry of fetal body proportions has been seen as indicative of the underlying etiology for FGR, with symmetrical FGR thought to correspond to fetal aneuploidy and progressive asymmetrical FGR thought to indicate placental insufficiency. However, fetal aneuploidy can result in asymmetrical FGR[8] and placental insufficiency can result in symmetrical FGR[9]; moreover, the symmetry of body proportions alone is not a consistent prognostic predictor[10–12].

A LGA fetus is one whose size is above a predefined threshold for its gestational age. LGA fetuses typically have EFW or AC above the 90th percentile, although 95th centile, 97th centile, +2SD and *Z*-score deviation have also been used as cut-offs in the literature. Macrosomia at term usually refers to a weight above a fixed cut-off (4000 or 4500 g).

Recommendations

- The following abbreviations should be used to describe fetal size and growth: AGA, SGA, LGA and FGR (**GOOD PRACTICE POINT**).
- The terms 'early-onset' (detected before 32 weeks' gestation) and 'late-onset' (detected after 32 weeks' gestation) can be added in case of FGR (**GRADE OF RECOMMENDATION: C**).
- The terms 'symmetrical' and 'asymmetrical' FGR should no longer be used, given that they do not provide additional information with regard to etiology or prognosis (**GRADE OF RECOMMENDATION: D**).

Main fetal measurements: what should be measured, when and how?

Individuals performing ultrasound scans and fetal biometric measurements on a routine basis should have specialized training in the practice of diagnostic obstetric ultrasound, including training in ultrasound safety. Exposure to ultrasound should comply with the ALARA ('as low as reasonably achievable') principle[1,2]. Ultrasound machines should be equipped with real-time, grayscale, two-dimensional (2D) transducers, and have adjustable and displayed output power, freeze frame and zoom options as well as electronic calipers. Image storage and printing should follow local guidelines[1,2]. These machines should undergo regular maintenance.

Before 14 weeks, CRL should be used to assess fetal size and to estimate gestational age. After 14 weeks, usual measurements include BPD, HC, AC and FL[1,2].

Measurements can be performed transabdominally or transvaginally. For all measurements, clear images with sufficient magnification and correct depiction of landmarks are needed to allow precise caliper placement[1]. Calipers should be placed as described in the charts that are chosen for gestational age or size determination. Regular quality control should be performed[1,2,13]. A review of measurement techniques and pitfalls can be found online on the INTERGROWTH-21st website[14]. With respect to HC and AC measurements, note that there are two possible methods, which are equally reproducible: using the ellipse tool and the two-diameters method; in both cases the calipers should be placed in an outer-to-outer position[15]. For consistency, it is essential that, within an institution or a referring hospital's local or national network, the same method is adopted, and that this is the same as that used in the studies which produced the reference curves being used. Using the ellipse measurement tool is recommended[15].

Recommendations

- BPD, HC, AC and FL should be measured on ultrasound scan from 14 weeks onwards (**GRADE OF RECOMMENDATION: D**).
- HC and AC should be obtained using the ellipse measurement tool, by placing the calipers on the outer edges of the soft-tissue circumference (**GOOD PRACTICE POINT**).
- Measurements should be taken following the same methodology as that used in the studies which produced the reference curves that are applied in the particular hospital or system (**GOOD PRACTICE POINT**).

Estimated fetal weight

EFW may be used to monitor fetal size and growth[4]. Using EFW allows: clinicians to summarize fetal growth, depending on which size parameters are included; use of the same anatomic parameter(s) for monitoring growth prenatally and postnatally (i.e. weight); and communication with parents and pediatricians regarding the anticipated birth weight.

However, use of EFW also has disadvantages[16,17]: errors in single-parameter measurements are multiplied; accuracy of EFW is compromised by large intra- and interobserver variability, with errors in the range of 10–15% being common[18]; errors are relatively larger in the fetuses of greatest interest, i.e. those that are SGA or LGA; very different fetal phenotypes can have the same EFW (e.g. a fetus with large HC and small AC may have the same EFW as a fetus with small HC and large AC); most EFW prediction models require AC, a size parameter that can be difficult to measure due to technical factors.

Given the errors inherent in estimation of fetal weight, the time interval between scans should typically be at least 3 weeks, to minimize false-positive rates for the detection of fetal growth disorders, although this recommendation does not preclude more frequently performed scans when clinically indicated[19]. However, monitoring of fetal status may require interval scans with no EFW computation. The EFW should be compared to one of several dedicated nomograms for this purpose. EFW should not be plotted on newborn birth-weight charts, given that the latter include a large proportion of growth-restricted fetuses that are delivered early in gestation[20,21].

Recommendations

- Individual anatomic size parameters should be interpreted carefully. When EFW is computed, the calculated value should be interpreted based on existing nomograms (**GOOD PRACTICE POINT**).
- EFW should not be plotted on newborn birth-weight charts (**GRADE OF RECOMMENDATION: C**).

Quality control of fetal biometric measurements

Quality control in fetal biometry is essential for auditing and monitoring purposes. A comprehensive quality-control strategy should involve image storage and review, and assessment of intra- and interobserver reproducibility[3,13,22]. National guidelines and local institution guidelines should promote the use of standardized planes of acquisition and caliper-placement methods. Such an approach has been demonstrated to improve the reproducibility of measurements[23].

Quality control of images for CRL, HC, AC and FL measurement can be performed using scored criteria; such a scoring system is outlined in Table 1[24,25]. Quality control of fetal biometry data can also be achieved by assessment of intraobserver reproducibility (by reacquisition of images and by caliper placement on stored images by the same operator) or interobserver reproducibility (by caliper placement by a second operator)[26]. Finally, analysis of measurement distribution can be performed[27].

Recommendations

- Biometric images should undergo quality-control checks routinely (**GOOD PRACTICE POINT**).
- National and local institution guidelines should be followed (**GOOD PRACTICE POINT**).
- Quality-control processes may include the following (**GOOD PRACTICE POINT**): (1) image review (best performed by an experienced individual who understands basic principles of quality assurance and ultrasound practice); (2) performance of quality control on a random selection of at least 10% of stored images for interobserver reproducibility, by placement of calipers on stored images, and intraobserver reproducibility, by reacquisition of images and caliper placement by the same operator; (3) analysis of *Z*-score distribution of specific fetal size parameters, including EFW.
- Operators should undergo retraining if images are of poor quality, measurements are persistently outside the 95% limits of agreement or *Z*-score distributions differ from expected values (**GOOD PRACTICE POINT**).

Biometric reference ranges and growth standards

The difference between descriptive reference ranges and prescriptive standards of growth is fundamental. There are several reference curves, constructed retrospectively, which describe the distribution of a measurement in a given population over a given time period (e.g. Hadlock *et al.* (1991)[28]). However, only a limited number of descriptive reference ranges or population-based charts are of high methodological quality[22]. Prescriptive standards describe growth under optimal conditions; they provide ranges for what should be expected when women are healthy and are from healthy populations (e.g. INTERGROWTH-21st charts[4]). Comparison with healthy-population standards is the usual method of comparing observations of a single case in medicine; this may be different from the situation in populations at higher risk of growth aberrations. Prescriptive standards are constructed mainly from prospective data, for which sample size and population selection are predefined, preferably from international geographical sites, with appropriate pregnancy dating, ultrasound protocols and quality control. Pregnancy outcomes should be as complete as possible and there should be a low expected prevalence of pregnancy complications.

Table 1 Criteria for score-based objective evaluation of quality of biometric images

Type of image		
Cephalic	*Abdominal*	*Femoral*
Symmetrical plane	Symmetrical plane	Both ends of bone clearly visible
Plane showing thalami	Plane showing stomach bubble	< 45° angle to horizontal
Plane showing cavum septi pellucidi	Plane showing portal sinus	Femur occupying more than half of total image
Cerebellum not visible	Kidneys not visible	Calipers placed correctly
Head occupying more than half of total image	Abdomen occupying more than half of total image	
Calipers and dotted ellipse placed correctly	Calipers and dotted ellipse placed correctly	

Each fulfilled criterion scores one point. Reproduced from Salomon *et al.*[25].

Regardless of whether the design is prescriptive or descriptive, fixed or random sampling should allow for uniformly balanced data across gestation.

The following World Health Organization (WHO) criteria should be considered when producing growth standards. They can be grouped into three main domains: selection of the observed population; collection of outcome; and standardization of the technique for observation.

Regarding selection of the population, the study should be large, prospective and truly population-based (different from reference population-based). Geographical locations of institutions providing pregnancy care should be limited to urban areas with low rates of adverse perinatal outcome and low exposure to pollution, domestic smoke, radiation and other toxic substances, and where the health, educational and nutritional needs of all the inhabitants are mostly met.

Sampling of women should use predefined criteria for construction of standards, and specific outcomes should be collected, including: neonatal anthropometry (newborn body composition, infant feeding practices and preterm postnatal growth, as well as postnatal growth), perinatal conditions for the entire population, and postnatal motor development assessment following WHO milestones. Standardized procedures, identical equipment and centrally trained staff should be used.

Finally, ultrasound equipment should be selected based on predefined criteria after extensive public consultation according to WHO administrative requirements. Multiple ultrasound measurements should be taken and they should be corroborated by newborn anthropometry. Ultrasound biometry results should be masked from operators to eliminate expected-results bias. The quality-control strategy for all maternal and postnatal measures should include training, standardization and certification of ultrasound operators, using protocols for quality control of ultrasound image review, data monitoring and random sample remeasurement.

Different reference charts may report different centiles for the same fetal measurement; this may be due to methodological differences in creating them[3,22,29]. More recently, prescriptive charts have reported on how a population 'should grow' rather than how a population has grown at a specific point in time[4,30–32]. This concept led to the construction of international standards for fetal biometry, which describe optimal growth in fetuses from pregnancies at low risk of FGR[4,31]. These standards, derived from multicenter, multiethnic, geographically diverse populations at low risk of adverse maternal and perinatal outcome, may reflect more appropriately modern clinical practice. Adoption of such prescriptive charts would also allow continuity of assessment of growth between intrauterine and postnatal life. Customized and conditional charts have been proposed as an alternative to population-based or reference charts[32,33–35]. Customized reference charts are used by adjusting for variables known to affect fetal weight and growth, such as maternal height and weight, ethnic origin, parity and fetal sex. Compared with population-based non-customized reference charts, a customized chart will assign a different proportion of fetuses as SGA at birth. This may be relevant to units in which the antenatal population is diverse with respect to those factors, by better capturing fetuses at risk of perinatal complications, but the benefit of such a customized approach over population-based charts was not demonstrated in a recent prospective study[36]. Evaluating the impact of using one chart over another by applying it to a local database may be performed as an exploratory and preliminary process.

Recommendations

- Fetal biometry charts which are prescriptive, obtained prospectively, truly population-based and derived from studies with the lowest possible methodological bias should be used (**GOOD PRACTICE POINT**).
- Routine evaluation of the number (%) of fetuses considered abnormally grown (i.e. below a given cut-off) should be carried out (**GOOD PRACTICE POINT**).
- Practitioners should be aware of nationally or locally mandated charts (**GOOD PRACTICE POINT**).

Which metric should be used in describing biometry and which cut-off to define abnormal biometry?

Measurements made on fetal ultrasound can be reported as raw data, expressed in mm or cm. Because measurements and their distributions change with advancing gestation, centiles, *Z*-scores, percentage deviation from the mean or multiples of the median[23] may also be used when referring to raw data of a reference range. Centiles or *Z*-scores are measures of deviation from the mean of a population, under the assumption of underlying normality of distribution of the measured parameter. The use of *Z*-scores has several advantages, including that the scale is linear, allowing comparison between different biometric variables at different gestational ages[37]. Centiles are intuitively more understandable than are *Z*-scores and there is a precise relationship between them when there is a standard normal distribution of the population (5^{th} centile is equivalent to −1.64 *Z*-score; 10^{th} centile is equivalent to −1.28 *Z*-score)[38].

A cut-off point below the 10^{th} centile for gestation for AC and/or EFW is a commonly accepted definition of FGR. However, the 10^{th} centile cut-off value varies depending on the chart used. Moreover, most SGA babies are not growth-restricted at birth, and some babies with FGR due to placental insufficiency who are at risk of compromise or stillbirth are AGA[39]. The lower the cut-off of AC and EFW, the higher the risk of true FGR[36]. An international Delphi consensus recently proposed that a cut-off of AC or EFW below the 3^{rd} centile may be used as the sole diagnostic criterion for FGR[5]. In case of AC or EFW below the 10^{th} centile, the diagnosis of FGR should be considered only in association with other parameters (Table 2). Depending on the gestational age, these include maternal (uterine artery) or fetal (umbilical or cerebral/umbilical

Table 2 Consensus-based definitions for early and late fetal growth restriction (FGR) in absence of congenital anomalies

Early FGR: *GA < 32 weeks, in absence of congenital anomalies*	*Late FGR:* *GA ≥ 32 weeks, in absence of congenital anomalies*
AC/EFW < 3rd centile *or* UA-AEDF	AC/EFW < 3rd centile
Or	*Or at least two out of three of the following*
1. AC/EFW < 10th centile *combined with*	1. AC/EFW < 10th centile
2. UtA-PI > 95th centile *and/or*	2. AC/EFW crossing centiles > 2 quartiles on growth centiles*
3. UA-PI > 95th centile	3. CPR < 5th centile *or* UA-PI > 95th centile

*Growth centiles are non-customized centiles. AC, fetal abdominal circumference; AEDF, absent end-diastolic flow; CPR, cerebroplacental ratio; EFW, estimated fetal weight; GA, gestational age; PI, pulsatility index; UA, umbilical artery; UtA, uterine artery. Reproduced from Gordijn *et al.*[5].

artery) Doppler findings or a drop (of more than two quartiles) in AC or EFW centile in serial scans.

Recommendations

- Observed values should be plotted in mm or cm and centiles or *Z*-scores should be calculated (**GOOD PRACTICE POINT**).
- A small fetus (AC or EFW below 10th centile) should be considered at risk for FGR (**GRADE OF RECOMMENDATION: C**).
- Diagnostic criteria for FGR may also be based on Delphi consensus criteria[5] (**GOOD PRACTICE POINT**).

What is the difference between fetal size and growth and how can growth be evaluated?

There are various methods to construct standards for fetal growth. Ideally, studies should assess serial measurements of size parameters in growing fetuses, as this provides significant advantages over single size measurements in evaluating the growth process, allowing evaluation of true growth parameters (growth rates) and of growth trajectories, particularly in the third trimester when most growth abnormalities occur. The challenges of such studies are their relatively high cost, the time required for data acquisition and the necessity for strong patient compliance.

Serial ultrasound scans should be used to construct longitudinal growth charts, in which several measurements are taken from the same fetuses at different gestational ages[40]. Fetal growth velocity, typically represented as deviation from growth-velocity charts (change in centiles or *Z*-score with advancing gestation), is particularly relevant for assessing fetal growth, rather than fetal size. Some[36,41,42], but not all[43–45], studies have reported that reduced third-trimester growth velocity is associated with an increase in incidence of certain adverse pregnancy outcomes, but the association of growth velocity in the earlier trimesters with adverse outcome is still unclear. Individualized growth assessment is based on measuring second-trimester change in fetal-size parameters to estimate growth potential. These estimates specify size models that generate individualized third-trimester size trajectories and predict birth characteristics[46]. Conditional biometry is performed intuitively, and involves a clinician undertaking visual assessment of the patterns of acceleration or deceleration of growth over time; it is possible to assess conditional distributions of growth formally, using information from previous measurements to assess an individual's growth[40].

Overall, direct growth-rate measurements have generally not been shown to add significant information to growth assessment. However, a 2015 publication by Sovio *et al.*[36] indicated that fetuses considered SGA by EFW that had abnormally low AC growth had a significantly increased likelihood of neonatal morbidity, suggesting that growth rates may have to be combined with other assessment procedures to be useful in third-trimester evaluation of growth.

Recommendations

- Appropriate statistical procedures should be used to develop fetal growth standards (**GOOD PRACTICE POINT**).
- Fetal growth analysis may help in the management of pregnancy, although clinical implementation will depend on local practice and institutional guidelines (**GOOD PRACTICE POINT**).
- Observation of drop in centile or *Z*-score on growth charts should trigger further monitoring (**GRADE OF RECOMMENDATION: C**); a drop of more than two quartiles (or more than 50 centiles) has been recommended by consensus criteria for FGR[5].
- The relationship between growth velocity over time and the detection of small fetuses at risk for adverse outcome requires additional investigation (**GOOD PRACTICE POINT**).

How and when should we screen for FGR and/or SGA fetuses?

A routine mid-trimester ultrasound scan is typically performed between 18 and 22 weeks of gestation[1]. This period represents a compromise between dating the pregnancy (which is more accurate if established earlier) and the timely detection of major congenital anomalies. The performence of or need for any additional third-trimester scans is based on local guidelines, and the presence or absence of maternal or fetal conditions and of risk factors or related findings that are known to be associated with abnormal growth[6]. Serial scans for interval growth are best performed at least 3 weeks after a preceding scan[1], when indicated. Computer modeling indicates that ultrasound scanning to measure AC at 2-week intervals is associated with false-positive rates for FGR in excess of 10%, increasing to excessively high rates late in the third trimester[19].

Additional scans may also be beneficial for monitoring fetal status and for subsequent detection of fetal growth abnormalities[36]. Ultrasound examination at 36 weeks' gestation was found to be more effective than that at 32 weeks' gestation in detecting FGR and predicting related adverse perinatal and neonatal outcome[47]. Future research should include more accurate sonographic detection of SGA infants, to identify a small fetus at risk for morbidity and to determine interventions that could improve neonatal outcome[48].

What to do in case of abnormal biometry?

Management of FGR is beyond the scope of these Guidelines.

Abnormal biometry should trigger a referral for detailed assessment of the fetus, including confirmation of accurate dating of the pregnancy as well as assessment of potential factors that may have resulted in the abnormal biometry, including maternal factors and related treatment (hypertension, diabetes, infectious exposure); detailed evaluation of fetal anatomy and consideration of karyotype; and evaluation for uteroplacental insufficiency, including uterine and umbilical artery Doppler and objective placental morphology assessment (location of cord insertion, and size and appearance of the placenta).

A diagnosis of FGR should trigger referral to an appropriate unit for individualized management. Management will depend on the cause of FGR. In many cases, this will include assessment of fetal wellbeing in order to identify those fetuses requiring delivery. There is no consensus on the optimal approach to fetal assessment under these circumstances. Antenatal testing strategies include: cardiotocography (non-stress test) by means of computerized assessment (e.g. Dawes-Redman criteria)[49]; biophysical profile (BPP) score; amniotic fluid volume assessment; evaluation of Doppler indices of the umbilical artery, fetal middle cerebral artery or a combination of the two (cerebroplacental or umbilicocerebral ratio); and assessment of aortic isthmus and ductus venosus flow[50–52].

Recommendations

- In case of FGR, there should be timely referral to an appropriate unit for individualized management. This will depend on many factors, including maternal factors, gestational age and the results of ultrasound and other tests (**GOOD PRACTICE POINT**).
- In the presence of abnormal biometry, maternal symptoms of *de-novo* hypertension and/or absent/reversed end-diastolic umbilical artery blood flow should prompt urgent referral to a subspecialist in high-risk pregnancy (**GOOD PRACTICE POINT**).

What documentation should be produced to demonstrate measurements?

Fetal biometry/growth reports typically include: relevant medical or obstetric conditions; scan indication; scan date; best estimate of gestational age and estimated delivery date; agreed gestational age on date of scan; amniotic fluid assessment (either by visual assessment, deepest vertical pool or amniotic fluid index); BPD, HC, AC and FL (centile and/or *Z*-score, and reference/standard used); EFW in grams (with centile and/or *Z*-score, formula and reference/standard used); graphs (e.g. size parameters and EFW *vs* gestational age); antenatal testing results (e.g. BPP score or Doppler scans[53], if relevant); diagnostic impression; and recommendations for follow-up examination or management.

Assessment of fetal growth and development: additional approaches

Conventional 2D size parameters, such as BPD and FL, reflect skeletal development. AC reflects primarily liver size, with a small amount of surrounding skin and subcutaneous fat. Soft-tissue quantification allows indirect assessment of fetal nutritional status. Improvements in resolution of grayscale ultrasound and the more recent application of three-dimensional (3D) ultrasonography have made it easier to evaluate technically fetal fat and muscle components, for example, by means of whole fetal limb-volume measurements[54,55]. The concept of fractional limb volume was developed to improve the reproducibility and efficiency of manual tracing of fetal limb volumes[56]. These measurements can serve as an index of fetal nutritional status and there are studies suggesting that combining fractional limb volume with 2D biometry improves the precision of EFW[57–59], with some improvement in detection of late-onset FGR at 34–36 weeks[59].

Normal magnetic resonance imaging (MRI) biometric reference ranges have been developed for several fetal anatomical structures, with many publications describing growth and developmental landmarks for the brain and lungs. However, poor interobserver agreement indicates a need for technical refinement and reference ranges that are specific for MRI[60]. A recent meta-analysis of MRI and ultrasonography in the prediction of neonatal macrosomia found that there is insufficient evidence to conclude that MRI-based EFW is the more sensitive in this setting[61].

Areas for future research

Current research on FGR has focused on the poorer outcome of fetuses with EFW below the 10^{th} centile and with abnormal Doppler measurements. However, there are still babies born with birth weight above the 10^{th} centile whose postnatal outcome is inexplicably poor. Fetuses whose birth weight falls within the normal range, but, nevertheless, do not reach their growth potential, may represent those with a higher risk of poor perinatal outcome. Given this heterogeneity of groups defined by EFW/birth weight, it may be necessary to study individual fetuses using additional anatomical parameters or parameter sets. As growth abnormalities evolve in different ways, longitudinal studies of affected fetuses using methods that quantify growth pathology may be necessary to define those individuals truly at risk for adverse outcome.

The placenta plays a key role in abnormal growth. Functional imaging of the placenta may help in predicting adverse outcome[62].

CONCLUSION

The performance and interpretation of fetal biometry is an important component of obstetric ultrasound practice. In fetuses for which gestational age has been established appropriately, measuring key biometric parameters, together with transformation of these measurements into EFW using one of the many validated formulae, permits detection and monitoring of small fetuses. Serial sonographic assessment of fetal size over time can provide useful information about growth, with the possibility of improving the prediction of SGA infants, particularly those at risk for morbidity. However, errors and approximations that may occur at each step of such a process greatly hamper our ability to detect abnormal growth, and most importantly FGR. Therefore, in clinical practice, fetal biometry should represent only one component of how we screen for abnormal growth. It is reasonable to believe that no single measurement, EFW formula or chart will significantly improve our current practices. Improved FGR screening may be feasible by using a combined approach that includes biometry as well as other clinical, biological and/or imaging markers. This goal will come within reach only when the ‘biometric component’ is better standardized for all those who care for pregnant women.

GUIDELINE AUTHORS

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APPENDIX 1 Levels of evidence and grades of recommendation used in ISUOG Guidelines

Classification of evidence levels	
1++	High-quality meta-analyses, systematic reviews of randomized controlled trials or randomized controlled trials with very low risk of bias
1+	Well-conducted meta-analyses, systematic reviews of randomized controlled trials or randomized controlled trials with low risk of bias
1–	Meta-analyses, systematic reviews of randomized controlled trials or randomized controlled trials with high risk of bias
2++	High-quality systematic reviews of case–control or cohort studies or high-quality case–control or cohort studies with very low risk of confounding, bias or chance and high probability that the relationship is causal
2+	Well-conducted case–control or cohort studies with low risk of confounding, bias or chance and moderate probability that the relationship is causal
2–	Case–control or cohort studies with high risk of confounding, bias or chance and significant risk that the relationship is not causal
3	Non-analytical studies, e.g. case reports, case series
4	Expert opinion
Grades of recommendation	
A	At least one meta-analysis, systematic review or randomized controlled trial rated as 1++ and applicable directly to the target population; or systematic review of randomized controlled trials or a body of evidence consisting principally of studies rated as 1+ applicable directly to the target population and demonstrating overall consistency of results
B	Body of evidence including studies rated as 2++ applicable directly to the target population and demonstrating overall consistency of results; or evidence extrapolated from studies rated as 1++ or 1+
C	Body of evidence including studies rated as 2+ applicable directly to the target population and demonstrating overall consistency of results; or evidence extrapolated from studies rated as 2++
D	Evidence of level 3 or 4; or evidence extrapolated from studies rated as 2+
Good practice point	Recommended best practice based on the clinical experience of the Guideline Development Group