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REVIEW

Usefulness and timing of the third-trimester ultrasound scan: a review of guidelines and underlying evidence

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Abstract

Objectives Recommendations regarding the use of third-trimester ultrasound lack universal consensus. Yet, there is evidence which supports its value in assessing fetal growth, fetal well-being, and a number of pregnancy-related complications. This literature review evaluates the available scientific evidence regarding its applications, usefulness, and the timing of the third-trimester scan in a low-risk population.

Methods A literature search (PubMed, Embase, Scopus; until April 1st, 2025) identified English-language studies dealing with third-trimester ultrasound screening, its aims, and its best timing. International and national guidelines were reviewed to assess the current recommendations. Large, high-quality studies were then used to evaluate the completeness of the current recommendations and to analyze additional parameters that could be considered when assessing the usefulness of a third-trimester ultrasound screening.

Results Six international and national sets of guidelines regarding the third-trimester ultrasound were analyzed, showing wide variability in recommendations. While all six support its use, mainly for fetal growth, amniotic fluid, and placental assessment, only ISUOG and SIEOG specify the gestational age at which it should be performed (32–36 weeks). Fetal biometry and anatomy are universally suggested, while recommendations for Doppler studies, biophysical profile, and cervical length are inconsistent. Newer applications, such as pre-eclampsia screening and prediction of labor onset and intrapartum complications, are not yet included. Recent major studies in low-risk populations suggest 36-week gestation as the optimal screening time.

Conclusions There is a broad recognition of third-trimester ultrasound being useful for fetal monitoring, but consensus is lacking regarding its routine use in low-risk populations, its outcomes and timing. Major evidence supports ultrasound screening at 36-week gestation in low-risk pregnancies to predict fetal growth restriction, macrosomia, structural anomalies, complications due to placental abnormalities, pre-eclampsia and onset of labor. When preceded by effective risk stratification done earlier in pregnancy, this strategy may enhance pregnancy management potentially improving maternal–fetal outcomes.

Keywords Third trimester · 36-week model · Ultrasound · Screening · Fetal growth · Fetal well-being

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Background

The first-trimester screening has been standardized by extensive research from the Fetal Medicine Foundation (FMF) within a specific gestational age (GA) window of 11^{+0} to 13^{+6} weeks, owing to the accessibility and reproducibility of specific standardized views [1]. Similarly, the second-trimester screening is widely accepted and typically performed between 18 + 0 and 24 + 0 weeks, with timing often influenced by specific national regulations on pregnancy termination [2, 3]. However, currently there is no consensus among the available international guidelines regarding the universal implementation of third-trimester ultrasound screening, its specific aims, and optimal timing.

Evidence suggests that third-trimester US can be valuable for assessing fetal growth and development, fetal well-being, amniotic fluid level, and other critical indicators of the overall fetal, placental, and maternal health [4, 5]. This screening can help to identify key pregnancy-related concerns or complications that may affect maternal and fetal outcomes, including the course and safety of labor and delivery [6].

The third-trimester ultrasound can be either part of a specialistic follow-up initiated early in pregnancy due to maternal risk factors (e.g., advanced maternal age or history of adverse pregnancy outcomes), pre-existing conditions (e.g., chronic or gestational hypertension, diabetes mellitus type 1 or 2, autoimmune disorders, thrombophilia, recurrent miscarriage or bleeding), or complications that develop during pregnancy (e.g., gestational diabetes, short cervix, bleeding, structural anomalies, or placenta previa). In addition, it can be used as an additional screening tool for pregnancies that were deemed to be at low risk in the first and second trimesters [7, 8].

In high-risk populations, serial ultrasound examinations are usually employed to detect in a timely fashion the onset of potential complications, which are primarily due to placental dysfunction [9]. However, in low-risk pregnancies, third-trimester ultrasound is typically performed using a predefined protocol at a fixed GA. Sometimes, in otherwise low-risk pregnancies, specific clinical indications emerge during gestation, such as suspected fetal growth restriction or macrosomia, abnormal fetal lie or presentation, decreased fetal activity, preterm premature rupture of membranes, or a variety of maternal concerns, can be assessed by a third-trimester ultrasound examination [10, 11].

In accordance with these principles, as summarized by Nicolaides in his milestone paper describing the inverted pyramid of care, accurate screening programs carried out in the first and second trimesters (such as the screening for preterm pre-eclampsia) may play a key role in stratifying the level of risk in pregnant women based on a variety of factors early in pregnancy. Among other benefits, this approach may be helpful in establishing a patient-specific appropriate GA for third-trimester ultrasound screening [1, 12, 13].

Objectives

The aims of this study were the following: first, to evaluate the scientific evidence available in the literature regarding applications, usefulness, and timing of the third-trimester scan in the low-risk population navigating through the existing guidelines and other major studies; second, to provide an up to date guide for clinician embracing all available knowledge on the third-trimester scan in the low-risk population.

Methods

An extensive literature search starting at the point when data regarding routine third-trimester ultrasound first appeared in the literature up to April 1 st, 2025, was performed by three independent researchers (E.D., C.G., P.C.) using PubMed, Embase, and Scopus to find the pertinent papers in English language. The focus was the role of the third-trimester screening US scan, investigated outcomes, and recommended GA windows for implementation.

To ensure a comprehensive overview, both MeSH terms and free-text keywords were used, including, but not limited to, "third-trimester ultrasound," "fetal growth restriction," "small-for-gestational age (SGA)," "large-for-gestational age (LGA)," "estimated fetal weight," "macrosomia," "fetal anomalies," "amniotic fluid," "pre-eclampsia," "placenta previa," "placenta accreta spectrum," "vasa previa," "perinatal outcomes," "prediction of labor," "preterm birth," "cervical length," "uterine artery Doppler," "third-trimester screening," "low-risk pregnancy," and "routine antenatal care." Boolean operators (AND, OR) were applied to maximize sensitivity and specificity of the search. Bibliographies of relevant articles and systematic reviews were also scanned manually to identify additional references that may have been missed in the primary database search.

First, we reviewed the available official guidelines compiled by scientific societies and by other universally recognized scientific organizations to find and summarize standard indications and outcomes of interest. Second, we focused on the results of high-quality studies with large cohorts to analyze the existing literature data on benefits of the third-trimester ultrasound that might have not been included in the existing guidelines. These included studies with more than 500 low-risk pregnancies and with a robust

design, such as population-based studies, cohort studies, and randomized trials.

A comparison was then made among the guidelines, and their main differences as well as similarities were recorded. The major studies were also analyzed by the three independent researchers (E.D., C.G., and P.C.); they were then discussed according to their main topics and outcomes and qualitative conclusions were drawn. A summary table of the results was then created based on all the data that was deemed reliable.

Results

Main effects

Six guidelines were retrieved from different scientific societies; their comparison is summarized in Table 1. The review of major international and national guidelines reveals substantial variability in recommendations regarding third-trimester ultrasound in pregnancy. While all documents reviewed (International Society of Ultrasound in Obstetrics and Gynecology (ISUOG) 2024, The British Medical

Table 1 Overview of the available guidelines for third-trimester ultrasound in the literature

	ISUOG, 2024 [14]	BMUS, 2022 [15]	ASUM, 2014 [16]	CAR, 2010 [17]	AIUM–ACR–ACOG–SMFM–SRU, 2018 [18]	SIEOG, 2021 [19]
Routine	✓	✓	✓	✓	Not mentioned	✓
GA	32–36 weeks *	Not mentioned	Not mentioned	Not mentioned	Not mentioned	34–36 weeks
Fetal n°, presentation, LIE and EDD	✓	Not mentioned	✓	✓	✓	Not mentioned
Fetal biometry	✓	✓	✓	✓	✓	✓
Fetal anatomy	✓**	✓****	✓*****	Not mentioned	✓******	✓
Amniotic fluid	✓	✓	✓	✓	✓	Not mentioned
Placenta location	✓	✓	✓	✓	✓	✓
PAS	***	***	***	Not mentioned	✓	***
Vasa Previa	***	***	***	Not mentioned	✓	***
Cervical length	Not mentioned	Not mentioned	✓ (up to 34 w')	✓	✓	Not routine, only high-risk population
Biophysical profile	Not mentioned	Not routinely indicated	Not routinely indicated	Not mentioned	Not mentioned	Not mentioned
Doppler studies	Not mentioned	Not routinely indicated	✓(UA PI and RI)	Not mentioned	Not mentioned	Not routine, only high-risk population
Perinatal outcomes	No significant association	Not mentioned	Not mentioned	Not mentioned	Not mentioned	Not data available yet
Additional parameters						
Umbilical cord insertion site and vessels number	Not mentioned	✓ (n° of vessel)	Not mentioned	✓	✓	Not mentioned
Maternal anatomy	Not mentioned	✓ (If accessible)	Not mentioned	Not mentioned	✓(if accessible)	Not mentioned

ISUOG International society of ultrasound in obstetrics and gynecology, *BMUS* British medical ultrasound society, *ASUM* Australasian society for ultrasound in medicine, *CAR* Canadian association of radiologist, *AIUM* The American institute of ultrasound in medicine, *ACR* The American college of radiology (ACR), *ACOG* the American college of obstetricians and gynecologists, *SMFM* The society for maternal–fetal medicine, *SRU* The society of radiologists in ultrasound, *SIEOG* Società Italiana di ginecologia e ostetricia

*Should be decided based on individual maternal and fetal characteristics, the risk level of the pregnancy and local objectives and resources

**Structural examination, including head, brain, heart, chest, abdomen and urinary system

***Not routine, only high-risk population (placenta previa and prior Cesarean birth or uterine surgery)

****Structural examination, including brain, stomach, bladder and kidneys

*****Structural examination, including brain, heart, stomach, diaphragm and kidneys

******Structural examination, including head, face, and neck; chest (heart); abdomen (stomach, kidney, and bladder); spine; extremities

Ultrasound Society (BMUS) 2022, The Australasian Society for Ultrasound in Medicine (ASUM) 2014, Canadian Association of Radiologists (CAR) 2010, American Institute of Ultrasound in Medicine, American College of Radiology, The American College of Obstetricians and Gynecologists, Society for Maternal Fetal Medicine, Society of Radiologists in Ultrasound (AIUM–ACR–ACOG–SMFM–SRU) 2018, Società Italiana di Ecografia Ostetrico Ginecologica (SIEOG) 2021) [14–19] recognize the clinical value of this scan, particularly for assessing fetal growth, amniotic fluid, and placental location, there is no unified agreement on its universal implementation or optimal timing. Only ISUOG and SIEOG explicitly recommend performing the scan between 32 and 36 weeks of gestation. Evaluation of fetal biometry and anatomy, placental location, and amniotic fluid volume are included in most guidelines. However, more specific parameters, such as biophysical profile, cervical length, Doppler studies, are inconsistently addressed and are often reserved for high-risk populations. Some guidelines also mention additional parameters, such as cervical length assessment, placental umbilical cord insertion, vasa previa or placenta accreta spectrum disorder, though these are not routinely emphasized. Furthermore, the guidelines do not include recently emerging topics, such as prediction of the onset of spontaneous labor, intrapartum events such as fetal compromise, pre-eclampsia, and late preterm birth.

Specific effects

The gestational age for routine third-trimester ultrasound

The guidelines do not provide a definitive consensus on the optimal GA for the third-trimester scan. However, according to the latest ISUOG Practice Guidelines, the timing (typically 32–36-week gestation) should be based on factors, such as maternal and fetal conditions, pregnancy risk level, and local healthcare resources [14]. In addition, SIEOG suggests 34–36 weeks as the preferred window for third-trimester scanning [19].

The ideal GA for carrying out the third-trimester scan depends on the goals of the test. It is important to strike a balance between optimal visualization of fetal anatomy and accurate assessment of fetal growth. Late onset growth abnormalities are generally best detected at about 36 weeks, being often missed at an earlier assessment, though early onset growth abnormalities can be detected at 28–32 weeks or earlier.

According to large prospective studies by the Fetal Medicine Foundation, including more than 100,000 women, standard ultrasound examinations at 35–37-week gestation reveal a significant number of fetal anomalies for the first time. [20, 21] Diagnosis of fetal anomalies may help to plan the appropriate timing and location of delivery as well as postnatal investigations, which may improve postnatal outcomes. [20, 21]

Furthermore, ultrasonographic screening for neonatal SGA is most effective when performed at 35–37-week gestation, rather than 31–34 weeks. EFW may be effectively paired with maternal risk variables to estimate the patient-specific risk for fetal growth restriction [5]. A recent randomized controlled study enrolling 1061 low-risk pregnant women revealed that EFWs established between 35 and 37 weeks had a greater correlation with birthweight when compared with EFWs obtained at 30–33 weeks. The overall accuracy of an ultrasound performed at 35–37-week gestation for FGR screening was 94%. In addition, performing ultrasound at the later gestational age was associated with a more favorable perinatal outcome compared to the group, where the ultrasound was performed earlier in pregnancy [22].

Aims and outcomes of routine third-trimester ultrasound

Fetal growth The majority of available guidelines emphasize that fetal biometry is an essential parameter of the third-trimester scan. The 2024 ISUOG guidelines strongly recommend that screening for SGA/FGR and LGA fetuses in the general population should be done at 36-week gestation rather than at 32 weeks due to its greater accuracy [14]. Fetal growth disorders lead to higher perinatal death and morbidity rates, as well as long-term developmental problems [23, 24]. Although not supported by all major guidelines, evidence indicates that pregnancies conceived through medically assisted reproduction are at higher risk of abnormal fetal growth [25–27]. As such, they should be excluded from the low-risk group and considered for increased surveillance.

Large-for-gestational age Abdominal circumference (AC) or estimated fetal weight (EFW) > 90th centile is commonly used to identify large-for-gestational age (LGA) fetuses, whereas macrosomia is typically defined as an EFW higher than 4000 or 4500 g [14]. Predicting LGA is important, because it is linked to delivery problems such as shoulder dystocia, prolonged labor, and a higher chance of needing a cesarean or instrumental delivery [28].

A large retrospective study demonstrated that screening for LGA in low-risk pregnancies is more accurate when done later in pregnancy. It was found that EFW at 35–37 weeks accurately predicted 46% and 65% of LGA > 90th and LGA > 97th centile, respectively, with a screen-positive rate of approximately 10%. Births within 10 days of the scan resulted in considerably greater detection rates (71% and 84%, respectively) [23]. The detection rates for LGA at 31–33 weeks are 10–15% lower for a similar screen-positive rate [23].

Similar results were obtained in an earlier study, which showed that universal third-trimester ultrasound increased the prediction rate of LGA newborns from 27 to 38% [29]. Furthermore, LGA fetuses with greater abdominal circumference growth velocity (ACGV) had a significant risk increase in any newborn morbidity (RR = 2.0; $p = 0.04$) and of severe unfavorable neonatal outcome (RR = 6.5; $p = 0.01$) [29].

A large cohort study demonstrated that late third-trimester ultrasound assessment of fetal weight for any indication can accurately predict LGA at delivery. If an ultrasound is done, because macrosomia is suspected, the detection rate is higher, although there is a greater chance of a false positive result [30].

Early labor induction is one of the main strategies for managing suspected macrosomia [31]. A multicenter randomized controlled trial concluded that in cases of suspected macrosomia, induction of labor between 37 + 0 weeks and 38 + 6 weeks of gestation can reduce the risks of shoulder dystocia and perinatal morbidity by almost 70% without increasing the likelihood of needing a cesarean delivery, making it a reasonable option [32].

Small-for-gestational age Small-for-gestational age (SGA) is defined as an EFW or AC below the 10th percentile of gestational age-adjusted reference ranges [33]. Palpation of the maternal abdomen and serial measurements of symphysis–fundus height (SFH) are the conventional methods of screening for SGA. However, the detection rate of this method is poor (< 30%) [34].

Prenatal detection of SGA fetuses is important in reducing the risk of stillbirth by managing the timing of delivery. International Fetal and Newborn Growth Consortium for the twenty-first century (INTERGROWTH-21st) demonstrated that birth weight < 3rd centile was significantly associated with antepartum stillbirth (HR = 4.6), with the highest risk reported in neonates that were not suspected of being growth restricted antenatally (HR = 5.0; 95% CI, 3.6–7.0). The population-attributable risk of antepartum death was 11% for neonates identified as SGA at delivery [35].

A randomized controlled trial concluded that the detection rate of SGA infants by routine third-trimester ultrasound was 52.8%, whereas it was only 7.7% if the ultrasound was done only based on a small SFH measurement. The corresponding specificities were 95.5% and 97.9%, respectively. The detection rate of severe SGA obtained by routine ultrasound was 66.7%, whereas it was 8.3% in the population selected according to SFH measurements [8].

As for the best timing of ultrasound, a randomized trial found that FGR detection rate at 36 weeks was higher than at 32 weeks of gestation (sensitivity, 38.8% vs 22.5%) without an increase in perinatal complications due to diagnostic delay [36]. This finding has been corroborated by the FMF in a retrospective study showing that routine third-trimester ultrasonographic screening for prediction of SGA at birth performs better at 35–37-week gestation than when it is done at 31–34 weeks. [5].

Oxford Growth Restriction Identification Program (OxGRIP) Group concluded through a prospective cohort study that after the introduction of universal ultrasonography for fetal growth restriction both severe morbidity and extended perinatal fatalities decreased by 33% and 27%, respectively, though neither change was statistically significant (aOR = 0.53; and aOR = 0.71) [37].

Pre-eclampsia Pre-eclampsia (PE) has a global pooled prevalence of about 3%, while up to 10% of pregnant women suffer from a hypertensive disorder of pregnancy [38, 39]. Currently, international guidelines do not uniformly recommend routine screening for pre-eclampsia using combined algorithms. Most major guidelines stratify patients based primarily on maternal risk factors (e.g., age, mean arterial blood pressure, and chronic morbidities).

The Fetal Medicine Foundation proposed a multivariable screening for PE to be performed in the first, second and third trimesters. A large prospective multicenter study (SPREE trial) involving 16,747 women showed an increased detection rate for PE using a multiparametric approach (maternal factors, MAP, UtA-PI and biochemical factors, such as PlGF or PAPP-A) when compared to NICE method, which is based on maternal risk factors alone (42.5% vs 30.4%, respectively) [38]. When applied during the first trimester between 11 + 0 and 13 + 6 weeks of gestation, the FMF multiparametric approach showed a DR for both preterm and term PE (DR 75% and 47%, respectively), which compares favorably to the NICE method (DR 40% and 35%, respectively) [40].

Currently, there are no randomized trials evaluating the impact of third-trimester pre-eclampsia (PE) screening on maternal, fetal, and newborn outcomes and its routine use is not yet recommended by any of the guidelines. However, third-trimester screening has been extensively evaluated by the FMF by a combination of maternal characteristics, mean arterial blood pressure, pulsatility index of the uterine arteries and angiogenic markers, such as the sFlt-1/PlGF ratio [41]. PlGF and other biochemical markers are widely recognized as strong predictors of adverse events in both low- and high-risk pregnancies [42–44]. In a major study by FMF, this multiparametric approach performed at 35–37-week gestation predicted about 85% of late pre-eclampsia at a FPR of 10% [13].

Fetal anomalies There is a broad consensus among guidelines on the necessity of a third-trimester fetal anatomy assessment, as certain conditions (e.g., hydronephrosis, microcephaly, and fetal ovarian cysts) can develop or be

detected late in gestation. Several sources provide lists of structures which should be included in a third-trimester anatomic survey [14, 20, 21].

The added value of the late third-trimester (35–37 weeks) scan in the detection of fetal anomalies, which were either missed earlier in pregnancy or which became apparent only in the third trimester, has been demonstrated in two large studies [20, 21]. This is supported by another study which found 43 abnormalities on a 36-week scan in 13,023 women, i.e., one out of every 303 women had a new abnormality detected using this approach. Anomalies discovered during the standard third-trimester scan primarily included the urinary tract, central nervous system, and minor fetal ovarian cysts [45].

Furthermore, in a large meta-analysis involving 13 trials and a total of 141,717 women, 643 women were identified with an unexpected anomaly at the third-trimester routine scan with a pooled prevalence of a newly detected abnormality of 3.68 every 1000 scans (most frequently cardiac, central nervous system, and urogenital anomalies) [46].

A recent major prospective study of 104,151 singleton pregnancies concluded that routine ultrasound exams between 35 and 36 weeks of gestation showed fetal abnormalities in 2.5% of cases, about half of which had been diagnosed earlier in pregnancy [21]. The study found that diagnosis of new anomalies during the 36-week ultrasound occurred at a rate of 0.77%, whereas postnatal diagnoses of any anomaly occurred at 0.39% [21].

Thus, when establishing and evaluating the cost vs benefit ratio of third-trimester ultrasound screening program, the possibility of identifying previously undiagnosed fetal anomalies needs to be considered [47]. In addition, in some cases of heart abnormalities diagnosed in the third trimester, such as aortic coarctation and pulmonary stenosis, or in fetuses with diaphragmatic hernia the delivery should be planned in a tertiary center, where the necessary resources to treat such neonates are available, which may improve postnatal outcome. In other cases, such as those with hydronephrosis or duplex kidney or other minor anomalies, the value of a prenatal diagnosis lies in having an adequate postnatal diagnostic assessment and follow-up [20]. This information needs to also be shared with the patient when obtaining her consent for a third-trimester ultrasound examination.

Table 2 includes a list of fetal structures of which evaluation during the third-trimester ultrasound is potentially beneficial.

Placental location Most available guidelines emphasize the importance of assessing placental location as part of the third-trimester ultrasound.

One of the goals of obstetric ultrasound is to determine the placental location, specifically to rule out placenta previa and a low-lying placenta [47, 48]. Transvaginal ultrasonography (TVS) consistently provides a more accurate diagnosis than the transabdominal approach, especially in cases with a posterior placenta. The transvaginal approach provides an unobstructed view of the lower uterine segment and the location of the lower placental edge previa because of improved image quality. It also decreases time of scanning and has a low risk of bleeding [49]. A definite diagnosis of placenta previa is established sonographically in the third trimester, when further upward migration from the internal cervical os is unlikely to happen [50].

RCOG Green-top Guidelines recommend that women with a persistent low-lying placenta or placenta previa at 32 weeks of gestation who remain asymptomatic should have an additional TVS at 36 weeks to guide the counseling on mode and timing of delivery. In addition, patients with placenta previa and a short cervical length on TVS prior to 34 weeks of gestation are at an increased risk of premature emergency delivery and major hemorrhage during caesarean section [48, 51].

A meta-analysis of 13 studies including 1462 pregnancies with placenta previa found that the sensitivity and specificity of a cervical length ≤ 30 mm at 28–34 weeks of gestation for predicting an emergency cesarean birth were 61% and 83%, respectively [52].

Apparent placental 'migration' during third trimester as the lower uterine segment develops leads to resolution of a low-lying placenta in 90% of cases before term, but this is less likely in women with a previous cesarean delivery [48].

Table 2 The following could be part of a structural evaluation in the third trimester

Head	Fetal head size and shape [14]
Brain	The symmetry of the hemispheres, the texture of the cerebral cortex and parenchyma should be assessed, and the width of the lateral ventricles should be evaluated [14]
Heart	Heart location, size, and symmetry. The three-vessel-and-trachea, outflow-tract, and four-chamber views should be adopted [90]
chest	Lung texture should be assessed in a transverse view, while the sagittal and coronal views should be used to assess the diaphragm [14, 90]
Abdomen	Bowel dilatation with cutoff small bowel dilatation > 14 mm to be considered pathological, calcification, ascites and any cyst [14]
Urinary	Bladder size, wall thickness and renal pelvis anteroposterior (AP) diameter should be checked (cutoff and AP diameter > 15 mm is high risk of postnatal surgery)

Placenta accreta spectrum Ultrasound is the primary imaging technique used to diagnose Placenta Accreta Spectrum (PAS) [53]. Despite this, most of the current guidelines do not advocate routine screening for PAS in the third-trimester scan. They reserve it for high-risk cases, including women with placenta previa and prior Cesarean delivery or uterine surgeries.

According to a meta-analysis conducted by Hessami et al., ultrasound sensitivity and specificity for PAS detection in the first trimester are 86% and 63% compared to a sensitivity and specificity of 88% and 92%, respectively, in the second and third trimesters [54].

Furthermore, a modified Delphi study concluded that patients with a history of one or more Cesarean delivery, PAS or myomectomy, should be referred for a thorough PAS ultrasound evaluation, including the evaluation of the following parameters: retroplacental myometrial thinning, loss of the"clear zone", abnormalities of the bladder wall, placental bulge, bridging vessels, uterovesical hypervascularity and placental lacunae [55].

A prospective multicenter study involving 568 pregnant women with high-risk factors, which include a low-lying placenta or placenta previa, confirmed the good diagnostic performance of transabdominal and transvaginal ultrasound in identifying pregnancies, where PAS is unlikely [56]. Based on these results, it was concluded that ultrasound can be safely used to direct treatment choices and focus resources on individuals who are more likely to experience clinically severe PAS [57].

Vasa previa Vasa previa represents a rare but serious pregnancy condition that occurs when unprotected fetal vessels of the umbilical cord pass across or in proximity to the internal cervical os (ICO) [57]. The reported incidence is estimated around 1 per 2000–5000 deliveries [58]. In cases where the vessels do not cross the ICO, the maximum distance of the vessels from the ICO that defines vasa previa is yet to be firmly established. The shortest distance used as a cutoff is 2 cm, which is modeled after the definition of low-lying placenta. [59]. However, distances as large as 5 cm have been used. This decision should be made conservatively at an institutional level as there is no scientific evidence that would define a truly safe distance. Three types of vasa previa were described based on the relationship between the placental mass, the cord insertion, and the vessels running close to the internal os [60]. While an appropriate diagnosis ensures favorable neonatal outcomes [61], failure to prenatally recognize this condition is associated with a significant increase in neonatal mortality and morbidity [62].

Unfortunately, international guidelines do not recommend a routine screening for vasa previa in low-risk populations. On the other hand, a thorough transvaginal ultrasound assessment of the cervix and the lower uterine segment, which includes the use of color Doppler, is suggested in the presence of recognized risk factors, such as an IVF pregnancy, placenta previa or low-lying placenta seen earlier in pregnancy, anomalous cord insertion into the placenta (velamentous or marginal insertion), and bilobed or succenturiate lobes of the placenta [14]. However, considering that about 10% of vasa previa cases occur in low-risk pregnancies, universal screening may consistently reduce the number of undiagnosed cases and may be easily incorporated to the second-trimester screening for preterm birth by cervical length measurement and/or to the third-trimester scan [60, 63].

Given a resolution rate up to 25% of cases [64], appropriate screening using transvaginal ultrasound should be done in the third trimester in all patients diagnosed with vasa previa during the second-trimester scan. However, the benefit of screening for vasa previa routinely during the third-trimester scan even without such history is worth the effort, since it is potentially lifesaving for the fetus [60].

Amniotic fluid volume The importance of adequate amniotic fluid volume (AFV) cannot be overstated. It not only contributes to normal fetal development and well-being, but it is also an indicator of placental function [65]. Most guidelines advise, including AFV assessment in third-trimester ultrasound scans. Amniotic fluid index (AFI) and deepest vertical pocket (DVP) are the main methods used to estimate the AFV. According to ISUOG guidelines, AFI may be preferable in the diagnosis of polyhydramnios [14], defined as AFI > 25 cm or DVP > 8 cm (57). DVP may be a more accurate method in identifying oligohydramnios (16), defined as AFI < 5 cm or DVP < 2 cm [66].

A meta-analysis examining the correlation between isolated oligohydramnios and adverse perinatal outcomes, which included 27,526 uncomplicated pregnancies with isolated oligohydramnios, showed that there was a higher rate of emergency Cesarean delivery for fetal distress (OR = 2.16) and admission to the NICU (OR = 1.71) compared to patients with normal levels of amniotic fluid [66].

A retrospective cohort study examining perinatal outcome of 31,376 women showed that in cases with isolated polyhydramnios there was an increased prevalence of prolonged first stage of labor (OR = 3.6), cardiotocographic changes (OR = 2.6), shoulder dystocia (OR = 3.4), placental abruption (OR = 8.4), and respiratory distress syndrome (OR = 38.9) compared to uncomplicated pregnancies with a normal AFV [67].

Since abnormal AFV can be associated with a variety of fetal or maternal conditions, a proper assessment of amniotic fluid volume is strongly recommended as part of all routine ultrasound examinations.

Cervical length Cervical length (CL) measurement in the third trimester is not routinely assessed in asymptomatic pregnancies. The 2024 ISUOG guidelines do not refer to cervical length screening in the third trimester [14]. In contrast, other organizations, such as ASUM (2014) [16], CAR (2010) [17], and the joint (AIUM–ACR–ACOG–SMFM–SRU) guidelines (2018) [18] include cervical assessment as part of their third-trimester ultrasound. The transvaginal approach is preferable as the cervix may be very difficult to be visualized in late pregnancy. This examination provides the additional benefit of being the best approach to assess placental location and to look for the presence of placenta previa and vasa previa. It is more commonly used in women who have specific risk factors or symptoms suggesting preterm labor. Although it is mostly used earlier in pregnancy (particularly in the second trimester), measuring cervical length in the third trimester can still provide useful information about a woman's risk of preterm labor or the timing of term delivery.

A study involving 1003 singleton pregnancies revealed that cervical length assessment at 31–34 gestational weeks may contribute to the prediction of late preterm birth. [68] When combined with maternal characteristics, using a cervical length cutoff of 22 mm resulted in a detection rate of 35% with a false positive rate of 10% [68]. A significant association was identified between GA at birth and CL and there was a small, yet significant difference in the median CL between cases with late preterm deliveries and those at term (28 mm vs 32 mm) [68, 69].

When comparing transabdominal (TA) and transvaginal (TV) approaches, it has been suggested that screening by transabdominal cervical length measurements in a group of pregnant women at low risk for preterm birth is useful to determine which patients require transvaginal measurement [70].

Perinatal morbidity and mortality Most guidelines exclude prediction of perinatal morbidity and mortality from their third-trimester scan checklists. The 2024 ISUOG guidelines note that third-trimester scan has not yet been shown to have a clear benefit in this respect [14]. A multicenter study concluded that routine third-trimester ultrasound screening in low-risk groups appears to have no effect on perinatal mortality or early neonatal morbidity, as measured by Apgar scores or SGA [71]. Moreover, a systematic meta-analysis including 13 trials and 34,980 women showed that perinatal and neonatal mortality and morbidity did not differ between patients undergoing a late pregnancy ultrasonography and a control group [72]. Yet, data about significant long-term effects, like neurodevelopment, are scarce [72].

The IRIS study, which is a randomized controlled trial, was comprised of 13,046 women who were divided into an intervention group (two scheduled biometry scans at 28–30- and 34–36-week gestation) and a control group (serial SFH assessments and ultrasound only if clinically indicated) [6]. SGA at birth was much more frequently observed in the intervention group than in the routine care group. The intervention group resulted in a higher rate of induction of labor and a lower rate of augmentation of labor. However, this increase in intervention did not reduce severe adverse perinatal outcomes in low-risk pregnancies [6].

Ultrasound predictors that are associated with stillbirth also include elevated umbilical artery Doppler pulsatility index, and low cerebroplacental ratio (CPR). These are often added to fetal size and amniotic fluid volume assessments in high-risk women [73, 74]. A low CPR is due to increased resistance in the umbilical artery and decreased resistance in the middle cerebral artery (MCA). In addition to an increased resistance in the umbilical artery, poor placental function can also lead to arterial hypoxemia. The latter leads to a chemoreceptor-mediated decrease in vascular resistance of the arterial supply of the central nervous, which is then reflected in the decreased resistance in the MCA. These changes can happen in fetuses with a significant placenta-related growth restriction [75, 76]. For these women, appropriate timing of delivery is the most effective intervention to prevent stillbirth [77, 78].

In a recent randomized controlled trial (RATIO37) using the combination of fetal growth assessment and CPR during a third-trimester ultrasound between 35 and 37 weeks, a reduction in severe neonatal morbidity was noted (OR = 0.58) if delivery was carried out for CPR ratio < 5th centile as compared to a term-pregnancy management based on fetal growth assessment alone [79].

Prediction of labor events Available guidelines do not cover the potential prediction of labor-related events by evaluating specific parameters during a late third-trimester ultrasound.

Uterine contractions cause a 60% decrease in uterine artery flow velocity, potentially resulting in intrapartum hypoxia which is one of the main causes of poor perinatal outcomes, such as infant demise, hypoxic–ischemic encephalopathy (HIE) and cerebral palsy. Therefore, labor is a critical time for the fetoplacental unit [76].

Cervical length is a major independent predictor of the likelihood of spontaneous labor in both nulliparous and parous women with prolonged pregnancy and a predictor of successful vaginal birth in nulliparous women. Parity has a significant impact on the likelihood of a successful vaginal birth, although it has no independent effect on the prediction of the onset of spontaneous labor [80].

In a study involving 604 singleton pregnancies, labor was induced between weeks 35 and 42 of gestation. It was demonstrated that pre-induction cervical length, occipital position, posterior cervical angle, and maternal characteristics provide significant independent prediction of the

induction-to-delivery interval within 24 h, the likelihood of vaginal delivery within 24 h, and the likelihood of cesarean section. Furthermore, the sonographic parameters were superior to the Bishop score [81]

An expert review concluded that there is currently no evidence to justify prelabor and intrapartum Doppler assessment, either from clinical trials or randomized studies [82]. Even though there is evidence linking Doppler findings near or during labor to intrapartum fetal compromise, the currently available data indicates that Doppler ultrasound is not effective in predicting labor distress, and its use intrapartum could result in an unnecessary obstetrical intervention for fetuses with appropriate growth [82].

Third-trimester ultrasound, in combination with other clinical factors, can represent a useful tool to customize the most appropriate timing of delivery, allowing a patient-specific management of pregnancy [83].The competing-risk model combining maternal factors, MAP, UtA-PI, PlGF, and sFlt-1 to assess PE risk in accordance with the FMF 12-week and 36-week method, can be clinically useful for estimating the patient-specific likelihood of spontaneous onset of labor, as well as the risk of caesarean delivery due to fetal compromise after spontaneous onset of labor or after induction of labor [9]. The higher the risk of PE at 12 and 36 weeks, the higher the likelihood for spontaneous labor and subsequent risk of fetal compromise leading to cesarean delivery [44, 84, 85].

Therefore, for women at risk of PE and showing other factors related to placental dysfunction, third-trimester ultrasound may be a suitable guide for predicting labor and fetal compromise and optimizing timing for induction of labor [86]. This reinforces the importance of patient risk stratification starting in the first trimester [85].

Discussion

Summary of key findings

Current guidelines, published by different international societies, showed no universal consensus regarding both the most appropriate GA to perform a screening ultrasound in the third trimester and parameters that may potentially be useful in predicting specific obstetric outcomes. All six guidelines reviewed (ISUOG, BMUS, ASUM, CAR, AIUM–ACR–ACOG–SMFM–SRU, and SIEOG) [14–19] recognize the importance of third-trimester ultrasound in determining fetal growth, placental position, and amniotic fluid volume. However, only ISUOG and SIEOG specify the optimal gestational age (32–36 weeks of gestation) to perform this scan. The remaining recommendations provide broader or less directive guidance, frequently leaving the decision for a third-trimester ultrasound up to clinical judgment. However, they do enumerate specific maternal and fetal issues that may occur during pregnancy, where a late pregnancy ultrasound examination would help in management.

This review shows that, based on most available evidence, which is only partly implemented in clinical guidelines and recommendations, 36 weeks (35–37 weeks) is the optimal time for routine third-trimester scan in a low-risk population. It emphasizes the utility of this scan in the detection of fetal growth abnormalities and placental disorders. Our review also highlights benefits of recently proposed uses of a third-trimester ultrasound, such as an evaluation of the fetal anatomy, checking for vasa previa, and establishing personalized risk for labor-related adverse fetal outcomes.

Interpretation in the context of what is known

The lack of agreement on third-trimester ultrasound screening creates a significant gap in prenatal care. The discrepancy in these recommendations is especially notable given the expanding body of evidence showing the clinical benefits of third-trimester ultrasonography, even in pregnancies previously categorized as low risk.

It is now well-established that the role of third-trimester ultrasound goes well beyond the simple estimation of fetal weight but includes the evaluation of various aspects of both fetal and maternal health. To achieve this goal, it is of fundamental importance that the examination is performed by experienced operators, enabling high accuracy even in difficult settings [87, 88].

As shown by extensive research by the FMF, screening programs carried out in the first and second trimesters of pregnancy (such as the first-trimester-combined screening for aneuploidies and PE, the second-trimester screening for preterm birth and PE) play a key role in risk stratification of pregnant women early in pregnancy. Therefore, women who are early identified as low risk could benefit from just a routine late third-trimester ultrasound done at 36 weeks, whereas those that are at high risk would need to start their ultrasound surveillance earlier in pregnancy [1, 9, 12, 13].

A wide range of risk factors and patient-specific variables need to be considered to allow a proper risk stratification for each pregnancy starting with the method of conception. For example, IVF/ICSI singletons exhibited a twofold risk increase for preterm birth (PTB) as compared to natural conception [89]. Even more subtle differences can make a difference in risk—fresh embryo transfers specifically increase the incidence of iatrogenic PTB and PTB < 32 weeks, most likely due to placental disorders. An abnormal placentation alone is responsible for some risk factors. For example, pregnant women with confined placental mosaicism have a higher risk of poor fetal growth, indicating the need for greater antenatal surveillance [90].

The optimal timing of an ultrasound for detection of fetal growth abnormalities that can directly influence labor outcomes is at 35–37 weeks; specifically, determination of those fetuses that are either LGA or SGA at that gestational age helps to determine the risk of shoulder dystocia, the need for a cesarean section, and an increase in overall perinatal morbidity and mortality [5, 22, 23, 37].

A late third-trimester scan has also been proven to be useful for the detection of fetal structural abnormalities unseen during the first- and second-trimester screening, as well as in the identification of fetal life-threatening conditions, such as placenta previa or vasa previa. This allows for an appropriate centralization of care in second or third-level centers, with a significant impact on the reduction of perinatal mortality as well as short- and long-term morbidity [20, 21, 62].

Table 3 summarizes the usefulness of a third-trimester ultrasound based on our search of literature and available guidelines.

Limitations and strengths

This work is limited by the method of selection for papers included in the review. Specifically, we used only already established guidelines and large studies. However, this approach allows comparison of evidence from highly impactful quality studies to be related to what is clinically implemented in the guidelines.

The strength is that it summarizes the current knowledge of the subject and relates it to what is included in the present recommendations. Many patients are currently being assessed with a 32-week scan which effectively detects early SGA but predicts poorly LGA and SGA at term, hampering decisions that may improve perinatal care in late pregnancy and at the time of labor.

Future research

We believe that more research should be carried out dealing with the prediction of labor events by stratification of risk from the first up to the third trimester. An improved knowledge of placental function, accurate assessment of fetal

Table 3 Summary of the useful outcomes to assess through a third-trimester ultrasound and best GA for assessment

Outcomes	Aims	Best GA for assessment (weeks)
Large-for-gestational age (LGA)	Its diagnosis can reduce shoulder dystocia and perinatal morbidity by almost 70% without increasing the likelihood of needing a cesarean section	35–37
Small-for-gestational age (SGA)	Ultrasound based on serial SFH measures is inferior to standard ultrasonography conducted between 36 + 0 and 37 + 6 weeks in low-risk pregnancies, Prediction of SGA was higher at 35 + 0 to 36 + 6-week gestation, rather than 31 + 0 to 33 + 6 weeks	Early onset: 30–32 Late onset: 35–37
Pre-eclampsia	Predict preterm pre-eclampsia through the sampling of mean uterine artery pulsatility index and its integration with MAP	Early onset: 30–32 Late onset: 35–37
Fetal structural anomalies	Detecting fetal abnormalities that were either overlooked on earlier first- and second-trimester scans or became apparent only during the third trimester	35–37
Abnormal placenta location	Detection of placenta previa to set up the delivery management plan	32–36
Placenta accreta spectrum (PAS)	Good diagnostic performance to identify pregnancies at low risk of PAS	28–34
Vasa previa	An appropriate screening using transvaginal ultrasound should be recommended in the third trimester in all patients (particularly if diagnosed with vasa previa during the second-trimester scan of with risk factors)	28–36
Amniotic fluid abnormalities	A proper assessment of amniotic fluid volume should be strongly recommended as part of routine ultrasound examinations	28–36
Cervical length shortening	Even in the third trimester, in asymptomatic women with a cervical length less than 25 mm, it seems that the use of progesterone up to the 36 weeks can contribute to reducing the incidence of preterm birth	31–34
Spontaneous labor	Cervical length and risk of PE correlates with the onset of spontaneous labor at term in nulliparous women	35–37
Intrapartum fetal compromise	Third-trimester ultrasound can predict intrapartum fetal distress by detection of placental dysfunction (increased angiogenic markers and high risk for pre-eclampsia)	35–37
Stillbirth (perinatal mortality)	A late third-trimester ultrasound scan does not improve the rates, but most stillbirths are within the group of SGA, FGR and vasa previa	35–37
Preterm birth	Cervix shortening in asymptomatic women is associated with a higher risk of preterm birth	28–32

growth and amniotic fluid volume, and correct diagnoses of placental abnormalities have the potential to improve perinatal care late in pregnancy, a time when care has changed very little for quite a long time.

Conclusions

This review highlights the potential benefits of third-trimester ultrasound in standard obstetric care, as well as its limitations. Its use is widely accepted in high-risk pregnancies. However, in low-risk pregnancies it is used unevenly, and its benefit is generally underestimated. There is growing evidence that, in a setting where an appropriate risk stratification is carried out, a single third-trimester scan at 36 weeks, may greatly improve outcomes for the mother and the newborn even in low-risk pregnancies. However, in order for these suggestions to be widely accepted and implemented, national and international healthcare guidelines need to begin to incorporate the expanding available evidence shown by the major studies included in this review. Adopting a risk-based framework that incorporates third-trimester ultrasound into a personalized care model could be the key to realizing its full potential in modern obstetric practice.

Third-trimester ultrasound plays a critical role in monitoring maternal and fetal health as pregnancy approaches term, with value in identifying fetal growth abnormalities such SGA and LGA fetuses. It facilitates timely decision-making, including delivery planning and targeted interventions, thereby potentially improving perinatal outcomes. Studies suggest that fetal FGR is more accurately detected at 36 weeks than at 32 weeks, and for LGA fetuses, induction before 39 weeks can significantly reduce the risk of shoulder dystocia and related morbidity. Although widely recognized in guidelines for assessing fetal growth, amniotic fluid, fetal anatomy, placental location, and cervical length, third-trimester ultrasound lacks standardized indications, timing, and outcome measures across international recommendations. Emerging evidence supports its use in low-risk populations between 35 and 37 weeks to also screen for conditions, such as PE, vasa previa, and PAS, though these are not routinely included in current guidelines. The usefulness of the third-trimester ultrasound in the prediction of the onset of labor and in assessing the risk of late preterm birth, intrapartum fetal compromise, and perinatal morbidity and mortality have recently been studied.

Integrating this scan into a broader framework that includes first- and second-trimester risk stratification brings the fetus back into focus at a very important and vulnerable time in pregnancy when, in low-risk pregnancies, prenatal care consists simply of maternal assessment. It allows timely identification of high-risk pregnancies and leads to more personalized management. It has the potential to reduce fetal morbidity and mortality in late pregnancy.

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Declarations

Conflict of interest Paolo Ivo Cavoretto and Karl Oliver Kagan are respectively Editor and Editor in Chief of Archives of Gynecology and Obstetrics.

Institutional review board statement This study was based on review of published data from the literature and does not require approval from the Ethics Committee.

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