

Intrauterine Growth Restriction. Guideline of the German Society of Gynecology and Obstetrics (S2k-Level, AWMF Registry No. 015/080, October 2016)

Intrauterine Wachstumsrestriktion. Leitlinie der DGGG (S2k-Level, AWMF-Registernummer 015/080, Oktober 2016)

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ABSTRACT

Aims The aim of this official guideline published and coordinated by the German Society of Gynecology and Obstetrics (DGGG) was to provide consensus-based recommendations obtained by evaluating the relevant literature for the diagnostic treatment and management of women with fetal growth restriction.

Methods This S2k guideline represents the structured consensus of a representative panel of experts with a range of different professional backgrounds commissioned by the Guideline Committee of the DGGG.

Recommendations Recommendations for diagnostic treatment, management, counselling, prophylaxis and screening are presented.

ZUSAMMENFASSUNG

Ziel Das Ziel dieser offiziellen Leitlinie, die von der Deutschen Gesellschaft für Gynäkologie und Geburtshilfe (DGGG) publiziert und koordiniert wurde, ist es, durch die Evaluation der relevanten Literatur einen konsensbasierten Überblick über die Diagnostik und das Management der intrauterinen Wachstumsrestriktion zu geben.

Methoden Diese S2k-Leitlinie wurde durch einen strukturierten Konsens von repräsentativen Mitgliedern verschiedener Professionen im Auftrag der Leitlinienkommission der DGGG entwickelt.

Empfehlungen Es werden Empfehlungen zur Diagnostik, Management, Beratung, Prophylaxe und Screening gegeben.

I Guideline Information

Guidelines Program of the DGGG, OEGGG and SGGG

Information on the program is provided at the end of the article.

CITATION FORMAT

Intrauterine Growth Restriction. Guideline of the German Society of Gynecology and Obstetrics (S2k-Level, AWMF Registry Number 015/080, October 2016). *Geburtsh Frauenheilk* 2017; 77: 1157–1173

Guideline documents

The complete long version (in German), a PDF slideshow for Power-Point presentations and a summary of the conflicts of interest of all the authors is available on the AWMF homepage under: <http://www.awmf.org/leitlinien/detail/ll/015-080.html>

Guideline authors

The following professional and scientific societies/working groups/organizations/associations have stated their interest in contributing to the compilation of the guideline text and participating in the consensus conference and have sent representatives to the consensus conference (► **Table 1**).

► **Table 1** Authors and representatives: participation of the target user group.

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Abbreviations

AED	absent end-diastolic
AEDF	absent end-diastolic flow
ARED	absent or reversed end-diastolic
ASA	acetylsalicylic acid
CPR	cerebroplacental ratio
CTG	cardiotocography
GW	week of gestation
hCG	human choriongonadotropin
IUFD	intrauterine fetal death
IUGR	intrauterine growth restriction
NT	nuchal translucency
PAPP-A	pregnancy-associated plasma protein A
PI	pulsatility index
PIGF	placental growth factor
PP13	placental protein 13
RDS	respiratory distress syndrome
RED	reversed end-diastolic
REDF	reversed end-diastolic flow
RR	relative risk
SGA	small for gestational age
SDP	single deepest pocket
s/p	status post
STV	short-term variation

II Guideline Application

Purpose and Objectives

This guideline aims to summarize the current state of knowledge on intrauterine growth restriction (IUGR). It focuses on the definition, etiology, diagnosis and management of care and states the best time to deliver the baby.

Targeted areas of patient care

- Inpatient care
- Outpatient care

Target patient groups

This guideline is aimed at pregnant patients.

Target user groups/target audience

This guideline is aimed at the following groups:

- Gynecologists in private practice (non-hospital based)
- Hospital-based gynecologists
- Midwives

Adoption of the guideline and period of validity

This guideline is valid from May 1, 2017 through to April 30, 2020. Because of the contents of this guideline, the above-mentioned period of validity is only an estimate. If important changes to the available evidence should occur, then amendments to the guideline will be published even before the period of validity has expired, after a careful review of the new evidence in accordance with the methodology published by the AWMF.

III Methodology

Basic principles

The methodology used to prepare this guideline is determined by the class assigned to the guideline. The AWMF Guidance Manual (version 1.0) has set out the respective rules and requirements for different classes of guidelines. Guidelines are differentiated into lowest (S1), intermediate (S2) and highest (S3) class. The lowest class is defined as a set of recommendations for action compiled by a non-representative group of experts. In 2004 the S2 class was divided into two subclasses: the systematic evidence-based subclass S2e and the structural consensus-based subclass S2k. The highest S3 class combines both approaches.

This guideline is classified as: S2k

Grading of recommendations

While the classification of the quality of the evidence (strength of evidence) serves as an indication of the robustness of the published data and therefore expresses the extent of certainty/uncertainty about the data, the classification of the level of recommendation reflects the results of weighing up the desirable and adverse consequences of alternative approaches.

The grading of evidence and the grading of recommendations was not envisaged for S2k class guidelines. Individual recommendations are differentiated by syntax, not by symbols. The syntax chosen for the level of recommendation should be described in the background text (► Table 2).

► Table 2 Grading of recommendations.

Description of grade of recommendation	Syntax
Strong recommendation, highly binding	must/must not
Recommendation, moderately binding	should/should not
Open recommendation, not binding	may/may not

Statements

Expert statements included in this guideline which are not recommendations for action but are simple statements of fact are referred to as **Statements**. It is **not** possible to provide a level of evidence for these statements.

Achieving consensus and level of consensus

During structured consensus-based decision-making (S2k/S3 level), authorized participants present at a session vote on draft Statements and Recommendations. Discussions during sessions may lead to significant changes in the wording of Statements and Recommendations. The extent of agreement, which depends on the number of participants, is determined at the end of the session (► Table 3).

► Table 3 Classification of extent of agreement in consensus decision-making

Symbol	Level of consensus	Extent of agreement in percent
+++	Strong consensus	> 95% of participants agree
++	Consensus	> 75–95% of participants agree
+	Majority agreement	> 50–75% of participants agree
–	No consensus	< 50% of participants agree

Expert consensus

As the name implies, this refers to consensus decisions taken with regard to specific Recommendations/Statements without a previous systematic search of the literature (S2k) or when evidence is lacking (S2e/S3). The term “Expert Consensus” (EC) used here is synonymous with terms such as “Good Clinical Practice” (GCP) and “Clinical Consensus Point” (CCP) used in other guidelines. The level of recommendation is graded as previously described in the Chapter *Grading of recommendations* but only semantically (“must”/“must not” or “should”/“should not” or “may”/“may not”) and without the use of symbols.

IV Guideline

1 Definition

Consensus-based Statement 1.S1	
Expert consensus	Level of consensus +++
SGA = estimated fetal weight or birth weight < 10th percentile IUGR = estimated fetal weight < 10th percentile and/or non-percentile appropriate fetal growth during pregnancy and pathological Doppler of umbilical artery or pathological Doppler of uterine artery or oligohydramnios	
References: [1–3]	

Consensus-based Statement 1.S2	
Expert consensus	Level of consensus +++
Estimated fetal weight or birth weight < 3rd percentile is associated with higher levels of morbidity and mortality.	
References: [4]	

2 Epidemiology and Etiology

Consensus-based Recommendation 2.E1	
Expert consensus	Level of consensus +++
Based on their full medical history, all pregnant women must be evaluated for potential risk factors which could predispose to IUGR. Further diagnostic investigations must be offered or carried out if risk factors are present.	
References: [5–7]	

IUGR is a condition which affects approximately 5–10% of all pregnancies [5,6]. The etiology of IUGR is roughly divided into maternal, placental and fetal causes (► **Table 4**) [7]. Although the underlying pathophysiological mechanisms may be very different, they often (but not always) lead to the same endpoint: suboptimal uteroplacental perfusion and fetal nutrition. IUGR is therefore associated with high levels of morbidity and mortality.

► **Table 4** Risk factors for developing intrauterine growth restriction. Common risk factors are highlighted in bold.

Maternal causes	Alcohol abuse [8] Hypertensive disease of pregnancy (pre-eclampsia, gestational hypertension) [9] Drug/nicotine abuse [10, 11] Embryotoxic or fetotoxic medication [12] Maternal age (≥ 35 / > 40 years) [13] Maternal weight (high or very low BMI) [14] Low socio-economic status [15, 16] Nulliparity [17] s/p hypertensive disorder in a previous pregnancy s/p IUFD [9] s/p SGA/IUGR [9]
	<i>Preexisting maternal diseases, which can lead to reduced uteroplacental perfusion or reduced oxygenation of maternal blood, e.g.:</i> Chronic respiratory disease Chronic hypertension [18] Chronic renal disease [19] Diabetes mellitus with vascular disease [20] Heart disease, especially cyanotic heart disease [21] Severe anemia Systemic lupus erythematosus and antiphospholipid syndrome [22]
Uteroplacental causes	Placental abruption [23] Velamentous cord insertion Placental infarction [24] Disorders of placentation with inadequate trophoblast invasion and increased maternal risk of pre-eclampsia [25] Placental tumors
Fetal causes	Chromosomal abnormalities and syndromic disease [26,27] Intrauterine infections (particularly cytomegaly, toxoplasmosis, rubella, varicella zoster virus) Multiple pregnancy [28]

3 Diagnostics to Detect Possible IUGR

In addition to taking the patient's history, a clinical examination and various diagnostic procedures must be carried out to rule out or confirm IUGR. This is an important part of antenatal care as the majority of IUGR are not detected prenatally [29] and undetected IUGR is associated with an 8-fold higher risk of intrauterine fetal death [30].

3.1 Clinical examination

Consensus-based Recommendation 3.E2	
Expert consensus	Level of consensus +++
Clinical examinations are of only limited value when screening for SGA/IUGR. Ultrasound biometry must be carried out for further medical evaluation if there is a suspicion of anomalies.	
References: [31]	

3.2 Sonography

3.2.1 Biometry in early pregnancy (crown-rump length)

Consensus-based Recommendation 3.E3	
Expert consensus	Level of consensus +++
Fetal gestational age (based on maternal medical history) must be verified through measurement of the crown-rump length in early pregnancy and corrected if the discrepancy is 7 days or more.	
References: [32–36]	

3.2.2 Fetometry

Consensus-based Recommendation 3.E4	
Expert consensus	Level of consensus +++
Further diagnostic investigations must be carried out if the estimated fetal weight is less than the 10th percentile.	

In addition to estimated fetal weight, fetal abdominal circumference is the most important indicator of IUGR. Fetal head-to-abdomen discrepancy can also be an indication of IUGR. Assessment of estimated fetal weight should also take maternal and paternal characteristics into account [37–40]. If the estimated fetal weight is below the 10th percentile, further diagnostic investigations must be carried out (including precise sonographic diagnostics, Doppler sonography).

3.2.3 Amniotic fluid

Consensus-based Recommendation 3.E5	
Expert consensus	Level of consensus +++
Assessment of amniotic fluid volume should be carried out when investigating for possible SGA/IUGR.	
References: [41–43]	

3.2.4 Precise sonographic diagnostics (additional procedures for the differential diagnosis of different organs)

Consensus-based Recommendation 3.E6	
Expert consensus	Level of consensus +++
Precise sonographic diagnostics should be carried out as part of the investigation into possible SGA/IUGR.	
References: [24, 26, 27, 44–47]	

3.3 Doppler sonography

Consensus-based Recommendation 3.E7	
Expert consensus	Level of consensus +++
Doppler sonography must be carried out to investigate for possible IUGR.	
References: [48]	

3.4 Cardiotocography (CTG)

Cardiotocography (CTG) is known to have a high false-positive rate for the prediction of poor outcomes and is more likely to detect acute hypoxic events than chronic conditions [49]. Its value for detecting possible IUGR is therefore only limited; nevertheless, according to the German Maternity Guidelines, CTG should be carried out as part of antenatal care if there is a suspicion of placental insufficiency [48].

4 Differential diagnosis of a SGA/IUGR fetus

4.1 Chromosomal anomalies

Consensus-based Recommendation 4.E8	
Expert consensus	Level of consensus +++
Karyotyping should be considered when an SGA/IUGR fetus is identified, particularly if there is a suspicion of anomalies.	
References: [26, 27, 44, 45, 50–52]	

4.2 Infections

Consensus-based Recommendation 4.E9	
Expert consensus	Level of consensus +++
Examination for possible infections should be considered when an SGA/IUGR fetus is identified.	
References: [53]	

5 Management of IUGR

There is still very little evidence about the best antenatal method to monitor a fetus with IUGR [54]. No single monitoring method provides a valid prediction for the outcome of IUGR, which is why a combination of different procedures to monitor growth-retarded fetuses is recommended.

5.1 Diagnostic monitoring

5.1.1 Clinical examination

Consensus-based Recommendation 5.E10

Expert consensus	Level of consensus +++
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Monitoring should be carried out to detect early signs of pre-eclampsia when IUGR is caused by uteroplacental insufficiency.

5.1.2 Sonography (fetometry)

Consensus-based Recommendation 5.E11

Expert consensus	Level of consensus +++
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Serial sonographic monitoring of fetal growth must be carried out when IUGR has been identified or there is a suspicion of IUGR.

References: [55]

Consensus-based Recommendation 5.E12

Expert consensus	Level of consensus +++
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The interval between individual sonography scans to monitor fetal growth should be at least two weeks.

5.1.3 Sonography (amniotic fluid)

Consensus-based Recommendation 5.E13

Expert consensus	Level of consensus +++
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Sonographic assessment of amniotic fluid volume must only be interpreted in the context of and together with other monitoring methods.

Consensus-based Recommendation 5.E14

Expert consensus	Level of consensus +++
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The SDP (single deepest pocket) method should be used to assess amniotic fluid volume.

References: [56–58]

5.1.4 Doppler sonography (umbilical artery)

Consensus-based Recommendation 5.E15

Expert consensus	Level of consensus +++
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The management of IUGR must include Doppler sonography of the umbilical artery as it can reduce perinatal mortality in high-risk pregnancies.

References: [59, 60]

Consensus-based Statement 5.S3

Expert consensus	Level of consensus +++
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Normal results for Doppler sonography of the umbilical artery in early IUGR is associated with a low risk of poor perinatal outcome.

References: [4, 61]

Consensus-based Statement 5.S4

Expert consensus	Level of consensus +++
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Diastolic zero flow (AED flow) and reverse diastolic blood flow (RED flow) particularly in the umbilical artery are commonly associated with poor perinatal outcome when IUGR is present.

References: [62–67]

Consensus-based Recommendation 5.E16

Expert consensus	Level of consensus +++
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The intervals between control Doppler scans should always depend on the severity of IUGR and on previous Doppler findings.

Consensus-based Statement 5.S5

Expert consensus	Level of consensus +++
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When Doppler results for the umbilical artery are normal, repeat control scans every two weeks appear to be sufficient to monitor early IUGR. More frequent control scans may be needed in cases of severe IUGR.

References: [68, 69]

Consensus-based Recommendation 5.E17

Expert consensus	Level of consensus +++
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It is not clear how long the intervals between control Doppler scans should be if the findings of the umbilical artery are pathological. If pulsatility is increased (PI > 95th percentile) controls should be carried out at least once a week; in cases of ARED flow, monitoring must be carried out at even more frequent intervals.

Consensus-based Recommendation 5.E18

Expert consensus	Level of consensus +++
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If Doppler sonography of the umbilical artery shows abnormalities, additional Doppler scans of other vessels (middle cerebral artery, ductus venosus) should be carried out.

5.1.5 Doppler sonography (middle cerebral artery)

Consensus-based Recommendation 5.E19	
Expert consensus	Level of consensus +++
Doppler sonography of the middle cerebral artery should be done in addition to sonography of the umbilical artery when IUGR is detected.	
References: [70–72]	

Consensus-based Statement 5.S6	
Expert consensus	Level of consensus ++
Pathological Doppler findings for the middle cerebral artery (PI < 5th percentile) in late IUGR at term increases the risk of cesarean section and poor perinatal outcome.	
References: [73–75]	

5.1.6 Doppler sonography (cerebroplacental ratio, CPR)

Consensus-based Statement 5.S7	
Expert consensus	Level of consensus +++
The cerebroplacental ratio (CPR), which is calculated by dividing the PI of the middle cerebral artery by the PI of the umbilical artery, can be useful to monitor IUGR as a low CPR is a predictor for poor perinatal outcome.	
References: [70, 71, 76–80]	

5.1.7 Doppler sonography (ductus venosus)

Consensus-based Statement 5.S8	
Expert consensus	Level of consensus +++
An absent or reversed a-wave on Doppler sonography of the ductus venosus is an indication of imminent or manifest acidemia and the risk of fetal death.	
References: [81–83]	

Consensus-based Recommendation 5.E20	
Expert consensus	Level of consensus +++
Monitoring of early IUGR must include Doppler sonography of the ductus venosus.	
References: [72, 84, 85]	

5.1.8 Doppler sonography (other vessels)

The predictive value of Doppler sonography of the uterine arteries in the last third of pregnancy is unclear as no evidence-based data are available. Doppler sonography of other arterial (e.g. the fetal aorta) and venous (e.g. umbilical vein, inferior vena cava) vessels is currently only recommended if it is carried out as part of a study, as the evidence for its usefulness is still insufficient.

5.1.9 Cardiotocography (CTG)

Consensus-based Recommendation 5.E21	
Expert consensus	Level of consensus +++
Cardiotocography (CTG) must not be the only procedure used to monitor IUGR.	
References: [86, 87]	

5.1.10 Computerized CTG (Dawes-Redman CTG analysis)

Consensus-based Statement 5.S9	
Expert consensus	Level of consensus +++
Analysis of short-term fetal heart variation based on computerized CTG (Dawes-Redman CTG analysis) may be useful for monitoring IUGR.	
References: [84, 88–100]	

5.1.11 Biophysical profile

Consensus-based Recommendation 5.E22	
Expert consensus	Level of consensus +++
The biophysical profile (scoring) should not be used to monitor IUGR.	
References: [84, 101–103]	

5.2 Antenatal corticosteroids (RDS prophylaxis)

Consensus-based Recommendation 5.E23	
Expert consensus	Level of consensus +++
Antenatal corticosteroids should be administered once between GW 24 + 0 and GW 34 + 0 if it is expected that the infant will be delivered within the next 7 days.	
References: [104]	

5.3 Magnesium sulfate for fetal neuroprotection

Consensus-based Recommendation 5.E24	
Expert consensus	Level of consensus +++
Magnesium sulfate for fetal neuroprotection may be administered if pre-term birth (GW < 32 + 0) is expected, as there are indications that it has a neuroprotective effect.	
References: [105–115]	

5.4 Delivery

5.4.1 Place of delivery

Consensus-based Recommendation 5.E25	
Expert consensus	Level of consensus +++
If IUGR is present, the infant must be delivered in a perinatal center with a neonatal intensive care unit and an experienced team on hand to provide immediate and continuous care.	
References: [116, 117]	

5.4.2 Time of delivery

Consensus-based Recommendation 5.E26	
Expert consensus	Level of consensus +++
Early IUGR and late IUGR must be assessed differently. Increasing deterioration in a fetus with early IUGR is reflected in abnormalities of venous Doppler parameters, while increasing deterioration in a fetus with late IUGR is primarily visible in abnormal cerebral Doppler findings.	
References: [62]	

Consensus-based Recommendation 5.E27	
Expert consensus	Level of consensus +++
When planning the time of delivery, the risks associated with preterm birth must be weighed up against the risks of remaining in the womb.	
References: [118]	

Consensus-based Statement 5.S10	
Expert consensus	Level of consensus +++
Age of gestation is a significant factor affecting survival without morbidity.	
References: [3, 72, 119, 120]	

Consensus-based Recommendation 5.E28	
Expert consensus	Level of consensus +++
If CTG pathologies such as recurrent decelerations resistant to treatment occur, delivery of the infant must be considered at all times.	
References: [100]	

Consensus-based Recommendation 5.E29	
Expert consensus	Level of consensus +++
Delivery of the infant must be considered if short-term variation (STV) < 2.6 ms occurs between GW 26 + 0 and GW 28 + 6 or a STV < 3 ms occurs between GW 29 + 0 and GW 32 + 0.	
References: [100]	

Consensus-based Recommendation 5.E30	
Expert consensus	Level of consensus ++
If Doppler sonography of the ductus venosus shows increased pulsatility (PI > 95th percentile), delivery of the infant should be considered, depending on gestational age.	
References: [100, 118, 121, 122]	

Consensus-based Recommendation 5.E31	
Expert consensus	Level of consensus +++
If Doppler sonography of the ductus venosus shows an absence of a-wave (AEDF) or reverse flow (REDF) of a-wave, delivery of the infant must be considered.	
References: [100, 118, 121, 122]	

Consensus-based Recommendation 5.E32	
Expert consensus	Level of consensus +++
If Doppler sonography of the umbilical artery reveals reversed end-diastolic flow (REDF), the infant should be delivered by GW 32 + 0 at the latest.	

Consensus-based Recommendation 5.E33	
Expert consensus	Level of consensus +++
If Doppler sonography of the umbilical artery reveals absent end-diastolic flow (AEDF), the infant should be delivered by GW 34 + 0 at the latest.	

Consensus-based Recommendation 5.E34	
Expert consensus	Level of consensus +++
If Doppler sonography of the umbilical artery reveals increased pulsatility (PI > 95th percentile), the aim should be to deliver the infant from GW 37 + 0.	
References: [123]	

Consensus-based Recommendation 5.E35	
Expert consensus	Level of consensus ++
If Doppler sonography of the middle cerebral artery reveals decreased pulsatility (PI < 5th percentile), delivery of the infant by GW 37 + 0 at the latest should be considered.	

Consensus-based Recommendation 5.E36	
Expert consensus	Level of consensus +++
If the CPR (cerebroplacental ratio) is low, the aim from GW 37 + 0 should be to deliver the infant.	
References: [61, 77 – 80]	

Consensus-based Recommendation 5.E37	
Expert consensus	Level of consensus +++
In the case of an isolated SGA (normal Doppler results, no additional risks), delivery may be considered from GW 38 + 0.	
References: [124 – 126]	

Consensus-based Recommendation 5.E38	
Expert consensus	Level of consensus +++
In the case of an isolated SGA (normal Doppler results, no additional risks), the due date must not be exceeded.	

5.4.3 Type of delivery

Consensus-based Recommendation 5.E39	
Expert consensus	Level of consensus +++
Not every pregnant woman with IUGR must be delivered by C-section.	

Consensus-based Recommendation 5.E40	
Expert consensus	Level of consensus +++
In the case of IUGR with normal Doppler results or increased pulsatility in the umbilical artery (>95th percentile), labor may be induced with the goal of vaginal delivery but not if ARED flow is present. However the higher risk of complications must be taken into account and continuous intrapartum monitoring is required.	
References: [127 – 133]	

5.4.4 Additional recommendations Outpatient or inpatient monitoring and care

Consensus-based Recommendation 5.E41	
Expert consensus	Level of consensus +++
The decision for either outpatient or inpatient monitoring and care of the pregnant woman with IUGR must be taken on an individual basis.	

Bed rest

There is very little evidence-based data on hospitalization with bed rest when there is a suspicion of fetal growth restriction, and the data have not shown any benefit [134].

Diet

Changes in diet, dietary measures or additional intake of food supplements (e.g. calcium [135]) have not shown any benefit [136] and are therefore not recommended.

Cessation of nicotine use

Consensus-based Recommendation 5.E42	
Expert consensus	Level of consensus +++
Cessation of nicotine use must be recommended to all pregnant women.	
References: [137]	

Progesterone

Progesterone has shown no benefit in reducing IUGR [138] and should therefore not be administered for that purpose.

Maternal oxygen administration

The studies on the benefits of maternal oxygen administration are insufficient and some have methodological flaws. These studies were evaluated in an older Cochrane analysis which drew the conclusion that the existing evidence is insufficient to assess the benefits and risk of maternal oxygen administration [139]; maternal oxygen should therefore not be administered.

Other interventions

Numerous interventions which aim to improve blood flow to the placenta have been studied [140]. But neither the increase in plasma volume [141] nor the administration of low-dose ASA [142] or sildenafil [143, 144] showed any benefit, and they are therefore not recommended.

Antihypertensive therapy of pregnant women with hypertensive disease does not improve fetal growth [145, 146] and should not be recommended and neither should the administration of NO donors or vasodilator substances as they have not been sufficiently investigated yet [147].

6 Information and counseling

The pregnant woman or parents-to-be should receive detailed information and extensive counseling sessions about IUGR as a complication of pregnancy and the individual course and consequences of IUGR. The mother/parents-to-be should also be told that the infant could be constitutionally small, which does not inevitably lead to increased perinatal morbidity. These talks should be given by an interdisciplinary team which includes a specialist for prenatal medicine/obstetrician and neonatologist. Depending on the fetal clinical picture, additional pediatric specialists or specialists for human genetics should also be consulted. In addition to information about the possible causes, information should also be provided about the short-term and long-term consequences, the risk of recurrence and, depending on the case, the possible diagnostic investigations.

The individual medical, psychological and social questions of the pregnant woman or the parents-to-be about the diagnosis must then be discussed during a comprehensive medical consultation. All necessary decisions should be taken as part of a joint decision-making process. The most important results of the information and counseling sessions should be documented transparently (see also the S2k-guideline “Preterm infants born at the limits of viability”, currently only available in German: “Frühgeborene an der Grenze der Lebensfähigkeit” (196)).

Additional psychological or pastoral care, ideally initiated before the birth, can be an important aspect for parents-to-be [148].

7 Prophylaxis

Particularly after a previous IUGR pregnancy, the aim must be to prevent a recurrence of IUGR. Numerous approaches have been used in the past, but only a few of them offer an evidence-based benefit.

Acetylsalicylic acid (ASA)

Consensus-based Recommendation 7.E43	
Expert consensus	Level of consensus +++
If there is a risk of uteroplacental malperfusion and a risk of IUGR, prophylactic intake of low-dose ASA should be started at ≤ 16 GW.	
References: [149–151]	

Antihypertensive therapy

Antihypertensive therapy of mild to moderate hypertension during pregnancy does not appear to increase the risk of SGA fetus (RR: 1.02; 95% CI: 0.89–1.16) [145]. However, the use of beta-blockers in antihypertensive therapy is associated with growth restriction (RR: 1.36, 95% CI: 1.02–1.82) [152] and should therefore be avoided if possible.

Bed rest

There is no evidence that prophylactic (outpatient or inpatient) bed rest can prevent IUGR [134].

Diet

Consensus-based Recommendation 7.E44	
Expert consensus	Level of consensus +++
Special forms of nutrition or food supplements have not been shown to offer an evidence-based benefit and should therefore not be recommended as prophylaxis against IUGR.	
References: [135, 153–158]	

Heparin

Consensus-based Statement 7.S11	
Expert consensus	Level of consensus +++
The administration of low-molecular-weight heparin appears to be a promising prophylactic approach in IUGR. Nevertheless, the currently available evidence is not sufficient for it to be recommended, particularly as there is insufficient evidence concerning possible severe side-effects.	
References: [159–161]	

Nicotine

Consensus-based Recommendation 7.E45	
Expert consensus	Level of consensus +++
All pregnant women who smoke must be informed that abstaining from nicotine can reduce the risk of IUGR.	
References: [162, 163]	

8 Screening

Antenatal detection of IUGR is vitally important, as early detection significantly influences both the course of pregnancy and the neonatal outcome [29, 164, 165].

Medical history

A careful investigation of the patient's medical history, particularly with regard to potential risk factors for IUGR (see Chapter 2. Epidemiology and Etiology), is essential as close monitoring can be initiated if there is an increased risk of IUGR [166].

Clinical examination

(Cf. Chapter 3.1. Clinical examination)

Sonography

The basic prerequisite for effective screening is accurate data collection (Chapter 3.2.1. Crown-rump length).

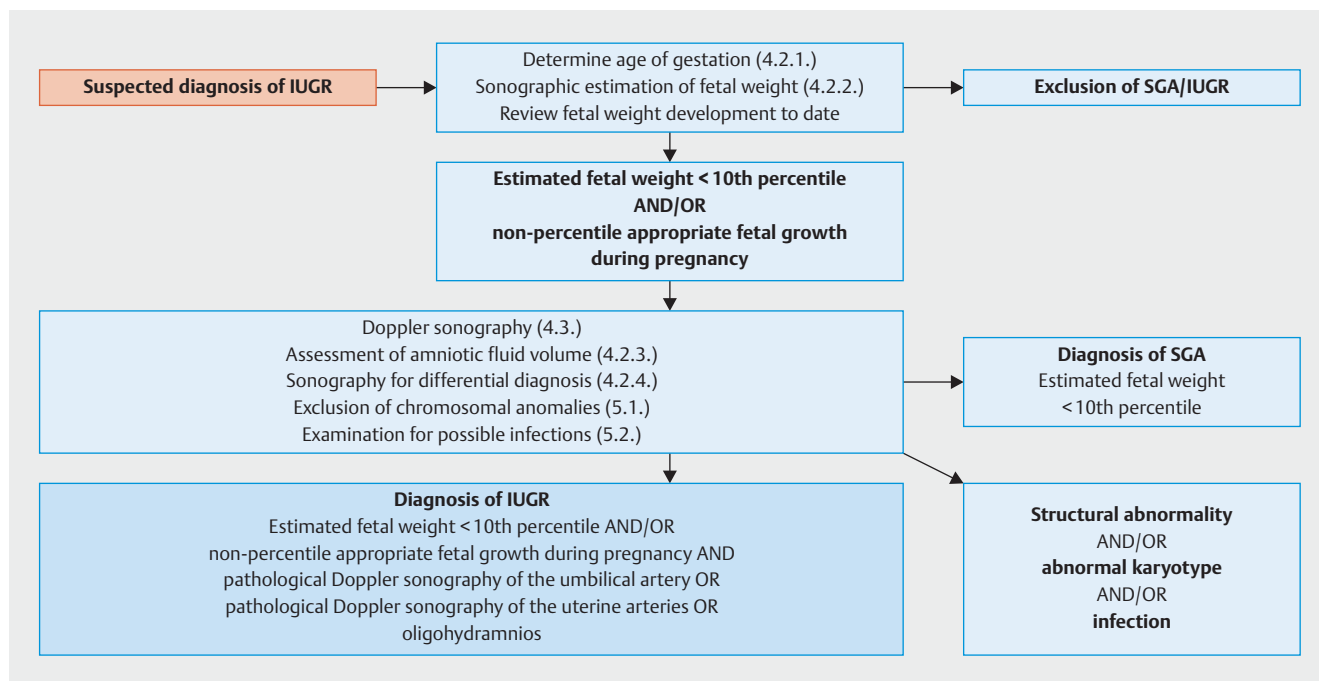
In addition, it is suggested that, similar to pre-eclampsia screening in the 1st trimester of pregnancy, an attempt could be made to screen for SGA/IUGR using a combination of different markers (maternal medical history, Doppler sonography of the uterine arteries, middle arterial pressure, NT and the maternal serum markers PAPP-A, free β -hCG, PlGF, PP13, and ADAM 12). General screening is not currently recommended yet.

Doppler sonography

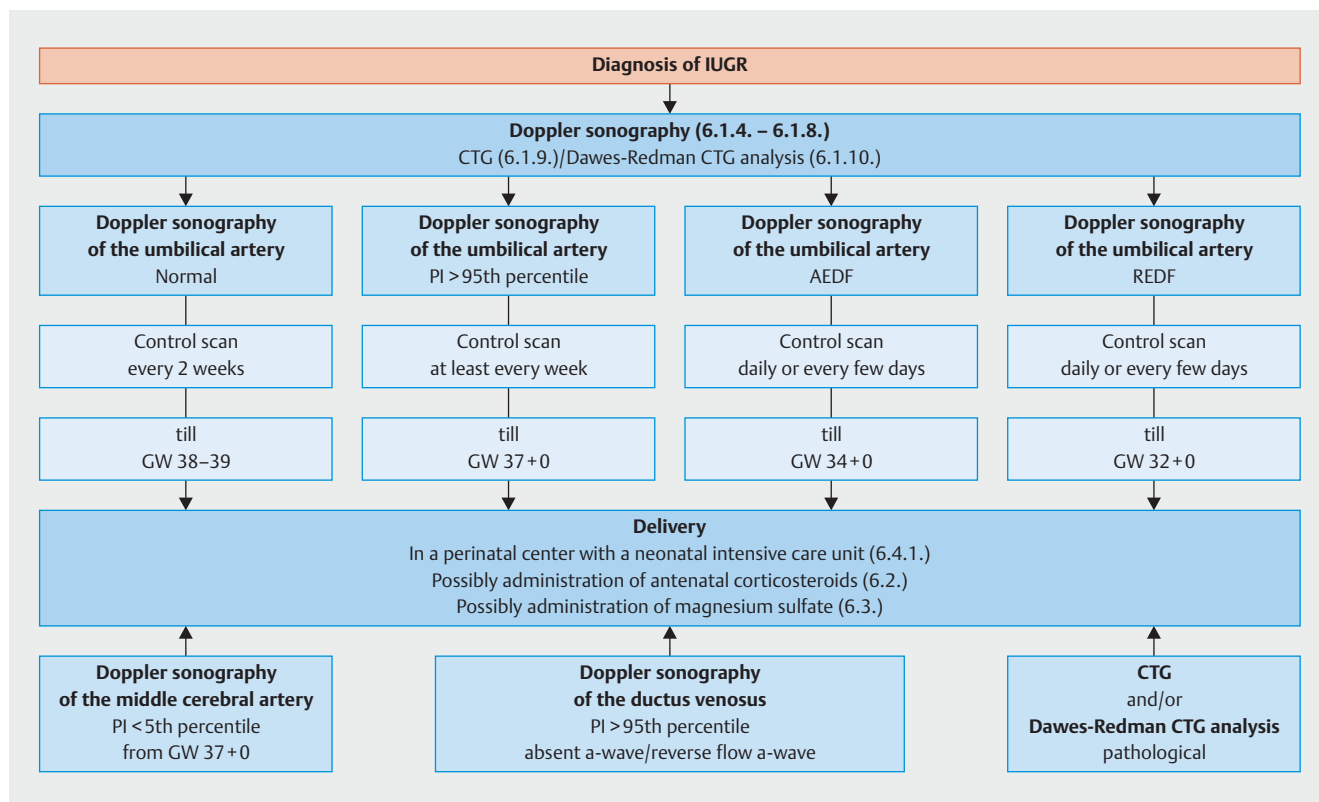
Consensus-based recommendation 8.E46	
Expert consensus	Level of consensus +++
Abnormal Doppler results for the uterine arteries in the form of increased pulsatility (PI > 95th percentile) should be a signal to start regular sonographic monitoring of fetal growth and Doppler sonography of the umbilical artery.	
References: [167, 168]	

9 Appendix

► Figs. 1 and 2)



► Fig. 1 Algorithm for the diagnosis of IUGR.



► Fig. 2 Algorithm for the management of IUGR.

10 References

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