HSE

National Women & Infants Health Programme

National Clinical Practice Guideline

Fetal Growth Restriction – Recognition, Diagnosis and Management

INSTITUTE OF OBSTETRICIANS & GYNAECOLOGISTS

ROYAL COLLEGE OF PHYSICIANS OF IRELAND

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Algorithm

Diagnosis and Management of Fetal Growth Restriction

Clinical suspicion or significant risk factors for example previous FGR, PET, pre-existing DM or HTN, previous stillbirth, renal disease, smoker. (See Table 1 for risk factors)

Sonographic assessment of fetal weight (Hadlock)

CLASSIFICATION OF FGR

Early onset FGR <32 weeks: An AC or EFW <3rd centile OR late changes in the umbilical artery Doppler (defined as AEDF or REDF) OR An AC or EFW <10th centile combined with Uterine artery mean PI >95th centile and/or Umbilical artery Doppler PI >95th centile

Late-onset FGR >32 weeks: An AC or EFW <3rd centile Or at least two out of three of the following: An AC or EFW <10th centile, An AC or EFW crossing two quartiles, Abnormal Doppler findings defined as an UAD PI >95th centile or a CPR <5th centile

Investigations

Ensure accurate dating

Detailed ultrasound – anatomy, placenta, amniotic fluid, UAD

Consider genetic testing especially if early onset FGR, severe FGR, congenital anomalies, polyhydramnios or soft markers

Screening for congenital infections

Fetal biometry every 2 weeks

MANAGEMENT

Deliver at any time in the maternal interest

Deliver any time >26 weeks if abnormal CTG findings such as spontaneous repeated decelerations or fetal bradycardia

Normal UAD

EFW 3rd-9th centile

UAD and AFI/DVP every 2 weeks

Deliver by 39 weeks

EFW <3rd centile

UAD and AFI/DVP weekly

Deliver by 37 weeks

UAD Increased Resistance (PI >95th centile)

UAD and AFI/DVP weekly

Deliver by 37 weeks or earlier if other associated abnormalities e.g. oligohydramnios, suboptimal interval growth

UAD AEDF

UAD and AFI/DVP twice weekly

CTG daily when >26/40

Consider inpatient admission if above cannot be facilitated as an outpatient

Deliver by 34 weeks

Timed corticosteroids

IV Magnesium sulphate 4 gram loading dose followed by 1gram/hr maintenance dose if <32 weeks

UAD REDF

Inpatient admission

UAD and AFI/DVP three times per week

CTG daily when >26/40

Deliver by 30 weeks

Timed corticosteroids

IV Magnesium sulphate 4 gram loading dose followed by 1 gram/hr maintenance dose if <32 weeks

Abbreviations: FGR fetal growth restriction, PET preeclampsia, HTN hypertension, DM diabetes mellitus, UAD umbilical artery Dopplers, CTG cardiotocograph, EFW estimated fetal weight, AFI amniotic fluid index, DVP deepest vertical pool, PI Pulsatility Index, AEDF absent end-diastolic flow, REDF reversed end-diastolic flow

Table 1: Risk Factors for Fetal Growth Restriction

Maternal Demographics	• Parity • Body mass index (BMI) less than 20 or greater than 25 • Extremes of maternal age (<16 years or >40 years) • Assisted conception • Ethnicity (minorities, non-white) • Low socio-economic status
Maternal co-morbidities and prior history	• Hypertension/pre-eclampsia/previous pre-eclampsia • Systemic lupus erythematosus • Pre-existing diabetes mellitus • Inflammatory bowel disease • Major renal disease, lung disease or heart disease • Previous FGR pregnancy • Previous stillbirth • Recurrent pregnancy losses • Antiphospholipid syndrome
Fetal	• Chromosomal abnormalities or genetic syndromes • Structural anomalies • Congenital infections (CMV, Toxoplasmosis, Rubella, Varicella, Syphilis, Malaria, Zika, HSV) • Multiple pregnancy
Placental	• Placental developmental abnormalities (for example abnormal placental shape/position, diffuse distal villous hypoplasia, delayed villous maturation/distal villous immaturity) • Maternal vascular malperfusion (characterised by features such as infarction, accelerated villous maturation, focal distal villous hypoplasia, decidual vasculopathy) • Fetal vascular malperfusion (defined as any pathology with evidence of abnormal perfusion of the placenta from the fetus or vice versa; may be of fetal, umbilical, mechanical or placental aetiology) • Chronic inflammatory processes (for example chronic histiocytic intervillositis, villitis of unknown aetiology) • Miscellaneous conditions such as massive perivillous fibrinoid deposition and maternal floor infarction
Environmental	• Substance misuse • Smoking • Alcohol • High altitude/hypoxia • Irradiation • Environmental pollutants • Exposure to teratogens (for example warfarin, methotrexate)

Key Recommendations

Classification

1. We recommend classifying Fetal Growth Restriction (FGR) into early-onset FGR if diagnosed before 32 weeks' gestation or late-onset FGR if diagnosed after 32 weeks' gestation. *Best Practice*

Screening and prevention

2. We recommend that women should have a booking visit by 14 weeks' gestation. This should include confirmation of gestational age, a comprehensive medical and obstetric history and screening for risk factors for Fetal Growth Restriction. *Best Practice*
3. We recommend that women with a history of placenta-mediated Fetal Growth Restriction or pre-eclampsia are offered aspirin 150 mg daily before 16 weeks' gestation, but ideally earlier than this. We do not recommend commencing aspirin after 16 weeks' gestation as there is no evidence at present of benefit. *1C*
4. Symphysis-fundal height can be used as a primary screening method for Fetal Growth Restriction in the antenatal setting in women classified as normal-risk with a body mass index (BMI) between 18.5 and 24.9. There should be a low threshold for sonographic assessment if there is any difficulty in clinically assessing fetal size, for example because of maternal obesity, multiple fibroids or a history or suspicion of polyhydramnios. *1B*
5. We recommend that women with a history of Fetal Growth Restriction or significant risk factors for Fetal Growth Restriction undergo serial sonographic evaluation of fetal weight, Deepest Vertical Pool (DVP) and Umbilical Artery Doppler (UAD). The timing of these scans should be individualised but there is no evidence of benefit in repeating these more frequently than every four to six weeks. *1C*
6. Clinicians should be aware that significant risk factors for Fetal Growth Restriction may include previous stillbirth, pre-existing hypertension, pre-existing diabetes mellitus, renal impairment, antiphospholipid syndrome, maternal age >40 years, current pregnancy induced hypertension or pre-eclampsia, current smoker of >10 cigarettes per day, maternal cocaine use and a body mass index (BMI) of greater than 35 or where clinical measurement of fetal size is limited due to maternal habitus. *Best Practice*
7. Third trimester growth ultrasound scans should not be routinely offered to women in the absence of significant risk factors for Fetal Growth Restriction or clinical concerns. From current evidence, they do not confer any benefit to mother or baby. *1A*
8. We recommend the use of population based fetal growth charts such as the Hadlock equation and growth chart for estimation of fetal weight. *1B*

Diagnosis

9. All women with Fetal Growth Restriction should have a thorough history taken at the time of its detection. This should include the identification of modifiable risk factors such as smoking and alcohol use. *Best Practice*

10. Women should have a detailed ultrasound scan at diagnosis to review fetal biometry, Deepest Vertical Pool (DVP) and Umbilical Artery Doppler (UAD). A review of fetal anatomy should be carried out in cases of severe early-onset Fetal Growth Restriction. *Best Practice*
11. Input from a Maternal Fetal Medicine specialist should be sought in cases of severe early-onset Fetal Growth Restriction <3rd centile, early-onset Fetal Growth Restriction with abnormal Umbilical Artery Doppler (UAD), or if there is evidence of any additional concerning sonographic features such as polyhydramnios, oligohydramnios, structural anomalies or soft markers. The intention of this review is to counsel and guide further investigations, offer invasive testing and instigate a fetal surveillance management plan going forward. Subsequent to this, in the event of sonographic and neonatal support availability locally to adequately monitor these cases and provide expert care in the event of a preterm delivery, care can be transferred back to the referring hospital for ongoing surveillance and delivery. *Best Practice*
12. Maternal screening for congenital infections such as Cytomegalovirus (CMV) testing can also be considered with additional viral screens requested if relevant risk factors are identified. *1C*

Management

13. We recommend fetal biometry, Deepest Vertical Pool (DVP) and Umbilical Artery Doppler (UAD) measurement is done every 2 weeks if Umbilical Artery Doppler (UAD) measurements are normal and estimated fetal weight >3rd centile. *1C*
14. We suggest weekly Umbilical Artery Doppler (UAD) measurements if Umbilical Artery Doppler (UAD) PI >95th centile or Estimated Fetal Weight (EFW) <3rd centile. *2C*
15. We recommend twice weekly Umbilical Artery Doppler (UAD) measurement if there is Absent end-diastolic flow (AEDF) in the Umbilical Artery Doppler (UAD) in the absence of any other indication for delivery. Twice weekly Umbilical Artery Doppler (UAD) measurements can also be considered on a case-by-case basis in the presence of plateauing of growth, oligohydramnios or other fetal concerns. *1C*
16. We recommend Umbilical Artery Doppler (UAD) measurement three times per week if there is Reversed end-diastolic flow (REDF) in the Umbilical Artery Doppler (UAD) in the absence of any other indication for delivery. *1C*
17. Ductus Venosus (DV) Doppler measurement can be used as an indicator of the optimal timing of delivery in severe early-onset Fetal Growth Restriction with abnormal Umbilical Artery Doppler (UAD). If not done locally, this should prompt consideration for referral to a Maternal Fetal Medicine specialist. *1C*
18. Although the Middle Cerebral Artery/Umbilical Artery Doppler PI ratio Cerebro-placental ratio (CPR) can be a helpful adjunct to Umbilical Artery Doppler (UAD) measurement to identify late-onset Fetal Growth Restriction, there are limited data to support its routine use in Fetal Growth Restriction surveillance or appropriate timing of delivery at present. The absence of MCA Doppler assessment facilities in a maternity unit / hospital does not need to prompt referral to a tertiary unit / hospital, due to the insufficient evidence to support its routine use. *2B*
19. We recommend using Deepest Vertical Pool (DVP) for the assessment of amniotic fluid in Fetal Growth Restriction pregnancies. *Best Practice*
20. Although a normal biophysical profile (BPP) is reassuring for the clinician, BPP is not recommended in isolation for routine fetal surveillance particularly in early-onset Fetal Growth Restriction and should not be relied upon solely to time delivery. *Best Practice*
21. Daily CTG monitoring after 26 weeks, or at a gestational age which would trigger intervention, should be considered when there is absent end diastolic flow or reversed end-diastolic flow in the Umbilical Artery Doppler (UAD). *Best Practice*
22. It is reasonable to advise women that continuing low to moderate intensity exercise during pregnancy for 30 minutes most days of the week is considered safe in Fetal Growth Restricted pregnancies. *1A*

23. Women and partners with a Fetal Growth Restriction affected pregnancy should be offered support by staff and provided with contact details for further supportive care, if desired. Consideration of referral to the social work counselling team should be given, especially in the event of a prolonged hospital admission. *Best Practice*

Delivery

24. We suggest delivery no later than 39+0 weeks if the Estimated Fetal Weight (EFW) is 3rd-9th centile with normal Dopplers and no plateauing of growth. *2C*
25. We recommend delivery by 37+0 weeks if the Estimated Fetal Weight (EFW) <3rd centile or Umbilical Artery Doppler (UAD) PI >95th centile. Delivery between 34-37 weeks can be considered if there are other mild associated abnormalities such as oligohydramnios or suboptimal interval growth. *1B*
26. We recommend delivery by 34+0 weeks in Absent end-diastolic flow (AEDF). Earlier delivery may be indicated in cases of suboptimal interval growth or a deterioration in sonographic values. *1B*
27. We recommend delivery by 30+0 weeks in Reversed end-diastolic flow (REDF). Earlier delivery may be indicated in cases of suboptimal interval growth or deterioration of sonographic variables. *1B*
28. Delivery should be considered between 26-30 weeks if there is absent or reversed a-wave in DV Dopplers with an abnormal Umbilical Artery Doppler (UAD). *1C*
29. We recommend delivery at any time for any maternal indication in Fetal Growth Restriction pregnancies. *Best Practice*
30. We recommend delivery in the fetal interest at any time after 26 weeks if abnormal CTG findings such as spontaneous repeated decelerations or fetal bradycardia. *Best Practice*
31. Delivery before 26+0 weeks in the fetal interest should be individualised based on discussion with the woman, obstetrics and neonatology teams due to the guarded neonatal outcomes at this gestation. *Best Practice*
32. We strongly recommend the administration of a course of timed antenatal corticosteroids, ideally within seven days of delivery, if delivery is anticipated at a gestational age of between 24+0 and 34+6 weeks. *1A*
33. A course of antenatal corticosteroids should consist of 24 mg of dexamethasone phosphate, or alternatively 24 mg of betamethasone phosphate, administered intramuscularly in two divided doses of 12 mg, given 24 hours apart. Administration of the second dose after a 12 hour interval may be considered when delivery is imminent. *1C*
34. Magnesium sulphate for fetal neuroprotection should be administered if less than 32 weeks' gestation and delivery is anticipated. *1A*
35. We recommend sending the placenta for histological examination in Fetal Growth Restriction pregnancies. *Best Practice*

Subsequent pregnancy

36. All women who have had a pregnancy affected by Fetal Growth Restriction should be offered postnatal support and the opportunity for follow-up discussion, if desired. *Best Practice*
37. Due to the higher risk of recurrence and impact on future pregnancies, all women who have experienced an adverse perinatal outcome as a result of Fetal Growth Restriction (for example a preterm birth or perinatal loss) should be offered an appointment for postnatal counselling, review of placental histology, investigation of underlying causes and a discussion on risk recurrence and modifiable risk factors, if applicable. *Best Practice*
38. We recommend that women are managed in a consultant led clinic in subsequent pregnancies with regular sonographic surveillance of fetal growth. *Best Practice*

Chapter 1: **Initiation**

The National Clinical Effectiveness Committee (NCEC) and Health Information and Quality Authority (HIQA) define clinical guidelines as systematically developed statements, based on a thorough evaluation of the evidence, to assist practitioner and patient decisions about appropriate healthcare for specific clinical circumstances, across the entire clinical spectrum.[1]

1.1 Purpose

This Guideline is primarily intended as a resource for obstetricians, trainees, midwives and student midwives working in Ireland but will also be useful for women and their partners, general practitioners and commissioners of healthcare. The aim of this Guideline is to standardise and improve antenatal care of pregnancies affected by fetal growth restriction based on best evidence based clinical practice approach. This Guideline is designed to guide clinical judgment, but not replace it.

1.2 Scope

Target Users

The Guideline is a resource for all healthcare staff caring for women with a singleton pregnancy complicated by fetal growth restriction (FGR). This includes healthcare providers, doctors, advanced midwifery practitioners,[2] midwives, students, sonographers, health and social care professionals.

Target Population

All women with a pregnancy complicated by FGR. This may also include their partner and/or family.

1.3 Objective

To provide evidence-based recommendations for the care of fetal growth restriction as well as promoting a standardised approach nationally across all maternity units/hospitals.

1 National Clinical Effectiveness Committee (NCEC) and Health Information and Quality Authority (HIQA) (2015) National quality assurance criteria for clinical guidelines. Version 2. Dublin: NCEC and HIQA. https://assets.gov.ie/11533/2d070cb758a44fcb8b56f28784b10896.pdf

2 Nursing and Midwifery Board of Ireland (NMBI) (2018) Advanced Practice (Midwifery) Standards and Requirements. Dublin. www.nmbi.ie/NMBI/media/NMBI/Advanced-Practice-(Midwifery)-Standards-and-Requirements-2018-final.pdf

1.4 Guideline development process

The Guideline Developers agreed to undertake this work under the direction of the Guideline Programme Team (GPT). An Expert Advisory Group (EAG) was commissioned by the GPT. Their role was to critically review the Guideline prior to submission to the National Women and Infants Health Programme (NWIHP) for final approval.

See Appendix 1 for EAG membership and Appendix 2 for Guideline Programme Process.

The principal Guideline developers were:

1. Dr Gabriela McMahon (Specialist Registrar Obstetrics and Gynaecology)
2. Dr Brendan McDonnell (Post-CSCST Fellow in Maternal Fetal Medicine)
3. Dr David Mackin (Fellow in Maternal Fetal Medicine)
4. Dr Etaoin Kent (Consultant Obstetrician and Gynaecologist and Maternal Fetal Medicine Sub-Specialist)
5. Professor Michael Geary (Consultant Obstetrician and Gynaecologist and Maternal Fetal Medicine Sub-Specialist)

1.5 Stakeholder involvement

Stakeholders are people who have a common interest in improving health services. This includes persons that are responsible for delivering and those who receive services related to the clinical Guideline.

The EAG has representatives from a broad range of professional backgrounds. Relevant to this Guideline there are representatives from Obstetrics, Neonatology and Midwifery. A public, patient representative is also included in the EAG from the Patient Advocacy Service Ireland and the Irish Neonatal Health Alliance.

The following stakeholders were consulted in regard to this Guideline:

- Dr Ann McHugh (Consultant Obstetrician and Gynaecologist and Maternal Fetal Medicine Sub-Specialist, National Maternity Hospital)
- Professor Keelin O'Donoghue (Consultant Obstetrician and Gynaecologist and Maternal Fetal Medicine Sub-Specialist, Cork University Maternity Hospital)
- Dr Carmen Regan (Consultant Obstetrician and Gynaecologist and Maternal Fetal Medicine Sub-Specialist, The Coombe Hospital)
- Dr Gillian Ryan (Consultant Obstetrician and Gynaecologist and Maternal Fetal Medicine Sub-Specialist, Galway University Hospital)
- Ms Ann Fleming (Midwife Sonographer RCSI, Rotunda Hospital, Assistant Professor/Lecturer Obstetrics and Gynaecology Programme, Radiography and Diagnostic Imaging, School of Medicine, University College Dublin)
- Dr Brendan Fitzgerald (Consultant Perinatal Pathologist, Cork University Hospital)
- Ms Bernadette Daly (Clinical Midwife Specialist, Fetal Assessment Unit, Our Lady of Lourdes Hospital, Drogheda)

The Guideline Development Group is grateful for their review and feedback on this Guideline.

1.6 Disclosure of interests

Guideline developers and reviewers bring a range of experiences and perspectives to the work of the national Guideline Programme. It is likely that both Guideline developers and stakeholders/reviewers will have a variety of interests, arising from different contexts and activities done in a professional or personal capacity. These can include employment and other sources of income, speaking engagements, publications and research, and membership of professional or voluntary organisations. The involvement of individuals with relevant content expertise is essential for enhancing the value of Guideline recommendations, but these individuals may also have interests that can lead to conflicts of interest, as may peer reviewers, patient representatives and researchers.

All interests should be declared if, in the view of a reasonable person, they are relevant, or could be perceived to be relevant, to the work of the Clinical Practice Guideline in question.[3] Declaring an interest does not mean there is a conflict of interest.

It is important that interests are openly declared so they can be appropriately managed. Conflicts of interest can bias recommendations and ultimately be harmful to women and the health system. Disclosures of interests and appropriate management of conflicts of interest, when identified, are therefore essential to producing high-quality, credible health guidelines.[4]

The Guidelines International Network (GIN), a global network of Guideline developers that aims to promote best practices in the development of high-quality guidelines, developed a set of 9 principles to provide guidance on how financial and non-financial conflicts of interest should be both disclosed and managed. It is recommended that Guideline developers follow the GIN principles.[5]

For this National Clinical Practice Guideline, all Guideline developers are asked to complete a conflict of interest declaration form. The response to declared interests will be managed by the Guideline programme team, in accordance with GIN principles. Conflicts of interest may be reported in the published Guideline and declarations of interest can be made available.

Professor Mike Geary is Associate Clinical Director for Women's and Infants Health for the Dublin/North East Hospitals Group. He has appointments at both RCSI and University of Toronto as a Professor in Obstetrics &Gynaecology. He is currently Editor-in-Chief of the International Journal of Gynaecology and Obstetrics, and serves as a member on Council for FIGO. He is the founding member and chair of the group of editors in chief in Obstetrics & Gynaecology tackling research integrity issues (OBGYN Editors' Integrity Group – OGEIG). Within the last five years he has been the Republic of Ireland Fellows representative on RCOG Council. He has received a $1.5 million MFM Team Grant from the Canadian Institutes of Health Research on Non-communicable Diseases in Obstetrics: Improving Quality of Care and Maternal-Infant Outcomes through an Obstetrical Research Network. Publications are ongoing with this work.

3 NICE (2019) Policy on declaring and managing interests for NICE advisory committees https://www.nice.org.uk/Media/Default/About/Who-we-are/Policies-and-procedures/declaration-of-interests-policy.pdf

4 Traversy G, Barnieh L, Akl EA, Allan GM, Brouwers M, Ganache I, Grundy Q, Guyatt GH, Kelsall D, Leng G, Moore A, Persaud N, Schünemann HJ, Straus S, Thombs BD, Rodin R, Tonelli M. CMAJ. 2021, 193(2):E49-E54. DOI: 10.1503/cmaj.200651 https://www.cmaj.ca/content/193/2/E49

5 Holger J. Schünemann, Lubna A. Al-Ansary, Frode Forland, et al.; for the Board of Trustees of the Guidelines International Network. Guidelines International Network: Principles for disclosure of interests and management of conflicts in guidelines. Ann Intern Med. 2015;163:548-553. doi:10.7326/M14-1885. https://www.acpjournals.org/doi/10.7326/m14-1885

1.7 Disclaimer

These guidelines have been prepared to promote and facilitate standardisation and consistency of good clinical practice, using a multidisciplinary approach. Information in this Guideline is current at the time of publication.

The ultimate judgement regarding a particular clinical procedure or treatment plan must be made by the Clinician in light of clinical data presented by the woman and the diagnostic and treatment options available.

Clinical material offered in this Guideline does not replace or remove clinical judgment or the professional care and duty necessary for each specific woman.

Clinical care carried out in accordance with this Guideline should be provided within the context of locally available resources and expertise.

This Guideline does not address all elements of standard practice and assumes that individual clinicians are responsible for:

- Discussing care with women in an environment that is appropriate and which enables respectful confidential discussion. This includes the use of interpreter services where necessary
- Advising women of their choices and ensure informed consent is obtained
- Provide care with professional scope of practice, meeting all legislative requirements and maintaining standards of professional conduct
- Applying standard precautions and additional precautions, as necessary, when delivering care
- Documenting all care in accordance with local and mandatory requirements.

1.8 Use of language

Within this guidance we use the terms 'woman' and 'women's health'. However, it is important to acknowledge that people who do not identify as cis-gender women are excluded from this descriptor, including people who identify as transgender, gender diverse and gender non-binary.[6] While there has been a trend to remove the word 'woman/women' and use 'gender neutral' language in policy and practice in relation to women's reproductive health and wellbeing, there is no evidence base to inform this change.[7] We also appreciate that there are risks to desexing language when describing female reproduction.[8] [9]

Services and delivery of care must be appropriate, inclusive and sensitive to the needs of people whose gender identity does not align with the sex they were assigned at birth. This includes training and education regarding diverse pathways to pregnancy and the use of practices which affirm the sexual and gender identities of all people using Obstetrics and Gynaecology services. Finally, all those using maternal and reproductive health care and services should receive individualised, respectful care including use of the gender nouns and pronouns they prefer.[7]

Language use is key to effectively communicate options, recommendations, and respectfully accept a woman's fully informed decision.[10] With this in mind, the use of birth is preferable to the term delivery in all circumstances and is used consistently where possible throughout the guidelines. It is acknowledged that in some circumstances (e.g., in the case of a medically indicated intervention or surgery) and in some contexts, substituting with the term delivery is considered appropriate and this term may be used instead.

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7 Council of Deans of Health. Midwifery Network position paper: use of sexed language. May 2023. https://www.councilofdeans.org.uk/2024/02/midwifery-network-position-paper-use-of-sexed-language/

8 Brotto LA, Galea LAM. Gender inclusivity in women's health research. BJOG: An International Journal of Obstetrics & Gynaecology. https://obgyn.onlinelibrary.wiley.com/doi/full/10.1111/1471-0528.17231

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10 https://blogs.bmj.com/bmj/2018/02/08/humanising-birth-does-the-language-we-use-matter/

1.9 Adopting a trauma-informed approach to maternity care

Many women accessing maternity services may have experienced historical or current trauma prior to, or during pregnancy - including emotional, physical, sexual abuse, rape and torture. The perinatal period (pregnancy, birth and the postpartum) can be a time when previous trauma is triggered.[11] Maternity care procedures which may seem routine and 'non-invasive' to healthcare professionals (HCPs), e.g., abdominal palpation or providing breastfeeding support can be triggering for some women with a history of trauma, as can intimate procedures such as vaginal examinations.[12]

Trauma-informed care (TIC) is a developing approach to healthcare which recognises the importance of psychological safety, and the need to prevent or resist re-traumatisation of individuals.[13] It is based on 4 key principles (known as the 4Rs): (1) realisation of trauma; (2) recognition of trauma; (3) responding to trauma and (4) resisting re-traumatisation.[14] A trauma-informed approach to maternity care means that all staff in an organisation have an understanding of the impact of trauma on individuals, families and organisations.[15] While a universal approach is yet to be agreed, within clinical practice and research, many organisations recognise the need to move towards becoming trauma-informed in the provision of maternity care.[15] [16] Such an approach requires commitment, investment and transformation within maternity services.

In simple terms, HCPs should recognise the impact of women's previous or current history of trauma (whether disclosed or not) and adopt a universally sensitive approach to care provision that recognises the impact of trauma on service users and HCPs. Examples of this include ensuring clear communication and consent is sought before any procedures/interventions, ensuring women are provided with dignity and respect at all times.

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12 Montgomery E. Feeling safe: a metasynthesis of the maternity care needs of women who were sexually abused in childhood. Birth 40:88–95. Birth. 2013 Jun;40(2):88-95. doi: 10.1111/birt.12043

13 Vogel TM, Coffin E. (2021). Trauma-informed care on labor and delivery. Anesthesiol Clin. 2021 Dec;39(4):779-791. doi: 10.1016/j.anclin.2021.08.007

14 SAMHSA's concept of trauma and guidance for a trauma-informed approach Rockville. October 2014. https://library.samhsa.gov/product/samhsas-concept-trauma-and-guidance-trauma-informed-approach/sma14-4884

15 Law C, Wolfenden L, Sperlich M, Taylor J. A (2021). Good practice guide to support implementation of trauma-informed care in the perinatal period. The centre for early child development (Blackpool, UK) commissioned by NHS England and NHS Improvement in 2021. https://www.england.nhs.uk/publication/a-good-practice-guide-to-support-implementation-of-trauma-informed-care-in-the-perinatal-period/

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Chapter 2:
Clinical Practice Guideline

Background

Fetal growth restriction (FGR) is a common and complex problem, which accounts for a considerable risk of morbidity and is a major contributor to perinatal mortality.[1 2 3]

FGR, intrauterine growth restriction (IUGR) and small for gestational age (SGA) are often used in an inconsistent and confusing manner. This is particularly evident in guidelines and literature where SGA and FGR are often either not clearly defined or these terms are used interchangeably and therefore the interpretation of data in regard to one or the other can be limited.

SGA describes an infant with a birth weight less than the 10th percentile, of which most are constitutionally small. The term IUGR can now be replaced by FGR. FGR is a pathological condition defined by the failure of a fetus to meet its predetermined growth potential because of an underlying pathological process, most commonly placental dysfunction.[4] It can also be described as an estimated fetal weight (EFW) or abdominal circumference (AC) less than the 10th percentile.[5 6 7]

A degree overlap of EFW between SGA and FGR is common and often the distinction between normal and pathologic growth cannot be reliably made by this cut-off.[4] Nearly 70% of infants with an EFW <10th centile will not have any severe neonatal morbidity outcome after delivery.[8] In contrast, some fetuses may develop FGR but maintain an EFW above the 10th percentile, thus underdiagnosing FGR.[9 10] Some countries therefore incorporate abnormal Doppler measurements or fetal growth trajectory into the definition of FGR to help differentiate it from SGA. Severe growth restriction can be defined as an EFW or AC <3rd centile and is associated with a higher level of neonatal morbidity or mortality, especially if accompanied by oligohydramnios or abnormal Doppler measurements.[11 12]

FGR is a major contributor to perinatal morbidity and mortality with associated complications. Antenatal complications of FGR include stillbirth, pre-eclampsia, placental abruption and preterm birth.[5] Pregnancies affected by FGR have double the rate of stillbirths compared to those with normal fetal growth.[13] Pregnancies with unrecognised FGR carry an over 8-fold increased risk of stillbirth when compared to pregnancies without FGR (19.8/1000 versus 2.4/1000 births).[14]

FGR is associated with a range of neonatal complications including neonatal mortality, hypoglycaemia, hyperbilirubinaemia, necrotising enterocolitis, respiratory morbidity, hypothermia and intraventricular haemorrhage. FGR is also associated with neurodevelopmental disorders and metabolic syndromes.[5]

Relevant recommendations can also be found in:

- National Clinical Practice Guideline: The Fetal Anatomy Ultrasound[17]
- National Clinical Practice Guideline: Antenatal Corticosteroids to Reduce Neonatal Morbidity and Mortality[18]
- National Clinical Practice Guideline: Induction of Labour[19]
- National Clinical Practice Guideline: Reduced Fetal Movements[20]
- National Clinical Practice Guideline: Fetal Heart Rate Monitoring[21]

Section 1: Classification

Clinical Question 2.1: **How can fetal growth restriction be classified?**

Evidence Statement

In 2016, an international Delphi consensus established diagnostic criteria for FGR based on ultrasound scan.[15] This classified FGR into two main categories based on the gestational age at the time of diagnosis; early-onset if occurring before 32 weeks' gestation or late-onset if occurring after 32 weeks.[16] The authors also agreed that congenital anomalies should be absent.[17] This classification has been shown to have a higher specificity for FGR in predicting adverse neonatal outcomes in a study of 1055 pregnancies compared to older definitions.[17]

Early-onset Fetal Growth Restriction (<32 weeks)

Early-onset FGR is less common (accounting for approximately 10-20% of FGR), usually more severe and more likely to be associated with pre-eclampsia, umbilical artery Doppler (UAD) and ductus venosus (DV) Doppler abnormalities in a predictable sequence of fetal deterioration:[5]

- Elevated UAD Pulsatility Index (PI) >95th centile
- Reduced Middle Cerebral Artery (MCA) PI or reduced cerebro-placental ratio (CPR) <5th centile
- Absent end diastolic flow (AEDF) in the UAD

17 Fleming, A., Corbett, G., McParland, P. National Clinical Practice Guideline: The fetal anatomy ultrasound. National Women and Infants Health Programme and The Institute of Obstetricians and Gynaecologists. January 2023

18 Murphy S, Murphy E, Dineen A, Ryan J, Dempsey E, O'Donoghue K. National Clinical Practice Guideline: Antenatal corticosteroids to reduce neonatal morbidity and mortality. National Women and Infants Health Programme and The Institute of Obstetricians and Gynaecologists. May 2024

19 Mitchell J.M, Nolan C, El Shaikh M, Cullinane, S, Borlase D. National Clinical Practice Guideline: Induction of Labour. National Women and Infants Health Programme and The Institute of Obstetricians and Gynaecologists. October 2023

20 Kalisse T, Farrell AM, Verling AM, Rutherford E, Ravinder M, Khalid A, O'Donoghue K. National Clinical Practice Guideline: Reduced Fetal Movements. National Women and Infants Health Programme and The Institute of Obstetricians and Gynaecologists. May 2024

21 Rowland M, Taylor J, McNamara K, Cronin M, Kinsella I, Murphy H, Carroll L, Murphy D, Purcell E, Murphy C. National Clinical Practice Guideline: Fetal Heart Rate Monitoring. National Women and Infants Health Programme and The Institute of Obstetricians and Gynaecologists. June 2025

- Reversed end diastolic flow (REDF) in the UAD
- Abnormal Ductus Venosus (DV) Dopplers – absent or reversed a-wave.[5 18]

The rate of progression for Doppler abnormalities is significantly related to gestational age, with a rapid progression often seen in very early-onset FGR.[18]

The Delphi consensus defined criteria for early-onset FGR to include:

- An AC or EFW <3rd centile *OR* late changes in the umbilical artery Doppler (defined as AEDF or REDF)

OR

- An AC or EFW <10th centile *combined with*
- Uterine artery mean PI >95th centile *and/or*
- Umbilical artery Doppler PI >95th centile[15]

Late-onset Fetal Growth Restriction (>32 weeks)

Late-onset FGR represents approximately 70-80% of FGR cases, is typically milder in presentation and associated with less extensive placental malperfusion and therefore often normal umbilical artery Dopplers.[19] Deterioration in late-onset FGR can be difficult to diagnose sonographically and sometimes only evident by the detection of cerebral redistribution.[15] This makes prognosis unpredictable, contributing to adverse perinatal outcomes.

The Delphi consensus defined criteria for late-onset FGR to include:

- An AC or EFW <3rd centile

Or at least two out of three of the following:

- An AC or EFW <10th centile
- An AC or EFW crossing two quartiles
- Abnormal Doppler findings defined as an UAD PI >95th centile or a CPR <5th centile[15]

Clinical Practice

FGR can be classified into two main categories based on the gestational age at the time of onset or diagnosis.

Early-onset FGR is diagnosed at less than 32 weeks' gestation. Conversely, late-onset FGR is diagnosed after 32 weeks' gestation.

Differentiating between these is important as each can follow a different sequence of progression leading a different management approach as detailed later in this Guideline.

Recommendations

1. **We recommend classifying FGR into early-onset FGR if diagnosed before 32 weeks' gestation or late-onset FGR if diagnosed after 32 weeks' gestation.**

Section 2: Screening And Prevention

Clinical Question 2.2:
What are the risk factors for fetal growth restriction?

Evidence Statement

As FGR is a heterogenous condition, antenatal recognition of risk factors (Table 1) which may lead to FGR is crucial.[5 7 20]

The booking visit should include a dating ultrasound scan, comprehensive medical and obstetric history and should ideally happen by 14 weeks. This is an optimal time to facilitate allocation to different care streams depending on the stratification of clinical risk, as set out in the Stratification of Clinical Risk in Pregnancy and the National Maternity Strategy.[21 22] It is also an appropriate time to screen for risk factors for FGR, encourage smoking, alcohol and/or illicit drug use cessation, stop prescribed medications that are teratogenic or associated with FGR such as ACE-inhibitors or beta-blockers if appropriate, discuss maternal weight management and discuss non-invasive prenatal screening (NIPS) options, although the latter is only available privately.[23] NIPS is currently not available in Ireland as part of a national funded prenatal screening programme. However, a recent survey has shown women wish to be more informed about NIPS.[24]

Women with a history of placenta-mediated FGR or pre-eclampsia should be offered aspirin 150 mg to be commenced prior to 16 weeks' gestation.[25–28] It is known that aspirin in doses above 100 mg daily is highly effective in preventing preterm preeclampsia when administered to high risk women before 16 weeks.[29] Although the ideal dosing of aspirin in the setting of FGR is yet to be established, studies have associated a higher dose of 100-150 mg with a greater reduction in FGR.[30]

A systematic review and meta-analysis published in 2017 including 45 randomised controlled trials (RCTs) and 20,909 women showed that 50-150 mg of aspirin daily is associated with a modest risk reduction of FGR in women with obstetric risk factors if commenced before 16 weeks (RR 0.56, 95% CI 0.44-0.70 p=0.044).[31 30] When commenced at greater than 16 weeks, there is no significant reduction in the FGR risk (RR 0.95, 95% CI 0.86-1.05, p=0.34).[30] A higher dose of aspirin was associated with a greater reduction in FGR. [30] Although the Aspirin for Evidence Based Preeclampsia Prevention (ASPRE) trial did not find a significant reduction in FGR when taking aspirin (aOR 0.77, 95% CI 0.56-1.06), this was a secondary outcome of the study and it was not powered for this.[32]

To date there is no evidence of benefit in commencing aspirin after 16 weeks' gestation.[30] Although aspirin is considered to be safe in pregnancy, it has recently been associated with an increased risk of placental abruption and postpartum haemorrhage, so its use should be limited to those deemed high risk and initiated at an appropriate time.[33]

Clinical Practice

Women should have a comprehensive medical and obstetric history taken at their booking visit, which should ideally happen by 14 weeks. This is also an optimal time to screen for risk factors for FGR (see table 1).

Modifiable risk factors for FGR, for example smoking, alcohol or illicit drug use, can addressed at this visit. A multi-disciplinary team approach- to cessation support services can be offered. This may include referral to the medical social work team, smoking cessation officer/team or addiction specialist/team.

Confirmation of gestational age at this stage is important. This should ideally occur between 10 and 14 weeks' gestation.

All women should be offered a fetal anatomy ultrasound scan, ideally between 20-22 weeks' gestation. Fetal biometry should also be reported at this ultrasound examination.

Information about NIPS can be given to women at booking. This should include relevant costs in the absence of a national screening programme, and an explanation of what is screened for, accuracy and the limitations of screening, delivery and timing of results, price and onward referral or invasive testing in the event of a high-risk result.

Women with a history of placenta-mediated FGR or pre-eclampsia should be offered aspirin 150 mg daily to be commenced before 16 weeks' gestation, but ideally at an earlier gestation such as 12 weeks. We do not recommend starting aspirin after 16 week's gestation as to date there is no evidence of benefit.

Recommendations

2. **We recommend that women should have a booking visit by 14 weeks' gestation. This should include confirmation of gestational age, a comprehensive medical and obstetric history and screening for risk factors for FGR.**
3. **We recommend that women with a history of placenta-mediated Fetal Growth Restriction or pre-eclampsia are offered aspirin 150 mg daily before 16 weeks' gestation, but ideally earlier than this. We do not recommend commencing aspirin after 16 weeks' gestation as there is no evidence at present of benefit.**

Clinical Question 2.3:
How can fetal growth restriction be detected?

Evidence Statement

The detection of FGR can be challenging. Even with sonographic assessment of fetal weight, this estimation is influenced by the maternal habitus, equipment, operator experience, training and competency.[34]

Symphysis-fundal Height

Symphysis-fundal height (SFH) can be a useful tool for primary screening for FGR in the antenatal setting in normal risk pregnancies.[5 26 5] A meta-analysis of 34 studies showed SFH had a sensitivity of 58% and specificity of 87% in predicting SGA.[35] A SFH +/- 2cm of gestational weeks is considered to be acceptable to detect an EFW in the normal range.[36] Any deviation from this should prompt referral for a fetal biometry ultrasound evaluation.[26] There should be a low threshold for referral for sonographic

assessment if there is any difficulty in clinically assessing fetal size by SFH, for example because of maternal obesity, multiple fibroids or a history or suspicion of polyhydramnios. A longitudinal study of SFH measurements in 4607 women showed a SFH 2cm less than expected for gestational weeks correlated with an EFW on the 10th percentile and a SFH 3cm less than expected for gestational weeks correlated with an EFW on the 5th percentile.[36]

Routine Growth Ultrasound Scan

There is no evidence to support routinely offering third trimester ultrasound scans to reduce perinatal morbidity and mortality associated with FGR in normal risk women.[37 5] Although routine third trimester ultrasound in women with no risk factors for FGR improves detection rates, it has not been shown to improve perinatal mortality, preterm birth less than 37 weeks or caesarean section rates.[38 39 40–43] The ROUTE RCT compared a routine third trimester ultrasound at 32 weeks or 36 weeks to detect FGR in normal risk women. This showed a similar false positive rate between the two (6.4% vs 8.2%) and a superior FGR detection rate at 36 weeks compared to 32 weeks (sensitivity 38.8% versus 22.5%, p=0.006). However, there was no significant differences in perinatal outcomes between the two groups.[44] A Cochrane review of routine ultrasound in late pregnancy included 13 trials recruiting 34,980 women and showed there was no association between ultrasound in late pregnancy and a reduction in perinatal mortality (RR 1.01, 95% CI 0.67-1.54), preterm birth less than 37 weeks (RR 0.96, 95% CI 0.85-1.08), induction of labour (RR 0.93, 95% CI 0.81-1.07) or caesarean section (RR 1.03, 95% CI 0.92-1.15).[39] In addition, serial growth assessment in the third trimester in normal risk pregnancies has a low predictive capacity for SGA and FGR compared to cross-sectional growth evaluation and therefore does not incur any additional benefit.[45] Based on this evidence, third trimester ultrasound should not be offered routinely in normal risk pregnancies as it does not confer any benefit to mother or baby.

However, in the presence of significant risk factors (those risk factors with an Odds Ratio of >2 for developing FGR) for FGR, evaluation of fetal growth, amniotic fluid and UAD is recommended to reduce perinatal adverse outcomes.[46 47] This should be individualised based on clinical history and may consist of a single third trimester fetal biometry assessment or serial growth assessments from 26-28 weeks' gestation. Sequential ultrasound measurements may identify fetuses crossing centiles as outlined in the Delphi criteria for late-onset FGR diagnosis.[15] Declining fetal growth velocity between 20 and 36 weeks has been associated with all indicators of placental insufficiency, defined as abnormal MCA Dopplers, low umbilical artery pH, small placental size and low neonatal body fat stores.[48] The use of fetal growth velocity and serial fetal biometry measurements appears promising in high risk pregnancies to improve FGR detection rates.[47]

Significant risk factors (Odds Ratio of >2 for developing FGR) that may prompt serial fetal biometry assessment in the third trimester include previous FGR pregnancy, previous stillbirth, pre-existing hypertension, pre-existing diabetes mellitus, renal impairment, antiphospholipid syndrome, maternal age >40 years, current pregnancy induced hypertension or pre-eclampsia, current smoker of >10 cigarettes per day, maternal cocaine use and a BMI of greater than 35 or where clinical measurement of fetal size is limited due to maternal habitus.[49] There is a paucity of data on the ideal timing of serial growth scans in detecting FGR in high risk populations, however one study showed four to six weekly intervals were superior to two weekly intervals in predicting fetuses with FGR.[50]

The Hadlock equation for the estimation of sonographic fetal weight estimation should be used for calculating estimated fetal weight.[51] This is based on measurements of the abdominal circumference (AC), head circumference (HC) and femur length (FL) and using the formula Log10 weight =1.326 – 0.00326*AC*FL + 0.0107*HC + 0.0438*AC + 0.158*FL.[5 52] A recent systematic review found Hadlock-3 to be the most accurate in estimating fetal weight compared to birth weight.[53] The addition of biparietal diameter measurement to calculate the Hadlock-4 formula can also be used. An EFW below the 10th centile is concerning for suboptimal fetal growth, recognising the limitations of this arbitrary cut-off to inform perinatal outcome and the multitude of formulae to calculate EFW.

Fetal Growth Charts

Customisation charts of fetal growth takes into account maternal constitutional variation such as ethnicity (although this is often self-reported), height, weight, parity and has been proposed by some centres as a more appropriate identification of fetal growth restriction.[14] Customised fetal growth charts may even be preferred to universal charts in some countries.[54] Their use in helping to improve pregnancy outcomes has been the subject of several recent studies.[19]

A prospective, non-randomised, controlled, population-based study of 1272 women reported customised fundal height growth charts had a higher antenatal detection of SGA babies compared to standard fundal height charts (48% vs 29%, OR 2.2, 95% CI 1.1-4.5).[55] The introduction of the Growth Assessment Protocol (GAP) in some units in England was reported to lead to a lower incidence of stillbirth compared to units who had not implemented GAP in a ten year review of stillbirths and SGA ($p<0.05$).[56] However, these studies all provided low quality evidence. A recent randomised control trial (2022) including 13 maternity units in England showed no effect of GAP on antenatal detection of SGA compared to standard care.[57]

A recent FIGO position paper reviewed two other recently published growth charts – the Intergrowth-21st and WHO charts.[58 59] The Intergrowth-21st charts assessed fetal growth by prospectively collecting data from healthy well-nourished populations in eight geographically defined urban populations with no maternal or fetal risk factors.[58] Gestational age-appropriate measurements and size at birth were designed to be an estimate of normal growth under ideal conditions. The Intergrowth authors found no significant differences between geographical areas, suggesting that differences between ethnic groups are largely a result of environmental and nutritional factors, which is strong evidence against customisation. However, using the Intergrowth-21st chart, only 2-3% of infants in high income countries will be found to be SGA, compared to 50% of cases in India. The overall difference in birthweights was reported to be as high as 20%.[54]

The concern with customised growth charts is the potential normalisation of pathological growth restriction, leading to an under detection of FGR.[9] Using maternal height, weight or parity in customisation are problematic because underweight, shorter, and first time mothers all have both smaller babies and higher perinatal mortality. As discussed previously, detection of FGR is crucial to reduce adverse perinatal outcomes. Future research is required to support the use of customised growth charts compared to population based fetal growth charts such as Hadlock. It is therefore important be aware that while a variety of customised growth charts have been developed, there are disadvantages to their use. The benefit of using customised growth charts to detect FGR and reducing perinatal morbidity and mortality is yet to be proven.[9 15 40 60]

Clinical Practice

Symphysis-fundal height is a useful tool in primary screening for FGR in the antenatal setting. This measurement is taken from the upper border of the symphysis pubis vertically to the fundus of the uterus with the woman lying in a recumbent position with an empty bladder. A SFH greater than 2cm less than gestational age in weeks should prompt referral for a fetal biometry ultrasound evaluation.

There should be a clear, consistent and well publicised referral pathways in place from primary care settings when FGR is suspected. Prompt referral to the attending maternity unit/hospital should take place to organise sonographic assessment of fetal size.

There should be a low threshold for referral for sonographic assessment of fetal weight if there is any difficulty in clinically assessing fetal size by SFH for example because of maternal obesity, multiple fibroids or a history or suspicion of polyhydramnios.

Routine growth ultrasound assessment should be offered to women with a history of FGR or significant risk factors for FGR. Depending on risk factors, severity and/or timing of onset of previous FGR, this can be commenced from 26-28 weeks' gestation. The interval between serial scans should be individualised to each case. Limited evidence shows no benefit in repeating these scans more frequently than four to six weekly intervals. Ultimately, this plan should be customised based on intervals deemed appropriate by the managing clinician.

Third trimester growth ultrasound scans should not be routinely offered to women in the absence of risk factors for FGR or clinical concerns. Although routine third trimester ultrasound in women with no risk factors for FGR improves detection rates, it has not been shown to improve perinatal mortality, preterm birth less than 37 weeks or caesarean section rates and therefore does not confer any benefit to mother or baby.

The Hadlock-3 equation for the estimation of sonographic fetal weight estimation should be used for calculating estimated fetal weight.

A variety of customised growth charts exist but the benefit of their use in detecting FGR and reducing perinatal morbidity and mortality compared to population-based growth charts such as Hadlock is yet to be proven.

Recommendations

4. **Symphysis-fundal height can be used as a primary screening method for FGR in the antenatal setting in women classified as normal-risk with a BMI between 18.5 and 24.9. There should be a low threshold for sonographic assessment if there is any difficulty in clinically assessing fetal size, for example because of maternal obesity, multiple fibroids or a history or suspicion of polyhydramnios.**
5. **We recommend that women with a history of FGR or significant risk factors for FGR undergo serial sonographic evaluation of fetal weight, DVP and UAD. The timing of these scans should be individualised but there is no evidence of benefit in repeating these more frequently than every four to six weeks.**
6. **Clinicians should be aware that significant risk factors for FGR may include previous stillbirth, pre-existing hypertension, pre-existing diabetes mellitus, renal impairment, antiphospholipid syndrome, maternal age >40 years, current pregnancy induced hypertension or pre-eclampsia, current smoker of >10 cigarettes per day, maternal cocaine use and a BMI of greater than 35 or where clinical measurement of fetal size is limited due to maternal habitus.**
7. **Third trimester growth ultrasound scans should not be routinely offered to women in the absence of significant risk factors for FGR or clinical concerns. From current evidence, they do not confer any benefit to mother or baby.**
8. **We recommend the use of population based fetal growth charts such as the Hadlock equation and growth chart for estimation of fetal weight.**

Section 3: Diagnosis

Clinical Question 2.4:
What are the essential steps when first assessing fetal growth restriction?

Evidence Statement

History

All women with suspected FGR should have a thorough history taken, the aim of which is to help identify the aetiology of FGR.[22] Confirmation of gestational age is important. Other than pregnancies achieved by assisted reproductive technology (ART), the crown-rump length (CRL) measurement between 11+2 and 14+0 weeks' gestation is the optimal tool for dating the pregnancy.[61 5] However, in the presence of a known last menstrual period (LMP) and regular 28 day cycle, the gestational age based on LMP can be accepted if calculated to be within five days of the CRL measurement. Pregnant women who present for their first ultrasound scan beyond 14 weeks should have an estimation of gestational age devised from measurement of the head circumference, biparietal diameter and femur length.[61] Pregnancies resulting from ART should use the ART derived gestational age. Any interpretation of fetal weight in relation to gestational age relies on accurate dating of pregnancies.

Screening for Congenital Infection

Maternal serum screening for congenital infections such as cytomegalovirus (CMV) should also be considered at this time. If CMV is suspected, CMV PCR can be requested if an amniocentesis is done.[19] A maternal serum TORCH screen to detect Toxoplasmosis, CMV, Rubella and Herpes Simplex Virus (HSV) can be considered. However, recent studies show the diagnostic yield of TORCH screening, especially in cases of isolated FGR, is low.[62] A systematic review which included 2538 pregnancies who underwent a TORCH screen for an ultrasound abnormality detected 26 cases of congenital CMV, of which 15 had multiple ultrasound abnormalities. No cases of congenital Toxoplasmosis, Rubella or HSV were found.[63] Toxoplasmosis, Syphilis, Rubella, HSV, Malaria or Zika virus screening should therefore only be done if other risk factors for these are present as the diagnostic yield in the population without risk factors is low.[7 19]

Ultrasound

A detailed ultrasound scan should be done at the time of diagnosis, including amniotic fluid index (AFI) or deepest vertical pool (DVP) measurement and umbilical artery Doppler studies. Abnormality of Doppler measurements suggest an underlying placental dysfunction leading to FGR but can also be seen in certain genetic conditions.[64] Serial monitoring of UAD over time is important as initial measurement of this may be normal, especially in late-onset FGR.[5] A review of fetal anatomy should be considered in cases of severe early-onset FGR.

Detailed ultrasound assessment of the placental morphology can also be considered but is not routinely encouraged at present outside of research settings. This should include placental size, shape and cord insertion.[5] Sonographic features of maternal vascular malperfusion (MVM) include a small placenta and abnormal uterine artery Doppler waveforms.[26 65]

The presence of any additional concerning sonographic features such as polyhydramnios, oligohydramnios, structural abnormalities or soft markers should raise the possibility of an underlying chromosomal or genetic abnormality.[5] Input from a Maternal Fetal Medicine specialist should be considered in these cases.

Prenatal Testing

Invasive prenatal diagnostic testing by amniocentesis should be offered to women especially in cases of early-onset FGR, severe FGR with an EFW <3rd centile, if congenital anomalies are present on ultrasound, soft markers seen on ultrasound, polyhydramnios or if there are no obvious signs of placental dysfunction.[19] Studies have shown the prevalence of a genetic syndrome can approach 12% and is increased in cases of early-onset FGR.[66 67 68 69] Tests to consider include karyotype, microarray and PCR for infectious agents deemed applicable given history and findings.[5]

NIPS screens for the most common aneuploidies and is not a diagnostic test. Reassurance is limited due to the wider range of genetic disorders that are associated with FGR.[70 71] If not already done in the pregnancy, NIPS should not be routinely considered when FGR is diagnosed on ultrasound and should not be used as a substitute to amniocentesis in these cases.[66 69]

Clinical Practice

All women with suspected FGR should have a thorough history taken, the aim of which is to help identify the aetiology of FGR. As well as reviewing maternal demographics, this should include risk factors for FGR, infectious or toxin exposures, travel history and family history.

Confirmation of gestational age is important. Other than pregnancies achieved by ART, gestational age should be confirmed using the CRL measurement before 14 weeks' gestation or the LMP calculated gestational age if the woman has a regular 28-day cycle and there is a discrepancy of less than five days from the CRL assigned dates.

A detailed ultrasound scan should be done at the time of FGR detection including a review of fetal growth, DVP and Doppler studies to include UAD. A review of fetal anatomy should be done in cases of severe early-onset FGR.

Input from a Maternal Fetal Medicine specialist should be sought in cases of severe early-onset FGR <3rd centile, early-onset FGR with abnormal UAD or if there is evidence of any additional concerning sonographic features such as polyhydramnios, oligohydramnios, structural anomalies or soft markers.

Due to the increased prevalence of genetic syndromes or infectious aetiologies in these cases, invasive prenatal diagnostic testing can be offered for karyotyping, microarray and/or PCR for infectious agents. NIPS should not be routinely considered when FGR is diagnosed on ultrasound and should not be used as a substitute to amniocentesis in these cases.

After a Fetal Medicine review and in the event of sonographic and neonatal support availability locally to adequately monitor these cases and provide expert care in the event of a preterm delivery, care can be transferred back to the referring hospital for ongoing surveillance and delivery.

Screening for congenital infections such as CMV testing can also be considered at this time. Screening for Toxoplasmosis, Syphilis, Rubella, HSV, Malaria or Zika virus should only be done if risk factors for these are present. The diagnostic yield in the population without risk factors is low.

Recommendations

9. All women with FGR should have a thorough history taken at the time of its detection. This should include the identification of modifiable risk factors such as smoking and alcohol use.
10. Women should have a detailed ultrasound scan at diagnosis to review fetal biometry, DVP and UAD. A review of fetal anatomy should be carried out in cases of severe early-onset FGR.
11. Input from a Maternal Fetal Medicine specialist should be sought in cases of severe early-onset FGR <3rd centile, early-onset FGR with abnormal UAD, or if there is evidence of any additional concerning sonographic features such as polyhydramnios, oligohydramnios, structural anomalies or soft markers. The intention of this review is to counsel and guide further investigations, offer invasive testing and instigate a fetal surveillance management plan going forward. Subsequent to this, in the event of sonographic and neonatal support availability locally to adequately monitor these cases and provide expert care in the event of a preterm delivery, care can be transferred back to the referring hospital for ongoing surveillance and delivery.
12. Maternal screening for congenital infections such as CMV testing can also be considered with additional viral screens requested if relevant risk factors are identified.

Section 4: Management

Clinical Question 2.5:
What is the recommended management pathway for fetal growth restriction?

Evidence Statement

The onset and severity of FGR should inform the management. The aim of this management is to initiate an appropriate fetal surveillance system to maximise gestation age while trying to avoid adverse perinatal outcomes.

As discussed earlier, select cases of severe early-onset FGR should be managed with input from Maternal Fetal Medicine specialists and ideally within a centre with appropriate neonatal support. This may include cases of severe early-onset FGR with an EFW or AC <3rd centile or early-onset FGR with abnormal UAD measurements.

Due to the association of early-onset FGR and hypertensive disorders of pregnancy, regular monitoring of blood pressure and urinary protein levels is recommended in these women.[6]

Fetal Biometry

Assessment of fetal biometry should be undertaken every 2 weeks combined with amniotic fluid measurement and relevant Doppler assessments. The Hadlock equation should be used for calculating estimated fetal weight.[51]

Umbilical Artery Doppler

Abnormal UAD is strongly associated with adverse perinatal outcome.[11] A Cochrane review in 2017 showed the use of UAD examination in high risk pregnancies was associated with fewer perinatal deaths (RR 0.71, 95% CI 0.52-0.98, 16 studies, 10,225 babies, evidence graded moderate).[72] Conversely, the routine measurement of UAD in low risk pregnancies does not offer any benefit to mother or baby.[72] The progression of UAD is variable. In the PORTO study of 1116 FGR fetuses, the mean time from diagnosis to delivery in increased resistance, AEDF and REDF was 26, 13 and 4 days respectively.[73]

If UAD PI measurements are normal and the EFW is 3rd-9th centile, UAD measurement every 2 weeks is reasonable. If the UAD demonstrates increased resistance (PI >95th centile) or the EFW is <3rd centile, UAD should be done weekly or more frequently if deemed necessary by the managing clinician.[19 5] A prospective observational study of FGR, the median time of progression from increased resistance in the UAD to further abnormalities was 7-33 days (median of 14 days), depending on timing of onset and the degree of placental insufficiency.[18]

If there is AEDF in the UAD prior to 34 weeks' gestation, twice weekly UAD and DVP measurement is recommended in the absence of any other indication for delivery.[19] The median interval for further fetal deterioration is five days. The risk of stillbirth is 6.8%, giving a weighted odds ratio for stillbirth of 3.6 (2.3-5.6).[5]

If there is REDF in the UAD prior to 30 weeks' gestation, three times per week UAD and DVP measurement is recommended in the absence of any other indication for delivery.[74 19] The median interval for further fetal deterioration is two days. The risk of stillbirth is 19%, giving a weighted odds ratio for stillbirth of 7.3 (4.6-11.4).[5] Inpatient management should be considered with daily CTG monitoring.[5]

Middle Cerebral Artery (MCA) Doppler

In late-onset FGR, the MCA PI or MCA/UAD PI ratio (cerebroplacental ratio or CPR) is sometimes considered to be a helpful measurement in identifying fetal deterioration as an adjunct to UAD.[75 76 77] This is because in late-onset FGR, the UAD may remain normal even in the presence of placental dysfunction, thus making the detection and management of such cases challenging.[6] MCA Dopplers have been shown to be accurate in the detection of FGR due to maternal vascular malperfusion.[78] The association of an abnormal CPR in predicting adverse perinatal outcome in FGR has been shown in the multicentre PORTO study of 881 cases (odds ratio 11.7 p<0.001).[79] In one retrospective study, which analysed 978 singleton pregnancies complicated by FGR, ten stillbirths occurred after 34 weeks' gestation and these were all associated with MCA redistribution on the last ultrasound scan prior to fetal death.[74]

A reduction in the CPR occurs as a response to fetal hypoxaemia due to cerebral vasodilation or the brain sparing effect in FGR. In the event of an abnormal MCA Doppler and in the absence of other indications for delivery, some studies suggest that consideration can be given to increasing surveillance to twice weekly as the median interval from abnormal MCA Doppler to further deterioration is four to five days.[5 74]

There is still limited evidence to support the use of MCA Dopplers routinely in predicting adverse perinatal outcomes.[80 76] Although a meta-analysis published in 2017, which included a database search up to June 2016, reported that CPR can add value to UAD in assessment in the prediction of adverse perinatal outcomes, it is unclear which group this should be applied to due to a high risk of bias and substantial heterogeneity found in the included studies.[81] In another systematic review and bivariate meta-analysis, abnormal MCA Doppler had a low likelihood ratio for prediction of perinatal mortality (LR 1.36 1.10-1.67) and adverse perinatal outcome (LR 2.77 1.93-3.96).[82] Both papers advised that before incorporating CPR into routine FGR management, RCTs were needed to assess its use in clinical practice.

Although MCA Doppler measurement is a useful adjunct in identifying late-onset FGR, there is insufficient evidence at present to recommend the routine use of MCA Dopplers for FGR management or deciding on appropriate timing of delivery. Evidence to date is limited to observational studies. The effectiveness of CPR in guiding clinical management needs to be further studied before routine surveillance is recommended.[19 6]

Ductus Venosus (DV) Doppler

DV Doppler is an important indicator of the optimal timing of delivery in early-onset FGR with abnormal UAD.[83 84] Abnormalities in the DV Doppler occur due to progressive dilation of the DV isthmus to increase blood flow towards the fetal heart, therefore making it an important measure of fetal cardiovascular adaption to hypoxaemia.[6] Persistent abnormality of the DV (absent or reversed a-wave) should prompt the consideration of delivery.[6 85] DV Doppler is a better predictor of fetal acidaemia when compared to computerised CTG (cCTG) or CTG monitoring before 32 weeks' gestation.[86 87] It is associated with a normal outcome at two years when used as an indication for delivery in early-onset FGR compared to CTG abnormalities.[88]

In a retrospective analysis of 171 study participants, the duration of absent or reversed a-wave in DV was a strong predictor of stillbirth that was independent of gestational age. In the stillbirth group, the median time from DV reversed or absent a-wave to stillbirth was six days (range 1-45 days).[19 89] The median interval of time for deterioration of DV Dopplers can be as short as two days. In the absence of an indication for delivery, consideration should be given to measurement three times weekly if DV Dopplers are abnormal.[5] The weighted odds ratio of absent or reversed DV a-wave for fetal death is 11.6 (95% CI 6.3-19.7) with a 20% risk of stillbirth in absent a-wave and 46% risk of stillbirth if reversed a-wave. This risk of fetal mortality outweighs the risk of prematurity after 28 weeks' gestation.[5] Although it is important for timing of delivery in early-onset FGR with abnormal UAD, further research is needed to identify the use of routine DV Doppler measurement surveillance in all cases of FGR.[19]

Amniotic Fluid Assessment

Amniotic fluid can either be assessed by measuring the AFI or the DVP.[90] However, the use of AFI increases the rate of diagnosis of oligohydramnios and the rate of induction for oligohydramnios, without an improvement in peripartum outcomes.[91] The SAFE trial comparing AFI to DVP in 1002 pregnancies demonstrated that neither is superior in predicting adverse pregnancy outcomes. There was no difference in NICU admission (4.2% vs 5.0%; RR 0.85 (95% CI 0.48–1.50); p=0.57) or the rate of arterial pH less than 7.10 (1.6% vs 3.0%; RR 0.54 (95% CI 0.23–1.26); p=0.15). When using AFI, there were more cases diagnosed with oligohydramnios (9.8% vs 2.2%; RR 4.51 (95% CI 2.37–8.57); p<0.01) and more labour inductions for oligohydramnios (12.7% vs 3.6%; RR 3.50 (95% CI 1.76–6.96); p<0.01).[91]

An earlier Cochrane review which included five trials and 3226 women supported these findings. There was no difference in NICU admission (RR 1.04; 95% CI 0.85-1.26), an umbilical artery pH of less than 7.10, the presence of meconium, an Apgar score of less than 7 at five minutes or caesarean delivery. Again, when AFI was used, significantly more cases of oligohydramnios were diagnosed (RR 2.39, 95% CI 1.73-3.28) and more women had an induction of labour (RR 1.92; 95% CI 1.50-2.46) and caesarean delivery for fetal distress (RR 1.46; 95% CI 1.08-1.96).[92] Similar results have also been shown in other studies including studies involving high risk pregnancies.[93 94]

AFI or DVP can be reported as centimetres or percentile for gestation. For DVP, the largest vertical pocket free of umbilical cord or fetal parts should be measured. A DVP >2 centimetres and ≤8 centimetres is considered to be a normal amniotic fluid level. Reference values for gestational age can also be used. AFI measurement of between 8 and 25 cm before 37 weeks and between 5 and 25cm after 37 weeks is considered to be normal.[95]

There is a paucity of data on the role of amniotic fluid assessment in timing of delivery in FGR or its ability to independently predict perinatal mortality in non-anomalous SGA fetuses who are monitored with UAD. 7 The PORTO study of 1100 pregnancies noted amniotic fluid abnormalities did not independently increase the risk of adverse outcomes in FGR and was only significant when combined with an EFW <3rd centile.[2] However, current international guidelines would suggest delivery between 34 and 37 weeks for FGR associated with oligohydramnios.[19]

Biophysical profile

The five component biophysical profile (BPP) is composed of an assessment of fetal body movements, fetal breathing movements, fetal tone, CTG and AFI/DVP. This is done over a 30-minute ultrasound observation of the fetus. The modified BPP is composed of an assessment of amniotic fluid assessment and CTG. The rate of stillbirth in the week following a normal BPP is 0.8/1000.[5] A BPP score of zero is associated with a umbilical venous pH of less than 7.20.[96]

Studies in preterm FGR suggest BPP is not an accurate predictor of fetal acidaemia and it has false negative rates approaching 11% in this group.[97] [86] The duration of reassurance proved by BPP is difficult to determine, especially in cases of early-onset FGR.[97] A Cochrane review of five trials and 2974 women showed there was insufficient evidence from randomised trials to support the use of BPP as an assessment of fetal wellbeing in high-risk pregnancies. Delivery based on an abnormal BPP is associated with a higher caesarean section rate (RR 1.60, 95% CI 1.05-2.44 p=0.03) without a difference in perinatal death (RR 1.33, 95% CI 0.60-2.98)[98]

In addition, due to the number of factors that can influence a BPP, its findings alone should not be used in isolation to monitor the fetus or to decide on timing of delivery. Due to the lack of evidence of the use of BPP in predicting both fetal deterioration and the rate of progression of fetal acidaemia, there are differences in practice regarding its use for fetal monitoring.[99] Although a normal BPP can be reassuring for the clinician, it is not recommended for routine fetal surveillance in the preterm FGR infant, particularly less than 32 weeks' gestation, and should not be relied upon solely to time delivery.[7]

Cardiotocograph

The goal of antenatal fetal heart rate surveillance is to reduce the risk of stillbirth.[100] A normal CTG is a strong marker of the absence of fetal hypoxaemia. Although it is not highly specific for fetal hypoxia, it has a negative predictive value of 99.8% for risk of stillbirth in an unselected population within one week.[5] Although a Cochrane review of antenatal CTG showed no clear evidence that antenatal CTG improves perinatal outcome in pregnancies, this encompassed low or very low quality evidence from the 1980's-1990's and recommended further studies focusing on the use of CTG in populations of women with increased risk of complications.[101] Consideration should be given to CTG monitoring in FGR, particularly in the event of associated abnormalities such as oligohydramnios, abnormal Dopplers or plateauing of growth.[102] The recommended minimum duration of an antenatal CTG is twenty minutes, once all features of a normal trace are seen during this time.[103]

Interpretation of CTGs in fetuses less than 26 weeks' gestation is difficult due to the immaturity of the fetal brain and has not been proven to be reliable.[104] CTG monitoring should therefore be done daily from 26 weeks, or at a gestational age that would trigger intervention, in singleton pregnancies with AEDF or REDF. Implementation of daily fetal monitoring can reduce the rate of stillbirth to less than 1% in these cases, with up to 31% of fetuses delivered based on an abnormal CTG between serial Doppler scans.[5] Consideration should be given to inpatient management if this cannot be facilitated on an outpatient basis. Limitations in CTG interpretation due to inter-observer variations in classification which can result in an increase in interventions should be acknowledged.[105]

Diet and exercise

The optimal gestational weight gain to decrease the risk of adverse obstetric and neonatal outcomes is dependent on pre-pregnancy BMI. Recommended levels are as follows: 4-10kg for BMI <20, 2-10kg for BMI 20-24.9, <9kg for BMI 25-29.9 and <6kg for BMI>30.[106] Insufficient gestational weight gain, especially in women with a BMI less than 18.5 is associated with an increased risk of FGR.[5] Is it reasonable therefore to refer this group of women for a nutritional assessment in the event of a diagnosis of FGR.

The benefits of exercise in pregnancy include a higher incidence of vaginal delivery, and a lower incidence of excessive gestational weight gain, gestational diabetes mellitus, gestational hypertensive disorders, preterm birth, caesarean birth, LGA and SGA.[107] [108] Exercises that have been studied extensively and found to be safe in pregnancy include walking, stationary cycling, aerobic exercise, dancing, resistance exercise, stretching exercises and hydrotherapy.[109] Guidelines recommended women undertake 30 minutes of moderate exercise on most days of the week in uncomplicated pregnancies.[108] There is a paucity of advice for women who are at risk of pregnancy complications. A study within the Danish National Birth Cohort between 1996 and 2002 did not indicate any sizeable effects on fetal growth measures related to exercise apart from a modest reduction of SGA and LGA infants.[110] A systematic review showed maternal physical activity during pregnancy has minimal implications on neonatal adiposity.[111] Another systematic review and meta-analysis of 135 studies of high-quality evidence showed a 39% reduction in fetal macrosomia in women who exercised during pregnancy compared to those who did not, without increasing the odds of a growth restricted, preterm or low birth weight infant. Exercise was not associated with any neonatal complications or adverse childhood outcomes.[112] Vigorous exercise in the third trimester is also not associated with any significant difference in birthweight.[113] [114]

Psycho-social support

Clinicians should acknowledge the psychological impact on women and partners of a pregnancy complicated by FGR. This is true at any gestation but can be particularly challenging in the management of cases in the peri-viable period where the risk of perinatal mortality and morbidity is high and decisions around delivery timing and resuscitative efforts after delivery have to be made.[115]

Where possible, it is advantageous that women are managed on an outpatient basis. A prolonged hospital admission in FGR is associated with a 32.9% prevalence of depressive symptoms, most notably seen in early-onset FGR and women who smoke.[116] This is compared to a background rate of depression in pregnancy of approximately 12%.[117] [118] A cross-sectional qualitative study on women's' feelings of a prolonged admission to hospital during pregnancy reported emotions of shock, worries and anxiety related to the pregnancy, self-blame for the consequences of hospitalisation on the family and the need for professional emotional support.[119]

Clinical Practice

Once FGR has been diagnosed, a fetal biometry ultrasound should be done every 2 weeks with AFI/ DVP and UAD measurement.

If the UAD demonstrates increased resistance (PI >95th centile) or the EFW is <3rd centile, UAD should be done weekly or more frequently if deemed necessary by the managing clinician.

If there is AEDF in the UAD prior to 34 weeks' gestation, twice weekly UAD and DVP measurement is recommended.

If there is REDF in the UAD prior to 30 weeks' gestation, three times per week UAD and DVP is recommended in the absence of any other indication for delivery. Inpatient management should be considered with daily CTG monitoring. Referral to a tertiary level unit with appropriate neonatal care should be considered, if not provided locally.

The timing of Doppler studies may be also influenced by other factors such as plateauing of growth or oligohydramnios. Consideration should be given to increasing surveillance to twice weekly in these instances in the absence of an indication for delivery.

It is reasonable that DV Doppler assessment be done in cases of early-onset FGR in the presence of abnormal UA Dopplers. DV Doppler measurement is an important indicator of the optimal timing of delivery in these cases and their persistent abnormality should prompt the consideration of delivery. If DV Dopplers are abnormal and in the absence of an indication for delivery, consideration should be given to measurement three times weekly. In the absence of DV Doppler assessment facilities locally, input or review by a Maternal Fetal Medicine specialist should be requested to help guide management in these cases.

In cases of late-onset FGR, the MCA/UAD PI or CPR is sometimes considered to be a helpful adjunct to UAD in identifying late-onset FGR. However, there is currently insufficient evidence to recommend the routine use of MCA Doppler measurement in FGR surveillance or deciding on appropriate timing of delivery. The absence of MCA Doppler assessment facilities in a local unit does not need to prompt direct referral to a tertiary unit, due to the insufficient evidence to support its routine use. In these instances, management with UAD and DVP assessment is considered sufficient. Each unit should have a local standardised protocol for the use of MCA Dopplers in the management of FGR.

It is reasonable to recommend DVP measurement over AFI measurement for the assessment of amniotic fluid in FGR pregnancies.

Although there is a paucity of data on the role of amniotic fluid assessment in timing of delivery in FGR or its ability to independently predict perinatal mortality, current international guidelines suggest delivery between 34 and 37 weeks for FGR associated with oligohydramnios.

Although a normal BPP can be reassuring for the clinician, it is not recommended for routine fetal surveillance in the preterm FGR fetus, particularly less than 32 weeks' gestation, and should not be relied upon solely to time delivery.

Daily CTG monitoring after 26 weeks, or at a gestational age which would trigger intervention, should be considered when there is AEDF or REDF in the UAD.

Women with a BMI less than 18.5, especially in the event of insufficient gestational weight gain and a diagnosis of FGR should be referred for a nutritional assessment.

As there is no evidence of fetal harm from exercise in pregnancy, it is reasonable to advise women that continuing low to moderate intensity exercise for 30 minutes most days of the week is considered safe. Women and partners with a pregnancy affected by FGR should be offered support by staff and provided with contact details for further supportive care, if desired. Consideration of referral to the medical social work counselling team should be given, especially in the event of a prolonged hospital admission.

Recommendations

13. We recommend fetal biometry, DVP and UAD measurement is done every 2 weeks if UAD measurements are normal and EFW >3rd centile.
14. We suggest weekly UAD measurements if UAD PI >95th centile or EFW <3rd centile.
15. We recommend twice weekly UAD measurement if there is AEDF in the UAD in the absence of any other indication for delivery. Twice weekly UAD measurements can also be considered on a case-by-case basis in the presence of plateauing of growth, oligohydramnios or other fetal concerns.
16. We recommend UAD measurement three times per week if there is REDF in the UAD in the absence of any other indication for delivery.
17. DV Doppler measurement can be used as an indicator of the optimal timing of delivery in severe early-onset FGR with abnormal UAD. If not done locally, this should prompt consideration for referral to a Maternal Fetal Medicine specialist.
18. Although the MCA/UAD PI ratio (CPR) can be a helpful adjunct to UAD measurement to identify late-onset FGR, there are limited data to support its routine use in FGR surveillance or appropriate timing of delivery at present. The absence of MCA Doppler assessment facilities in a maternity unit / hospital does not need to prompt referral to a tertiary unit / hospital, due to the insufficient evidence to support its routine use.
19. We recommend using DVP for the assessment of amniotic fluid in FGR pregnancies.
20. Although a normal biophysical profile (BPP) is reassuring for the clinician, BPP is not recommended in isolation for routine fetal surveillance particularly in early-onset FGR and should not be relied upon solely to time delivery.
21. Daily CTG monitoring after 26 weeks, or at a gestational age which would trigger intervention, should be considered when there is AEDF or REDF in the UAD.
22. It is reasonable to advise women that continuing low to moderate intensity exercise during pregnancy for 30 minutes most days of the week is considered safe in FGR pregnancies.
23. Women and partners with a FGR affected pregnancy should be offered support by staff and provided with contact details for further supportive care, if desired. Consideration of referral to the social work counselling team should be given, especially in the event of a prolonged hospital admission.

Section 5: Delivery

Clinical Question 2.6:
What is the optimal timing of delivery in FGR pregnancies?

Evidence Statement

The optimal timing of delivery in FGR is a complex decision and the clinician must balance risks of prematurity against the fetal exposure to hypoxaemia and acidaemia.[85] Decisions regarding the optimal timing of delivery need to be made on an individual basis and may require the involvement of an experienced obstetrician or Maternal Fetal Medicine specialist, in particular in severe or very preterm FGR. Involvement of the Neonatology team to form a multi-disciplinary approach to management is also important.

From 24-28 weeks' gestation, there is a 2-4-fold increase in neonatal mortality in FGR compared to non-FGR babies. During this stage, each day of pregnancy prolongation results in a 2% decrease in neonatal death as well as major neonatal morbidities. Neonatal death further decreases by 0.7% daily from 28-30 weeks, after which time neonatal survival is in excess of 90%.[5]

Timing of Delivery

Delivery should be considered no later than 39+0 weeks if the EFW is 3rd-9th centile with normal UAD and no plateauing of growth.[6 19 5] Induction of labour for FGR at this gestation is not associated with an increased rate of operative vaginal delivery, caesarean section or adverse neonatal outcome.[120] The rate of stillbirth doubles each week after 39 weeks if the pregnancy is continued.[5]

Although abnormal CPR is associated with increased adverse perinatal outcome in late-onset FGR, its use to plan timing of delivery has yet to be proven. International guidelines would suggest it is reasonable to consider delivery at 37-39 weeks in the presence of late-onset FGR and an abnormal CPR.[6] However, this cut off should not be used in isolation.

Delivery should be considered by 37+0 weeks if EFW<3rd centile or UAD PI >95th centile.[19 5] Delivery by 37 weeks in these cases is associated with a lower rate of stillbirth compared to delivery at 38 weeks. (RR of stillbirth at 38 weeks versus 37 weeks 2.3; 95% CI 1.4-3.8).[121] Studies have shown that a higher proportion of stillbirths in FGR occur in the severe FGR group, defined as <3rd centile, or particularly the <1st centile group.[6]

Delivery should be considered between 34-37 weeks in cases of FGR with early Doppler changes or mild associated abnormalities such as oligohydramnios or suboptimal interval growth.[5] Although there is a paucity of data on the role of AFI measurement in management and timing of delivery, international guidelines would suggest delivery between 34-37 weeks for FGR associated with oligohydramnios is reasonable.[11 19]

Delivery should be considered by 34+0 weeks if there is AEDF in the UAD.[6 19] Earlier delivery may be indicated in cases of poor interval growth or a deterioration in sonographic values. The risk of stillbirth is higher than the risk of infant mortality at 33-34 weeks for AEDF.[19]

Delivery should be considered by 32+0 weeks if there is AEDF in the UAD with abnormal DV measurements. The TRUFFLE study was a prospective, European multicentre, unblinded, randomised study which included women with singleton fetuses at 26-32 weeks' gestation who had very preterm FGR with an AC <10th centile and UAD PI >95th centile. It showed that timing of delivery based on late changes in the DV waveform (absent or reversed a-wave) compared to computerised CTG changes

might produce an improvement in developmental outcomes at 2 years of age without any significant difference in perinatal and infant mortality.[122]

Delivery should occur by 30+0 weeks in REDF.[5] Earlier delivery may be indicated in cases of deterioration of sonographic variables or based on results of other methods of evaluation of fetal well-being. The perinatal morbidity and mortality associated with continuing a pregnancy with REDF are higher than complications of prematurity at 30-32 weeks.[19]

Persistent abnormality of the DV (absent or reversed a-wave) accompanied by an abnormal UAD should prompt the consideration of delivery between 26-30 weeks.[5 6] The rate of stillbirth is 20% risk if there is an absent a-wave and 46% if reversed a-wave. This risk outweighs the risk of prematurity after 28 weeks' gestation.[5]

Delivery should be considered at any time for any maternal indication. This may include but is not limited to pre-eclampsia, HELLP syndrome or any obstetric emergency warranting delivery.[6]

Delivery should be considered at any time after 26 weeks if spontaneous repeated decelerations are present on CTG as this is a strong marker for fetal hypoxaemia and acidaemia.[6]

Delivery before 26+0 should be personalised based on multi-disciplinary discussion with obstetrics, neonatology and the woman due to the poor neonatal outcomes before 26 weeks.[6] Neonatal survival in early-onset FGR requiring delivery increases from 13% at 24 weeks to 43% at 25 weeks to 58-76% at 26 weeks. Intact survival, defined as survival without cerebral palsy or neurosensory impairment, increases from 0% at 24 weeks to 13% at 25 weeks and 6-31% at 26 weeks.[19 8 123]

Antenatal Corticosteroid Administration

Antenatal Corticosteroids should be given at less than 35+0 weeks and only if delivery is anticipated within the next week.[124 125] Appropriate timing of corticosteroids to reduce neonatal morbidity and mortality is crucial. The greatest benefit of corticosteroids is seen within 1-7 days after administration.[126]

Administration of corticosteroids in SGA preterm neonates 1-7 days before birth was associated with a decreased odds of neonatal morbidity and mortality in one retrospective cohort study of 918 neonates in neonatal units in Canada between 2010 and 2014.[127] This was also shown to be the optimal time of administration in a Swedish prospective cohort study of 591 infants and the Effective Perinatal Intensive Care in Europe (EPICE) study of 4594 infants.[128 129] Therefore, corticosteroids should not be given unless there is substantial concern or indication for delivery within the next week.

A systematic review and meta-analysis of 13 studies including 6387 preterm SGA infants indicated antenatal corticosteroid administration reduced neonatal mortality (12.8% vs 15.1%; pooled odds ratio 0.63; 95% CI 0.46-0.86, p=0.011). There was no significant difference in neonatal morbidity including respiratory distress syndrome, necrotising enterocolitis, intraventricular haemorrhage and periventricular leukomalacia.[130] The administration of corticosteroids can cause a transient improvement in the return of UAD end diastolic flow, a change seen for a median range of 3 days.[131]

Magnesium Sulphate Administration

The administration of magnesium sulphate by intravenous infusion for fetal neuroprotection should follow the same protocol used in pregnancies not affected by FGR and given if less than 32+0 weeks and delivery is anticipated within the next 24 hours.[132–134] This should consist of a 4 gram intravenous bolus over 15 minutes, followed by an intravenous infusion of 1 gram per hour until the birth or for 24 hours, whichever is sooner.[135] In animal studies, fetal blood magnesium concentration levels rose after two hours of maternal infusion and resulted in increased magnesium concentrations in the fetal forebrain

after four hours.[136] Neonatal magnesium sulphate levels remain elevated for up to 24 hours.[137] It is therefore recommended that magnesium sulphate is commenced as close as possible to four hours before birth if birth is planned.[137]

The administration of magnesium sulphate pre-delivery, especially prior to 30 weeks' gestation, is associated with a reduced odds of composite death and significant neurodevelopmental impairment in FGR fetuses (adjusted odds ratio 0.42; 95% CI 0.22-0.89).[134]

There is insufficient evidence available at present to inform management of women who do not deliver and may require repeated doses of magnesium sulphate. However, as neonatal magnesium levels remain elevated for 24 hours, it is reasonable to repeat infusion if 24 hours have lapsed since the cessation of a prior infusion.[137] Administration of magnesium sulphate for longer than 5-7 days in pregnancy may be associated with adverse fetal effects including hypocalcaemia, skeletal demineralisation, osteopaenia and other skeletal effects.[138] If prolonged or repeated doses of magnesium sulphate are given during the pregnancy, consideration should be given to neonatal monitoring of calcium and magnesium levels as well as skeletal adverse effects.[138]

Intrapartum Management

The location of delivery should ideally take place in a centre with appropriate neonatal care available. A Neonatology consult should be sought once regular fetal surveillance has been instigated and certainly when the woman has been admitted for daily monitoring or if there is a plan for delivery.[23]

Caesarean section is not routinely indicated for FGR but can be considered if any maternal indication is present, abnormal CTG, DV abnormalities, reduced BPP, UAD REDF or AEDF, early gestations or when the chance of a vaginal delivery is thought to be low.[5] For women undergoing induction of labour, the preferred method to soften and open the cervix remains unclear. In a recent meta-analysis of cervical ripening for induction of labour in FGR or SGA pregnancies, mechanical methods seemed to be associated with a lower occurrence of adverse intrapartum outcomes. However, they were unable to compare groups directly and commented that there was limited evidence available for analysis.[139] In the event of labour or induction of labour, continuous CTG monitoring once contractions have started is advised with a low threshold for caesarean section.[5]

After delivery, arterial and venous cord blood pH should be recorded for all FGR infants. The placenta should be sent for histological examination to identify any associated placental pathology.[65 140 141]

Clinical Practice

Delivery should occur no later than 39+0 weeks' gestation if the EFW is 3rd-9th centile with normal Dopplers and no plateauing of growth.

Delivery should be considered by 37+0 weeks if the EFW<3rd centile or UAD PI >95th centile. Delivery can be considered by 37-39 weeks if the MCA Doppler is pathological.

Delivery should be considered between 34-37 weeks in FGR with early Doppler changes or associated abnormalities such as oligohydramnios or suboptimal interval growth.

Delivery should occur by 34+0 weeks in AEDF. Earlier delivery may be indicated in cases of poor interval growth or a deterioration in sonographic values.

Delivery should occur by 30+0 weeks in REDF. Earlier delivery may be indicated in cases of deterioration of sonographic variables.

Delivery should be considered between 26-30 weeks if absent or reversed DV a-wave with an abnormal UAD.

Delivery should occur at any time for any maternal indication. This may include pre-eclampsia, HELLP syndrome or any obstetric emergency warranting delivery.

Delivery should occur at any time after 26 weeks if abnormal CTG findings such as spontaneous repeated decelerations or fetal bradycardia

Delivery before 26 weeks' gestation should be personalised based on discussion with the woman, and obstetrics and neonatology teams.

A course of antenatal corticosteroids should be strongly recommended where preterm delivery is anticipated between 24+0 and 34+6 weeks.

A course of 24 mg of dexamethasone phosphate, or alternatively 24 mg of betamethasone phosphate, should be administered intramuscularly in two divided doses of 12 mg, given 24 hours apart. Administration of the second dose after a 12 hour interval may be considered when delivery is imminent.

The administration of magnesium sulphate for fetal neuroprotection should follow the same protocol used in pregnancies not affected by FGR and given if less than 32+0 weeks and delivery is anticipated.

Caesarean section is not routinely indicated for FGR but can be considered if any maternal indication is present, abnormal CTG, DV abnormalities, reduced BPP, UAD REDF or AEDF, in early gestations or when the chance of a vaginal delivery is thought to be low. For women undergoing induction of labour in FGR pregnancies, the preferred method of cervical ripening remains unclear.

The placenta should be sent for histological examination. The woman should be informed that the placenta is sent for histological examination and the reasoning for this.

Table 2: Summary of indications for delivery

Delivery Gestation	Delivery Indication
No later than 39+0	EFW 3rd-9th centile, normal UAD, no plateauing of growth
No later than 37+0	EFW <3rd centile or UAD PI >95th centile
Consider 34+0-37+0	FGR with UAD PI >95th centile and oligohydramnios or suboptimal interval growth
No later than 34+0	UAD AEDF
No later than 30+0	UAD REDF
Consider 26+0-30+0	Abnormal UAD and abnormal DV waveform
Consider after 26+0	Abnormal CTG
Any gestation	Maternal indication for delivery

Recommendations

24. We suggest delivery no later than 39+0 weeks if the EFW is 3rd-9th centile with normal Dopplers and no plateauing of growth.
25. We recommend delivery by 37+0 weeks if the EFW <3rd centile or UAD PI >95th centile. Delivery between 34-37 weeks can be considered if there are other mild associated abnormalities such as oligohydramnios or suboptimal interval growth.
26. We recommend delivery by 34+0 weeks in AEDF. Earlier delivery may be indicated in cases of suboptimal interval growth or a deterioration in sonographic values.
27. We recommend delivery by 30+0 weeks in REDF. Earlier delivery may be indicated in cases of suboptimal interval growth or deterioration of sonographic variables.
28. Delivery should be considered between 26-30 weeks if there is absent or reversed a-wave in DV Dopplers with an abnormal UAD.
29. We recommend delivery at any time for any maternal indication in FGR pregnancies.
30. We recommend delivery in the fetal interest at any time after 26 weeks if abnormal CTG findings such as spontaneous repeated decelerations or fetal bradycardia.
31. Delivery before 26+0 weeks in the fetal interest should be individualised based on discussion with the woman, obstetrics and neonatology teams due to the guarded neonatal outcomes at this gestation.
32. We strongly recommend the administration of a course of timed antenatal corticosteroids, ideally within seven days of delivery, if delivery is anticipated at a gestational age of between 24+0 and 34+6 weeks.
33. A course of antenatal corticosteroids should consist of 24 mg of dexamethasone phosphate, or alternatively 24 mg of betamethasone phosphate, administered intramuscularly in two divided doses of 12 mg, given 24 hours apart. Administration of the second dose after a 12 hour interval may be considered when delivery is imminent.
34. Magnesium sulphate for fetal neuroprotection should be administered if less than 32 weeks' gestation and delivery is anticipated.
35. We recommend sending the placenta for histological examination after delivery in FGR pregnancies.

Section 6: Subsequent Pregnancy

Clinical Question 2.7:
What postpartum follow up should women with FGR pregnancies have, including advice for future pregnancies?

Evidence Statement

Postnatal Counselling

All women who have given birth to a growth restricted infant should be offered postnatal support and the opportunity for follow-up discussion, if desired. Due to the higher risk of recurrence and impact on future pregnancies, women who have experienced an adverse perinatal outcome as a result of FGR (for example a preterm delivery or perinatal loss) should routinely be offered an appointment for postnatal counselling, review of placental histology and investigation of underlying causes.[142–144] Women should be counselled on the risk of recurrence based on timing of onset, severity of FGR and placental histological findings.[5] Quantifying this risk can be difficult due to the multiple risk factors for FGR that can be present.[145] A population-based study over twenty years showed a recurrence rate of 24.3%, compared to 6% of women with no history of FGR (OR 3.9; 95% CI 3.7-4.0). This was found to be incrementally proportional to the severity of FGR, with an odds ratio of 5.7 if the EFW was <5th centile.[146]

Placenta histological examination

Histopathological examination of the placenta is strongly recommended in all cases where FGR is diagnosed to understand the underlying causes and guide management in a subsequent pregnancy.[147] A range of placental pathologies can result in FGR.[147] Some of these may be associated with recurrence risks that require specific therapy. MVM has a recurrence rate of approximately 10%.[6] Other pathologies, although rarer, have a higher recurrence rate compared to MVM. Villitis of unknown aetiology has a recurrence rate of 10-37%. Massive perivillous fibrinoid deposition and chronic intervillositis have a recurrence rate of up to 70%. Consideration of additional medical treatments such as heparin or hydroxychloroquine in addition to aspirin can be given in these cases. Recurrence of fetal vascular malperfusion features such as cord compression resulting in thrombosis of vascular tree is minimal.[65]

Modifiable risk factors

Addressing modifiable risk factors postpartum is vital, not only as a risk reducing strategy for future pregnancies, but also for future maternal health.[148 145 149] Complications of pregnancy related to a FGR baby are associated with an increased risk of ischaemic heart disease in the mother.[150] Adverse pregnancy outcomes including preeclampsia, pregnancy induced hypertension, gestational diabetes mellitus and FGR are emerging as important future maternal cardiovascular risk factors.[149 151 152]

Optimising body mass index (BMI) should also be advised.[153] Health professionals should use any opportunity to provide women with a BMI of 30 or more information on the health benefits of losing weight.[154] The RCOG recommends that all women of childbearing age are given advice on weight and lifestyle pre-conceptually to encourage women to optimise their weight before future pregnancies.[153] Weight loss prior to subsequent pregnancies additionally reduces the risk of stillbirth, hypertensive conditions, fetal macrosomia, caesarean section and venous thromboembolism.[153] Conversely, women with a BMI or less than 18.5 should have a nutritional assessment to optimise BMI as this is also associated with an increased risk of FGR.[155]

Women should be informed that smoking, alcohol and/or illicit drug use cessation decreases the risk of FGR.[156 157] Many studies have shown the strong association of smoking with FGR.[158 159] A systematic review of the impact of maternal smoking on fetal measurements showed it was associated with reduced fetal measurements after the first trimester.[160] Smoking cessation information is therefore very important to impart both postpartum and pre-conceptually. Adherence to pharmacological nicotine replacement therapy regimens in pregnant women is generally low.[161 162] Therefore, emphasis on a multi-disciplinary team approach to provide smoking cessation support in these women may be a more suitable approach.[163] Consideration may be given to a social work referral to aid smoking, alcohol and/or illicit drug use cessation.

Management in subsequent pregnancies

In cases of placenta-mediated FGR, aspirin 150 mg is recommended in future pregnancies to reduce the risk of FGR recurrence, to be commenced prior to 16 weeks' gestation.[32] This is particularly important if MVM features were present on placental histology or there is a history of pre-eclampsia.[65] There is no evidence to support the routine use of low molecular weight heparin (LMWH) in subsequent pregnancies, as it does not seem to reduce the risk of recurrent placenta-mediated pregnancy complications in at-risk women.[164 5] In patients at high risk of a serious adverse pregnancy outcome owing to placental disease, the addition of LMWH to aspirin prophylaxis in the early second trimester may restore deficient circulating placental growth factor to mediate an improved perinatal outcome. However, further research is needed in this area.[165]

There is a weak association between inherited thrombophilia and placenta mediated pregnancy complications such as FGR.[166] The association between antiphospholipid antibodies and FGR is also weak and conflicting, despite preterm birth before 34 weeks due to pre-eclampsia or placental insufficiency incorporated in the consensus criteria for antiphospholipid syndrome.[5 167] In addition, although LMWH has beneficial effects in reducing the risk of recurrent miscarriage in antiphospholipid syndrome, there is no evidence to date that it improves outcomes in placenta related pregnancy complications such as FGR.[5] As a result, maternal thrombophilia testing is not routinely indicated unless there is a history of a maternal thromboembolic event or recurrent early pregnancy loss.[23]

Women should be managed in the specialised care pathway, in a consultant led clinic in subsequent pregnancies with regular sonographic surveillance of fetal growth commencing from 26-28 weeks or earlier if indicated by history.[22]

Clinical Practice

All women who have given birth to a growth restricted infant should be offered postnatal support and the opportunity for follow-up discussion, if desired.

Due to the higher risk of recurrence and impact on future pregnancies, all women who have experienced an adverse perinatal outcome as a result of FGR (for example a preterm delivery or perinatal loss) should be offered a postnatal appointment. This visit should include postnatal counselling, review of placental histology and further investigation of underlying causes and a discussion on risk recurrence and modifiable risk factors, if deemed to be relevant.

Risk of recurrence in future pregnancies can be discussed. Women can be informed that recurrence risk of FGR is approximately 25%. However, this may differ depending on placental histology findings.

This is an opportunity to identify any modifiable risk factors, such as obesity, smoking, alcohol consumption and illicit drug use. Addressing these risk factors prior to planning a future pregnancy can help decrease the risk of FGR recurrence. The role of commencing aspirin 150 mg daily prior to 16 weeks in future pregnancies to reduce the risk of FGR recurrence can also be discussed.

Women should be informed that they will be managed in a consultant led clinic in subsequent pregnancies with regular sonographic surveillance commencing from 26-28 weeks or earlier, depending on clinical history including the onset and severity of FGR.

Recommendations

36. All women who have had a pregnancy affected by FGR should be offered postnatal support and the opportunity for follow-up discussion, if desired.
37. Due to the higher risk of recurrence and impact on future pregnancies, all women who have experienced an adverse perinatal outcome as a result of FGR (for example a preterm birth or perinatal loss) should be offered an appointment for postnatal counselling, review of placental histology, investigation of underlying causes and a discussion on risk recurrence and modifiable risk factors, if applicable.
38. We recommend that women are managed in a consultant led clinic in subsequent pregnancies with regular sonographic surveillance of fetal growth.

Chapter 3: Development of Clinical Practice Guideline

3.1 Literature search strategy

A comprehensive literature review was undertaken which included national and international publications.

The guidelines on fetal growth restriction from five international bodies, thought to be most applicable to the Irish population, were selected for review; Society for Maternal-Fetal Medicine Consult Series #52: Diagnosis and management of fetal growth restriction (2020)[19], ISUOG Practice Guidelines: diagnosis and management of small-for-gestational-age fetus and fetal growth restriction (2020)[6], FIGO (International Federation of Gynaecology and Obstetrics) initiative on fetal growth: best practice advice for screening, diagnosis, and management of fetal growth restriction (2021)[5], RCOG Green-top Guideline No. 31: Small-for-Gestational-Age Fetus, Investigation and Management[7] and SOGC Clinical Practice Guideline No. 422: Fetal Growth Restriction: Screening, Diagnosis and Management in Singleton Pregnancies.[23] One professional body updated their guidelines during the review process and this new evidence was included in the guideline. See Appendix 3 for comparison of clinical practice guidelines on FGR.

Beyond the review of clinical guidelines, the search strategy with regard to the available and current literature depended on the nature of the clinical question to be addressed. This search was conducted in July-August 2022 and included papers up to this date. Medline, PubMed, and the Cochrane Database of Systematic Reviews were searched looking for relevant studies. Terms used included “fetal growth”, “fetal growth restriction”, “intra-uterine growth restriction”, “low birth weight”, “small for gestational age”, “umbilical artery Doppler”, “middle cerebral artery Doppler” and “ductus venosus Doppler”, both independently and in combination. Reference lists from key papers were searched by hand. Searches were limited to human studies and the English language. A further literature search was undertaken by the primary author in March 2024 to ensure the evidence was up to date.

3.2 Appraisal of evidence

Following a comprehensive literature review the quality, validity and relevance of the evidence gathered were critically appraised by the Guideline developers under the following headings:

- Study design
- Relevance of primary and secondary outcomes
- Consistency of results across studies
- Magnitude of benefit versus magnitude of harm
- Applicability to practice context.

A number of evidence-based recommendations for management of FGR were agreed upon. They have been developed/adapted from other international guidelines to reflect care in the Irish healthcare setting.

3.3 AGREE II process

While being developed, the Guideline was assessed using the AGREE II checklist (Appendix 4) as recommended by the Department of Health in the 'How to Develop a National Clinical Guideline: a manual for guideline developers', 2019.[22]

The purpose of AGREE II is to provide a framework to:

1. Assess the quality of guidelines;
2. Provide a methodological strategy for the development of guidelines; and
3. Inform what information and how information ought to be reported in guidelines.

3.4 Literature review

Details of supportive evidence-based literature for this Guideline are reported throughout Chapter two.

The Guideline committee met to consider and agree on the clinical questions to be addressed. GMcM conducted a comprehensive literature review. GMcM, BMcD and DM divided the clinical questions to be answered and researched these areas independently. The Guideline committee met regularly to discuss recommendations for each area. Where there was no evidence to support certain recommendations, these were made based on group consensus and committee expertise. The final draft of the Guideline was reviewed by all members.

3.5 Grades of recommendation

GRADE offers a transparent and structured process for developing and presenting evidence summaries and for carrying out the steps involved in developing recommendations.[23]

While we acknowledge that for this particular work an extensive GRADE approach is not possible, we have used the suggested language set out in the GRADE table when making recommendations.[24] (Appendix 5)

3.6 Future research

An important outcome of the Guideline development process is in highlighting gaps in the evidence base. Although FGR is common, the management of fetal surveillance and delivery is still challenging.

22 Department of Health (2019). How to develop a National Clinical Guideline: a manual for guideline developers. Available at: https://www.gov.ie/en/collection/cd41ac-clinical-effectiveness-resources-and-learning/

23 Guyatt, Gordon, et al. "GRADE Guidelines: 1. Introduction—GRADE Evidence Profiles and Summary of Findings Tables." Journal of Clinical Epidemiology, vol. 64, no. 4, 2011, pp. 383–94, https://doi.org/10.1016/j.jclinepi.2010.04.026

24 SMFM adopts GRADE (Grading of Recommendations Assessment, Development, and Evaluation) for clinical guidelines. Society for Maternal-Fetal Medicine (SMFM), Chauhan SP, Blackwell SC. Am J Obstet Gynecol. 2013 Sep;209(3):163-5. doi: 10.1016/j.ajog.2013.07.012. PMID: 23978245 https://pubmed.ncbi.nlm.nih.gov/23978245/

The questions of relevance to this Guideline include:

- Optimal timing of fetal growth surveillance in women with a history of FGR or risk factors for FGR.
- The role of specialist antenatal care in subsequent pregnancy after FGR.
- Establishing the use of MCA Dopplers in FGR. This could include use in diagnosing FGR, optimal timing for fetal surveillance, the role in deciding on the timing of delivery and whether incorporation into clinical practice improves perinatal outcomes.
- Methods to improve detection rates of FGR, using existing tests and monitoring procedures (and/or novel tests) and especially in populations without risk factors.
- The use of customisation of fetal growth charts in clinical practice and improvement in outcomes for FGR.
- Genetic aetiologies associated with FGR.
- The role of aspirin in the prevention of FGR in women with a history of FGR or risk factors for FGR, and associated outcomes, along with optimal dosing regimens.

Chapter 4: Governance And Approval

4.1 Formal governance arrangements

This Guideline was written by the Guideline developers under the direction of the Guideline Programme Team (GPT). An Expert Advisory Group was formed to review the Guideline prior to submission for final approval with the National Women and Infants Health Programme. The roles and responsibilities of the members of each group and their process were clearly outlined and agreed.

4.2 Guideline development standards

This Guideline was developed by the Guideline Developer Group (GDG) within the overall template of the HSE National Framework[25] for developing Policies, Procedures, Protocols and Guidelines (2023) and under supervision of the Guideline Programme Team.

A review was conducted by a group of experts, specialists and advocates (the EAG) prior to approval by the Clinical Advisory Group (CAG) of the National Women and Infants Health Programme (NWIHP) with final sign off for publication by CAG Co-Chairs, the Clinical Director of NWIHP and the Chair of the IOG. See appendix 6 for list of CAG members.

25 Health Service Executive (2023). How to develop HSE National Policies, Procedures, Protocols and Guidelines (PPPGs).

Chapter 5: Communication and Dissemination

A communication and dissemination plan for this Guideline has been developed by the GPT and endorsed by NWIHP.

Effective ongoing clear communication is essential in explaining why the Guideline is necessary and securing continued buy-in. It provides an opportunity to instil motivation within staff, helps overcome resistance to change and gives an opportunity for feedback.[26]

The Clinical Guideline will be circulated and disseminated through the Guideline Programme Team as well as through the professional networks who participated in developing and reviewing the document.

Senior management within the maternity units are responsible for the appropriate dissemination of new and updated guidelines. Local hospital groups including Guideline committees are also instrumental in the circulation of new and updated guidelines and promoting their use in the relevant clinical settings.

The HSE will make this Guideline available to all employees through standard networks as well as storing it in the online PPPG repository. Electronic versions available on the NWIHP https://www.hse.ie/eng/about/who/acute-hospitals-division/woman-infants/clinical-guidelines/ and RCPI websites (https://www.rcpi.ie/faculties/obstetricians-and-gynaecologists/national-clinical-guidelines-in-obstetrics-and-gynaecology/) and other communication means can be used to maximise distribution. The NWIHP website aims to provide a training webinar introducing each Guideline and where relevant a downloadable version of the recommended algorithm will be available.

26 Department of Health (2018). NCEC Implementation Guide and Toolkit. Available at: https://www.gov.ie/en/collection/cd41ac-clinical-effectiveness-resources-and-learning/?

Chapter 6: **Implementation**

6.1 Implementation plan

Implementation was considered at the beginning, and throughout the Guideline development process. The local multidisciplinary clinical team, senior executive and clinical management in each maternity and gynaecology unit are ultimately responsible for the appropriate structured adoption and implementation of the Guideline within their area of responsibility. They must ensure that all relevant personnel under their supervision have read and understood the Guideline and monitor both its effectiveness and adoption.

Within each site, local multidisciplinary teams are responsible for the clinical implementation of Guideline recommendations and ensuring that their local clinical practices and processes reflect and are aligned with the Guideline recommendations.

The following have been put in place to help facilitate the implementation of this Guideline.

- Quick Summary Document (QSD) for clinical staff (includes key recommendations, auditable standards, algorithms and recommended reading)
- Clinical Guideline mobile application
- Plain language summary

6.2 Education plans required to implement the Guideline

There should be a formal launch of the guideline for national awareness followed by presentations in each unit to identify service and knowledge gaps and formalise an appropriate and achievable implementation plan at a local level. It is acknowledged that this Guideline should be complemented by ongoing education, training and assessment where required, particularly in advanced Doppler measurements. It is essential to provide support for ongoing professional development.

6.3 Barriers and facilitators

To ensure successful implementation of guidelines, it is first necessary to look at potential barriers and facilitators. Taking these into account when developing the implementation plan should improve levels of support from relevant users. (DOH 2018, 2019)

Barriers may be categorised as internal (specific to the Guideline itself) or external (specific to the clinical environment).

The Guideline Development Group has aimed to address any internal barriers during the development of this Guideline.

Potential external barriers include:

- Structural factors (e.g. budget or service redesign)
- Organisational factors (e.g. lack of facilities or equipment)
- Individual factors (e.g. knowledge, skills, training)
- Woman's perceptions

In the case of this Guideline, it will be necessary to examine possible barriers and consider implementation strategies to address them. By example, this may include discussion with relevant management groups with regards budgetary impact or providing training to the relevant staff.

In the case of this Guideline only units with appropriate obstetric and neonatal expertise will be able to provide all investigations and levels of management as described for FGR. This may include access to specific Doppler assessments, prenatal diagnosis or levels of neonatal care available. There is a discrepancy in both the availability of and access to NIPS nationally. Access for invasive prenatal testing is limited to the tertiary centres with Maternal Fetal Medicine sub-speciality providers.

The national shortage of sonography staff may be a significant and increasing barrier to the delivery of fetal growth surveillance in the third trimester in women with a history of FGR, significant risk factors for FGR or a BMI in which clinical assessment of fetal size is difficult. This is also a growing concern due to the increasing prevalence of obesity in the antenatal population in Ireland. In this instance, fetal growth surveillance may be limited to a bedside ultrasound scan done by a clinician, which is not ideal and not best practice.

Additional funding may be needed in each maternity unit to allow for additional ultrasound machines and staff training to facilitate adequate fetal surveillance.

6.4 Resources necessary to implement recommendations

The implementation of this Guideline should be undertaken as part of the quality improvement of each hospital. Hospitals should review existing service provision against this Guideline, identifying necessary resources required to implement the recommendations in this Guideline.

Chapter 7: Audit and Evaluation

7.1 Introduction to audit

It is important that both implementation of the Guideline and its influence on outcomes are audited to ensure that this Guideline positively impacts on the care of the woman. Institutions and health professionals are encouraged to develop and undertake regular audits of Guideline implementation. Personnel tasked with the job of conducting the audit should be identified on receipt of the most recent version of the Guideline.

7.2 Auditable standards

Audit using the key recommendations as indicators should be undertaken to identify where improvements are required and to enable changes as necessary. Audit should also be undertaken to provide evidence of continuous quality improvement initiatives.

Suggested auditable standards for this Guideline include:

1. Number of women attending for a booking ultrasound scan by 14 weeks' gestation.
2. Number of women with a previous history of placenta mediated FGR or PET commencing low-dose aspirin therapy by 16 weeks.
3. Number of women with a history of FGR referred for fetal growth assessment.
4. Adherence to the Guideline's recommended ultrasound biometry and Doppler measurement schedule.
5. Number of women who received antenatal corticosteroids within one week of delivery if less than 35+0 weeks' gestation.
6. Number of women offered a postnatal visit if they experienced an adverse perinatal outcome as a result of FGR.

7.3 Evaluation

Evaluation is defined as a formal process to determine the extent to which the planned or desired outcomes of an intervention are achieved.[27]

Implementation of this Guideline will be audited periodically at national level, with standards for this set by the NWIHP. Evaluation of the auditable standards should also be undertaken locally by senior hospital clinical management to support implementation.

27 Health Information Quality Authority (2012). National Standards for Safer Better Healthcare [Internet]. Available from: https://www.hiqa.ie/reports-and-publications/standard/national-standards-safer-better-healthcare

Chapter 8: Revision Plan

8.1 Procedure for the update of the Guideline

It may be a requirement to amend, update or revise this Guideline as new evidence emerges. This Guideline will be reviewed at national level every three years, or earlier if circumstances require it, and updated accordingly.[28]

The Guideline Development Group will be asked to review the literature and recent evidence to determine if changes are to be made to the existing Guideline. If the Guideline Development Group are unavailable, the GPT along with the NWIHP senior management team will select a suitable expert to replace them.

If there are no amendments required to the Guideline following the revision date, the detail on the revision tracking box must still be updated which will be a new version number and date.

The recommendations set out in this Guideline remain valid until a review has been completed.

8.2 Method for amending the Guideline

As new evidence become available it is inevitable that Guideline recommendations will fall behind current evidence based clinical practice. It is essential that clinical guidelines are reviewed and updated with new evidence as it becomes available.

In order to request a review of this Guideline one of the following criteria must be met:

a) 3 years since the Guideline was published

b) 3 years since last review was conducted

c) Update required as a result of new evidence

Correspondence requesting a review of the Guideline should be submitted to the National Women and Infants Health Programme. Any such requests should be dealt with in a timely manner.

28 Health Service Executive (2023). How to develop HSE National Policies, Procedures, Protocols and Guidelines (PPPGs).

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Supporting Evidence

GRADE: http://www.gradeworkinggroup.org/

AGREE: http://www.agreetrust.org/agree-ii/

HSE: https://www.hse.ie/eng/about/who/qid/nationalframeworkdevelopingpolicies/

Glossary
(for the Purpose of this Guideline)

AC Abdominal circumference

ACOG American College of Obstetricians and Gynaecologists

AEDF Absent end-diastolic flow

AFI Amniotic fluid index

AGREE Appraisal of Guidelines for Research and Evaluation

ART Artificial reproductive technology

BMI Body mass index

BPP Bio-physical profile

CAG Clinical Advisory Group

CMV Cytomegalovirus

CPR Cerebro-placental ratio

CRL Crown-rump length

CTG Cardiotocograph

DV Ductus venosus

DVP Deepest Vertical Pool

EAG Expert Advisory Group

EFW Estimated fetal weight

FGR Fetal Growth Restriction

GDG Guideline Developer Group

GPT Guideline Programme Team

GRADE Grading of Recommendations, Assessments, Developments and Evaluations

HIQA Health Information and Quality Authority

HSE Health Service Executive

IOG Institute of Obstetricians and Gynaecologists

IUGR Intra-uterine growth restriction

FIGO International Federation of Gynaecology and Obstetrics

LGA Large for Gestational Age

MCA Middle cerebral artery

MVM Maternal vascular malperfusion

NCEC National Clinical Effectiveness Committee

NICE The National Institute for Health and Care Excellence

NICU Neonatal Intensive Care Unit

NIPS Non-invasive prenatal screening

NWIHP National Women and Infants Health Programme

PCR Polymerase Chain Reaction

PI Pulsatility Index

PPPG Policy, Procedures, Protocols and Guidelines

RCOG Royal College of Obstetricians and Gynaecologists

RCPI Royal College of Physicians of Ireland

RCT Randomised control trial

REDF Reversed end-diastolic flow

SFH Symphysis-fundal height

SGA Small for gestational age

TORCH Toxoplasmosis, Other infections Rubella, Cytomegalovirus, and Herpes simplex virus

UAD Umbilical Artery Doppler

Appendix 1:
Expert Advisory Group Members 2024

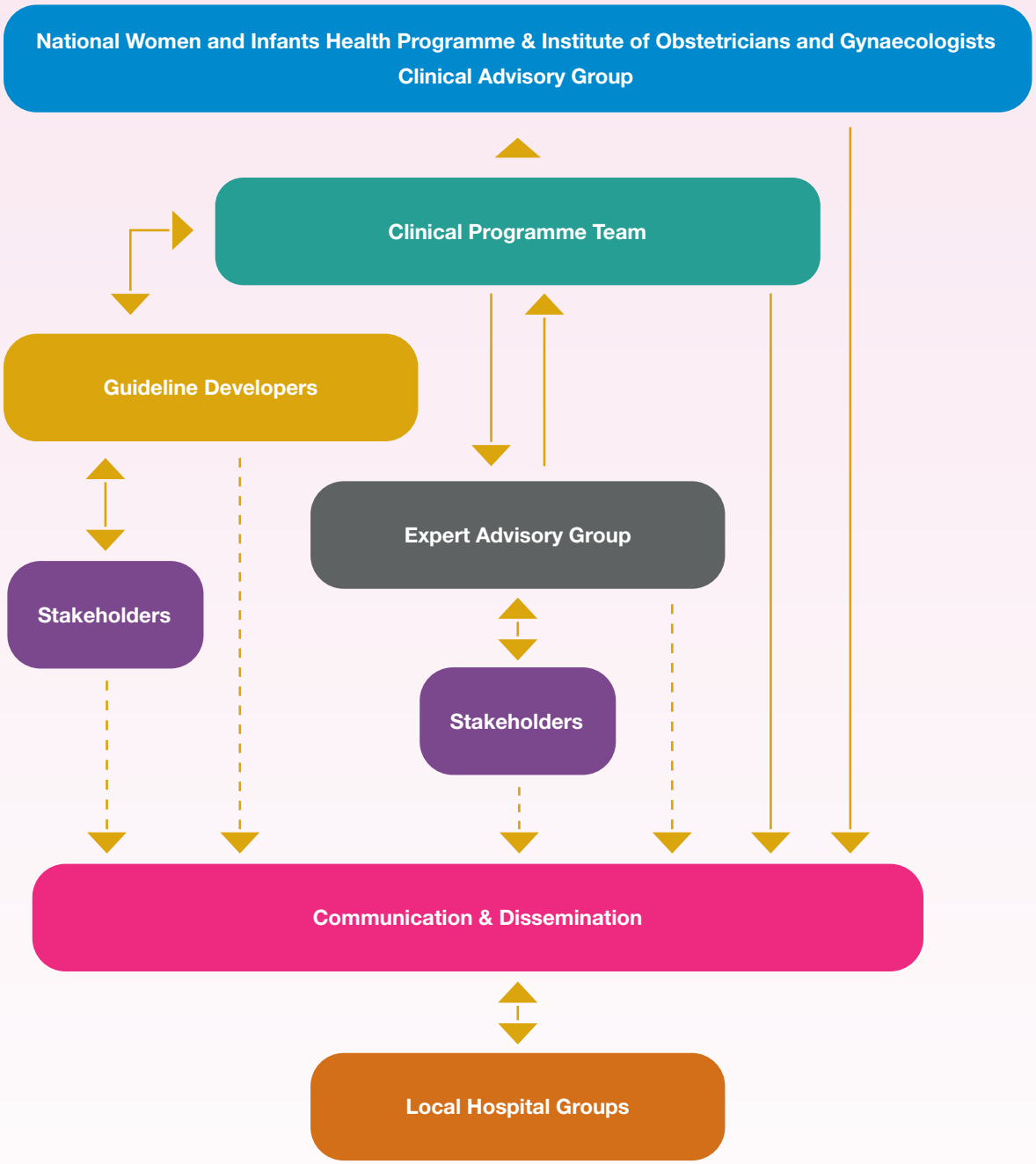
Member	Profession	Location
Dr Mairead Butler	Consultant Obstetrician and Gynaecologist	University Hospital Waterford
Dr Nicholas Barrett	Consultant Anaesthesiologist, Lead for Obstetric Anaesthesiology services	Limerick University Hospital
Dr Venita Broderick	Consultant Obstetrician and Gynaecologist	National Maternity Hospital Dublin
Ms Siobhan Canny	Group Director of Midwifery	Saolta University Health Care Group
Ms Triona Cowman	Director of the Centre for Midwifery Education	Centre for Midwifery Education, Coombe Women & Infants University Hospital
Ms Marie Culliton	Lab Manager/Chief Medical Scientist	National Maternity Hospital Dublin
Ms Niamh Connolly-Coyne *and* **Ms Mandy Daly**	Board of Directors Members *(Shared nomination)*	Irish Neonatal Health Alliance
Ms Sinéad Curran	Dietician Manager	National Maternity Hospital
Dr Niamh Conlon	Consultant Histopathologist	Cork University Hospital
Ms Georgina Cruise	Service Manager	Patient Advocacy Ireland
Dr Orla Donohoe	Specialist Registrar, Obstetrics and Gynaecology and SWEC Fellow	St George Hospital, Sydney, Australia
Ms Alana Dineen	Senior Clinical Pharmacist	Cork University Maternity Hospital
Prof Maeve Eogan	Consultant Obstetrician and Gynaecologist National Clinical Lead SATU (HSE)	Rotunda Hospital Dublin
Dr Brendan Fitzgerald	Consultant Perinatal Pathologist	Cork University Hospital
Dr Daniel Galvin	Specialist Registrar, Obstetrics and Gynaecology	Cork University Maternity Hospital

Member	Profession	Location
Ms Stacey Grealis	Patient Research Partner	Independent Living Movement Ireland
Ms Fiona Hanrahan	Director of Midwifery and Nursing	Rotunda Hospital Dublin
Ms Laura Harrington	Principal Medical Social Worker	National Maternity Hospital Dublin
Ms Marita Hennessy	Post-Doctoral Researcher	Pregnancy Loss Research Group, INFANT Centre, University College Cork
Ms Caroline Joyce	Principal Clinical Biochemist PhD Candidate	Cork University Hospital University College Cork
Dr Chaitra Jairaj	Consultant Perinatal Psychiatrist	Coombe Women & Infants University Hospital, Dublin Midland Regional Hospital Portlaoise
Dr Cathy Monteith	Consultant Obstetrician and Gynaecologist	Our Lady of Lourdes Hospital Drogheda
Prof John Murphy	Consultant Neonatologist Clinical Lead for the National Clinical Programme for Paediatrics and Neonatology	National Women and Infants Health Programme
Ms Janet Murphy	Advanced Midwifery Practitioner	University Hospital Waterford
Dr Jill Mitchell	Specialist Registrar, Obstetrics and Gynaecology	Cork University Maternity Hospital
Dr Aisling McDonnell	Specialist Registrar, Obstetrics and Gynaecology	Mater Misericordiae University Hospital Dublin
Dr Ciara McCarthy	General Practitioner ICGP and NWIHP Women's Health Lead	Irish College of General Practitioners
Ms Orla McCarthy	Clinical Specialist Physiotherapist in Pelvic Health	Cork University Hospital
Dr Donough J. O'Donovan	Director Neonatal Intensive Care Unit Consultant Neonatologist / Paediatrician	University College Hospital Galway

Member	Profession	Location
Mr Fergal O' Shaughnessy *and* **Dr Brian Cleary** *(Shared nomination)*	Senior Pharmacist, Honorary Lecturer and Chief Pharmacist, Honorary Clinical Associate Professor and Medications Lead, Maternal & Newborn Clinical Management System	Rotunda Hospital Dublin Royal College of Surgeons in Ireland
Ms Margaret Quigley	National Lead for Midwifery	Office of Nursing and Midwifery Services Director
Dr Gillian Ryan	Consultant Obstetrician and Gynaecologist	University Hospital Galway
Prof Valerie Smith	Chair of Midwifery	University College Dublin
Ms Nora Vallejo	Advanced Midwife Practitioner	Coombe Women & Infants University Hospital, Dublin

Member 2021-2023	Profession	Location
Dr Katherine Astbury	Consultant Obstetrician and Gynaecologist	University Hospital Galway
Dr Richard Duffy	Consultant Perinatal Psychiatrist	Rotunda Hospital Dublin
Ms Clare Farrell	Physiotherapy Manager	Coombe Women & Infants University Hospital, Dublin
Ms Marie Finn	Medical Social Work Counsellor	Saolta University Health Care Group
Prof Declan Keane	Consultant Obstetrician, Gynaecologist, Professor of Obstetrics and Gynaecology	National Maternity Hospital Dublin, Royal College of Surgeons in Ireland
Ms Áine Kelly	Physiotherapy Manager	Coombe Women & Infants University Hospital, Dublin
Dr Fergus McCarthy	Consultant Obstetrician, Gynaecologist	Cork University Maternity Hospital, University College Cork
Dr Sarah Petch	Specialist Registrar, Obstetrics and Gynaecology	National Maternity Hospital Dublin

Appendix 2:
Guideline Programme Process



Appendix 3: **Comparison of Clinical Practice Guidelines on FGR**

	RCOG Green-top Guideline (No.31)	SMFM Practice Bulletin (No. 52)	FIGO Initiative on Fetal Growth	ISUOG Practice Guideline	SOGC Clinical Practice Guideline No. 442
Country	United Kingdom	United States	International	International	Canada
Date	May 2024	May 2020	March 2021	August 2020	October 2023
Name	Investigation and Care of a Small for Gestational Age Fetus and a Growth Restricted Fetus	Diagnosis and Management of Fetal Growth Restriction	Best Practice Advice for Screening, Diagnosis, and Management of Fetal Growth Restriction	Diagnosis and Management of Small-for-Gestational Age Fetus and Fetal Growth Restriction	Fetal Growth Restriction: Screening, Diagnosis and Management in Singleton Pregnancies
Pages	50	16	55	15	26
References	374	177	430	130	157
Definition	SGA: Fetal size <10th% FGR: Fetal size or AC <3rd% or <10th% with Doppler abnormalities	EFW and/or AC <10th% Early <32 weeks Late >32 weeks Severe <3rd%	EFW <10th% with Doppler abnormalities Early >32 weeks Late >32 weeks Delphi consensus	Delphi consensus	Delphi consensus
Customisation	Hadlock-3	Hadlock	Hadlock-3 or local growth chart	No	Hadlock-3

	RCOG Green-top Guideline (No.31)	SMFM Practice Bulletin (No. 52)	FIGO Initiative on Fetal Growth	ISUOG Practice Guideline	SOGC Clinical Practice Guideline No. 442
Management	Offer MFM referral if FGR diagnosed at anomaly USS Biometry 2-weekly	Detailed ultrasound	Detailed history, detailed ultrasound, UAD	Consider MFM referral	Fetal anatomy Consider MFM referral Placenta ultrasound
Amniocentesis	Offer in severe FGR with structural anomalies, consider if non-anomalous and <23/40 and normal uterine Dopplers	If early-onset FGR, sonographic abnormalities, polyhydramnios	If severe early-onset, genetic or infectious sonographic findings, no obvious signs of placental dysfunction	Not mentioned	Early-onset FGR, or additional soft markers, structural abnormalities or polyhydramnios
TORCH	Offer CMV and Toxo if severe FGR	CMV PCR if amnio Otherwise only if risk factors	CMV and Toxo, others if risk factors	Not mentioned	Consider if suspected, CMV most common
UAD	Yes	Yes	Yes	Yes	Yes
MCA	Can inform monitoring, should not be used to time delivery before 37+0	Not routinely used for surveillance	Yes, if late-onset	Yes, not to time delivery	Yes, if UAD abnormal
DV	Yes, in early FGR if UAD abnormal	Not routinely used for surveillance	Yes, use to time delivery <30 weeks	Yes, use to time delivery <32 weeks	Yes, if UAD abnormal
CTG	Yes, cCTG	Yes	Yes	Yes (STV)	Yes (not in isolation)
Amniotic fluid	DVP	DVP	AFI or DVP	Yes	Yes
BPP	Not mentioned	Further research needed	Yes, if non-reactive CTG	Yes, if cCTG not available	Yes (not in isolation)

	RCOG Green-top Guideline (No.31)	SMFM Practice Bulletin (No. 52)	FIGO Initiative on Fetal Growth	ISUOG Practice Guideline	SOGC Clinical Practice Guideline No. 442
Delivery	Maternal indication Spontaneous repeated persistent unprovoked decelerations on CTG: from 26+0	Repetitive late decelerations after viability	Maternal status Abnormal CTG BPP<4/10 cCTG STV <2.6ms	Maternal indications Spontaneous repeated persistent decelerations on CTG BPP <4/10	Maternal indication Abnormal CTG
Timing	EFW 3rd-9th%: 39 weeks UAD PI >95th%: 37+0-37+6 Abnormal MCA/CPR: 37+0-37+6 AEDF or STV<4.5ms: 34+0 REDF or ST <3.5ms: 32+0-33+6 DV a-wave at or below baseline or STV <3.0ms: 29+0-31+6 DV a-wave at or below baseline: 26+0-28+6	EFW 3rd-9th%: 38-39 weeks EFW <3rd%: 37 weeks UAD PI >95th%: 37 weeks AEDF: 33-34 weeks REDF: 30-32 weeks	EFW 3rd-9th%: 37-39 weeks EFW <3rd %: 36-38 weeks UAD PI >95th%, oligo-hydramnios, suboptimal interval growth: 34-37 weeks AEDF: 32 weeks REDF: 30 weeks Abnormal DV: 26-30 weeks	EFW 3rd-10th%: by 39 weeks EFW <3rd% or UAD PI >95th%: 36+0-37+6 Altered CPR: 38+0-39+0 AEDF: 34 weeks REDF: 32 weeks DV a-wave at or below baseline: 26+0-31+6 STV<2.6ms: 26+0-28+6 STV <3.0ms: 29+0-31+6	EFW 3rd-9th: by 39 weeks EFW <3rd%, UAD PI >95th%, abnormal CPR, abnormal BPP or oligo-hydramnios: by 37 weeks AEDF: 32-34 weeks REDF: 30-32 weeks
Steroids	24+0-34+6 Ideally 48 hours before birth anticipated	<34+0 34+0-36+6 if no prior steroids	Same as pregnancies without FGR	<34+0	Yes

	RCOG Green-top Guideline (No.31)	SMFM Practice Bulletin (No. 52)	FIGO Initiative on Fetal Growth	ISUOG Practice Guideline	SOGC Clinical Practice Guideline No. 442
Mag sulphate	Offer 24+0-29+6 Consider up to 33+6	<32+0	Same as pregnancies without FGR	Yes, refer to local guidelines	Same as pregnancy without FGR
Prevention	Smoking cessation, BMI, optimise medical conditions, aspirin	Aspirin if other risk factors	Smoking/ alcohol/ illicit drugs cessation Aspirin 100-150 mg at 12-16 weeks If PET or placenta-mediated FGR	Not mentioned	Smoking cessation Contraception Aspirin 150-162 mg
Postnatal Management	Placenta histology Postnatal counselling	Not mentioned	Placental histology Postnatal education	Not mentioned	Mental health support

Appendix 4: **AGREE II checklist**[29]

AGREE Reporting Checklist 2016

This checklist is intended to guide the reporting of Clinical Practice Guidelines.

CHECKLIST ITEM AND DESCRIPTION	REPORTING CRITERIA	Page #
DOMAIN 1: SCOPE AND PURPOSE		
1. OBJECTIVES *Report the overall objective(s) of the guideline. The expected health benefits from the guideline are to be specific to the clinical problem or health topic.*	☐ Health intent(s) (i.e., prevention, screening, diagnosis, treatment, etc.) ☐ Expected benefit(s) or outcome(s) ☐ Target(s) (e.g., patient population, society)	
2. QUESTIONS *Report the health question(s) covered by the guideline, particularly for the key recommendations.*	☐ Target population ☐ Intervention(s) or exposure(s) ☐ Comparisons (if appropriate) ☐ Outcome(s) ☐ Health care setting or context	
3. POPULATION *Describe the population (i.e., patients, public, etc.) to whom the guideline is meant to apply.*	☐ Target population, sex and age ☐ Clinical condition (if relevant) ☐ Severity/stage of disease (if relevant) ☐ Comorbidities (if relevant) ☐ Excluded populations (if relevant)	
DOMAIN 2: STAKEHOLDER INVOLVEMENT		
4. GROUP MEMBERSHIP *Report all individuals who were involved in the development process. This may include members of the steering group, the research team involved in selecting and reviewing/ rating the evidence and individuals involved in formulating the final recommendations.*	☐ Name of participant ☐ Discipline/content expertise (e.g., neurosurgeon, methodologist) ☐ Institution (e.g., St. Peter's hospital) ☐ Geographical location (e.g., Seattle, WA) ☐ A description of the member's role in the guideline development group	

29 AGREE Reporting Checklist is available on the AGREE Enterprise website, a free and open access resource to support the practice guideline field (www.agreetrust.org)

CHECKLIST ITEM AND DESCRIPTION	REPORTING CRITERIA	Page #
5. TARGET POPULATION PREFERENCES AND VIEWS *Report how the views and preferences of the target population were sought/considered and what the resulting outcomes were.*	☐ Statement of type of strategy used to capture patients'/publics' views and preferences (e.g., participation in the guideline development group, literature review of values and preferences) ☐ Methods by which preferences and views were sought (e.g., evidence from literature, surveys, focus groups) ☐ Outcomes/information gathered on patient/public information ☐ How the information gathered was used to inform the guideline development process and/or formation of the recommendations	
6. TARGET USERS *Report the target (or intended) users of the guideline.*	☐ The intended guideline audience (e.g. specialists, family physicians, patients, clinical or institutional leaders/administrators) ☐ How the guideline may be used by its target audience (e.g., to inform clinical decisions, to inform policy, to inform standards of care)	
DOMAIN 3: RIGOUR OF DEVELOPMENT		
7. SEARCH METHODS *Report details of the strategy used to search for evidence.*	☐ Named electronic database(s) or evidence source(s) where the search was performed (e.g., MEDLINE, EMBASE, PsychINFO, CINAHL) ☐ Time periods searched (e.g., January 1, 2004 to March 31, 2008) ☐ Search terms used (e.g., text words, indexing terms, subheadings) ☐ Full search strategy included (e.g., possibly located in appendix)	
8. EVIDENCE SELECTION CRITERIA *Report the criteria used to select (i.e., include and exclude) the evidence. Provide rationale, where appropriate.*	☐ Target population (patient, public, etc.) characteristics ☐ Study design ☐ Comparisons (if relevant) ☐ Outcomes ☐ Language (if relevant) ☐ Context (if relevant)	

CHECKLIST ITEM AND DESCRIPTION	REPORTING CRITERIA	Page #
9. STRENGTHS & LIMITATIONS OF THE EVIDENCE *Describe the strengths and limitations of the evidence. Consider from the perspective of the individual studies and the body of evidence aggregated across all the studies. Tools exist that can facilitate the reporting of this concept.*	☐ Study design(s) included in body of evidence ☐ Study methodology limitations (sampling, blinding, allocation concealment, analytical methods) ☐ Appropriateness/relevance of primary and secondary outcomes considered ☐ Consistency of results across studies ☐ Direction of results across studies ☐ Magnitude of benefit versus magnitude of harm ☐ Applicability to practice context	
10. FORMULATION OF RECOMMENDATIONS *Describe the methods used to formulate the recommendations and how final decisions were reached. Specify any areas of disagreement and the methods used to resolve them.*	☐ Recommendation development process (e.g., steps used in modified Delphi technique, voting procedures that were considered) ☐ Outcomes of the recommendation development process (e.g., extent to which consensus was reached using modified Delphi technique, outcome of voting procedures) ☐ How the process influenced the recommendations (e.g., results of Delphi technique influence final recommendation, alignment with recommendations and the final vote)	
11. CONSIDERATION OF BENEFITS AND HARMS *Report the health benefits, side effects, and risks that were considered when formulating the recommendations.*	☐ Supporting data and report of benefits ☐ Supporting data and report of harms/side effects/risks ☐ Reporting of the balance/trade-off between benefits and harms/side effects/risks ☐ Recommendations reflect considerations of both benefits and harms/side effects/ risks	
12. LINK BETWEEN RECOMMENDATIONS AND EVIDENCE *Describe the explicit link between the recommendations and the evidence on which they are based.*	☐ How the guideline development group linked and used the evidence to inform recommendations ☐ Link between each recommendation and key evidence (text description and/or reference list) ☐ Link between recommendations and evidence summaries and/or evidence tables in the results section of the guideline	

CHECKLIST ITEM AND DESCRIPTION	REPORTING CRITERIA	Page #
13. EXTERNAL REVIEW *Report the methodology used to conduct the external review.*	☐ Purpose and intent of the external review (e.g., to improve quality, gather feedback on draft recommendations, assess applicability and feasibility, disseminate evidence) ☐ Methods taken to undertake the external review (e.g., rating scale, open-ended questions) ☐ Description of the external reviewers (e.g., number, type of reviewers, affiliations) ☐ Outcomes/information gathered from the external review (e.g., summary of key findings) ☐ How the information gathered was used to inform the guideline development process and/or formation of the recommendations (e.g., guideline panel considered results of review in forming final recommendations)	
14. UPDATING PROCEDURE *Describe the procedure for updating the guideline.*	☐ A statement that the guideline will be updated ☐ Explicit time interval or explicit criteria to guide decisions about when an update will occur ☐ Methodology for the updating procedure	
DOMAIN 4: CLARITY OF PRESENTATION		
15. SPECIFIC AND UNAMBIGUOUS RECOMMENDATIONS *Describe which options are appropriate in which situations and in which population groups, as informed by the body of evidence.*	☐ A statement of the recommended action ☐ Intent or purpose of the recommended action (e.g., to improve quality of life, to decrease side effects) ☐ Relevant population (e.g., patients, public) ☐ Caveats or qualifying statements, if relevant (e.g., patients or conditions for whom the recommendations would not apply) ☐ If there is uncertainty about the best care option(s), the uncertainty should be stated in the guideline	
16. MANAGEMENT OPTIONS *Describe the different options for managing the condition or health issue.*	☐ Description of management options ☐ Population or clinical situation most appropriate to each option	

CHECKLIST ITEM AND DESCRIPTION	REPORTING CRITERIA	Page #
17. IDENTIFIABLE KEY RECOMMENDATIONS *Present the key recommendations so that they are easy to identify.*	☐ Recommendations in a summarized box, typed in bold, underlined, or presented as flow charts or algorithms ☐ Specific recommendations grouped together in one section	
DOMAIN 5: APPLICABILITY		
18. FACILITATORS AND BARRIERS TO APPLICATION *Describe the facilitators and barriers to the guideline's application.*	☐ Types of facilitators and barriers that were considered ☐ Methods by which information regarding the facilitators and barriers to implementing recommendations were sought (e.g., feedback from key stakeholders, pilot testing of guidelines before widespread implementation) ☐ Information/description of the types of facilitators and barriers that emerged from the inquiry (e.g., practitioners have the skills to deliver the recommended care, sufficient equipment is not available to ensure all eligible members of the population receive mammography) ☐ How the information influenced the guideline development process and/or formation of the recommendations	
19. IMPLEMENTATION ADVICE/TOOLS *Provide advice and/or tools on how the recommendations can be applied in practice.*	☐ Additional materials to support the implementation of the guideline in practice. For example: • Guideline summary documents • Links to check lists, algorithms • Links to how-to manuals • Solutions linked to barrier analysis (see Item 18) • Tools to capitalize on guideline facilitators (see Item 18) • Outcome of pilot test and lessons learned	

CHECKLIST ITEM AND DESCRIPTION	REPORTING CRITERIA	Page #
20. RESOURCE IMPLICATIONS *Describe any potential resource implications of applying the recommendations.*	☐ Types of cost information that were considered (e.g., economic evaluations, drug acquisition costs) ☐ Methods by which the cost information was sought (e.g., a health economist was part of the guideline development panel, use of health technology assessments for specific drugs, etc.) ☐ Information/description of the cost information that emerged from the inquiry (e.g., specific drug acquisition costs per treatment course) ☐ How the information gathered was used to inform the guideline development process and/or formation of the recommendations	
21. MONITORING/ AUDITING CRITERIA *Provide monitoring and/or auditing criteria to measure the application of guideline recommendations.*	☐ Criteria to assess guideline implementation or adherence to recommendations ☐ Criteria for assessing impact of implementing the recommendations ☐ Advice on the frequency and interval of measurement ☐ Operational definitions of how the criteria should be measured	
DOMAIN 6: EDITORIAL INDEPENDENCE		
22. FUNDING BODY *Report the funding body's influence on the content of the guideline.*	☐ The name of the funding body or source of funding (or explicit statement of no funding) ☐ A statement that the funding body did not influence the content of the guideline	
23. COMPETING INTERESTS *Provide an explicit statement that all group members have declared whether they have any competing interests.*	☐ Types of competing interests considered ☐ Methods by which potential competing interests were sought ☐ A description of the competing interests ☐ How the competing interests influenced the guideline process and development of recommendations	

From: Brouwers MC, Kerkvliet K, Spithoff K, on behalf of the AGREE Next Steps Consortium. The AGREE Reporting Checklist: a tool to improve reporting of clinical practice guidelines. BMJ 2016;352:i1152. doi: 10.1136/bmj.i1152.

For more information about the AGREE Reporting Checklist, please visit the AGREE Enterprise website at http://www.agreetrust.org.

Appendix 5: **Grades of Recommendation**[30]

Grade of recommendation	Clarity of risk/ benefit	Quality of supporting evidence	Implications	Suggested Language
1 A. Strong recommendation, high-quality evidence	Benefits clearly outweigh risk and burdens, or vice versa	Consistent evidence from well-performed randomized, controlled trials or overwhelming evidence of some other form. Further research is unlikely to change our confidence in the estimate of benefit and risk	Strong recommendations can apply to most patients in most circumstances without reservation. Clinicians should follow a strong recommendation unless a clear and compelling rationale for an alternative approach is present	We strongly recommend… We recommend that …should be performed/ administered… We recommend that … is indicated/ beneficial/ effective…
1 B. Strong recommendation, moderate-quality evidence	Benefits clearly outweigh risk and burdens, or vice versa	Evidence from randomized, controlled trials with important limitations (inconsistent results, methodologic flaws, indirect or imprecise), or very strong evidence of some other research design. Further research (if performed) is likely to have an impact on our confidence in the estimate of benefit and risk and may change the estimate	Strong recommendation and applies to most patients. Clinicians should follow a strong recommendation unless a clear and compelling rationale for an alternative approach is present	We recommend… We recommend that … should be performed/ administered… We recommend that … is (usually) indicated/ beneficial/ effective…

30 SMFM adopts GRADE (Grading of Recommendations Assessment, Development, and Evaluation) for clinical guidelines. Society for Maternal-Fetal Medicine (SMFM), Chauhan SP, Blackwell SC. Am J Obstet Gynecol. 2013 Sep;209(3):163-5. https://pubmed.ncbi.nlm.nih.gov/23978245/

Grade of recommendation	Clarity of risk/ benefit	Quality of supporting evidence	Implications	Suggested Language
1 C. Strong recommendation, low-quality evidence	Benefits appear to outweigh risk and burdens, or vice versa	Evidence from observational studies, unsystematic clinical experience, or from randomized, controlled trials with serious flaws. Any estimate of effect is uncertain	Strong recommendation that applies to most patients. Some of the evidence base supporting the recommendation is, however, of low quality	We recommend… We recommend that … should be performed/ administered… We recommend that … Is (maybe) indicated/ beneficial/ effective…
2A. Weak recommendation, high-quality evidence	Benefits closely balanced with risks and burdens	Consistent evidence from well-performed randomized, controlled trials or overwhelming evidence of some other form. Further research is unlikely to change our confidence in the estimate of benefit and risk	Weak recommendation: best action may differ depending on circumstances or patients or societal values	We suggest… We suggest that … may/might be reasonable…
2B. Weak recommendation, moderate-quality evidence	Benefits closely balanced with risks and burdens, some uncertainty in the estimates of benefits, risks and burdens	Evidence from randomized, controlled trials with important limitations (inconsistent results, methodologic flaws, indirect or imprecise), or very strong evidence of some other research design. Further research (if performed) is likely to have an impact on our confidence in the estimate of benefit and risk and may change the estimate	Weak recommendation; alternative approaches likely to be better for some patients under some circumstances	We suggest… We suggest that … may/might be reasonable…

Grade of recommendation	Clarity of risk/ benefit	Quality of supporting evidence	Implications	Suggested Language
2C. Weak recommendation, low-quality evidence	Uncertainty in the estimates of benefits, risks, and burdens; benefits may be closely balanced with risks and burdens	Evidence from observational studies, unsystematic clinical experience, or from randomized, controlled trials with serious flaws. Any estimate of effect is uncertain	Very weak recommendation: other alternatives may be equally reasonable.	We suggest… is an option We suggest that … may/might be reasonable.
Best practice	A recommendation that is sufficiently obvious that the desirable effects outweigh undesirable effects, despite the absence of direct evidence, such that the grading of evidence is unnecessary			We recommend… We recommend that … should be performed/ administered… We recommend that … Is usually) indicated/ beneficial/ effective

Appendix 6: **NWIHP/IOG CAG (2024)**

Dr Cliona Murphy (Chair, 2023-). Consultant Obstetrician and Gynaecologist, Coombe Women and Infants University Hospital. Clinical Director, National Women and Infants Health Programme.

Dr Sam Coulter-Smith (2023-). Consultant Obstetrician and Gynaecologist, Rotunda Hospital. Chair, Institute of Obstetricians and Gynaecologists.

Dr Venita Broderick (2024-). Clinical Lead Gynaecology, National Women and Infants Health Programme.

Dr Brian Cleary (2023-). Chief Pharmacist, Rotunda Hospital. Medications Lead, Maternal and Newborn Clinical Management System Project.

Ms Angela Dunne (2023-). Director of Midwifery, National Women and Infants Health Programme.

Prof Seán Daly (2023-). Master, Consultant Obstetrician and Gynaecologist, Rotunda Hospital.

Prof Maeve Eogan (2023-). Consultant Obstetrician and Gynaecologist, Rotunda Hospital. Clinical Lead, Sexual Assault Treatment Units, National Women and Infants Health Programme.

Prof Richard Greene (2023-). Consultant Obstetrician and Gynaecologist, Cork University Maternity Hospital. Clinical Director, National Perinatal Epidemiology Centre, University College Cork.

Prof John Higgins (2023-). Cork University Maternity Hospital, Consultant Obstetrician and Gynaecologist, Clinical Director, Ireland South Women and Infants Directorate.

Prof Shane Higgins (2023-). Master, Consultant Obstetrician and Gynaecologist, National Maternity Hospital.

Dr Mendinaro Imcha (2023-). Clinical Director, Consultant Obstetrician and Gynaecologist, University Maternity Hospital Limerick.

Prof John Murphy (2023-). Clinical Lead Neonatology, National Women and Infants Health Programme.

Dr Aoife Mullaly (2023-). Consultant Obstetrician and Gynaecologist, Coombe Women and Infants University Hospital. Clinical Lead, Termination of Pregnancy Services, National Women and Infants Health Programme.

Prof John Morrison (2023-). Consultant Obstetrician and Gynaecologist, University Hospital Galway. Clinical Director, Saolta Maternity Directorate.

Mr Kilian McGrane (2023-). Director, National Women and Infants Health Programme.

Prof Keelin O'Donoghue (2023-). Consultant Obstetrician and Gynaecologist, Cork University Maternity Hospital. Clinical Lead, National Guidelines, National Women and Infants Health Programme.

Dr Suzanne O'Sullivan (2023-). Consultant Obstetrician and Gynaecologist, Cork University Maternity Hospital. Director of Education and Training, Obstetrics and Gynaecology, Institute of Obstetricians and Gynaecologists.

Prof Mike O'Connell (2023-). Master, Consultant Obstetrician and Gynaecologist, Coombe Women and Infants University Hospital.

Ms Davinia O'Donnell (2024-). General Manager | National Women and Infants Health Programme Office of the Chief Clinical Officer, Health Service Executive

Dr Vicky O'Dwyer (2023-). Consultant Obstetrician and Director of Gynaecology, Rotunda Hospital.

Dr Mairead O'Riordan (2024-). Consultant Obstetrician and Gynaecologist, Cork University Maternity Hospital.

Ms Danielle Prenderville (2024-). Senior Executive Assistant – Master's Office.

Prof Nóirín Russell (2023-). Consultant Obstetrician and Gynaecologist, Cork University Maternity Hospital. Clinical Director, Cervical Check.

Dr Carmen Regan (April 2024). Clinical Lead Obstetrics, National Women and Infants Health Programme.

Dr Orla Shiel (2024-). Consultant Obstetrician and Gynaecologist, National Maternity Hospital.

Ms Clare Thompson (2023-). Consultant Gynaecological Oncologist, The Mater, Dublin.