Small for Gestational Age and Fetal Growth Restriction in Aotearoa New Zealand

He Aratohu Ritenga Haumanu mō te Tōhuatanga Kōpiri me te Pakupaku Rawa

A clinical practice guideline: Summary of recommendations

Te Whatu Ora
Health New Zealand

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Contents

Introduction

This clinical practice guideline aims to reduce rates of stillbirth and neonatal mortality and morbidity associated with fetal growth restriction (FGR) by standardising care across Aotearoa New Zealand. This guideline:

- provides evidence-based best practice recommendations for screening, diagnosing and managing small for gestational age (SGA) and FGR in singleton pregnancies

- focuses on placental insufficiency, which is the most common cause of FGR

- is not a comprehensive guide for managing chromosomal and anatomical abnormalities, but contains aspects relevant to those pregnancies

- was developed with consideration of equity, hauora Māori and te ao Māori

- supersedes previous guidelines on SGA and FGR used in Aotearoa New Zealand, including the New Zealand Maternal Fetal Medicine Network's 2014 guideline

- recognises that even with optimal screening practices, up to approximately 60% of SGA babies are detected and 40% or more are not detected.[1,2]

This clinical practice guideline reflects international best practice. The FGR Guideline Development Panel interpreted literature and developed recommendations specifically for Aotearoa New Zealand and its model of maternity care.[a]

This clinical practice guideline should be read in conjunction with *Ngā Paerewa Health and disability services standard 8134:2021* and the corresponding sector guidance for birthing units and in-patient or private hospital services.[3] ***Ngā Paerewa***, alongside the sector guidance, contains information about best practice maternity and neonatal service provision.

> **The term SGA refers to an estimated fetal weight (EFW) or birthweight < 10th customised centile.**
>
> **The term FGR refers to fetal growth that is abnormally reduced (that is, less than expected due to pathology).**
>
> **Most, but not all, fetuses and neonates with FGR are SGA, while some SGA fetuses and neonates are not growth restricted.**

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[a] Panel members were Dr Ngaire Anderson (Chair), Anna Francis, Dr Chris McKinlay, Claire MacDonald, Horiana Thompson, Katarina Komene, Dr Kirsten Gaerty, Martin Necas, and Dr Rachael McEwing.

Review date

This clinical practice guideline should be reviewed in 2027.

Intended users of this clinical practice guideline

The intended users of this clinical practice guideline are health practitioners involved in pregnancy, birth, and postnatal care in Aotearoa New Zealand. This group includes midwives, nurses, obstetricians, maternal fetal medicine specialists, neonatologists, paediatricians, general practitioners, sonographers and radiologists. Health practitioners should use this clinical practice guideline to support their clinical judgement, knowledge and expertise and provide for a timely, consistent and effective approach to diagnosing and managing SGA and FGR pregnancies and neonates with FGR.

Whānau can use this clinical practice guideline to understand how pregnancies with small babies or babies with FGR are diagnosed and managed.

Summary of changes

	NZMFMN 2014 guideline[1]	This guideline
Definition of early-onset SGA or FGR	< 34 weeks' gestation	< 32+0 weeks' gestation
Suspicion of SGA	AC < 5th centile	AC < 10th centile based on the Australasian Society of Ultrasound Medicine fetal biometry chart, with centile documented in report
	Discrepancy between HC and AC	Removed from diagnosis of FGR
Slowing of fetal growth	Reduction in EFW percentile ≥ one third or reduction in AC of > 30 centiles or a change in AC of < 5 millimetres over 14 days	Decline in EFW > 30 centiles ≥ 28 weeks' gestation or decline in AC > 30 centiles ≥ 28 weeks' gestation
Risk factors for SGA and FGR	PAPP-A < 0.4 MoM (if performed)	Removed
	Maternal age > 40 years	Major risk factor: Maternal age ≥ 40 years (nulliparous) Minor risk factor: Maternal age ≥ 40 years (multiparous)
	Not defined	Addition of minor risk factors
Schedule of growth scans for those with SGA or FGR risk factors		Addition of screening schedule for those with three of more minor risk factors
MCA Doppler and CPR in late-onset FGR	MCA and CPR used for monitoring of late-onset FGR	Only CPR used for monitoring late-onset FGR
Definition of neonatal FGR	Not defined	See Table 5

AC = abdominal circumference; CPR = cerebroplacental ratio; EFW = estimated fetal weight; FGR = fetal growth restriction; HC = head circumference; MCA = middle cerebral artery; MoM = multiple of medians; NZMFMN = New Zealand Maternal Fetal Medicine Network ; PAPP-A = pregnancy-associated plasma protein-A; SGA = small for gestational age.

Clinical practice recommendations

The clinical practice recommendations follow the course of pregnancy and birth, with six groups of recommendations:

- definition and classification

- risk assessment for the development of FGR and interventions to reduce risk

- antenatal screening for FGR

- antenatal management of FGR

- maternal postnatal management

- diagnosis and management of neonates with FGR.

Alongside each recommendation is a grade for the certainty of the evidence (that is, the evidence level) that has informed the recommendation and the strength of the recommendation (that is, the grade of recommendation).

Principles underpinning the clinical practice recommendations

Five principles underpin the clinical practice recommendations:

- The pregnant woman/person is at the centre of all care decisions and shares decision-making with health practitioners within Aotearoa New Zealand's model of continuity of midwifery care.

- The optimal pregnancy outcome is the birth of a healthy, well-grown baby and a well woman/person following spontaneous onset of labour at term.

- Where a pregnancy is identified as SGA or FGR, additional monitoring and judicious use of intervention is planned with informed decision-making between the pregnant woman/person and care provider with the aim of optimising outcomes for the pregnant woman/person and baby.

- Where possible, expectant management should be planned, supporting the safe prolonging of pregnancy and physiological birth.

- Potential resource limitations and access to care and equity are considered at each step, but these considerations do not change the best practice recommendations.

The certainty of evidence for each recommendation is rated using a modification of the Royal College of Obstetricians and Gynaecologists' four-level classification system (A to

D). All recommendations were agreed by consensus among panel members. The evidence grading approach is summarised below.

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

GPP = good practice point; RCT = randomised control trial.

Definition and classification

	Definition and classification recommendations	Evidence level	Grade of recommendation	Rationale
1	Assess EFW and birthweight using customised centile standards.*	2+	C	Customised SGA better identifies at-risk fetuses and neonates than population-based SGA definitions, particularly among Aotearoa New Zealand's diverse ethnicities. Use of a single customised reference supports consistent national practice and audit.[2]
2	Define SGA as EFW or birthweight < 10th centile.	1++	A	This reflects the internationally accepted definition of SGA.
3	Define FGR using a combination of fetal size, fetal growth, and fetal and maternal Doppler assessment: • Early-onset FGR is diagnosed < 32^{+}0 weeks' gestation • Late-onset FGR is diagnosed ≥ 32+0 weeks' gestation.	2+	C	For further definition of early-onset and late-onset FGR, see Table 1.
4	Define slowing of fetal growth as a decline in EFW or AC of > 30 centiles at ≥ 28+0 weeks' gestation. If there is a decline in growth < 28 weeks' gestation, consider a	3	D	The threshold to define FGR based on a decrease in EFW or AC remains unclear.[†,4,5] Slowing of fetal growth is not a standalone criterion to define FGR.

	further growth scan in two to three weeks' time. Where possible, electronic plotting is recommended to improve accuracy and reduce transcription errors.			Growth scans performed at least three weeks apart minimise false positive diagnoses associated with the inherent error within fetal biometry measurements. Timing of scans should be tailored to the individual clinical scenario.
5	When FGR is suspected (EFW or AC < 10th centile, or slowing of fetal growth), perform these Doppler parameters: • Umbilical artery (UA) Doppler[6] • Uterine artery (UtA) Doppler mean pulsatility index (PI) and assessment of notching – assess only once[6] *See Recommendation 11 for UtA Doppler in FGR risk assessment* • MCA Doppler PI ≥ 32+0 weeks' gestation.[6] Report only CPR. If Doppler studies are normal, perform a repeat growth scan to assess fetal growth trajectory.	2- 1+ 2+ 2+	C A C C		The customised EFW centile should be plotted at the earliest possible opportunity to minimise delays in diagnosis and subsequent care. This is usually performed by the LMC or referrer.‡ If possible, assessment of customised EFW at the time of ultrasound allows additional Doppler studies to be performed concurrently if required. This minimises delays and return scanning for Doppler assessment. Doppler studies provide an indirect assessment of placental function and fetal wellbeing. UtA Doppler (abnormal if mean PI > 95th centile and/or bilateral notching) does not show progression in the third trimester. A single measurement can be

| | | | | performed at the time of diagnosis.

International consensus on the use of MCA Doppler in late-onset FGR is lacking. SGA fetuses with abnormal MCA and/or CPR have higher rates of adverse perinatal outcome.[8,9] CPR has a stronger association with adverse outcome than MCA has.

Growth scans performed at least three weeks apart minimise false positive diagnoses associated with the inherent error within fetal biometry measurements. |

AC = abdominal circumference; CPR = cerebroplacental ratio; EFW = estimated fetal weight; FGR = fetal growth restriction; GROW = gestation-related optimal weight; MCA = middle cerebral artery; PI = pulsatility index; SGA = small for gestational age; UA = umbilical artery; UtA = uterine artery.

* Customised centiles for Aotearoa New Zealand are available online at GROW-App NZ (**https://nzaws.growservice.org/App/Account/Login**) and are incorporated into the BadgerNet platform.

† The promising Hugh and Gardosi model of fetal growth assesses customised EFW gain as percentage deviation from expected.[7] It can be used to assess growth trajectory over a shorter time frame. This model should be investigated further in the Aotearoa New Zealand context, including implications for implementation.

‡ Radiology providers do not have the required clinical information to create a customised antenatal chart, which is recommended at booking.

Table 1: Definition for early and late-onset FGR in the absence of congenital anomalies[4]

Early-onset FGR Diagnosed < 32+0 weeks' gestation	Late-onset FGR Diagnosed ≥ 32+0 weeks' gestation

EFW customised or AC < 3rd centile
or
UA with absent or reversed end-diastolic flow
or
EFW customised or AC < 10th centile plus one or more of:
 	
• UA Doppler PI > 95th centile
• UtA Doppler mean PI > 95th centile or bilateral notching (perform only once at the time of diagnosis).
	EFW customised or AC < 3rd centile
	or
	Two or more of:
	
	• EFW customised or AC < 10th centile
	• slowing of fetal growth: decline in EFW or AC of > 30 centiles from 28+0 weeks' gestation onwards*
	• any of:
	  - UA Doppler PI > 95th centile or
	  - CPR < 5th centile or
	  - UtA mean PI > 95th centile or bilateral notching (perform only once at the time of diagnosis).

AC = abdominal circumference; CPR = cerebroplacental ratio; EFW = estimated fetal weight; FGR = fetal growth restriction; PI = pulsatility index; UA = umbilical artery; UtA = uterine artery.

* If there is decline in EFW or AC of > 30 centiles before 28 weeks' gestation in the absence of early-onset FGR, consider another growth scan in two to three weeks. If the fetal growth trajectory between the last two scans is normal, the AC and EFW is > 10th centile, the fetus is not suspected to be growth restricted and further growth scans should follow risk-factor screening recommendations (see Table 4).

Risk assessment for the development of FGR and interventions to reduce risk

Risk assessment and intervention recommendations		Evidence level	Grade of recommendation	Rationale
6	Inform women/people considering pregnancy of periconception lifestyle advice, including a healthy diet, regular moderate exercise, and entering pregnancy at as healthy a weight as possible.	4	GPP	Those entering pregnancy with a BMI 18.5 kg/m^2 to 25 kg/m^2 have the lowest chance of having an SGA pregnancy. Rates of SGA increase as BMI moves further from the healthy weight range (u-shaped curve). Higher rates of pre-existing hypertension and diabetes are experienced by people with obesity.
7	Advise women/people considering pregnancy to supplement diet with daily folic acid.	2++	B	Pre-conceptual folic acid supplementation may reduce the risk of FGR as well as neural tube defects.
8	Advise women/people to stop cigarette smoking and other recreational drug use (including cannabis) before pregnancy. Follow advice about supporting smoking cessation as set out in the ***New Zealand Guidelines for Helping People Stop Smoking***.[10]	1+ 4	A GPP	Stopping tobacco use < 15+0 weeks' gestation decreases the chance of FGR.

9	Perform a clinical risk assessment for FGR for pregnant women/people in early pregnancy. Continue to screen for the development of new clinical risk factors throughout pregnancy.	2+ 4	B GPP	Risk factors for FGR pregnancies may be present at booking or may develop as pregnancy progresses. Timely identification enables appropriate ultrasound growth assessment and management.
10	Do not use biomarkers or integrated risk assessments as screening tools for FGR (combinations of clinical risk factors, biomarkers and early pregnancy ultrasound parameters).	2+	C	There is limited evidence that biomarkers or early pregnancy Dopplers have sufficient sensitivity or specificity to accurately predict FGR.
11	In pregnancies with **risk factors for early-onset FGR**, perform mean UtA Doppler PI with assessment of notching at 20 to 24 weeks' gestation.	2+	C	An abnormal UtA Doppler PI at mid-pregnancy, combined with maternal characteristics is better at predicting early-onset FGR (and pre-eclampsia) compared with late-onset FGR.
12	Offer low-dose aspirin to pregnant women/people who have had a previous FGR pregnancy or who have **a major risk factor** for pre-eclampsia. *Low-dose aspirin 100 milligrams per day taken at night, starting between 12+0 to 16+6 weeks' gestation until 36 weeks' gestation.*	1+	B	Pregnant women/people with major risk factors for pre-eclampsia have a reduced risk of FGR (and pre-eclampsia) when taking low-dose aspirin. They also benefit from calcium supplementation to reduce the risk of hypertensive disorders of pregnancy. For further advice about risk factors for hypertension and pre-eclampsia in pregnancy and the use of low-dose

				aspirin and calcium, see the *Diagnosis and Treatment of Hypertensions and Pre-eclampsia in Pregnancy in Aotearoa New Zealand* guideline.[11]
13	Do not use low molecular weight heparin for the prevention of FGR.	2++	A	High-quality trials show that heparin provides no beneficial moderating effect on the risk of developing pre-eclampsia or SGA and FGR outcomes.

BMI = body mass index; FGR = fetal growth restriction; GPP = good practice point; SGA = small for gestational age; UtA = uterine artery.

Table 2: Major risk factors for SGA and FGR (OR or RR > 2.0)[12,13]

Maternal demographics	Maternal medical history
Maternal age ≥ 40 years (nulliparous) Continued smoking ≥ 16 weeks' gestation (> 10 per day) Recreational drug use	Chronic hypertension*† Diabetes with vascular disease*† Renal impairment*† Antiphospholipid syndrome*†
Previous pregnancy history	**Current pregnancy risk**
Previous SGA or FGR pregnancy*† Previous hypertensive disorder of pregnancy*† Previous stillbirth†	Heavy bleeding < 20 weeks Pre-eclampsia or gestational hypertension Antepartum haemorrhage or placental abruption

FGR = fetal growth restriction; OR = odds ratio; RR = relative risk; SGA = small for gestational age.

* Low-dose aspirin is recommended, starting 12+0 to 16+6 weeks' gestation, taken at night. For further advice about the use of low-dose aspirin and calcium, see the Diagnosis and Treatment of Hypertension and Pre-eclampsia in Pregnancy in Aotearoa New Zealand guideline.11

† Risk factors for early-onset FGR include previous FGR birth < 32 weeks' gestation, previous hypertensive disease with birth < 34 weeks' gestation, significant maternal medical disease and previous stillbirth (particularly early gestation or associated with FGR).

Table 3: Minor risk factors for SGA and FGR (OR or RR <2.0)[12-16]

Maternal demographics	Maternal medical history
Nulliparity Maternal age ≥ 40 years (multiparous) Smoking one to 10 cigarettes per day	Conception via assisted reproductive technology BMI ≥ 30 kg/m^2 or < 18.5 kg/m^2
Previous pregnancy history	**Current pregnancy risk**
Short (< 6 months) or long (> 60 months) interpregnancy interval	Placenta praevia Low gestational weight gain‡

BMI = body mass index; FGR = fetal growth restriction; OR = odds ratio; RR = relative risk; SGA = small for gestational age.

‡ Low gestational weight gain (GWG) can be considered when a woman/person's weight gain (compared to pre-pregnancy or early pregnancy) at any given gestation is not on track to reach minimum recommended GWG for her/their BMI category by end of pregnancy. For further information about total weight gain recommendations for each BMI category, see Table 4 in the Evidence Statements.

Antenatal screening for FGR

Antenatal screening for FGR recommendations	Evidence level	Grade of recommendation	Rationale
14 Do not offer routine ultrasound for fetal growth assessment to pregnant women/people without ≥ 1 major or > 3 minor risk factors for FGR.	1+	A	Routine ultrasound can result in increased false positive diagnoses and unnecessary intervention without evidence of improved outcomes. See *Recommendation 16* for screening where fundal height measurements are unreliable.
15 Recommended screening for pregnant women/people at **low risk of FGR** (that is, no major and two or fewer minor risk factors) is serial fundal height assessment at each antenatal visit, plotted on a customised fundal height chart, starting at 26 to 28 weeks' gestation. Measurements should be at least two weeks apart. If the plotted fundal height is < 10th centile or if fundal height declines > 30 centiles, refer for ultrasound assessment of fetal growth.	2+ 3	B GPP	There are no published data on the degree of decline in fundal height centile that is associated with an increased risk of FGR.

16	Recommended screening for pregnant women/people **where fundal height measurements are unreliable** (BMI > 35 kg/m^2, large or multiple fibroids, polyhydramnios) is ultrasound assessment of fetal size between 30 and 32 weeks' gestation and again between 36 and 38 weeks' gestation.*	4	GPP		If only one scan is possible, a scan between 36 and 38 weeks' gestation is more likely to identify late-onset FGR. A single scan cannot assess fetal growth trajectory.
17	Consider screening pregnant women/people with **three or more minor risk factors** with ultrasound assessment of fetal size between 30 to 32 weeks' gestation and again between 36 to 38 weeks' gestation.*	4	GPP		When combined, multiple minor risk factors are likely to increase the risk of late-onset FGR.

If only one scan is possible, a scan between 36 to 38 weeks' gestation is more likely to identify late-onset FGR. A single scan cannot assess fetal growth trajectory. |
| 18 | Recommended screening for pregnant women/people with **one or more major risk factors for FGR** is monthly ultrasound growth assessments starting between 28 and 30 weeks' gestation until birth.* | 3 | B | | Serial ultrasound monitoring enables early identification of suspected FGR with appropriate assessment and ongoing monitoring. |
| 19 | Recommended screening for pregnant women/people with **risk factors for early-onset** | 3 | C | | Consider more frequent maternal and fetal assessment with abnormal screening UtA |

	FGR is monthly ultrasound growth assessments starting at 24 to 26 weeks' gestation until birth.*			Doppler (*see Recommendation 11*).
20	Ultrasound assessment: • Plot fetal biometry on an Australasian Society of Ultrasound Medicine chart (electronically if possible) and routinely report AC centile. • Use the Hadlock three or four parameter formulae to calculate EFW in grams and report a customised centile where possible.[20]	4 2+	GPP B	The use of locally developed fetal biometry charts is recommended.[17,18,19] The Australasian Society of Ultrasound Medicine fetal biometry charts are the most commonly used standard and using these will support national consistency.

AC = abdominal circumference; BMI = body mass index; EFW = estimated fetal weight; FGR = fetal growth restriction; GPP = good practice point; UtA = uterine artery.

* More frequent and/or earlier initiation of growth scans may be indicated based on individualised risk assessment (such as the development of an additional risk factor like pre-eclampsia).

Table 4: Recommended screening schedule of growth scans for pregnant women/people with FGR risk factors or unreliable fundal height measurement but with a normally growing fetus

Three or more minor risk factors or unreliable fundal height	Major risk factor for SGA or FGR	One or more risk factors for early-onset FGR
Consider **two** growth scans: • at 30 to 32 weeks' gestation and • at 36 to 38 weeks' gestation† *(For example, one scan at 32 weeks' gestation and one scan at 37 weeks' gestation)*	**Monthly** growth scans starting from between 28 and 30 weeks' gestation until birth *(For example, one scan at each of 30, 34 and 38 weeks' gestation)*	**Monthly** growth scans starting from between 24 and 26 weeks' gestation until birth plus Consider UtA Doppler study between 20 and 24 weeks' gestation‡ *(For example, one scan at each of 24, 28, 32, 36 and 40 weeks' gestation)*

AC = abdominal circumference; BMI = body mass index; EFW = estimated fetal weight; FGR = fetal growth restriction; GPP = good practice point; UtA = uterine artery.

† If only one scan is possible, a scan between 36 and 38 weeks' gestation is more likely to identify late-onset SGA or FGR. A single scan cannot assess fetal growth trajectory.

‡ UtA Doppler modifies the risk assessment for early-onset FGR (and pre-eclampsia). Closer maternal and fetal monitoring is recommended in the presence of an abnormal UtA Doppler. A normal UtA Doppler indicates that the development of early-onset FGR (and pre-eclampsia) is unlikely. Individualised clinical assessment of FGR risk may mean more frequent assessment of fetal size is appropriate. If FGR is confirmed, increased growth monitoring is required.

Antenatal management of FGR

Antenatal management recommendations	Evidence level	Grade of recommendation	Rationale
Actions to be completed by primary maternity services provider			
21 If FGR is suspected, complete an initial assessment: • confirm gestational age • consider risk factors for placental-mediated FGR, including risk factors that may have developed during pregnancy • review antenatal screening for aneuploidy and other conditions (such as MSS1, MSS2 and NIPT), if performed • review ultrasound for fetal biometry and Doppler studies (UA, UtA and CPR if ≥ 32+0 weeks' gestation) • review ultrasound for fetal anatomy and placental location or morphology.	2++	B	These parameters enable the accurate diagnosis and management of FGR, including identification of non-placental causes of FGR.
22 Recommend referral for obstetric specialist review for all pregnant women/people with SGA or FGR.	4	GPP	Fetal medicine review includes a detailed anatomy survey and discussion of options of genetic testing, including amniocentesis with testing

	Refer or discuss with fetal medicine: • early-onset FGR (particularly < 28+0 weeks' gestation) • FGR with associated polyhydramnios or fetal malformation, regardless of gestational age.			for FISH or qfPCR and, if abnormal, Giemsa-band karyotype. If normal, proceed with microarray. Also consider PCR for infectious agents at the time of invasive testing.
Actions to be completed by specialist maternity services providers				
23	In early-onset or severe FGR (EFW < 3rd centile), consider screening for congenital infection with maternal serology for: • CMV (IgG and IgM) • rubella if not clearly immune (IgG and IgM) • syphilis (if higher risk; EIA screen initially) • toxoplasmosis (IgG and IgM).	2++	B	Services may request LMCs to order these tests as part of their agreed referral pathways. A full TORCH screen is not required in all cases.
24	Clinical management of pregnant women/people with suspected or confirmed FGR includes consideration of gestational age, severity of FGR and multimodality assessment, including cardiotocograph (CTG), ultrasound for fetal biometry and fetal	2+	C	These parameters enable accurate understanding of fetal wellbeing and inform management.

	Doppler (UA, CPR, UtA, ± ductus venosus, DV, if indicated). Do not use CTG assessment in isolation	1+	A	CTG provides an assessment of current fetal wellbeing but has limited ability to predict fetal deterioration.
25	For an isolated finding of abnormal CPR in a term SGA fetus without evidence of FGR consider repeating the ultrasound assessment within 24 to 48 hours (if resources allow) to mitigate the possibility of a false positive result, particularly if the result informs a planned birth < 38+0 weeks' gestation.	3	D	SGA without FGR is defined as EFW from 3rd to < 10th centile, normal fetal and maternal Dopplers, and normal fetal growth. MCA PI measurements have poor inter-observer reliability. To support sonography resources, repeat Doppler studies within a short timeframe should be targeted to Doppler studies (± amniotic fluid assessment). Further 'routine' examination of the fetus is not required.
26	Ensure all Doppler studies are performed by operators with appropriate training and expertise in each study to minimise measurement errors.	4	GPP	Technical information on Doppler measurements is detailed in the _**New Zealand Obstetric Ultrasound Guidelines**_.[6]
27	Use computerised cardiotocograph (cCTG) where possible rather than CTG in the assessment of **early-onset FGR**.	2+	C	Fetal heart rate (FHR) assessments with cCTG improve interobserver reliability and allow for detailed assessment of STV. cCTG has an inbuilt algorithm for assessing short-term variability

	If cCTG is not available or not used, assess fetal wellbeing using a combination of conventional CTG and fetal Doppler studies.			(STV). This is different to electronic CTG, which is a digital version of a conventional CTG.
28	Where there is isolated SGA without evidence of FGR, up to **36+6** weeks' gestation, perform: • ultrasound for fetal growth, UA Doppler and amniotic fluid volume (± CPR if ≥ 32+0 weeks' gestation) every two weeks • clinical review every two weeks. In addition, from **37+0** weeks' gestation: • perform weekly clinical review • consider weekly ultrasound for UA Doppler, amniotic fluid volume and CPR • recommend birth at 40+0 weeks' gestation (and not earlier than 39+0 weeks' gestation) if spontaneous labour has not occurred.	2+	B	SGA without FGR is EFW 3rd to < 10th centile, normal fetal and maternal Dopplers and normal fetal growth. Increase surveillance and/or consider inpatient monitoring if there is oligohydramnios, static or very poor interval growth or suspected pre-eclampsia. Individualise timing of birth recommendations and discuss and agree with the pregnant woman/person, their whānau (if appropriate) and the LMC.

29	Where early-onset FGR occurs with forward flow in the UA, perform: • at least weekly ultrasound for UA Doppler and amniotic fluid volume • at least weekly clinical review and cCTG (or CTG if cCTG is not available) • ultrasound for fetal growth every two weeks.	3	C		Increase surveillance and/or consider inpatient monitoring if there is oligohydramnios, static or very poor interval growth or suspected pre-eclampsia.
30	Where early-onset FGR occurs with absent end-diastolic flow (AEDF) or reversed end-diastolic flow (REDF) in the UA: • admit to a unit with appropriate neonatal services for inpatient monitoring and birth planning • perform at least twice daily cCTG (or CTG if cCTG is not available) and clinical review • perform ultrasound for UA, DV Doppler and amniotic fluid volume two to three times every week For AEDF: recommend birth by pre-labour	2++	A		Do not perform DV Doppler after 34+0 weeks' gestation as fetuses with AEDF or REDF in the UA have met the gestation criteria for birth. Individualise timing of birth recommendations and discuss and include fetal medicine and neonatology input. Discuss and agree recommendations with the pregnant woman/person, their whānau (where appropriate) and the LMC.

	caesarean by 32+0 to 33+6 weeks' gestation. For REDF: recommend birth by pre-labour caesarean by 30+0 to 31+6 weeks' gestation.			
31	Where late-onset FGR occurs: • perform ultrasound for UA, CPR Doppler and amniotic fluid volume two times per week • perform clinical review and CTG two times per week • perform ultrasound for fetal growth every two weeks • recommend birth by 38+0 weeks' gestation (usually not before 37+0 weeks' gestation).	2+	B	Increase surveillance and/or consider inpatient monitoring or earlier birth if clinical concern exists (oligohydramnios, static or very poor interval growth or suspected pre-eclampsia). Individualise timing of birth recommendations and discuss and agree with the pregnant woman/person, their whānau (if appropriate) and the LMC.
32	Absolute indications for birth are: • grossly abnormal CTG or cCTG (eg, unprovoked decelerations, or reduced STV in babies intended for neonatal intensive care admission) • severe maternal concerns (eg, pre-eclampsia with uncontrolled	4	GPP	Reduced STV are: • 26+0 to 28+6 weeks' gestation: STV < 2.6 ms • 29+0 to 31+6 weeks' gestation: STV < 3.0 ms. The definition of grossly abnormal cCTG or CTG aligns with the findings of the TRUFFLE study.[21]

	hypertension, HELLP syndrome or other end-organ damage).			Individualise timing of birth recommendations and discuss and agree with the pregnant woman/person, their whānau (if appropriate) and the LMC.
33	Follow the same administration protocols for antenatal corticosteroids (including repeated doses) and magnesium sulphate in FGR pregnancies at risk of preterm birth as for non-FGR pregnancies. Do not delay birth to complete corticosteroids or magnesium sulphate if concern exists about imminent fetal or maternal deterioration.	1+	A	Antenatal corticosteroids and magnesium sulphate improve outcomes for FGR neonates.
34	Following antenatal corticosteroid administration, decisions on birth for presumed fetal compromise should be consultant-led and made with appropriate caution due to corticosteroid effects on FHR.	4	D	Antenatal corticosteroids can cause transient changes in fetal Doppler, FHR and fetal movements that make interpretation of true fetal compromise more difficult.
35	Transfer pregnant women/people with FGR to a hospital with a tertiary neonatal unit if: • at risk of birth < 28+0 weeks' gestation	4	D	Antenatal transfer of pregnant women/people with FGR pregnancies at risk of preterm birth improves neonatal outcomes and prevents postnatal tertiary transfer.

	• EFW < 1,000 g. Discuss transfer of pregnant women/people to a tertiary service if: • at risk of birth at 28 to 32 weeks' gestation • EFW 1,000 grams to 1,500 grams, depending on the local level of neonatal care available and consideration of overall risk.			
36	Recommend birth by pre-labour caesarean if there is late UA (AEDF or REDF) or DV Doppler changes, abnormal CTG or contraindications for vaginal birth. Consider induction of labour for most other pregnant women/people with FGR. Consider birth by pre-labour caesarean for maternal indications such as severe pre-eclampsia or HELLP.	4	GPP	FGR alone is not an indication for caesarean.
37	Consider using mechanical methods to induce labour (such as a Foley or balloon catheter).	4	GPP	Mechanical methods may be associated with lower rates of uterine hyperstimulation than vaginal dinoprostone. Low dose oral misoprostol

				probably has a similar risk of uterine hyperstimulation and may reduce the risk of caesarean compared with mechanical methods, however the certainty of evidence is low. Robust data on the optimum method of IOL in FGR pregnancies are lacking.
38	Recommend continuous CTG monitoring in active labour for all SGA and FGR pregnancies (that is, from the onset of regular contractions), including a full discussion of the risks and benefits.	4	GPP	While isolated SGA without evidence of FGR carries a lower risk of intrapartum compromise than FGR, SGA pregnancies still have higher rates of placental under-perfusion and a greater chance of fetal compromise requiring caesarean birth compared with appropriate for gestational age pregnancies.[*]

AEDF = absent end-diastolic flow; cCTG = computerised cardiotocography; CMV = cytomegalovirus; CPR = cerebroplacental ratio; CTG = cardiotocography; DV = ductus venosus; EFW = estimated fetal weight; EIA = enzyme immunoassay; FGR = fetal growth restriction; FHR = fetal heart rate; HELLP = haemolysis, elevated liver enzymes and low platelets; IgG = immunoglobulin G; IgM = immunoglobulin M; IOL = induction of labour; LMC = Lead Maternity Carer; MCA = middle cerebral artery; NIPT = non-invasive prenatal testing; PCR = polymerase chain reaction; PI = pulsatility index; REDF = reversed end-diastolic flow; SGA = small for gestational age; STV = short-term variability; UA = umbilical artery; UtA = uterine artery.

* Respect the pregnant women/person's decision if they decline continuous CTG.

Maternal postnatal management

Maternal postnatal recommendations	Evidence level	Grade of recommendation	Rationale
Provided by maternity services in the postnatal period			
39 Send placenta of all FGR babies and (if possible) SGA babies for histopathology. Report histopathology using the Amsterdam workshop consensus criteria[22] to identify placental pathologies that have high recurrence rates, particularly for: • babies with FGR who do not have an obvious identifiable cause or • severe FGR (< 3rd centile), early-onset FGR and/or preterm birth < 37+0 weeks' gestation.	3	GPP	A lack of rurally available perinatal pathologists means the placenta may need to be transported to a main centre. This raises concerns about cultural acceptability for some parents and whānau. Providing placental histopathology to those without obvious risk factors for FGR (including those with early-onset, severe growth restriction or preterm birth) may be acceptable given the recurrence risk. Whānau must be offered return of the placenta, given the option of not having it treated with chemicals for preservation, and informed if any portion of the placenta will not be returned to them (for example, if a sample is taken from the placenta for analysis).
40 Tailor counselling about the risk of recurrence of FGR to the woman/person, taking into consideration individual risk factors, severity of the FGR, any co-existing pre-	4	GPP	This information will help parents and whānau to prepare for any future pregnancies.

	eclampsia and any placental histopathology results.			
Provided by general practice-led primary care services				
41	Advise those who have given birth to a baby with FGR of their increased long-term chance of developing cardiovascular disease. Offer cardiovascular health and wellbeing advice, and recommend regular lifelong screening for cardiovascular complications such as hypertension and hypercholesterolaemia to those who have given birth to a baby with FGR.	4 4	GPP GPP	Those who give birth to a baby with FGR or who experience another placental-mediated complication (such as pre-eclampsia) have a well-established increase in long-term cardiovascular risk.

CVD = cardiovascular disease; FGR = fetal growth restriction; GPP = good practice point; SGA = small for gestational age.

Diagnosis and management of neonates with FGR

Neonatal recommendations		Evidence level	Grade of recommendation	Rationale
42	Calculate a customised birthweight centile for all babies using the GROW app.*	3	D	Customised SGA better identifies at-risk fetuses and neonates than population-based SGA definitions, particularly among Aotearoa New Zealand's diverse ethnicities. Use of a single customised reference supports

				consistent national practice and audit.[2]
43	Assess neonates suspected of FGR (that is, customised birth centile ≥ 3 to < 10) by reviewing maternal risk factors for FGR and calculating population cross-sectional z-scores for length, HC and BMI.[†]	3	D	Customised references are available for only birthweight. Cross-sectional population references are needed to assess other anthropometric parameters. Electronic online calculators are available for all neonatal biometry z-scores. LMC and/or secondary services may agree to be responsible for gathering these measurements, depending on local referral pathways.

44	Diagnose FGR in the neonate if one or more of:
	
	• customised birthweight < 3rd centile
	• customised birthweight centile from ≥ 3 to < 10 with two or more additional features:
	
	  • BMI z-score < -1.3[‡]
	  • length z-score < -1.3[‡]
	  • skin or body fat z-score < -1.3 (where equipment and expertise allow)[‡]
		4	D	This definition is a modification of the Delphi expert consensus to ensure consistency with the Growth Assessment Protocol. It recognises low body fat as a key feature of FGR and placental insufficiency as the predominant cause.
				
				The inclusion of an antenatal diagnosis of FGR with evidence of placental insufficiency recognises that FGR may occur within the normal birthweight

	• antenatal diagnosis of FGR • one or more major maternal risk factors for FGR • evidence of placental insufficiency on histology • antenatal diagnosis of FGR and evidence of placental insufficiency (eg, abnormal Doppler studies), even if the customised birthweight is ≥ 10 centile.			range. Although placental histology will not generally be available until the second week after birth, this criterion ensures discharge and clinic diagnoses are as accurate as possible and informs care in a subsequent pregnancy.
45	Arrange paediatric or neonatal review for neonates with FGR and any of: • customised birthweight centile < 3 • abnormal first or second trimester maternal screening tests • confirmed or suspected genetic abnormality (eg, dysmorphism, malformation, body asymmetry or disproportionate microcephaly or macrocephaly) • confirmed or suspected congenital infection (eg,	4	GPP	Neonates with customised birthweight centile < 3 are at greatest risk of transitional problems. They may need ongoing inpatient medical review as well as paediatric or neonatal outpatient follow-up. Neonates with FGR without placental insufficiency are more likely to have a maternal and/or fetal cause. A baby with customised birthweight ≥ 3 centile, with evidence of placental insufficiency and no other issues, does not routinely require a paediatric review.

	thrombocytopaenia, hepatosplenomegaly, skin rash or disproportionate microcephaly) • disproportionate microcephaly or macrocephaly (eg, difference between length and HC z-score > 1) • poor postnatal growth.			
46	If the baby's length is measured, use a neonatometer, large calliper or measuring mat.	3	D	Accurate measurement of length requires a neonatometer or calliper. A measuring mat will give measurement within 0.5 centimetres if used on a flat surface with two people. Tape measures are not accurate.
Specialist services				
47	Assess neonates suspected of FGR (customised birthweight centile ≥ 3 to < 10th) by measuring skin fat, where equipment and expertise allow.	3	D	Neonates with SGA who have low adiposity are at increased risk of transitional problems after birth.[28,29] Direct measurement of neonatal adiposity (skinfold or air displacement plethysmography) is increasingly used as a routine clinical tool, with air displacement plethysmography available at several large maternity centres.
48	Complete the following first-line investigations of	2-	D	If placental insufficiency is established,

	neonates with FGR and no clinical evidence of placental insufficiency (ie, abnormal Doppler studies):
	
	• review routine maternal antenatal serology, including for rubella, HIV and syphilis
	• consider placental histology (see *Recommendation 39*)
	• neonatal
	
	   • FBC
	   • urine CMV PCR
	
	Ensure newborn hearing screen is completed.
				alternative diagnoses are rare. In the absence of placental insufficiency, a stepwise approach is recommended, starting with first-line investigations followed by investigation for congenital infections and genetic disorders (as indicated by the clinical features). Positive rubella IgG with negative IgM in later pregnancy does not necessarily exclude primary infection as IgM may clear within a couple of months. A negative syphilis serology screen in early pregnancy does not preclude later primary infection.

49	Complete the following investigations if congenital infection is suspected (such as purpura, hepatosplenomegaly, microcephaly, thrombocytopenia, early jaundice, hearing impairment),:
	
	• maternal
	
	   • CMV serology (IgG and IgM)
	   • syphilis serology (EIA screen initially) if not
		4	D	Blood CMV PCR is not routinely required but may be considered if the CMV urine is positive, after discussion with an infectious diseases specialist to assess response to anti-viral treatment.
				
				Positive maternal CMV or rubella IgG with negative IgM in later pregnancy does not necessarily exclude primary infection as IgM may clear within a couple of months.

		tested in third trimester • rubella serology (IgG and IgM) if not clearly immune • toxoplasmosis serology (IgG and IgM). • neonatal • FBC, LFT, total and conjugated bilirubin • urine CMV PCR • ensure newborn hearing screen is completed • rubella serology (IgG and IgM) if the mother is not clearly immune or negative • syphilis (PCR) if the mother is not clearly negative • toxoplasmosis serology (IgG and IgM) if the mother is not clearly immune or negative • ophthalmology review: cataracts and chorioretinitis • cranial ultrasound: calcifications, ventriculomegaly, cysts			A negative syphilis serology screen in early pregnancy does not preclude later primary infection.

	• consider abdominal ultrasound (hepatosplenome galy, calcification, ascites) and long bone X-rays. • *if congenital rubella is confirmed, request blood PCR (EDTA), cerebrospinal fluid PCR and echocardiography* • *if congenital syphilis is confirmed, request placental PCR, cerebrospinal fluid testing (VDRL) and long bone X-rays* • *if congenital toxoplasmosis is confirmed, request placental and cerebrospinal fluid PCR.*			
50	If a genetic disorder is suspected, complete the following investigations: • molecular karyotype (EDTA) or • if aneuploidy is suspected, FISH and standard karyotype (heparin).	4	D	If placental insufficiency is well established, alternative diagnoses are rare. In the absence of placental insufficiency, a stepwise approach is recommended, starting with first-line investigations followed by further investigation

	Consider consultation with a clinical geneticist.			for congenital infections and genetic disorders as indicated by the clinical features.
51	Monitor neonates with FGR with the New Zealand Newborn Observation Chart and the Newborn Early Warning Score (NOC and NEWS) for ≥ 24 hours.	2+	C	NOC and NEWS have been adopted in most hospitals and are available on the BadgerNet platform.
52	Screen neonates with FGR for hypoglycaemia for 12 to 24 hours.§	4	D	FGR is an important risk factor for transitional neonatal hypoglycaemia.

BMI = body mass index; CMV = cytomegalovirus; EDTA = ethylenediaminetetraacetic acid; EIA = enzyme immunoassay; FBC = full blood count; FGR = fetal growth restriction; GAP = Growth Assessment Protocol; GROW = gestation-related optimal weight; HC = head circumference; HIV = human immunodeficiency virus; IgG = immunoglobulin G; IgM = immunoglobulin M; LFT = liver function test; LMC = Lead Maternity Carer; NOC = Newborn Observation Chart; NEWS = Newborn Early Warning Score; PCR = polymerase chain reaction; SGA = small for gestational age.

* Customised centiles for Aotearoa New Zealand are available online at GROW-App NZ (https://nzaws.growservice.org/App/Account/Login) and are incorporated into the BadgerNet platform.

† BMI as an indicator of proportionality provides consistency through childhood and beyond. Measures of body composition like fat mass should be referenced to length.[23,24] Use of BMI allows for partitioning into fat mass index and lean mass index, aiding interpretation.[25] The Fenton reference or length and HC is the largest cross-sectional reference of neonates from 23+0 to 40 weeks' gestation. It is widely used in Aotearoa New Zealand for monitoring the growth of preterm infants. The Fenton reference is intended to be used with the WHO Child Growth Standard after 50 weeks. Thus, curves from term postmenstrual age have been smoothed to join the WHO Standard.[26] The Olsen BMI reference is very large.[27] Electronic calculators are available for both references (for example, www.nepios.net) and will be incorporated into the BadgerNet platform.

‡ For assessment of fetal or neonatal growth abnormalities, z-scores are preferred as these reflect the degree of deviation from normal more clearly than centiles. For example, a 40-point drop from the 70th centile is a z-score change of 1, but a 4-point drop from the 5th centile is also z-score change of 1. Z-scores are determined from LMS (Lambda for the skew, Mu for the median, and Sigma for the generalized coefficient of variation) data at each postmenstrual week, which avoids the need to smooth variance and skew that may vary across data sets). A z-score of -1.3 approximates the 10th centile, and a z-score of -1.9 approximates the 3rd centile. Virtually all neonates with a customised centile < 3 also have a population birthweight z-score < -2. If the population birthweight z-score is -2 to -1.3 and customised birthweight centile is ≥ 10, the neonate is considered to have excessively constrained in utero growth (that is, low uteroplacental capacity due to physiological factors).

§ Among at-risk neonates who develop transitional hypoglycaemia, 90% present within the first 12 hours after birth. It is unclear whether neonates who are born SGA without FGR have a similar risk of transitional hypoglycaemia. Aotearoa New Zealand clinical practice guidelines for neonatal hypoglycaemia are being

developed and will provide evidence-based recommendations for screening neonates who are FGR and/or SGA.

Table 5: Definition for FGR in the neonate

Diagnosis of FGR in the neonate

• Customised birthweight < 3rd centile
• Customised birthweight centile from ≥ 3 to < 10 with two or more additional features:
 	
    • BMI z-score < -1.3
    • length z-score < -1.3
    • skin or body fat z-score < -1.3 (where equipment and expertise allow)
    • antenatal diagnosis of FGR
    • one or more major maternal risk factors for FGR
    • Evidence of placental insufficiency on histology
 	
• Antenatal diagnosis of FGR and evidence of placental insufficiency (eg, abnormal Doppler studies), even if the customised birthweight is ≥ 10th centile.

BMI = body mass index; FGR = fetal growth restriction.

Recommended antenatal screening

Risk assessment

Performed at booking and at regular intervals throughout pregnancy

Major risk factors for SGA and FGR

Maternal demographics
- Maternal age ≥ 40 years (nulliparous)
- Continued smoking ≥ 16 weeks' gestation (> 10 per day)
- Recreational drug use

Previous pregnancy history
- Previous FGR pregnancy*†
- Previous hypertensive disease of pregnancy*†
- Previous stillbirth†

Maternal medical history
- Chronic hypertension*†
- Diabetes with vascular disease*†
- Renal impairment*†
- Antiphospholipid syndrome*†

Current pregnancy risk
- Heavy bleeding < 20 weeks' gestation
- Pre-eclampsia or gestational hypertension
- Antepartum haemorrhage or placental abruption

Minor risk factors for SGA and FGR

Maternal demographics
- Nulliparity
- Maternal age ≥ 40 years (multiparous)
- Smoking 1 to 10 cigarettes per day

Previous pregnancy history
- Short (< 6 months) or long (> 60 months) interpregnancy interval

Maternal medical history
- Conception via assisted reproductive technology
- BMI > 30 kg/m² or < 18.5 kg/m²

Current pregnancy risk
- Placenta praevia
- Low gestational weight gain

Antenatal screening

Starting from 20 to 24 weeks' gestation and performed until birth

Low risk: no major and < 3 minor risk factors

Serial fundal height assessment from 26 to 28 weeks' gestation until birth, plotted on customised antenatal growth chart

Suspected FGR

Slowing of customised fundal height > 30 centiles

or

Customised fundal height centile < 10

Increased risk

One or more major risk factors
- Start low-dose aspirin if indicated*
- Monthly serial ultrasound growth assessments starting from 28 to 30 weeks' gestation until birth

Risk factors for early-onset FGR†
- Monthly serial ultrasound growth assessments starting from 24 to 26 weeks' gestation until birth **plus** UtA Doppler at 20 to 24 weeks

Three or more minor risk factors
- Consider two ultrasound growth assessments in the third trimester: one at 30 to 32 weeks' gestation and one at 36 to 38 weeks' gestation

Unreliable fundal height measurement§
- Two ultrasound growth assessments in the third trimester: one at 30 to 32 weeks' gestation and one at 36 to 38 weeks' gestation

Ultrasound growth assessment

Customised antenatal growth chart ideally sent with referral or provided by pregnant woman/person

Normal fetal biometry

Customised EFW and AC ≥ 10th centile, normal interval growth

Abnormal fetal biometry or growth

Customised EFW or AC centile < 10

or

Slowing of fetal growth (ie, decline in customised EFW or AC > 30 centiles from 28 weeks' gestation)

Perform Doppler assessment

UA Doppler
Abnormal if PI is > 95th centile

UtA Doppler
Abnormal if mean PI > 95th centile or bilateral notching

CPR (≥ 32+0 weeks)
Abnormal if < 5th centile

Normal UA Doppler
- Normal UtA Doppler
- Normal CPR (if ≥ 32 weeks' gestation)
- EFW ≥ 3rd centile

Specialist referral for review within 1 to 2 weeks‡

Normal UA Doppler
- Abnormal UtA and/or
- Abnormal CPR (if ≥ 32 weeks' gestation) or
- EFW < 3rd centile

Specialist referral for review within 1 week‡
- If ≥ 38+0 weeks, review within 48 hours for consideration of planned birth

Abnormal UA Doppler
Forward flow present

Same day referral for specialist review

Abnormal UA Doppler
AEDF or REDF

Urgent inpatient management

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* Low dose aspirin is recommended, starting between 12+0 and 16+6 weeks' gestation, taken at night.
† Risk factors for early-onset FGR include previous FGR birth < 32 weeks' gestation, previous hypertensive disease with birth < 34 weeks' gestation, significant maternal medical disease and previous stillbirth (particularly early gestation or FGR).
‡ Clinical concern may override the recommended timeframes for specialist review (eg, oligohydramnios, significant slowing of growth or reduced fetal movements).
§ Unreliable fundal height measurements may be due to BMI > 35 kg/m² large or multiple fibroids or polyhydramnios.
Abbreviations: AC = abdominal circumference; AEDF = reversed end-diastolic flow; CPR = cerebroplacental ratio; EFW = estimated fetal weight; FGR = fetal growth restriction; PI = pulsatility index; RDEF = reversed end-diastolic flow; SGA = small for gestational age; UA = umbilical artery; UtA = uterine artery.

Management of FGR < 32+0 weeks

Review history
- Confirm gestational age
- Antenatal combined or maternal serum screening results
- Antenatal screening for aneuploidy and other conditions (such as MSS1, MSS2 and NIPT), if performed
- Medical, FGR risk factors
- Consider serology for congenital infection screen especially if < 28 weeks' gestation or severe FGR (EFW < 3rd centile)

Review fetal anatomy
- Consider referral for tertiary review including anatomical survey, especially if < 28 weeks' gestation or severe FGR

Isolated SGA
- EFW and/or AC 3rd to < 10th centile
- Normal UA and UtA Dopplers

Once ≥ 32+0 weeks' gestation, manage as per late-onset flowchart

FGR
- EFW or AC < 3rd centile or
- EFW or AC < 10th centile plus
  - Abnormal UA (forward flow present) or
  - Abnormal UtA Doppler (performed once at diagnosis)

Once ≥ 32+0 weeks' gestation, manage as per late-onset flowchart

FGR at high risk of deterioration
- AEDF or REDF

Perform every two weeks
- Ultrasound for growth, UA Doppler, liquor
- Clinical review

If fetal growth normalises to > 10th centile with all normal Dopplers over ≥ 1 month, transfer to routine low-risk care

At least weekly	**Every two weeks**
- Ultrasound for UA Doppler, liquor - cCTG (or CTG)* - Clinical review	- Ultrasound for growth

- Consider antenatal steroids
- Increase surveillance and/or consider inpatient monitoring if there is oligohydramnios, static or very poor interval growth or suspected pre-eclampsia.

Admit for birth planning
In-patient management
- Antenatal steroids < 35+0 weeks ± magnesium sulphate < 30+ 0 weeks
- Twice daily cCTG (or CTG)*
- At least daily maternal BP and pre-eclampsia assessment
- UA and DV Doppler, liquor performed two to three times per week

Birth
- AEDF birth by 32 to 34 weeks' gestation
- REDF birth by 30 to 32 weeks gestation
- If absent or reversed DV a-wave
- If reduced cCTG (or CTG) STV*
- By pre-labour caesarean

* cCTG is preferred in the assessment of early-onset FGR. If cCTG is not available, fetal wellbeing should be assessed using conventional CTG and fetal Doppler studies. STV criteria for birth are STV < 2.6 ms (26+0 to 28+6 weeks' gestation) and STV < 3.0 ms (29+0 to 31+6 weeks' gestation). **Abbreviations:** AC = abdominal circumference; AEDF = absent end-diastolic flow; BP= blood pressure; CPR = cerebroplacental ratio; cCTG = computerised cardiotocograph; CTG = cardiotocograph; DV = ductus venosus; EFW = estimated fetal weight; FGR = fetal growth restriction; HELLP = haemolysis, elevated liver enzymes and low platelets; IOL = induction of labour; REDF = reversed end-diastolic flow; UA = umbilical artery; UtA = uterine artery.

Absolute indications for birth
- Abnormal fetal heart rate (eg, repetitive unprovoked decelerations on cCTG or CTG)
- Maternal deterioration (eg, severe pre-eclampsia with uncontrolled hypertension/HELLP syndrome or other end-organ damage)

⚠️ **Management of FGR should be individualised.**
Increased surveillance or expedited birth should occur if there are features of concern (eg, cessation of growth, oligohydramnios, repeated episodes of reduced movements)

Management of FGR ≥ 32+0 weeks

Review history
- Confirm gestational age
- Antenatal combined or maternal serum screening results
- Antenatal screening for aneuploidy and other conditions (such as MSS1, MSS2 and NIPT) if performed
- Medical, FGR risk factors
- Review fetal anatomy and placental location/morphology
- Consider serology for congenital infection screen, especially if severe FGR (EFW < 3rd centile)

Isolated SGA
- EFW and/or AC 3rd to < 10th centile
- Normal UA, CPR and UtA Dopplers

FGR
- EFW or AC < 3rd centile or
- Two of three:
  - EFW or AC < 10th centile
  - Slowing of fetal growth
  - Abnormal UA (forward flow present), CPR or UtA Doppler (performed once, at diagnosis)

FGR at high risk of deterioration
- UA AEDF or REDF

Perform every two weeks
- Ultrasound for growth, UA Doppler, CPR, liquor
- Clinical review

NOTE: If fetal growth normalises to ≥ 10th centile with all normal Dopplers over ≥ 1 month, transfer to routine low-risk care

Birth
- At 40+0 weeks' gestation (and not earlier than 39+0 weeks' gestation), usually via IOL
- Continuous CTG in active labour*

Twice per week	Every two weeks	Birth
• Ultrasound for UA Doppler, CPR, liquor • CTG • Clinical review	• Ultrasound for growth	• By 38+0 weeks' gestation, usually via IOL • Continuous CTG in active labour*

Consider need for antenatal steroids <35+0 weeks' gestation

Admit for birth planning
- Antenatal steroids <35+0 weeks
- Twice daily cCTG (or CTG)
- At least daily maternal BP and pre-eclampsia assessment
- Consider UA and DV Doppler, liquor performed two to three times per week if birth not imminent

NOTE: Do not perform DV Doppler after 34+0 weeks' gestation as fetuses with AEDF or REDF in the UA have met the gestation criteria for birth.

Birth
- Most births will be as soon as possible
- AEDF birth by 32 to 34 weeks' gestation
- REDF birth by 30 to 32 weeks' gestation
- By pre-labour caesarean

Absolute indications for birth
- Abnormal fetal heart rate (eg, repetitive unprovoked decelerations on cCTG or CTG)
- Maternal deterioration (eg, severe pre-eclampsia with uncontrolled hypertension/HELLP syndrome or other end-organ damage)

* Offer continuous CTG after a full discussion of the benefits and risks. Respect woman/person's decision if they decline continuous CTG.
Abbreviations: AC = abdominal circumference; AEDF = absent end-diastolic flow; BP= blood pressure; CPR = cerebroplacental ratio; cCTG = computerised cardiotocograph; CTG = cardiotocograph; DV = ductus venosus; EFW = estimated fetal weight; FGR = fetal growth restriction; HELLP = haemolysis, elevated liver enzymes and low platelets; IOL = induction of labour; REDF = reversed end-diastolic flow; UA = umbilical artery; UtA = uterine artery.

⚠️ **Management of FGR should be individualised.**
Increased surveillance or expedited birth should occur if there are features of concern (eg, cessation of growth, oligohydramnios, repeated episodes of reduced movements).

Management of the neonate with FGR

For All Babies		
1) Review fetal growth monitoring	2) Review risk factors for FGR	3) Calculate customised birthweight centile using GROW

Customised birthweight centile ≥ 10 → Antenatal FGR diagnosis including evidence of placental insufficiency (for example, abnormal Doppler studies) → **NO** → **NOT FGR**
→ **YES** → **Neonate with FGR**

Customised birthweight centile ≥ 3 to 10 → Calculate z-score for BMI and length ± skin/body fat, where expertise and equipment allow →

Two or more of the following?
- BMI z-score < –1.3
- Length z-score < –1.3
- Skin/body fat z-score < –1.3
- Antenatal FGR diagnosis
- Major FGR risk factor
- Placental insufficiency on histology

→ **NO** → **NOT FGR**
→ **YES** → **Neonate with FGR**

Customised birthweight centile < 3 → **Neonate with FGR**

Management Of Neonates With FGR

Monitor with NOC/NEWS for ≥ 24 hours
Screen for hypoglycaemia for 12 to 24 hours

↓

Arrange paediatric/neonatal review for any of:
- Customised birthweight centile < 3
- Confirmed or suspected genetic abnormality
- Confirmed or suspected congenital infection
- Disproportionate microcephaly or macrocephaly
- Poor postnatal growth
- Neonatal diagnosis of FGR with no evidence of placental insufficiency (abnormal Doppler)

Paediatric/neonatal review
- Full examination
- Review maternal serology and Doppler studies
- Review newborn hearing screen

Evidence of placental insufficiency and no genetic or infection concerns
No further investigation needed

No clinical evidence of placental insufficiency (eg, normal Doppler studies): first-line investigation
- FBC
- Urine CMV PCR
- Consider placental histology
- Ensure newborn hearing screen is completed

Suspected congenital infection: maternal first-line investigations
- CMV serology (IgG and IgM)
- Syphilis serology (EIA screen initially) if not tested in third trimester
- Rubella serology (IgG and IgM) if not clearly immune
- Toxoplasmosis serology (IgG and IgM)

Suspected congenital infection: neonatal first-line investigations
- FBC, LFT, total and conjugated bilirubin
- Urine CMV PCR
- Ensure newborn hearing screen is completed

Suspected genetic disorder
- Molecular karyotype (EDTA) OR
- If aneuploidy is suspected, FISH and standard karyotype (heparin)
- Consider consultation with a clinical geneticist

Appendix 1: Abbreviations

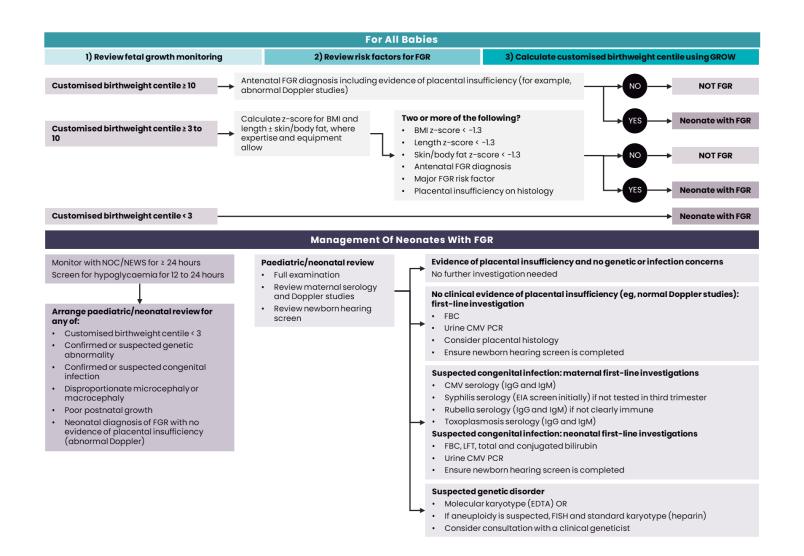|	
AC	Abdominal circumference
AEDF	Absent end-diastolic flow
CMV	Cytomegalovirus
CPR	Cerebroplacental ratio
cCTG	Computerised cardiotocograph
CTG	Cardiotocograph
DV	Ductus venosus
EDTA	Ethylenediaminetetraacetic acid
EFW	Estimated fetal weight
EIA	Enzyme immunoassay
FBC	Full blood count
FGR	Fetal growth restriction
FHR	Fetal heart rate
GPP	Good practice point
HC	Head circumference
HELLP	Haemolysis, elevated liver enzymes and low platelets
HIV	Human immunodeficiency virus
IgG	Immunoglobulin G
IgM	Immunoglobulin M
LFT	Liver function test
LMC	Lead maternity carer
MCA	Middle cerebral artery
MoM	Multiple of medians

NEWS   Newborn Early Warning Score

NIPT   Non-invasive prenatal testing

NOC   Newborn Observation Chart

NZMFMN   New Zealand Maternal Fetal Medicine Network

PAPP-A   Pregnancy-associated plasma protein-A

PCR   Polymerase chain reaction

PI   Pulsatility index

RCT   Randomised controlled trial

REDF   Reversed end-diastolic velocity

SGA   Small for gestational age

STV   Short-term variability

UA   Umbilical artery

UtA   Uterine artery

WHO   World Health Organization

Appendix 2: Te reo Māori kupu

hauora Māori   Holistic view of health and wellbeing

te ao Māori   The Māori worldview

te reo Māori   The Māori language

whānau   Family (in a broad sense)

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