GUIDELINE FOR THE
MANAGEMENT OF SUSPECTED SMALL FOR GESTATIONAL AGE
SINGLETON PREGNANCIES AFTER 34 WEEKS GESTATION

This guideline has been developed to achieve a more consistent approach to management of small for gestational age (SGA) singleton pregnancies and infants in New Zealand. Unaltered copies of this guideline may be freely reproduced and distributed.

Authorship and consultation process

This guideline was written by Professors Lesley McCowan and Frank Bloomfield with input from Dr Katie Groom and Dr Emma Parry and sonographer Martin Necas. Feedback was obtained from: the NZ Maternal Fetal Medicine Network, ADHB staff, Clinical Directors in Obstetrics and Gynaecology and Clinical Directors in Neonatology.
1. **DEFINITION**

SGA is defined as an infant with birthweight less than the 10th customised birth weight centile or a fetus with an estimated fetal weight (EFW) on a customised growth chart less than the 10th customised centile for gestation. Definitions which use customised standards to define SGA have been shown to be better associated with perinatal morbidity and mortality than definitions of SGA derived from population-based standards [1, 2]. Fetal growth restriction (a fetus that has failed to reach its growth potential) is another commonly used term which has considerable overlap with SGA but is more difficult to define in practice. Note: a fetus whose estimated fetal weight or abdominal circumference is crossing centiles on serial scans or who has a discrepancy between head and abdominal circumference may be growth restricted but may or may not meet the criteria for SGA.

2. **BACKGROUND**

SGA infants have increased rates of perinatal morbidity and mortality. New Zealand Perinatal and Maternal Mortality Review Committee data show that approximately 40% of normally-formed singleton stillborn infants born after 24 weeks’ have a birth weight < 10th customised centile [3]. Less than a quarter of these SGA stillborn infants are currently diagnosed before birth. Reductions in perinatal mortality in these vulnerable small babies depend on improved antenatal detection as well as careful management and timely delivery, the combination of which has been associated with reduced morbidity and mortality in SGA pregnancies [4].

3. **RISK ASSESSMENT, PREVENTION AND EARLY DETECTION**

All women require assessment at booking for risk factors for SGA infants. Those with major risk factors such as a history of a previous SGA infant or maternal diseases associated with increased risk (e.g. chronic hypertension, maternal renal disease, anti-phospholipid syndrome) require a plan for serial growth scans and, if seen at <20 weeks’, consideration of treatment with low dose aspirin which reduces the risk by 10-50% [5-7] (NZ committee of RANZCOG and New Zealand College of Midwives (NZCOM) guideline in press 2013). A detailed list of risk factors for SGA can be found in the recently published RCOG SGA guideline [8].

a. **Low risk women**

We recommend that all women should have a gestation-related optimal weight (GROW) chart generated at booking. This can be downloaded from the gestation network at [https://www.gestation.net/fetal_growth/download_grow.htm](https://www.gestation.net/fetal_growth/download_grow.htm) and is also available on many DHB computer systems. This chart generates the woman’s BMI and birth weight centile of any previous infant. All women should have symphysis-fundal height (SFH) measured and plotted regularly (but not more frequently than fortnightly) after 24 weeks. A growth scan should be undertaken if SFH is crossing centiles or < 10th (see ADHB GROW guideline for more details: [http://nationalwomenshealth.adhb.govt.nz/Portals/0/Documents/Policies/Customised%20Antenatal%20Growth%20Chart_.pdf](http://nationalwomenshealth.adhb.govt.nz/Portals/0/Documents/Policies/Customised%20Antenatal%20Growth%20Chart_.pdf)).

b. **High risk Women**

**Primary prevention of SGA**

The risk of SGA may be reduced, in women at high risk, by treatment with low dose aspirin, started before 20 weeks and preferably in the first trimester [5-7]. In New Zealand 100 mg low dose Aspirin tablets are widely available and subsided by Pharmac and this is the recommended dose (NZ committee of RANZCOG and NZCOM Aspirin guideline in press 2013).
Early detection of SGA
In women assessed to be at high risk of severe or early SGA [e.g. previous early SGA with delivery <34 weeks, anti-phospholipid syndrome, severe chronic hypertension, maternal renal disease or an autoimmune condition] uterine artery Doppler studies at 20-24 weeks may help to identify the subgroup at highest risk [9]. Those with very abnormal uterine artery Doppler studies have an approximately 60% risk of developing SGA or preeclampsia requiring delivery <34 weeks and should have regular scans and maternal surveillance [10].

Women at high risk should all have serial growth scans planned in addition to regular measurement of symphysis-fundal height. Individual ultrasound measurements of head, abdomen and femur length should be plotted on the population ASUM ultrasound charts and the estimated fetal weight plotted on the GROW chart. The information from both sources as well as the clinical information should be used to make a full assessment. As >80% of SGA infants are born after 37 weeks [15] serial growth scans should continue to at least 36-37 weeks and scans should not be discontinued earlier in the third trimester if growth is normal in at risk women.

4. WHO SHOULD BE CONSIDERED FOR GROWTH SCANS?

a. Previous SGA baby
These women have a threefold increase in risk of SGA. Monthly growth scans should be planned. The gestation at which growth scans are started should be individualised, depending on the gestation of delivery of the previously affected infant e.g. if a previous SGA infant was born preterm, monthly scans should be planned from 24 weeks; if born at term, plan monthly scans from 32 weeks.

b. Underlying Medical Conditions
(e.g. moderate to severe chronic hypertension, renal disease, autoimmune disease, anti-phospholipid syndrome, moderate to severe cardiac disease)
These women need a plan for monthly scans with more frequent scans if suboptimal growth is suspected. Again, gestation at initiation should be individualised according to the degree of risk.

c. Smokers
Women who continue to smoke in pregnancy have a twofold increase in risk of SGA whereas those who become smoke-free by 15 weeks have no increase in risk compared with non-smokers [11]. Most SGA infants born to smokers are born at term. At a minimum, a growth scan should be considered at approximately 36 weeks of gestation. More frequent scans should be considered if there are additional risk factors for SGA.

d. Obese Women
The cut-off BMI at which fundal height measurement is less reliable is difficult to prescribe as it depends on distribution of fat and maternal height. As a guide, a plan for growth scan(s) usually should be recommended with a BMI of >35 [8]. Antenatal detection of SGA is reduced in obese women [12].

At National Women’s Hospital, recent research has suggested that obese women (BMI >30) also have a 25% increased risk of having an SGA baby after adjustment for confounding factors such as chronic hypertension [13]. This means that the absolute risk of SGA in a woman with uncomplicated obesity is about 15%. Obese women should therefore be considered for a scan
at approximately 36-37 weeks’. More frequent scans should be considered if there are additional risk factors for SGA.

e. Abnormal serum analytes
First trimester aneuploidy screening includes measurement of PAPP-A and hCG. Abnormal levels of these analytes (in particular low PAPP-A) is associated with increased risks of SGA and preeclampsia. The National Screening Unit identifies and reports these abnormal results (PAPP-A <0.2 MoM, hCG >5 MoM). Low dose aspirin (100 mg) is recommended starting <20 weeks’, especially in those with other risk factors. Serial growth scans in the third trimester should also be considered.

f. Multiple pregnancies
Monthly scans are recommended for di-chorionic di-amniotic twin pregnancies, and fortnightly scans for mono-chorionic di-amniotic twins – links to RANZCOG guidelines can be found at the following site: http://www.ranzcog.edu.au/womens-health/statements-a-guidelines/new-a-revised-statements-and-guidelines/413-management-of-monochorionic-twin-pregnancy-c-obs-42.html

5. ANTE NATAL MANAGEMENT OF SUSPECTED SGA

In cases of very early onset SGA (<32 weeks’) intrinsic fetal causes such as chromosomal abnormality, structural anomalies and fetal infection need to be considered. Women should be referred for specialist and/or MFM review and further investigation. Detailed management of early onset SGA is not considered further in this guideline.

Once an SGA infant is suspected, umbilical artery (UA) Doppler studies should be performed at the time of the growth scan to stratify risk and enable planning of on-going management. Specialist referral must be made and a follow up growth scan arranged (See Figure 3).

The optimum interval for serial scanning in suspected SGA is at least two weeks with fewer false positive diagnoses of SGA if the interval between scans is three weeks [14].

NOTE:
In all cases where SGA is suspected, antenatal surveillance should include advice about fetal movements. The ANZSA leaflet about fetal movements is a useful resource and can be found at the following site: http://www.stillbirthalliance.org.au/guideline4.htm.

In nulliparous women about 25% of SGA babies are born to women with hypertensive complications (preeclampsia, gestational hypertension, chronic hypertension) [15]. SGA can be the first presentation in hypertensive pregnancy and women should be informed about the symptoms of preeclampsia, and regular monitoring of BP and urinalysis should be performed at each clinical assessment.
a. **Interpretation of growth scans**

Individual ultrasound measurements of the fetal head, abdomen, and femur length should be plotted on the Australasian Society of Ultrasound in Medicine (ASUM) population ultrasound charts and the estimated fetal weight plotted on the GROW chart. The information from both sources should be used to make a full assessment.


**NOTE:**

The abdominal circumference (AC) is usually the first fetal measurement to become reduced in SGA. Suboptimal fetal growth should be suspected when:

- The abdominal circumference on the population scan chart is $< 5^{th}$ centile
- Discrepancy between head and abdominal circumferences (e.g. HC $75^{th}$ centile and AC $20^{th}$ centile which suggests wasting)
- AC is $> 5^{th}$ % but is crossing centiles e.g. $> 20\%$ reduction
- EFW on the GROW chart is $< 10^{th}$ centile
- EFW on the GROW chart is crossing centiles (see examples in Figure 1).

When interpreting growth scan results it is also important to consider the margin of error (which is usually about 10%) especially if measurements vary from one scan to the next e.g. if EFW or AC fluctuates around the $5^{th}$ or $10^{th}$ centile this is likely to be a baby with a growth problem and a follow up scan should be performed.

Interpretation of growth trend improves with a greater number of biometric data points. In general, it is more difficult to be certain of small changes in growth trend when only two sets of measurements are available, especially if these were not performed by the same practitioner.

**Figure 1: EFW patterns on GROW charts that suggest suboptimal fetal growth**
Figure 2a: Examples of suspected sub-optimal fetal growth on ASUM population ultrasound chart

Asymmetric SGA with reduced interval growth of AC
Figure 2b: Examples of suspected sub-optimal fetal growth on ASUM population ultrasound chart

Scan at 34 weeks suggests asymmetry between head and abdomen. The patient needs umbilical artery Doppler and follow up growth scan in 3 weeks.
Figure 2c: Examples of suspected sub-optimal fetal growth on ASUM population ultrasound chart

Minimal interval growth of abdominal circumference even though measurements still in normal range. The patient needs umbilical Doppler, specialist referral and ongoing scans.
b. **SGA with normal UA Doppler**

Approximately two thirds of SGA infants identified in the antenatal period will have normal UA Doppler studies, and this is usual in SGA infants diagnosed after 34 weeks (see the Appendix for reference ranges). Normal UA Doppler findings exclude major fetoplacental vascular pathology but can still be associated with placental pathology such as abnormal utero-placental perfusion or abnormal transfer of nutrients. The morbidity and mortality in these SGA infants is increased compared with appropriate for gestational age babies but to a lesser extent than in SGA babies with abnormal UA Doppler. Subgroups of SGA babies with normal UA Doppler who are at higher risk of morbidity (acidosis at birth, LSCS for fetal distress) include those with:

- Abnormal middle cerebral artery (MCA) Doppler studies [16, 17]
- Abnormal ratio of MCA / UA Doppler indices (cerebro placental ratio (CPR) [16, 17]
- Abnormal uterine artery Doppler studies at time of diagnosis of SGA [17, 18]
- Extreme SGA with estimated fetal weight <3rd centile [19]

**It is recommended that delivery is undertaken in these higher risk SGA pregnancies by 38 weeks, or earlier if additional maternal or fetal concerns.**

A suggested management algorithm for clinical services with access to MCA and uterine artery Doppler assessments is outlined in Figure 3.

**Abnormal MCA Doppler or CPR indices**

Fetuses with abnormal MCA Doppler studies or a low CPR are at increased risk of acidosis at birth [16, 17], may benefit from more frequent surveillance [20] and, as suggested above, earlier delivery by 38 weeks or earlier if concern. Twice-weekly surveillance is recommended, including clinical review, CTG, scan for liquor volume and umbilical artery and MCA Doppler studies, in addition to growth scans where possible at 3 weekly intervals (see Figure 3). Document the management plan in the clinical record (see the Appendix for MCA & CPR Doppler reference ranges).

**Abnormal Uterine artery Doppler studies**

SGA pregnancies with normal umbilical artery Doppler studies and abnormal mean uterine artery Doppler indices (see the Appendix for reference ranges) or bilateral uterine artery notching at the time SGA is diagnosed are a subgroup with abnormal placental blood supply who are also at increased risk of fetal compromise in labour [17, 18].

**Severe SGA**

Fetuses with EFW < 3rd centile with normal UA, MCA, CPR and uterine artery Doppler studies still have an increased risk of fetal compromise in labour and this may occur soon after the onset of contractions [19]. They therefore also comprise a high risk subgroup.

Note- when using GROW the clinician will need to eyeball the plot of the EFW on the GROW chart and identify babies with EFW well below the 10th centile who may fit into this more severe SGA category.

**Normal MCA/CPR and uterine artery Doppler studies and EFW >3rd centile**

It has been suggested that these small babies, who have low rates of hypoxia, may be considered constitutionally small and delivered at 40 weeks, unless there is other clinical concern (Figuers personal communication). Weekly clinical visits and three weekly growth scans and Doppler studies are recommended when the above Doppler parameters are normal and the fetus is not suspected to have severe SGA [20] (Figure 3). Document plan in clinical record.
6. DELIVERY PLANNING

a. Delivery at 38 weeks
   This approach is recommended in centres where additional fetal assessment with MCA and uterine artery Doppler studies is not possible to identify further the SGA babies at highest risk and is in keeping with recent SMFM guidelines which recommend induction at 38-39 weeks in SGA with normal umbilical artery Doppler studies [21]. The consensus view from the recent Disproportionate Intrauterine Growth Intervention Study at Term (DIGITAT) is that the optimum time for induction in SGA pregnancies is at around 38 weeks’ - this was associated with the lowest perinatal morbidity [22, 23] and is cost effective. This recommendation is in keeping with findings from population-based studies which suggest that delivery of SGA infants at 38 weeks of gestation may be associated with lower perinatal mortality compared with later delivery [24]. Data from DIGITAT also showed that a policy of induction of labour in SGA babies at term (greater than 37 weeks’) was not associated with increased risk of Caesarean section [23].

All women with SGA pregnancies need a plan for serial monitoring for maternal and fetal wellbeing. In the DIGITAT study surveillance with twice weekly CTGs and daily fetal movement monitoring was undertaken in expectantly managed women. There is no good evidence to support this surveillance regimen other than the fact that in DIGITAT there were no perinatal deaths in over 600 SGA pregnancies. Women with normal umbilical artery Doppler studies who do not have additional Doppler parameters performed should therefore be considered for twice weekly surveillance as per DIGITAT.

b. Management plan with MCA, uterine artery Doppler and severity of SGA (Fig 3)
   As outlined above, in settings where more detailed assessment is possible with MCA and uterine artery Doppler an alternative approach is recommended with induction of labour of the highest risk subgroups by 38 weeks’ (or earlier if concern) whereas babies with normal MCA, CPR, uterine artery Doppler and with EFW not <10th centile are likely to be constitutionally small and deliver y at 40 weeks’ is reasonable unless there is other clinical concern.

   Method of induction of labour
   The optimum mode of induction of labour for these infants may be with a Foley catheter, as this reduces the risk of hyper stimulation with fetal heart changes [25] which the SGA fetus may not tolerate as well as an appropriately-grown fetus.

   Labour and birth
   SGA fetuses have increased rates of acidosis in labour. Women with SGA pregnancies and spontaneous labour should be advised to be admitted early in labour to enable fetal monitoring. For SGA fetuses with evidence of brain sparing (low MCA resistance or a low CPR) continuous fetal heart rate monitoring is recommended from the onset of uterine activity.

c. SGA with Abnormal UA Doppler
   These pregnancies have an elevated pulsatility index in the UA but antegrade end-diastolic flow
is still present. They are often pre-term and the association with maternal hypertension is common. It is recommended that these pregnancies should have twice-weekly fetal and maternal surveillance as an outpatient (see Figure 3). If preeclampsia is confirmed admission is recommended. Arrange surveillance through day assessment unit (DAU) or local alternative. Clarify with DAU staff, the woman and her LMC the name of the specialist and/or team responsible for clinical decision-making. Document plan in clinical record.

There should be a low threshold for delivery if there is any concern about maternal or fetal wellbeing or suspected cessation of fetal growth. These fetuses are at higher risk in labour; however, they may still tolerate vaginal birth. Fetal monitoring should be undertaken from the onset of uterine activity and induction of labour (if undertaken) may be preferable with a Foley balloon catheter [25]. Again, if spontaneous labour occurs, women need to be admitted early in labour. It is unusual for delivery to be required at less than 34 completed weeks’ but if it is necessary and time allows, then corticosteroids should be administered.

d.  **SGA with Absent (AEDV) or Reversed End-diastolic Velocity (REDV)**

This markedly abnormal Doppler finding occurs in 1-2% of all SGA pregnancies, usually in the second or early third trimester. If this very abnormal Doppler finding is identified same day admission should be arranged.

7. **NEONATAL MANAGEMENT AFTER BIRTH**

a.  **Neonatal problems in SGA babies**

Babies born SGA (defined as birthweight <10th percentile on whichever growth charts are used at the birth facility [26] for discussion of growth charts) are at increased risk for common neonatal morbidities, most notably hypoglycaemia, hypothermia and jaundice.

Note that a birthweight of <2.5 Kg (low birthweight) is substantially below the 10th percentile at term and represents a profoundly small baby; this criterion, therefore, is not a suitable lower limit for initiating monitoring of SGA babies.

If there is access to full growth standards (i.e. length and head circumference centile charts in addition to birthweight centiles) then disproportionate growth (length and head circumference on significantly higher centiles than weight) may also be an indication for regarding the baby at risk secondary to IUGR, even if the birthweight is above the 10th customised percentile.

b.  **Hypoglycaemia:**

In healthy, term babies, there is a transient rise in glucose concentrations around the time of birth secondary to glycogenolysis and gluconeogenesis. This, however, is followed by a rapid decline, reaching a nadir at 1-2 hours of age. Concentrations then rise to be similar to fetal concentrations (approximately two-thirds maternal concentrations) by about 3-4 hours of age. Adult concentrations usually are not reached until 3-4 days of age. SGA babies are at increased risk for hypoglycaemia secondary to decreased hepatic glycogen stores and, frequently, an inappropriately high level of insulin secretion for the prevailing glucose concentrations. This has the potential to make the hypoglycaemia more dangerous as glycogenolysis and production of alternative cerebral fuels are inhibited by insulin. Hypoglycaemia is common in SGA babies. A
recent New Zealand study found that 52% of babies with a birthweight below the 10th customised percentile will have an episode of hypoglycaemia (blood glucose concentration <2.6 mmol/L) [27]. Most of these (50%) occurred during the first 6 hours after birth but 37% of babies had their first low blood glucose concentration after three normal measurements. Low blood glucose concentrations are associated with brain injury [28, 29] and, therefore, babies at risk should have regular blood glucose monitoring until confirmation of transition. It is important to note that the majority of babies with hypoglycaemia will not exhibit any symptoms.

c. Monitoring at-risk babies for hypoglycaemia
- Only a device that uses the glucose oxidase method (e.g. blood gas analyser, EPOC, iSTAT, laboratory analyser) reliably detects hypoglycaemia. Point-of-care devices (e.g. BM Stix, Precision G monitors, Accu Chek) do not detect hypoglycaemia reliably.
- Blood glucose concentration should be measured at approximately one hour of age and then pre-feed thereafter.
- Feeding should commence early; complementary feeds are not indicated unless the blood glucose concentration is <2.6 mmol/L.
- Blood glucose monitoring can be discontinued once three consecutive blood glucose concentrations are within the normal range (≥2.6 mmol/L).
- However, if the baby is not feeding well, there is a poor milk supply or the baby has any symptoms that may be due to hypoglycaemia (lethargy, irritability, jitteriness, hypothermia) on-going monitoring, or recommencement of monitoring, is indicated.

d. Management of hypoglycaemia
Many hospitals will have their own algorithm for the management of babies with hypoglycaemia detected on the postnatal ward and local guidelines should be followed until a national guideline is developed and adopted. This is an area of active research within New Zealand and new information is likely to be available for incorporation into local guidelines by the end of 2013. Examples of algorithms can be found at:
- Generally, mildly or moderately low blood glucose concentrations (e.g. 2.0–2.6 mmol/L) can be managed in the first instance with additional / complementary feeds followed by a repeat measurement after 30 minutes.
- Babies with moderately or profoundly low blood glucose concentrations (e.g. <2.0 mmol/L) should be referred urgently to the paediatric service for admission to NICU/SCBU and an additional feed, using complementary feeds if necessary, be given immediately pending admission.
- Babies with hypoglycaemia that does not respond to additional breast or complementary feeds, or that is recurrent, should be referred for paediatric assessment, even if the hypoglycaemia is only mild.
- Babies with symptomatic hypoglycaemia should be referred for paediatric assessment.

e. Management of hypothermia
Hypothermia is consequent upon an increased body surface area to weight ratio, augmenting heat loss.
- SGA babies should have their temperature monitored for at least 12 hours or until stable.
- Ongoing hypothermia or temperature instability may be a sign of underlying metabolic illness or sepsis and further advice should be sought.

f. Monitoring and management of jaundice
Jaundice in the newborn is a normal phenomenon, as bilirubin acts as a scavenger of free
radicals which are high after birth. However, jaundice can also be a sign of underlying problems which may be serious and high levels of jaundice can cause kernicterus, a devastating neurological illness. The significance of jaundice in any given baby depends upon the maturity and age of the baby, on the clinical condition and whether there are any other conditions present.

- It is difficult to estimate serum bilirubin concentrations by skin colour alone: if there is concern, a blood test should always be taken
- Any clinical jaundice in the first 24 hours after birth should be regarded as abnormal and should be referred to the paediatric service
- Jaundice is more common in SGA and IUGR babies because they frequently have a degree of polycythaemia
- Prolonged jaundice (definitions may vary, but generally beyond 10-14 days, serum bilirubin >150-200 µmol/L in term babies) should be evaluated to exclude a conjugated hyperbilirubinaemia or other underlying cause
- Late onset jaundice (>7-10 days after birth) should also be evaluated as this is unlikely to be physiological
- To assist in the evaluation of serum bilirubin concentrations, these should be plotted on a chart that gives guidance as to intervention (an example can be found at http://www.adhb.govt.nz/newborn/Guidelines/images/SBR%20Chart%20-%20term%20without%20haemolysis.jpg

Note preterm babies, babies with ongoing haemolysis or those with co-existing conditions may have different thresholds for intervention (an example can be found at http://www.adhb.govt.nz/newborn/Guidelines/images/SBR%20Chart%20-%20preterm%20and%20haemolysis.jpg

### g. Investigation of underlying cause of SGA

The pregnancy and maternal histories may provide a good explanation for the cause of SGA or IUGR, such as pre-existing maternal disease, evidence of placental vascular disease, exposure to toxins such as cigarette smoking etc. However, consideration should be given as to whether further investigations are indicated. In the absence of an identifiable cause in the history, further investigations should always be undertaken as this may impact on management of the SGA baby, the likely risk of recurrence in subsequent pregnancies and management of those pregnancies. Investigations may include the following:

- Consent must be obtained for pathological examination of the placenta
- Karyotype (of the baby and, in cases of extreme IUGR with a very small placenta, of the placenta for confined placental mosaicism)
- Congenital infection
- Additional investigations for rarer metabolic / endocrine / genetic causes if indicated

### h. Preterm, SGA babies

Babies born preterm are at risk of similar morbidities as babies born SGA, regardless of whether they are themselves SGA. Babies born both preterm and SGA are, therefore, at increased risk and should be monitored closely, particularly for poor feeding, hypoglycaemia and hypothermia.

### 8. MATERNAL FOLLOW-UP/ADVICE FOR FUTURE PREGNANCIES

Women who have given birth to a SGA infant have an increased risk of recurrence in a future pregnancy. They need to be advised to book early in a future pregnancy so that a specialist consultation can be performed and low dose aspirin prescribed. Attention needs, to be paid to modifiable risk factors such as cigarette smoking.
Figure 3: Management of SGA ≥ 34 weeks gestation

1 AC≤5%; discrepancy between HC and AC; customized EFW < 10%; AC or customized EFW crossing centiles
2 Recommend Foley catheter induction of labour
3 Recommend computerised cardiotocograph
4 Reversed or absent end diastolic velocity
5 Middle cerebral artery,
6 Cerebro-placental ratio
7 Continuous fetal heart rate monitoring from onset of contractions
8 Continuous fetal heart rate monitoring in established labour
References:


### Quick reference tables for Umbilical Artery, MCA, Uterine artery Doppler and Cerebroplacental ratio

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### References:


### Note to ultrasound practitioners:

Further information about the standards of performance and reference ranges of obstetric Doppler examinations is available in the NZMFMN Obstetric Doppler Guideline 2013.
References: