ANTENATAL OBSTETRIC ULTRASOUND: INDICATIONS FOR DOPPLER ASSESSMENT

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The aim of this guideline is to achieve a standardised approach to Doppler examinations performed in obstetric patients in the Christchurch region.

It is based on the New Zealand Obstetric Doppler Guideline, New Zealand Maternal Fetal Medicine Network 2014, slightly tailored to accommodate clinical practice specific to the Christchurch region.

Its primary focus is to recommend indications and pathways for Doppler assessment. Details in regards to Doppler technique, reference tables and reference graphs for Doppler values are not included in this document but can be found in the New Zealand Obstetric Doppler Guideline, New Zealand Maternal Fetal Medicine Network 2014.

**DEFINITIONS**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
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<tbody>
<tr>
<td>SGA</td>
<td>small for gestational age</td>
</tr>
<tr>
<td>IUGR</td>
<td>intrauterine growth restriction</td>
</tr>
<tr>
<td>AC</td>
<td>abdominal circumference</td>
</tr>
<tr>
<td>EFW</td>
<td>estimated fetal weight</td>
</tr>
<tr>
<td>GROW chart</td>
<td>customised fetal growth chart</td>
</tr>
<tr>
<td>IUD</td>
<td>intrauterine death</td>
</tr>
<tr>
<td>IDDM</td>
<td>insulin dependent diabetes</td>
</tr>
<tr>
<td>NIDDM</td>
<td>non-insulin dependent diabetes</td>
</tr>
<tr>
<td>IVF</td>
<td>in vitro fertilisation</td>
</tr>
<tr>
<td>PI</td>
<td>pulsatility index</td>
</tr>
<tr>
<td>UA</td>
<td>umbilical artery</td>
</tr>
<tr>
<td>MCA</td>
<td>middle cerebral artery</td>
</tr>
<tr>
<td>V max</td>
<td>peak systolic velocity</td>
</tr>
<tr>
<td>CPR</td>
<td>cereboplaental ratio</td>
</tr>
<tr>
<td>DV</td>
<td>ductus venosus</td>
</tr>
<tr>
<td>MoM</td>
<td>multiples of median</td>
</tr>
<tr>
<td>DCDA twins</td>
<td>dichorionic diamniotic twins</td>
</tr>
<tr>
<td>MCDA twins</td>
<td>monochorionic diamniotic twins</td>
</tr>
<tr>
<td>MCMA twins</td>
<td>monochorionic monoamniotic twins</td>
</tr>
<tr>
<td>TTTS</td>
<td>Twin Twin Transfusion Syndrome</td>
</tr>
<tr>
<td>TAPS</td>
<td>Twin Anaemia Polycythaemia Sequence</td>
</tr>
</tbody>
</table>
SINGLETON PREGNANCIES

UMBILICAL ARTERY DOPPLER (UA)

Use
- An indicator of placental function

Measurement
- Measured as Pulsatility Index (PI)
- > 95th percentile is abnormal
- Absent or reversed end diastolic flow is abnormal

Clinical indications
- Current SGA/IUGR
- Previous Intrauterine death (IUD) or stillbirth
- Previous IUGR
- Maternal hypertensive disorders (preeclampsia, pregnancy induced hypertension, essential hypertension)
- Maternal smoking or illicit drug use (including methadone program/Ngā Taonga Pēpi)
- Maternal diabetes (IDDM or NIDDM)
- Abnormal uterine artery Dopplers in the current pregnancy
- Abnormal UA, MCA or DV Doppler on a previous scan in the current pregnancy
- Significant antepartum haemorrhage (abruption)
- Decreased fetal movement

AND/OR

Ultrasound scan indications
- SGA/IUGR:
  – Abdominal circumference (AC) < 10th percentile and/or
  – Estimated fetal weight (EFW) < 10th percentile
- AC dropping centiles between 2 growth scans >= 30%
- EFW dropping centiles between 2 growth scans >=30%
- Static or near static interval AC growth
- Oligohydramnios
- Hydrops

Doppler not indicated
The clinical indications outlined above are HIGH risk for SGA/IUGR and it is recommended Doppler assessment be performed in these patients.

Pregnancies with NO or LOW maternal or fetal risk factors with normal growth and normal amniotic fluid do not require Doppler assessment.

eg. gestational diabetes, low risk maternal medical disease such as Thyroid disease, Graves’ disease, Crohn’s disease, maternal fibroids, low risk fetal anomalies, IVF, low Papp A with normal uterine artery Dopplers
Troubleshooting tips
- If PI is abnormal sample both umbilical arteries and use the more normal (lower) value
- Sample approximately mid umbilical cord (sampling too close to the fetal abdomen may produce a falsely elevated PI value)
- Perform Doppler at the start of the scan and if abnormal repeat at the end of the scan (allows time for an active baby to quieten down which may normalise the PI)

MIDDLE CEREBRAL ARTERY DOPPLER (MCA)

Use
- An indicator of blood flow through the fetal brain
- Abnormal = ‘fetal brain sparing’

Measurement
- Measured as Pulsatility Index (PI).
- $< 5^{th}$ percentile is abnormal

Indications
- SGA/IUGR on scan but normal UA PI Doppler in a fetus after 34 weeks’ gestation
- Abnormal UA PI Doppler at any gestation

MCA PEAK SYSTOLIC VELOCITY (MCA V MAX)

Use
- Detection of fetal anaemia

Measurement
- cm/sec
- $> 1.5$ MoM is abnormal
- Angle correction is necessary

Indications
- Maternal fetal isoimmunisation
- Any suspicion of fetal anaemia
- Unexplained hydrops
- MCDA twins with suspicion of TTTS or TAPS.

CEREBROPLACENTAL RATIO (CPR)

Measurement
- Defined as the ratio of the Middle cerebral artery PI and the Umbilical artery PI
- $< 5^{th}$ percentile is abnormal

Indications
- Should always be calculated if Umbilical artery PI and Middle Cerebral Artery PI are performed
DUCTUS VENOSUS DOPPLER (DV)

**Use**
- Is an indicator of fetal cardiac function

**Measurement**
- Either Pulsatility Index (PI) AND/OR A wave above or below the baseline
- PI > 95th percentile is abnormal
- A wave below baseline/reversed is abnormal

**Indications**
- Raised UA PI AND low MCA PI in an SGA/IUGR baby

UTERINE ARTERY DOPPLER

**Use**
- Screening for patients at high risk of early onset SGA or early preeclampsia

**Measurement**
- Pulsatility Index (PI)
- PI is recorded as the Mean PI value between the two uterine artery Dopplers
- > 95th percentile is abnormal
- Bilateral notching after 24 weeks is abnormal

**Indications**
- High risk for early onset SGA or early preeclampsia
- Known hypertensive disorder
- Low Papp A on first trimester screening.

**Timing**
- Perform at 20 or 24 weeks’ gestation
- If abnormal at 20 weeks repeat at 24 weeks

TWIN PREGNANCIES

DICHORIONIC DIAMNIOTIC TWINS
- Doppler assessment as per singleton pregnancy Doppler guideline above

MONOCHORIONIC TWINS (MCDA AND MCMA)
- If any suspicion of TTTS at any gestation from 16 weeks:
  - UA PI + MCA PI + CPR + MCA (V max) + DV PI
  - (report UA diastolic flow as present, absent or reversed between 16 and 21 weeks)
  - (report UA PI from 21 weeks)
If no suspicion of TTTS:
UA PI from 16 weeks
(report UA diastolic flow as present, absent or reversed between 16 and 21 weeks)
(report UA PI from 21 weeks)
add in MCA (V max) from 24 weeks

DOPPLERS FOR SPECIFIC CLINICAL SITUATIONS

HISTORY OF REDUCED FETAL MOVEMENT

- If the patient presents with a history of reduced fetal movement the sonographer should assess:
  1. growth
  2. amniotic fluid
  3. UA PI Doppler
  4. fetal movement (eg. Good movement, reduced movement etc)
  5. fetal cardiac activity
- If abnormal UA PI Doppler or if baby SGA on scan perform MCA Doppler + CPR

POST DATES

- Defined as greater than 40 weeks’ gestation

If Doppler examination is specifically requested

- Assess growth and amniotic fluid
- If BOTH growth and fluid are normal then Doppler assessment is not required. Report to state:

  “Normal Dopplers post-dates may be falsely reassuring. Clinical assessment is required.”

- If abnormal growth OR abnormal fluid perform Dopplers as per Doppler Indication Section above (page 3)
  ie. perform UA PI if normal growth but oligohydramnios or other significant clinical risk
  ie. perform UA PI + MCA PI + CPR if reduced interval growth ≥ 30% or SGA on scan

If Growth scan only is requested

- Assess growth and amniotic fluid.
- If BOTH growth and fluid are normal then Doppler assessment is not required
- If EITHER of these are abnormal perform as per Doppler Indication Section above (page 3)
  ie. perform UA PI if normal growth but oligohydramnios or other significant clinical risk
  ie. perform UA PI + MCA PI + CPR if reduced interval growth ≥ 30% or SGA on scan
**DOPPLER EXAMINATION SPECIFICALLY REQUESTED BY REFERRER**

- If there are no clinical risk factors indicated or low clinical risk (see above)

AND

- NORMAL fetal growth (including interval growth) + NORMAL amniotic fluid then Doppler assessment is not required.
- The report should state:

> “As there are no clinical risk factors for SGA indicated and normal growth, Doppler assessment has not been performed as per New Zealand Obstetric Doppler Guideline NZMFMN 2014.”

**CUSTOMISED GROW CHART**

- Reporting Radiologists in Christchurch do not currently have access to GROW charts which plots customised Estimated Fetal Weight (EFW) for each individual patient
- Until this can be resolved Radiology reports currently include a recommendation at the end:

> “Growth measurements in this report are plotted on population based growth charts. It is recommended that EFW be plotted on a customised GROW chart. If the EFW is less than 10th percentile on GROW chart, recommend the patient return for Doppler assessment if this has not already been performed.”

**REFERENCES**


**CONTRIBUTORS**

Dr Rachael McEwing (Obstetric Radiologist, Christchurch Women’s Hospital and Christchurch Radiology Group)
Dr Rachel Belsham (Obstetric Radiologist, Christchurch Women’s Hospital)
Dr Suganthi Chandru (Fetal Medicine Specialist, Christchurch Women’s Hospital)
Dr Jerome Mayers (Fetal Medicine Specialist, Christchurch Women’s Hospital)
Dr Shelly Mather (Fetal Medicine Specialist, Christchurch Women’s Hospital)
Rex de Ryke (Charge Sonographer Christchurch Women’s Hospital)
Julie Beaumont (Branch Manager Reflect, Christchurch Radiology Group)
Lizzie Notley (Senior Obstetric Sonographer, Christchurch Radiology Group)
Gillian Waterhouse (Senior Obstetric Sonographer, Christchurch Radiology Group)
Reviewed by Dr Rosemary Reid (Fetal Medicine Specialist, Christchurch Women’s Hospital)
## APPENDIX 1: SUMMARY DOPPLER INDICATIONS 2016

### UMBILICAL ARTERY DOPPLER INDICATIONS

<table>
<thead>
<tr>
<th>CLINICAL INDICATION</th>
<th>and/or</th>
<th>SCAN INDICATION</th>
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<tbody>
<tr>
<td>• Current SGA/IUGR</td>
<td>• SGA/IUGR:</td>
<td>• AC &lt; 10th percentile</td>
</tr>
<tr>
<td>• Previous Intrauterine death (IUD) or stillbirth</td>
<td>and/or</td>
<td>• EFW &lt; 10th percentile</td>
</tr>
<tr>
<td>• Previous SGA/IUGR</td>
<td>• AC dropping centiles between 2 growth scans by &gt; = 30%</td>
<td></td>
</tr>
<tr>
<td>• Maternal hypertensive disorders (preeclampsia/PET, pregnancy induced hypertension/PIH, essential hypertension/increased bp)</td>
<td>• EFW dropping centiles between 2 growth scans by &gt; = 30%</td>
<td></td>
</tr>
<tr>
<td>• Maternal smoking or illicit drug use (incl. methadone program/Ngā Taonga Pēpi)</td>
<td>• Static or near static interval growth</td>
<td></td>
</tr>
<tr>
<td>• Maternal diabetes (IDDM or NIDDM)</td>
<td>• Oligohydramnios</td>
<td></td>
</tr>
<tr>
<td>• Abnormal uterine artery Dopplers in the current pregnancy</td>
<td>• Hydrops</td>
<td></td>
</tr>
<tr>
<td>• Abnormal UA, MCA or DV Dopplers in the current pregnancy</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>• Significant APH (possible abruption)</td>
<td>•</td>
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<tr>
<td>• Decreased fetal movement</td>
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### MIDDLE CEREBRAL ARTERY DOPPLER INDICATIONS

- SGA/IUGR on scan but normal UA Doppler after 34 weeks’ gestation
- Abnormal UA at any gestation

### CEREBROPLACENTAL RATIO

- Calculate when both UA and MCA Dopplers are performed

### DUCTUS VENOSUS DOPPLER INDICATION

- Abnormal UA Doppler AND abnormal MCA Doppler in an SGA/IUGR baby.

### MCA PEAK SYSTOLIC VELOCITY (MCA V MAX)

- Maternal fetal isoimmunisation
- Any suspicion of fetal anaemia
- Unexplained hydrops
- MCDA twins with suspicion of TTTS or TAPS

### DCDA TWINS

- As per singleton Dopplers above
MONOCHORIONIC TWINS

- If any suspicion of TTTS at any gestation from 16 weeks:
  UA PI + MCA PI + CPR + MCA (V max) + DV PI
  (report UA diastolic flow as present, absent or reversed between 16 and 21 weeks)
  (report UA PI from 21 weeks)

- If no suspicion of TTTS:
  UA PI from 16 weeks
  (report UA diastolic flow as present, absent or reversed between 16 and 21 weeks)
  (report UA PI from 21 weeks)
  add in MCA (V max) from 24 weeks

MEAN UTERINE ARTERY DOPPLER

- Screening for patients at high risk of early onset preeclampsia or early onset SGA at 20 or 24 weeks
- Hypertensive disorder
- Low Papp A on first trimester screening
**Appendix 2: Summary Doppler Pathways Flowchart**

- **High clinical risk for SGA/IUGR and/or SGA/IUGR on scan**
  - Any gestation UA PI
  - Normal UA PI
  - Abnormal UA PI
  - Add MCA PI and CPR
  - UA and MCA BOTH abnormal Add DV Doppler

- **SGA/IUGR on scan after 34 weeks**
  - Normal UA PI
  - Abnormal UA PI

- **High risk of early onset preeclampsia or early onset IUGR, hypertensive disorder, low Papp A**
  - Mean Uterine Artery PI at 20 or 24 weeks
  - MCA Peak Systolic Velocity (V max)

- **Suspected Fetal Anaemia**
  - As per Singleton Doppler pathway above

- **Dichorionic Diamniotic Twins**

- **Monochorionic Twins (MCDA or MCMA)**
  - If suspicion of TTTS at any gestation from 16 weeks
  - UA PI + MCA PI + MCA (Vmax) + CPR + DV PI (report UA diastolic flow as present, absent or reversed between 16 and 21 weeks) (report UA PI from 21 weeks)

- **No suspicion of TTTS**
  - UA PI from 16 weeks + MCA (Vmax) from 24 weeks (report UA diastolic flow as present, absent or reversed between 16 and 21 weeks) (report UA PI from 21 weeks)