

OBSTETRIC DOPPLER

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PURPOSE

- The aim of this guideline is to achieve a standardised approach to Doppler examinations performed in obstetric patients at Health New Zealand, Te Whatu Ora, Waitaha, Canterbury.
- It is based on the New Zealand Obstetric Ultrasound Guideline (NZ Ministry of Health 2019) and the new SGA/FGR Guideline (Health NZ, Te Whatu Ora, 2023) which supersedes previous guidelines including the NZ Maternal Fetal Medicine Network Obstetric Doppler Guideline 2014.
- Its primary focus is to recommend indications and pathways for Doppler assessment.
- Recommendations in this guideline are slightly tailored to accommodate clinical practice in the high risk patient population specific to Christchurch Hospital.

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Details in regard to Doppler pathophysiology, 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 (NZ Maternal Fetal Medicine Network 2014) and Doppler in Obstetrics (Nicolaides et al 2002).

DEFINITIONS

FGR	fetal growth restriction
SGA	small for gestational age
BPD	biparietal diameter
HC	head circumference
AC	abdominal circumference
FL	fetal length
EFW	estimated fetal weight
GROW chart	customized fetal growth chart
IUD	intrauterine death
PI	Pulsatility index
UA	umbilical artery
MCA	middle cerebral artery
V max	peak systolic velocity
CPR	cerebroplacental ratio
DV	ductus venosus
MoM	multiples of median
DCDA twins	dichorionic diamniotic twins
MCDA twins	monochorionic diamniotic twins
MCMA twins	monochorionic monoamniotic twins
TTTS	Twin Twin Transfusion Syndrome
TAPS	Twin Anaemia Polycythaemia Sequence

INDICATIONS FOR DOPPLER ASSESSMENT

1. Suspected fetal growth restriction
2. Screening for early onset pre-eclampsia/hypertensive disorder and early onset SGA/FGR in high risk women
3. Assessment of fetal anaemia
4. Twins

Doppler assessment is not indicated in routine screening of normal or low risk pregnancies with no maternal or fetal risk factors.

See summary and pathways flowchart below (Appendix 1 and 2)

1 SUSPECTED FETAL GROWTH RESTRICTION

UMBILICAL ARTERY DOPPLER (UA)

- Is an indicator of placental dysfunction
- Measured as Pulsatility Index (PI)
- PI > 95th percentile is abnormal
- The abnormal UA waveform shows high resistance progressing to absent or reversed end diastolic flow

Indications

- Known small or growth restricted fetus at any gestation
- EFW below 10th percentile on GROW or population chart
- AC below 10th percentile on population chart
- EFW or AC dropping centiles by ≥ 30
- Maternal hypertensive disorders eg. Pre-eclampsia/HELLP, Pregnancy induced hypertension (PIH), essential hypertension
- Decreased fetal movement
- Abnormal Doppler on a previous scan in the current pregnancy

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 fetus to quieten down which may normalise the PI)

MIDDLE CEREBRAL ARTERY DOPPLER (MCA)

- An indicator of blood flow through the fetal brain
- Measured as Pulsatility Index (PI)
- < 5th percentile is abnormal
- Indicates redistribution of blood flow to the fetal brain ("fetal brain sparing")
- Performed for the purposes of calculating a CPR after 32 weeks
- Not to be included in the Radiology report as itself has found to be of no significant prognostic value.

Indications

- SGA or FGR fetus after 32 weeks
- Reduced interval growth with EFW and or AC dropping centiles by ≥ 30 after 32 weeks.
- Preeclampsia or other maternal hypertensive disorder (eg. PIH) after 32 weeks

CEREBROPLACENTAL RATIO (CPR)

- Defined as the ratio of the MCA PI and the UA PI divided by the UA PI
- < 5th centile is abnormal
- Should always be calculated when both the Umbilical artery PI and Middle Cerebral artery PI are performed after 32 weeks

DUCTUS VENOSUS DOPPLER (DV)

- Is an indicator of fetal cardiac function
- Measured as Pulsatility Index PI
- > 95th percentile is abnormal
- An abnormal waveform shows an absent or reversed A wave below the baseline and indicates fetal cardiac decompensation

Indications

- Abnormal raised UA PI (> 95th percentile) with absent end diastolic flow (AEDF) or reversed diastolic flow (REDF) in an SGA/FGR fetus before 32 weeks

Troubleshooting tips

- Technically challenging to measure and should only be performed by experienced individuals
- If initially abnormal repeat with optimisation of technical factors (eg. Small sample size, sample on inlet, good Doppler angle, quiet fetal breathing, no contamination from adjacent vessels)

UTERINE ARTERY DOPPLER

- Predictor of impaired placentation in an FGR fetus in the third trimester

Indication

- Perform at the first third trimester growth scan with a finding of SGA/FGR
- No need to repeat on subsequent growth scans.

Measurement

- Measure right and left uterine artery PI and comment on notching present or absent.
- Calculate Mean Pulsatility Index PI
- Above 95th percentile is abnormal
- Bilateral notching after 24 weeks is abnormal

2 SCREENING FOR EARLY ONSET PRE-ECLAMPSIA AND EARLY ONSET FGR

UTERINE ARTERY DOPPLER

- Screening test for patients at high risk of early pre-eclampsia or early onset SGA/FGR

Indication

- Perform at 20 weeks
- If abnormal at 20 weeks repeat at 24 weeks then stop

Measurement

- Measure right and left uterine artery PI and comment on notching present or absent.
- Calculate Mean Pulsatility Index PI
- Above 95th percentile is abnormal
- Bilateral notching after 24 weeks is abnormal

3 ASSESSMENT OF FETAL ANAEMIA

MIDDLE CEREBRAL ARTERY PEAK SYSTOLIC VELOCITY (MCA VMAX)

- Used for the detection of fetal anaemia
- Measured in cm/sec
- Plot on multiple of median graph (MoM)
- > 1.5 MoM is abnormal

Indications

- Maternal-fetal alloimmunisation
- Any suspicion of fetal anaemia
- Unexplained hydrops
- MCDA twins known or suspected TTTS or TAPS (see Twin section)

Troubleshooting

- Angle correction is necessary for an accurate trace.
- Repeat if necessary and use the highest value.

4 TWINS

DICHORIONIC DIAMNIOTIC TWINS

- Doppler assessment is the same as for singletons pregnancies (see above)

MONOCHORIONIC TWINS (MCDA AN MCMA)

- Require additional Doppler assessment to exclude common complications of monochorionic twins due to placental sharing (eg. Selective IUGR, Twin to Twin Transfusion syndrome TTTS, Twin Anaemia Polycythaemia sequence TAPS)
- See summary table and pathways flowchart below (Appendix 1 and 2)

If suspicion of TTTS at any gestation from 16 weeks

- UA PI + + CPR + MCA peak systolic velocity (V max) + Ductus venosus PI
- Report umbilical artery waveform diastolic flow as present, absent or reversed between 16 and 21 weeks
- Report umbilical artery PI from 21 weeks

If no suspicion of TTTS

- Umbilical artery Doppler from 16 weeks
- Report umbilical artery waveform diastolic flow as present, absent or reversed between 16 and 21 weeks)
- Report UA PI from 21 weeks
- add in MCA peak systolic velocity (V max) from 24 weeks to exclude TAPS

DOPPLER IN SPECIFIC CLINICAL SITUATIONS

1 REDUCED FETAL MOVEMENT

- If a patient presents with a history of reduced fetal movement the sonographer should perform a fetal wellbeing scan (growth, amniotic fluid)
- Assessment to include comment on fetal movement (normal, reduced, present, absent)
- Perform umbilical artery PI Doppler

2 POST-DATES

- Doppler assessment post-dates (40 weeks gestation or later) is of uncertain significance as data requires extrapolation off the limits of standardised Doppler graphs.
- Perform growth and fluid assessment.
- If normal then no Doppler is required.
- If abnormal then perform Doppler assessment (see Suspected Fetal Growth Restriction section above)
- Report to state: *“Normal Dopplers post-dates may be falsely reassuring. Recommend correlation with other clinical findings.”*

3 CUSTOMISED GROW CHARTS

- Reporting Radiologists at Christchurch Hospital do not currently have access to GROW charts which plot customised Estimated Fetal Weight (EFW) for each individual patient.
- It is recommended the referring LMC plot the EFW on their own customised GROW chart for their patients and arrange for the patient to return for Doppler assessment if the EFW is less than 10th centile.
- Radiology reports currently include this recommendation at the end: *“Customised GROW charts are currently unavailable to Radiologists. Recommend EFW is plotted on a customized GROW chart by the referring LMC and if EFW is less than 10th centile then return for Doppler assessment.”*

REFERENCES

1. Small for Gestational Age/Fetal Growth Restriction Guideline, Health New Zealand, Te Whatu Ora, July 2023
2. New Zealand Obstetric Ultrasound Guidelines (NZ Ministry of Health 2019). www.health.govt.nz.
3. NZ Maternal Fetal Medicine Network. *New Zealand Obstetric Doppler Guideline. September 2014.*
4. NZ Maternal Fetal Medicine Network. *Multiple Pregnancy Guideline. Updated September 2015.*

CONTRIBUTORS

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APPENDIX 1 SUMMARY OBSTETRIC DOPPLER INDICATIONS

UMBILICAL ARTERY DOPPLER (UA) INDICATIONS

- Known small or growth restricted fetus at any gestation
- EFW below 10th percentile on GROW or population chart
- AC below 10th percentile on population chart
- EFW or AC dropping centiles by ≥ 30
- Maternal hypertensive disorders eg. Pre-eclampsia/HELLP, Pregnancy induced hypertension (PIH), essential hypertension
- Decreased fetal movement
- Abnormal Dopplers on a previous scan in the same pregnancy

MIDDLE CEREBRAL ARTERY (MCA) DOPPLER INDICATIONS

- SGA/FGR on scan after 32 weeks' gestation
- Reduced interval growth with EFW and or AC dropping centiles by $\geq 30\%$ after 32 weeks
- Pre-eclampsia after 32 weeks gestation

CEREBROPLACENTAL RATIO (CPR)

- SGA/FGR on scan after 32 weeks gestation
- Reduced interval growth with EFW and or AC dropping centiles by $\geq 30\%$ after 32 weeks
- Pre-eclampsia after 32 weeks gestation

DUCTUS VENOSUS (DV) DOPPLER INDICATIONS

- Abnormal UA Doppler with either absent diastolic flow (AEDF) or reversed diastolic flow (REDF) before 32 weeks gestation

UTERINE ARTERY DOPPLER INDICATIONS

- Screening for patients at high risk of early onset preeclampsia, hypertensive disorder or early onset SGA/FGR at 20 or 24 weeks gestation
- At first presentation of a third trimester growth scan showing SGA/FGR

MCA PEAK SYSTOLIC VELOCITY (MCA VMAX) INDICATIONS

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

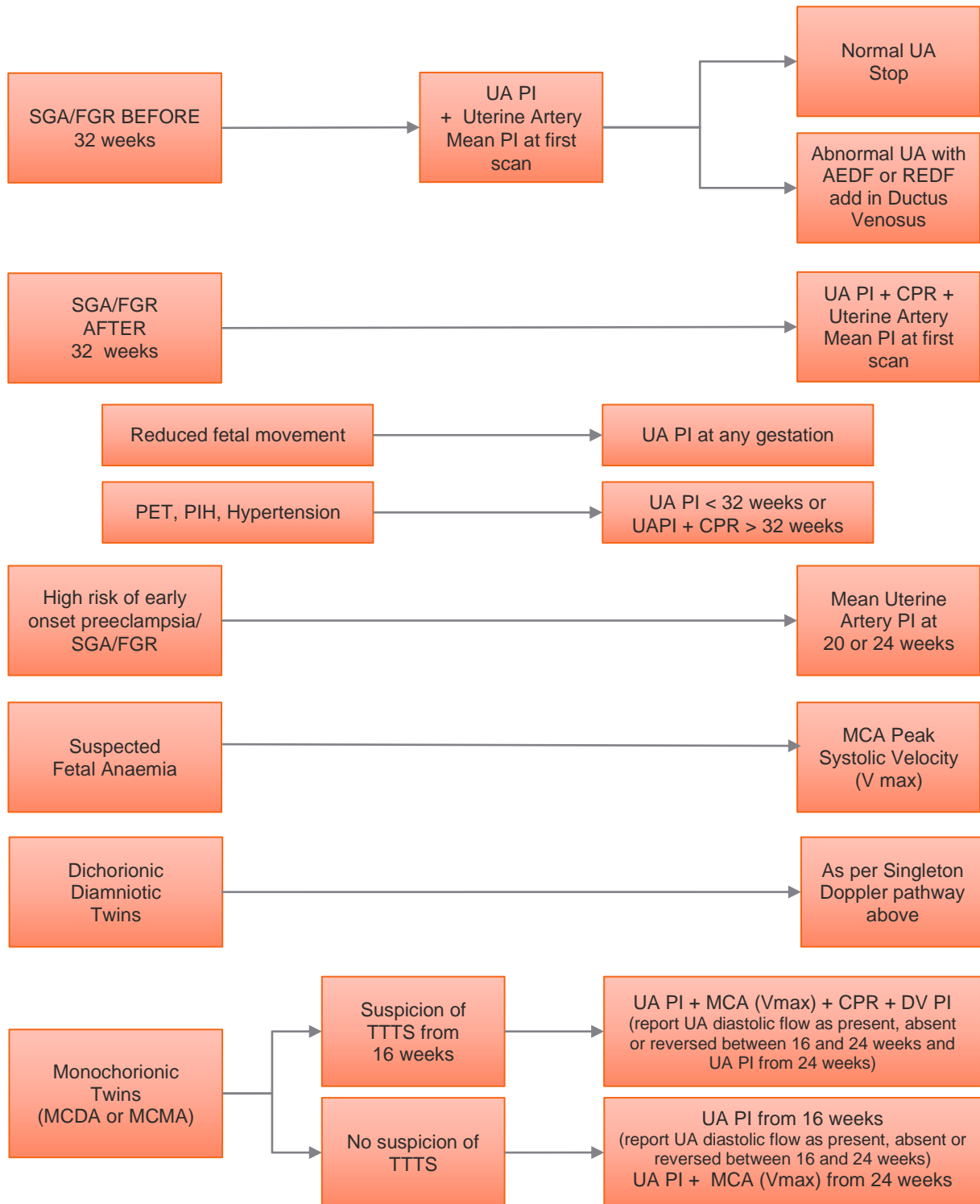
DCDA TWINS DOPPLER INDICATIONS

- As per singleton Dopplers above

MONOCHORIONIC TWINS (MCDA OR MCMA) DOPPLER INDICATIONS

- If any suspicion of TTTS at any gestation from 16 weeks:
UA 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

APPENDIX 2 SUMMARY OBSTETRIC DOPPLER PATHWAYS
FLOWCHART



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