



Addressing Obesity Management Alongside Fetal Assessment and Wellbeing

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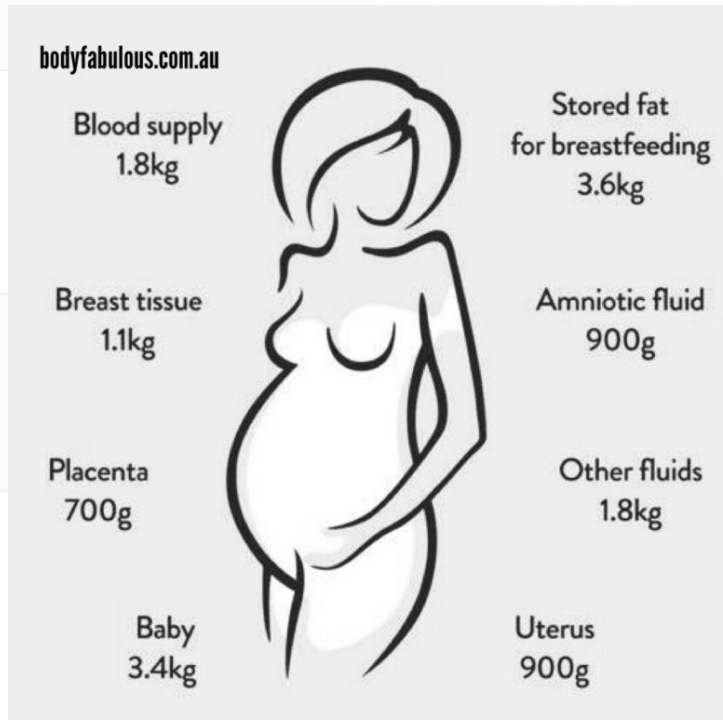
Obesity in pregnancy

Obesity in pregnancy

- ▶ SA PPG defines obesity as:
 - ▶ A body weight above 80 kg (!!!)
 - ▶ A weight 50 % or more above the ideal pre-pregnancy weight for height
- ▶ According to maternal body mass index (preferred method – WHO criteria)
 - ▶ 25kg/m² to 29.9kg/m² (overweight)
 - ▶ 30kg/m² to 34.9kg/m² (obese I)
 - ▶ 35kg/m² to 39.9kg/m² (obese II)
 - ▶ Greater or equal to 40kg/m² (obese III or morbidly obese)
- ▶ 50% OBESE OR OVERWEIGHT IN AUSTRALIAN PREGNANCIES

Weight gain parameters

Pre-pregnancy BMI	Recommended weight gain over the whole pregnancy	Recommended weight gain per month in the 2nd and 3rd trimester
BMI less than 18.5 (underweight)	12.5kg to 18kg	2kg to 2.6kg
18.5 to 24.9 (healthy weight)	11.5kg to 16kg	1.5kg to 2.3kg
18.5 to 22.9 if Asian		
25 to 29.9 (overweight)	7kg to 11.5kg	1kg to 1.5kg
23 to 27.5 if Asian		
30 or more	5kg to 9kg	0.8kg to 1.2kg
or over 27.5 if Asian	(less than 8kg if Asian)	



Obesity in pregnancy

- ▶ SA 2016 data: 27.8% are overweight on entering pregnancy
 - ▶ a further 24.2% classified as obese
- ▶ Strong association with increasing BMI and almost all pregnancy complications
 - ▶ hypertension, diabetes, VTE, wound infection, PPH
 - ▶ Anaesthetic issues
 - ▶ IOL and cesarean section – uterine contractions less efficient in higher BMI
 - ▶ Stillbirth
 - ▶ Congenital abnormalities (eg of CDH in a BMI 56 patient of mine)
- ▶ Increased risk to newborns, not just LGA:
 - ▶ macrosomia, traumatic birth, shoulder dystocia

Obesity complications - maternal

- ▶ Longer time conceive, increased miscarriage and still birth
- ▶ Diabetes (pre-gestational and gestational)
- ▶ Hypertension (chronic and preeclampsia)
- ▶ Respiratory disorders (asthma and sleep apnoea)
- ▶ Infections (urinary tract, wound, endometritis)
- ▶ Thromboembolic disorders (link to thromboembolism in pregnancy)
- ▶ Anaesthetic (difficult intubation, placement of epidural)
- ▶ Increased preterm labour
- ▶ Increased IOL and Caesarean section
- ▶ Increased PPH
- ▶ Depression and other MH
- ▶ Breastfeeding challenges

Obesity complications - neonatal

- ▶ Preterm birth
- ▶ Higher perinatal mortality
- ▶ Congenital malformations – missed on US
- ▶ Macrosomia – even if no GDM
- ▶ Intensive care unit admission – often lung related
- ▶ Treatment of jaundice
- ▶ Hypoglycaemia
- ▶ Neonatal and infant death
- ▶ Later childhood obesity, neurodevelopmental differences, language delay

Obesity Antenatal Care (some aid fetal assessment*)

- ▶ Cared for in facility that can manage potential complications – PPG can guide
 - ▶ Specialist management
- ▶ Accurate pregnancy dating - late in the first or early in the second trimester of the pregnancy
- ▶ Encourage First trimester screen and morphology scan - ? Early morph*
- ▶ Lifestyle counselling; Dietary advice – dietician review
- ▶ Early oral glucose challenge test*. Then usual time thereafter if negative.
- ▶ Always do OGTT if AC >90%ile at morph*.
- ▶ Consider US for BMI > 40 to better estimate EFW – both FGR and macrosomia are hard to pick*.
- ▶ Blood pressure* using an appropriately sized blood pressure cuff
- ▶ Anaesthetic review
- ▶ Don't forget VTE thromboprophylaxis

SA PPG Summary Recommendations

- ▶ All pregnant women with a BMI $> 35\text{kg}/\text{m}^2$ require a specific management plan and women with a BMI $> 40\text{kg}/\text{m}^2$ require a Specialist Obstetrician to manage their care
- ▶ Management plans should include any equipment requirements
- ▶ Obese pregnant women should be cared for in a health care facility capable of managing the potential complications of her obesity
- ▶ Obese pregnant women should be provided with appropriate healthy lifestyle counselling (e.g. balanced diet, exercise) +/- referral to specific additional services (e.g. dietician)
- ▶ Arrange antenatal anaesthetic referral / review for pregnant women with a BMI $\geq 35\text{kg}/\text{m}^2$
- ▶ Consider early oral glucose challenge test (especially if estimated fetal weight $> 90\text{th}$ centile on routine ultrasound)
- ▶ Consider estimation of fetal weight by ultrasound
- ▶ Consider oral Ranitidine 150 mg every 12 hours in labour
- ▶ Determine risk for postpartum thromboembolic prophylaxis

Bariatric surgery

- ▶ Types
 - ▶ Adjustable laparoscopic banding
 - ▶ Gastroplasty
 - ▶ Bypass surgery
- ▶ May need to have bands reduced
- ▶ Extra care with adequate nutrition and supplementation
 - ▶ - micronutrients, check B12, minerals
- ▶ High dose Folate
- ▶ GDM best diagnosed with diurnal BSL readings

Fetal Assessment and Wellbeing

Fetal Wellbeing Assessment Tools

- medical

- ▶ First trimester screening/NIPT
- ▶ NT scan
- ▶ Early 16 week morphology (?transvaginally)
- ▶ 19-21 week standard morphology
- ▶ Fetal diagnosis by amnio/CVS
- ▶ Fetal growth scans for BMI > 40 as a standard
- ▶ Clinically indicated fetal growth scans
 - ▶ GDM (32wk and 36wk)
 - ▶ Other chronic illness
 - ▶ Pre-eclampsia
 - ▶ Risk FGR – abnormal Ut Art Doppler at morph (done for risk or PappA < 0.3MoM)

Fetal Wellbeing Assessment Tools

- maternal

- ▶ Fetal movements
- ▶ From Stillbirth Care – Still birth rate rate of 7 per 1000 births and a neonatal death rate of 2 per 1000 births:
 - ▶ All pregnant women should be routinely provided with verbal and written information about fetal movements by 28 weeks. Women should be advised that it is normal to perceive increasingly strong movement, episodes of movements that are more vigorous than usual, occasional fetal hiccups, and a diurnal pattern involving strong fetal movement in the evening.
 - ▶ Clinicians should remind women at each scheduled and unscheduled antenatal visit after 28 weeks' gestation of the importance of maternal awareness of fetal movements and to report concerns of a decrease in strength and/or frequency or a non-diurnal pattern of movements.
 - ▶ Kick charts should not be used
- ▶ Helping a woman understand or decide when the movements or natural pattern of her baby is or isn't normal is exceptionally hard

Decreased Fetal Movement (DFM) Care Pathway

for women with singleton pregnancies from 28+0 weeks' gestation



Assessing decreased FM

- ▶ Take Hx of Risk factors
 - ▶ Previous stillbirth
 - ▶ Fetal growth restriction and Small for gestational age (<10%ile)
 - ▶ Antepartum haemorrhage
 - ▶ Diabetes (pre-existing)
 - ▶ Hypertension (pre-existing) or pre-eclampsia
 - ▶ Parity of 0 or >3
 - ▶ Advanced maternal age (>35 years)
 - ▶ IVF
 - ▶ Indigenous ethnicity
 - ▶ **Maternal obesity (BMI >25)**
 - ▶ Smoking or illicit drug use
 - ▶ Low socioeconomic status – no antenatal care/low education
 - ▶ Advanced gestation > 41 wk

Assessing decreased FM

- ▶ Educate patient - understand that cortically driven movement is not present until 28+ weeks → role of pamphlets
- ▶ https://stillbirthcre.org.au/wp-content/uploads/2021/03/MovementsMatter_flyer_A5.pdf
- ▶ a diurnal pattern with strong fetal movements felt by most women in the evening and at night-time.
- ▶ Misconception that fetal movements decrease in strength or frequency towards the end of pregnancy because the fetus has “less room to move”. Healthy fetuses near term have longer periods of activity and rest. Some women report feeling less kicks and more rolling, shuffling and pushing or stretching movements. Healthy fetuses continue to move every day towards the end of pregnancy and have bouts of strong movements right up to and including during labour
- ▶ Sleep cycle usually last 20 to 40 minutes, rarely exceeding 90 minutes in a healthy fetus

Examination and Investigations for DFM

- ▶ CTG or FHR by Doppler (gestation dependent)
 - ▶ No further investigations are required for women if: (1) CTG and clinical assessment is normal; (2) no risk factors for stillbirth are identified; (3) it is the woman's first presentation for DFM and; (4) there are no maternal concerns of DFM at time of assessment.
- ▶ +/- Kleihauer
 - ▶ Testing for fetal to maternal haemorrhage should be considered in the preliminary investigation of women with DFM where FMH is suspected, particularly if there is a history of sustained or recurrent DFM.
- ▶ +/- Fetal growth US
 - ▶ Ultrasound scan assessment including fetal biometry, estimated fetal weight, umbilical artery Doppler and amniotic fluid volume for undetected FGR should be **considered** for all women if not performed in the last two weeks. The timeframe to perform this investigation will depend on the woman's preferences, clinical urgency, presence of risk factors and service capability.
- ▶ Follow up in acceptable time frame

Management of DFM

- ▶ Depends on:
- ▶ Gestation
- ▶ Clinical indication for delivery otherwise
- ▶ Maternal access to monitoring services
- ▶ Surveillance of previously unknown IUGR
- ▶ One Stillbirth study showed an increase in detection of FGR, resulting in reduction of number of SGA babies born past 40wks - May have been the reason for no change in stillbirth rate overall in comparison groups
- ▶ May include delivery

How do we monitor fetuses?

- ▶ Antenatal care
- ▶ Education re FM
- ▶ Symphysis-fundal height (try detect IUGR)
- ▶ CTG
- ▶ Ultrasound
 - ▶ EFW, Doppler, AFI
 - ▶ Biophysical profile

Estimated fetal weight and AFI

- ▶ Biparietal Diameter and Head circumference
- ▶ Abdominal circumference
- ▶ Femur length
- ▶ AFI
 - ▶ Measure of depth of amniotic fluid in four quadrants of the uterus
 - ▶ Pool of liquor needs to be $>1\text{cm}$ wide and have no cord in it
 - ▶ Single deepest pool $>8\text{cm}$ \rightarrow polyhydramnios
 - ▶ Single deepest pool $<2\text{cm}$ \rightarrow oligohydramnios



Dopplers

- ▶ The Doppler effect is the name given to the perceived change in frequency of a sound wave, detected by an 'observer' moving relative to the source of the sound wave.
- ▶ The frequency is perceived as higher as you approach the source, is identical at the moment of passing the source and it is perceived as lower as you move from the source.
- ▶ It was first described by Christian Doppler in 1842 and first applied to ultrasound physics in the 1960s, when continuous wave Doppler was used to first detect fetal cardiac pulsations. The first fetal pulse detector was marketed in 1965.
- ▶ Work was begun on pulse wave doppler in the late 60s and the first 2D and M-Mode cardiac echographic machine was developed from 1970-1972.
- ▶ See table – open it

Uterine artery dopplers

- ▶ Can be used as an assessment tool to predict pre-eclampsia
- ▶ Usually elevated early in pregnancy and when non-pregnant
- ▶ Uterine arteries become low resistant vessels in normal pregnancy
 - ▶ In normal placental development, there is trophoblast invasion into maternal spiral arteries in two phases
 - ▶ 1) decidual and then
 - ▶ 2) myometrial, thus establishing placental blood supply.
- ▶ The uterine arteries concurrently dilate and become low resistant vessels
- ▶ Uterine arteries become high resistance vessels in Pre-Eclampsia – with notching
 - ▶ In pre-eclampsia, there is impaired placentation, poor invasion of trophoblast into maternal spiral arteries and they remain tight and narrow. Subsequently the uterine arteries remain constricted providing high pressure just to maintain placental perfusion

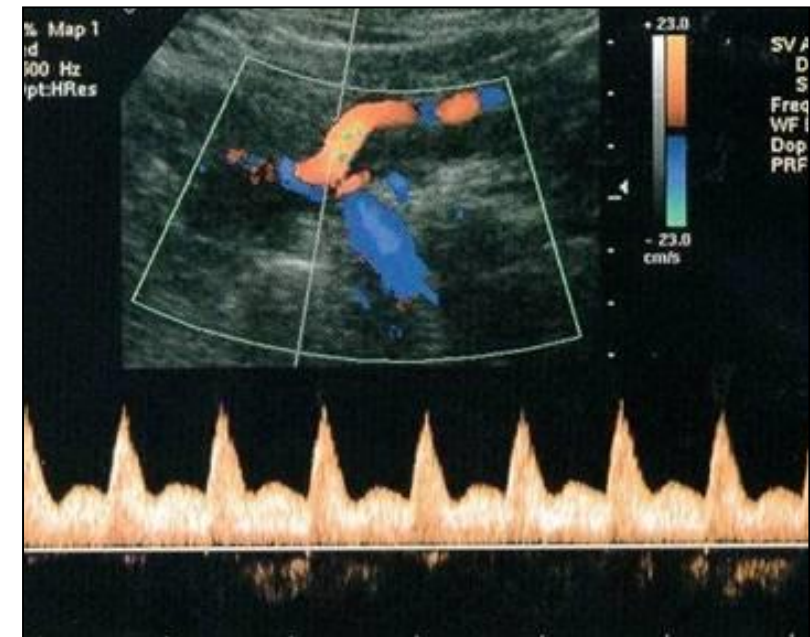
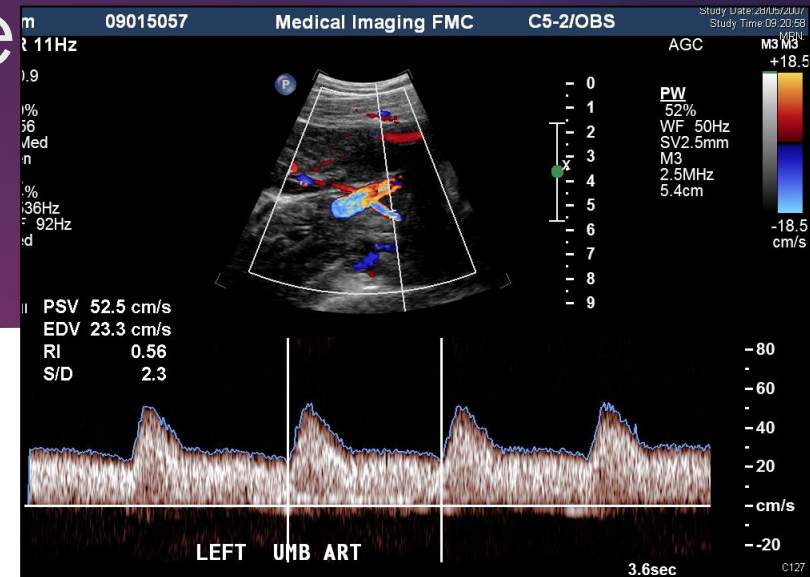
Uterine Artery Dopple

▶ Normal

- ▶ Notch should disappear
- ▶ Low resistance

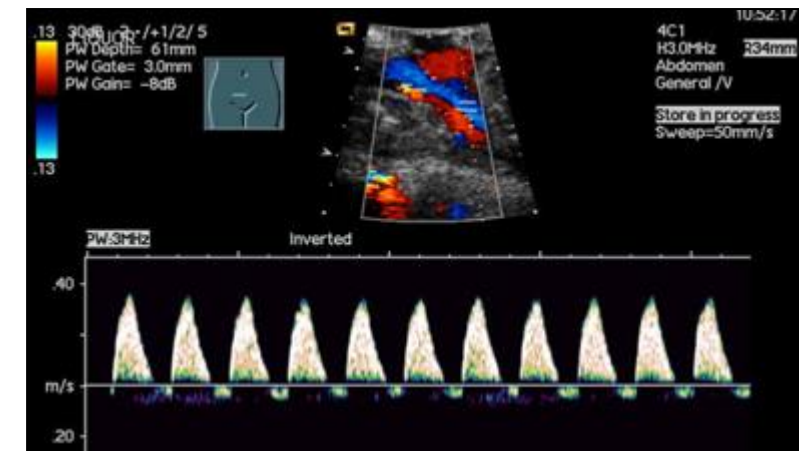
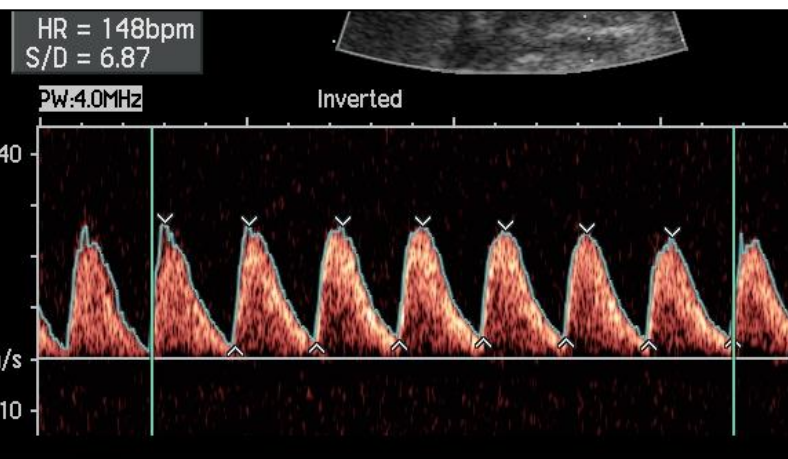
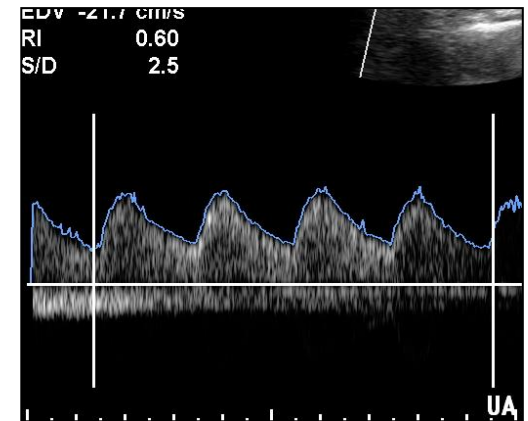
▶ Abnormal

- ▶ Presence of notch after 23 weeks
- ▶ High resistance waveform as defined by RI or PI (>95%)



Umbilical artery dopplers

- ▶ A measure of down stream placental vascular resistance
- ▶ Fetal placenta is usually one of low resistance and the resistance decreases further approaching term
- ▶ Increased placental vascular resistance is either the result of a poorly implanted placenta and/or a loss of tertiary placental stem villi
- ▶ There is a subsequent reduction in surface areas for gas and nutrient exchange in the fetus and therefore the UmAD can be used to identify the growth restricted fetus at risk of hypoxia, acidosis and death

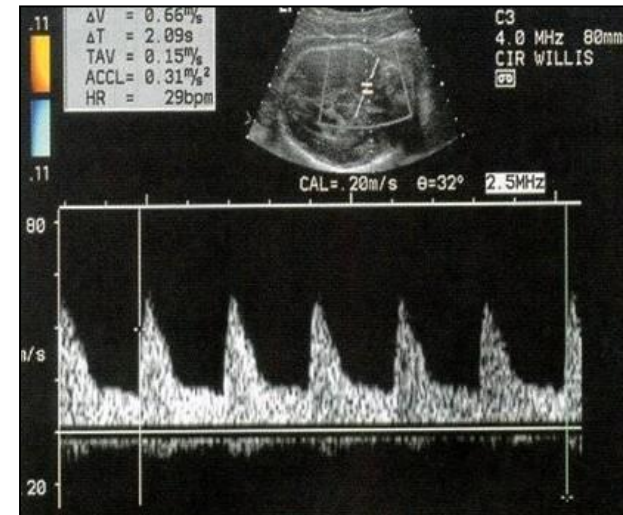
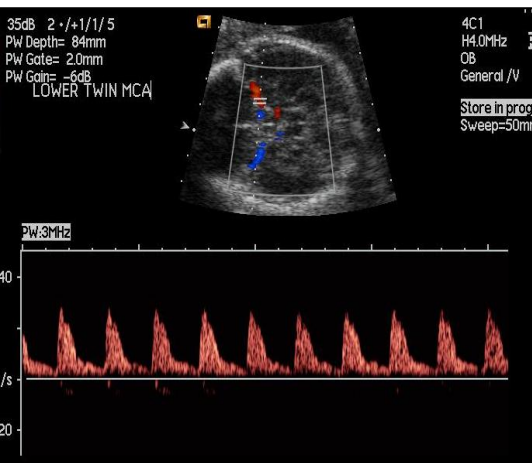


Middle carotid artery – IUGR and hypoxia

- ▶ Used as a monitoring tool in severe IUGR, to assess for circulatory redistribution
- ▶ Blood flow in the MCA is usually high resistance and in IUGR we see a decrease in the resistance of the vessel and increasing diastolic flow
- ▶ Normalisation of the MCA Doppler, 'loss of brain sparing', is an ominous sign as it means the fetus has lost its ability to compensate for the relative hypoxia it is experiencing
- ▶ Index for measurement here is the RI, PI or S/D
- ▶ We currently use RI based on studies in high risk pregnancies (PET and IUGR)
- ▶ Supportive studies
- ▶ Mari et al. Middle cerebral artery peak systolic velocity: a new doppler parameter in the assessment of Growth restricted fetuses. *Ultrasound Obstet Gynecol* 2007;29:310-316
 - ▶ Compared PSV and PI of the MCA in growth restricted fetuses with abnormal umbilical artery dopplers
 - ▶ Showed that PSV shows changes earlier and is the best predictor of perinatal mortality in this group
 - ▶ The PSV showed an increase initially then a decrease later in the process (akin to the loss of brain sparing)

Fetal cardiovascular response to IUGR

- ▶ increased placental resistance
- ▶ redistribution of blood flow away from non-essentials – gut, kidneys, peripheral and pulmonary (basically favour the brain)
- ▶ blood flow centralised toward essential circulations – brain – MCA dilates and increases flow to brain in diastole – this decreases pulsatility
 - ▶ if MCA normalizes then the fetus has lost its ability to compensate and is usually very sick
- ▶ increased blood flow through the ductus venosus (a reflection of RA function) to preferentially stream more O₂ to the heart and brain. DV dilates and becomes pulsatile. This reverses as blood flow is further compromised.

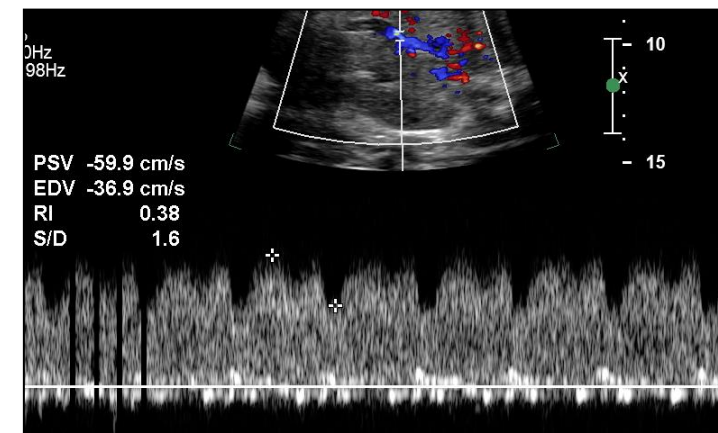
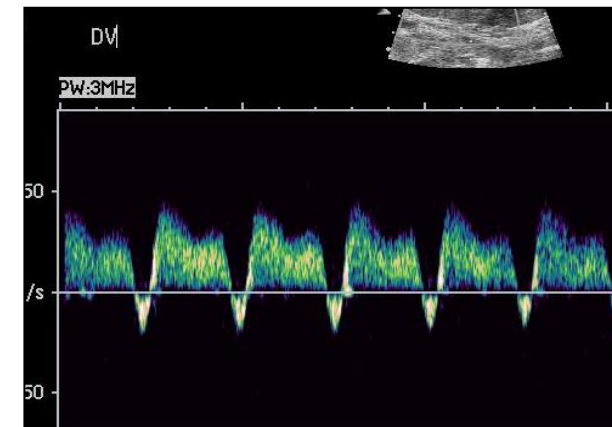


Middle carotid artery – fetal anaemia

- ▶ Also used when monitoring Iso-immunised babies or babies with infection that cause anaemia and subsequent hydrops
- ▶ Index for measurement here is the PSV
 - ▶ Faster blood flow through the MCA reflects decreased viscosity of blood due to reduced red cell concentration as well as increased cardiac output
- ▶ Supportive studies
 - ▶ MARI et al. Noninvasive diagnosis by Doppler ultrasonography of fetal anemia due to maternal red-cell alloimmunization. NEJM 2000;342:9-14.
 - ▶ Showed that MCA Doppler could be used to reliably detect anaemia in fetuses with red cell isoimmunisation
 - ▶ Identified that PSV of >1.5MoM identified fetuses with moderate to severe anaemia
 - ▶ Anaemia confirmed with cordocentesis
 - ▶ DIAMOND STUDY
 - ▶ Compared the use of amniotic fluid OD 450 test with MCA Peak Systolic Velocity as a measure of anaemia
 - ▶ Showed that MCA was able to detect anaemia with the 88% sensitivity and 82% specificity compared to OD 450 measurements at 76% sensitivity and 77% specificity

Ductus venosus

- ▶ a measure of heart failure in the fetus – essentially equivalent to the JVP in an adult
- ▶ Blood goes through the umbilical vein, Ductus venosus and upper part of inferior cavum to the right atrium and through the foramen ovale to the left side of heart. The DV is very narrow and so it has high speed of blood going through it to the heart
- ▶ It has continuous flow velocity through the cardiac cycle and is not pulsatile. In conditions of compromise however, it becomes pulsatile
 - ▶ Cord compressions → systolic pulsations
 - ▶ End of diastole pulsations → ominous and indicative of severe fetal compromise
- ▶ Changes usually occur later than the MCA changes and the DV is therefore useful in monitoring the very preterm IUGR fetus, where a change in the DV waveform can be the trigger for deliver



When to deliver the compromised baby?

- ▶ GRIT TRIAL
- ▶ consider soon (await steroid administration) if dopplers show consistently absent end diastolic flow
- ▶ often deliver when reversed end diastolic flow
- ▶ in MFM setting the above two may continue to be present in the presence of a brain sparing MCA and normal DV and delivery will still not occur – especially if very premature baby
- ▶ loss of brain sparing effect will then often trigger delivery
 - ▶ as will loss of fetal movements or abnormal biophysical profile
- ▶ if CTG abnormal – decelerative
- ▶ rapid crossing of %iles – ie 10th → 5th between scans
- ▶ term gestation reached (37 weeks)
- ▶ Mode delivery depends on urgency, gestation, fetal condition (and lie) and obstetrician

Biophysical profile

- ▶ Involves:
- ▶ CTG
- ▶ AFI – 2
- ▶ Fetal breathing movements – 2
- ▶ Gross body movements – 2
- ▶ Tone – 2

Biophysical Variable	Normal (score = 2)	Abnormal (score = 0)
Fetal breathing movements	1 episode FBM of at least 30 s duration in 30 min	Absent FBM or no episode >30 s in 30 min
Fetal movements	3 discrete body/limb movements in 30 min	2 or fewer body/limb movements in 30 min
Fetal tone	1 episode of active extension with return to flexion of fetal limb(s) or trunk. Opening and closing of the hand considered normal tone.	Either slow extension with return to partial flexion or movement of limb in full extension Absent fetal movement
Amniotic fluid volume	1 pocket of AF that measures at least 2 cm in 2 perpendicular planes	Either no AF pockets or a pocket <2 cm in 2 perpendicular planes

FBM = fetal breathing movement; AF = amniotic fluid.

Biophysical profile

- ▶ The fetal biophysical profile combines five factors that are thought to predict fetal status, including fetal movement, amniotic fluid volume, and fetal tone.
- ▶ After two decades of clinical use, fewer than 3000 women have participated in randomised trials of this test, and the evidence is insufficient for its usefulness.
- ▶ However, the profile seems to have good negative predictive values when used in high-risk populations



References (dopplers and US)

- ▶ The performance of routine ultrasonographic screening of pregnancies in the Eurofetus Study. Am J Obstet Gynecol. 1999 Aug;181(2):446-54.
- ▶ Royal College of Obstetricians and Gynaecologists. The investigation and management of the small-for-gestational-age fetus. RCOG Guideline 31. London: Royal College of Obstetricians and Gynaecologists, 2002)
- ▶ Precise mid-trimester placenta localisation: Does it predict adverse outcomes? Australian and New Zealand Journal of Obstetrics and Gynaecology Volume 52, Issue 2, pages 156–160, April 2012
- ▶ The relevance of placental location at 20–23 gestational weeks for prediction of placenta previa at delivery: evaluation of 8650 cases. *Ultrasound Obstet Gynecol* 2001; 17: 496–501
- ▶ Dating document Dept US WCH
- ▶ Sonographic Solutions Ultrasound course
- ▶ Fetal Surveillance – A Practical Guide
- ▶ Obstetric and Gynaecological Ultrasound Made Easy
- ▶ Historical information as per Dr Earl's presentation 2014
- ▶ Various papers quoted within

Resources

- ▶ Handbook of Obstetric Medicine – Catherine Nelson-Piercy
- ▶ Examinations in O&G – Judith Goh
- ▶ <https://www.health.qld.gov.au/qcg/publications>
- ▶ https://www.sahealth.sa.gov.au/wps/wcm/connect/69226e0047feea3cac28fe21d1663cdf/Women+with+high+BMI_PPG_v4_1.pdf?MOD=AJPERES&CACHEID=ROOTWORKSPACE-69226e0047feea3cac28fe21d1663cdf-oc.kQ00
- ▶ https://www.sahealth.sa.gov.au/wps/wcm/connect/eb01df804d5dc7208ec1ff4c56539eed/Obese+Obstetric+Woman+Management+in+SA+2019_Brochure_v3_0.pdf?MOD=AJPERES&CACHEID=ROOTWORKSPACE-eb01df804d5dc7208ec1ff4c56539eed-nwKFLU3
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