OBJECTIVE

Alberta obstetric providers will:

- Understand common risk factors of perinatal morbidity/mortality, and potential indications for monitoring fetal well-being with ultrasound
- Be aware of the standard components for ultrasound evaluation of fetal well-being in the third trimester
- Provide appropriate notification and actions based on ultrasound findings

TARGET POPULATION

All pregnant women

EXCLUSIONS

None

PREAMBLE

- **Alberta has an opportunity to improve prenatal diagnosis of fetal abnormality and access to specialized multidisciplinary care, as both are associated with improved perinatal outcomes.**
- **Effective evaluation of fetal well-being in the third trimester, when indicated, is an important part of prenatal care. (See Appendix A: Obstetrical history and current pregnancy conditions associated with increased perinatal morbidity/mortality where antenatal fetal surveillance may be beneficial.)**
- **In Alberta, ultrasound is a very important and commonly used tool for monitoring fetal well-being. Accurate fetal assessment, interpretation, and timely clinical action can reduce the risks of perinatal morbidity and mortality.**
- **An obstetrician and/or Maternal Fetal Medicine (MFM) via Alberta Health Services Referral, Access, Advice, Placement, Information & Destination (RAAPID) (north or south) are available 24/7 to offer advice and/or take referrals. See http://www.albertahealthservices.ca/info/Page13345.aspx**

ROLE OF THIRD TRIMESTER ULTRASOUND

- ✓ **Assess fetal growth and well-being.**
- ✓ **Use as a diagnostic tool to assess for the following indications, including but not limited to:**
  - **Follow up of previously identified, or suspected, fetal abnormality**
  - **Previous complicated obstetric history**
  - **Suspected or known low placental position, marginal or placental previa, vasa previa**
  - **Bleeding, fluid loss or abdominal pain**

- Maternal medical conditions associated with increased fetal risks (e.g., hypertensive disorders of pregnancy, diabetes, autoimmune disorders)
- Perceived decreased fetal movements and/or atypical/abnormal non-stress test (NST)
- Clinically suspected Fetal Growth Restriction (FGR), Small for Gestational Age (SGA), or Large for Gestational Age (LGA)
- Late maternal age (e.g., >35 years)
- Prolonged pregnancy (>42 weeks)

PRACTICE POINT

Although routine comprehensive third trimester ultrasound examination is not standardly performed for routine low-risk pregnancy care, indications commonly arise for ultrasound assessment of fetal well-being in both low- and high-risk pregnancies.

RECOMMENDATIONS

ULTRASOUND

- ✓ Abnormal third trimester ultrasound results should be communicated same day to the obstetrical provider, and the final report for all cases provided the same day or next day.
- ✓ If a second trimester anatomic ultrasound has not yet been performed, every reasonable effort should be made to assess and adequately document all structures listed in the second trimester ultrasound study and report whether the anatomical structures were assessed or not assessed.
- ✓ While fetal visualization may be limited in the third trimester, ideally the following evaluations should routinely be attempted.

STANDARD THIRD TRIMESTER FETAL WELL-BEING ULTRASOUND COMPONENTS:

Component	Reporting/Recommendations
Fetal Number	✓ Number ✓ Multiple pregnancy – see Toward Optimized Practice Ultrasound for Twin and Multiple Pregnancies clinical practice guideline (CPG).
Presentation	✓ Report presentation (i.e., cephalic, transverse, breech). ✓ If breech, describe the "type" of breech:

Component	Reporting/Recommendations
	○ Frank ○ Complete ○ Incomplete ○ Footling *Note: It is good practice to identify the type of breech at ≥37 weeks, or the head position if cephalic (flexed vs. military or extended). Once the patient goes into labour, the last known position is relevant, especially if it was unfavourable.*
Fetal Biometry and Estimated Fetal Weight (EFW)	✓ Routinely measure: ○ Biparietal diameter (BPD) ○ Head circumference (HC) ○ Abdominal circumference (AC) ○ Femur length (FL) ▪ Take at least two measurements of each view and report the best or mean measurement. ▪ Outliers should trigger the need for a repeat measurement prior to reporting. ✓ Routinely report the Estimated Fetal Weight (EFW) using Hadlock's[1] formula (for weight in grams) followed by the Alberta Health gender specific growth curves (see Appendix B) which will provide the percentile or percentile range for that weight by gestational age and gender.
Amniotic Fluid Volume	✓ Amniotic fluid volume may be reasonably assessed subjectively, by amniotic fluid index (AFI), or by single deepest pocket (SDP). ✓ For SDP assessments, use the Chamberlain[2] classification during routine obstetrical scanning to define: ○ Normal: SDP 2-8 cm (by 1 cm wide) ○ Oligohydramnios: SDP <2 cm in depth (by 1 cm wide) ○ Polyhydramnios: SDP >8 cm in depth (by 1 cm wide) *Note: If SDP is abnormal, an AFI should be performed.* ✓ AFI is most commonly performed for singleton gestations in Alberta. While there are various AFI measures available, the following interpretation is suggested: ○ <5 cm is oligohydramnios

Component	Reporting/Recommendations
	○ 5-25 cm is normal ○ >25 cm is polyhydramnios ○ >35 cm is severe polyhydramnios ✓ Same day clinical assessment is indicated for oligohydramnios (by any of the definitions above) and same or next day for severe polyhydramnios. X DO NOT use "low normal," "borderline oligo," or other ambiguous terminology.
Placentation	✓ Although best seen the in second trimester, report (if possible) the location of the placental cord insertion. ○ Central or eccentric is normal. ○ Marginal is 0-20 mm from the placental edge. ○ Velamentous inserts into the fetal membranes. ✓ Apply color Doppler near the internal os to assess for the presence or absence of fetal vessels in the membranes (vasa previa). If the placental location is suspected to be <20 mm from the os on transabdominal assessment, proceed with endovaginal (EV) assessment. ✓ For all patients with previous or current low lying placenta based on trans-abdominal assessment, EV assessment with color Doppler is required for follow-up. ✓ Placental position is best reported as distance in mm either away from or overlapping the internal os. ✓ Report the placental location in relation to the internal cervical os: ○ >20 mm from the internal os is normal. ○ 1-19 mm from the internal os is low lying ○ 0 mm from the os is marginal placenta previa. ○ >1 mm of overlap is placenta previa. ✓ Assess placental echotexture for lesions such as sub-chorionic or retroplacental hemorrhages, infarction, echogenic cystic lesions, placental masses etc. ✓ Assess the placental implantation for irregularities. *Note: Patients with a prior C-section are at increased risk of placenta accrete.* ✓ When there is a low lying anterior placenta in patients with a prior C-section, specifically evaluate for ultrasound signs of invasive placentation (placenta accrete) and/or consider referral to MFM for specialist assessment.

Component	Reporting/Recommendations
Cervix (up to 32 weeks)	Endovaginal (EV) assessment for cervical length predicts risk for spontaneous preterm birth, when assessed prior to 32 weeks GA. ✓ If there is increased risk for preterm birth identified by past obstetric history or current pregnancy complication, consider assessing the closed cervical length by EV ultrasound. X Screening for cervical length trans-abdominally is NOT traditionally recommended for the low risk population. ✓ However, if cervical shortening or insufficiency is incidentally suspected <32 weeks, an EV ultrasound is required and/or a next day clinical assessment is recommended. ✓ Refer for obstetrical assessment and possible intervention in women diagnosed with short cervical length (<25 mm) on EV scan prior to 32 weeks of gestation, to optimize clinical management of these "at risk" patients. ✓ Same or next day clinical assessment is recommended if cervix is <15 mm at <32 weeks. X Transabdominal ultrasound alone for assessment of cervical length is NOT recommended. ✓ Transperineal scanning can be considered as an alternative to EV scanning only when EV scanning is unacceptable or unavailable.
Fetal Movements	✓ Report as to normal or abnormal fetal movements and tone. ✓ If >28 weeks, consider reporting a biophysical profile (BPP).
Fetal Anatomy	✓ Consider re-visualizing select fetal anatomic structures when a third trimester assessment is being performed, whenever possible or at least once in the third trimester:
Brain	• CSP, normal mid line structures • Lateral ventricles • Posterior fossa
Heart	• Fetal heart rate (FHR), rhythm • Cardiac size, axis • Four-chamber view, outflow tracts
Chest	• Chest mass (i.e., diaphragmatic hernia)

Component	Reporting/Recommendations
Abdomen	• Stomach • Kidneys • Bladders • Bowel

INTERPRETATION OF RESULTS AND PATIENT MANAGEMENT

1. ASSESSMENT OF FETAL SIZE AND GROWTH:

- Date the pregnancy accurately and consistently in order to assess fetal size and growth reliably. See Determination of Gestational Age by Ultrasound clinical practice guideline.
- Use Alberta-derived, contemporaneous, gender specific Alberta health growth charts for estimated fetal weight (EFW) percentiles. See Appendix B. If the gender is unknown, use female percentiles by default.
    - EFW is the clinically useful assessment of fetal size; composite ultrasound assessments of gestational age alone are not clinically useful for assessing fetal size/growth in the third trimester.
- Fetal growth is best assessed in relation to previous ultrasound assessments of fetal growth.
    - Previous ultrasound reports and images from the majority of Alberta units are available in Alberta Netcare for reference.

A. DIAGNOSIS OF FETAL GROWTH RESTRICTION:

- Small for gestational age size (SGA) is defined as estimated fetal weight (EFW) <10th percentile on ultrasound. This diagnosis does not necessarily imply pathologic growth abnormalities, but is the best approach for initially identifying pregnancies at risk of having pathologic fetal growth restriction.
- Intrauterine growth restriction (IUGR) refers to a fetus <10th percentile for EFW or abdominal circumference on ultrasound that, because of a pathologic process, has not attained its growth potential.
- Fetal growth restriction (FGR) includes IUGR but can also be identified by deceleration of growth, i.e., "falling off the growth curve," or absent/poor interval growth even when EFW and abdominal circumference (AC) remain above the 10th percentile.

PRACTICE POINT

Fetal weight determination has at least a 15% error rate across gestation, therefore do not make determinations of fetal growth rate compared to an exam done<14 days prior.

- The differential diagnosis for FGR includes: uteroplacental vascular insufficiency, congenital fetal infection, aneuploidy, genetic syndrome, and normal smaller fetus.
- If the fetus measure <10th percentile by EFW or AC measurement, or growth is decelerating:
    - Perform umbilical artery Doppler and assess for other signs of uteroplacental vascular insufficiency.
        - In pregnancies affected by intrauterine growth restriction, umbilical artery Doppler studies after 24 weeks may prompt clinical management to reduce perinatal mortality and severe perinatal morbidity resulting from the intrauterine growth restriction.
        - Additional fetal Doppler studies (middle cerebral artery [MCA), ductus venosus [DV]) are not presently routinely performed outside of MFM units.
- Imaging in fetal growth restriction (especially preterm FGR or expectantly managed FGR) is often best managed by MFM. Delivery is often indicated at term, and may be indicated preterm following a detailed maternal and fetal assessment.

B. *Diagnosis of Large for Gestational Age*

- Large for gestational age size (LGA) is defined as estimated fetal weight (EFW) >90th percentile on ultrasound. This diagnosis does not necessarily imply pathologic growth abnormalities, but (with limitations) is the current best imaging option for identifying fetuses at risk for a postnatal diagnosis of macrosomia.
- The differential diagnosis for LGA includes maternal Type 1 and 2 diabetes, gestational diabetes (known and undiagnosed), rare fetal overgrowth syndromes, and a normal congenitally large fetus.
- LGA fetuses are at increased risk for labour dystocia, operative delivery, and birth trauma such a shoulder dystocia. At present, ultrasound is an imperfect predictor of these adverse outcomes. Obstetric consultation is often indicated for LGA fetuses, especially those estimated at >4500 g.

2. *Biophysical Profile (BPP)*

Component	Criteria
1. Breathing movement	At least one episode continuing more than 30 seconds.
2. Movement	At least three body or limb movements.
3. Tone	An episode of active extension with return to flexion of a limb or trunk, or opening and closing of the hand.
4. Amniotic fluid volume	At least one cord and limb-free fluid pocket which is 2 cm x 2 cm in two measurements at right angles (*independent of SDP)

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- ✓ See Appendix C for impact of BPP score on fetal well-being.
- ✓ BPP is recommended for evaluation of fetal well-being when clinically indicated or as required in pregnancies at increased risk for adverse perinatal outcome.
- ✓ Suggest a BPP be routinely reported on fetal assessments >28 weeks GA.
    - At <28 weeks GA, a BPP need not be routinely reported. However, the report should include a comment on the presence or absence of fetal movement. If performed <28 weeks, a BPP of 6/8 with no respirations but normal amniotic fluid volume is likely reassuring but a BPP of 4/8 is abnormal and requires same day clinical assessment.
- ✓ By definition, a complete BPP includes a NST. However, if a BPP is 8/8 on ultrasound criteria with normal amniotic fluid volume, a NST can be omitted.
- ✓ If a BPP is 6/8 or less by ultrasound criteria after 28 weeks a NST is normally required to complete the fetal assessment.

  Note: If a BPP is 6/8 due to 0/2 breathing in an otherwise completely normal fetus (e.g., fluid, movement, growth, and size) a NST might not be performed based on local practice variation, clinical judgement, access to NST, etc.
- ✓ Ensure the following comments are included in the report as applicable:
    - *Communication has occurred with patient, referring obstetrician, MFM, and/or hospital physician.*
    - *Patient has been given instructions.*
    - *Follow-up plan is in place with their obstetric care provider, with/without ultrasound assessment.*

> **PRACTICE POINT**
>
> *Timely follow-up by the obstetrical provider is critical for abnormal BPP results.*

3. Fetal Doppler Studies

DO NOT use umbilical artery Doppler as a screening tool in healthy pregnancies, as it has not been shown to be of value in this patient population.

- ✓ Consider umbilical artery Doppler assessment:
    - At assessment for suspected fetal growth restriction
    - For surveillance in diagnosed fetal growth restriction
    - In follow-up for suspected placental pathology or uteroplacental vascular insufficiency otherwise

- ✓ If performing fetal Doppler:
  - Choose a free loop of cord (not close to the fetal or placental cord insertion).
  - Interrogate during fetal apnea.
  - For additional information on technique: https://fetalmedicine.org/var/uploads/Doppler-in-Obstetrics.pdf.
- ✓ Umbilical Doppler is assessed most importantly as to the presence/absence of end diastolic flow.
  - Note absent end diastolic flow (AEDF) or reversed end diastolic flow (REDF) if present. These findings are associated with adverse pregnancy outcome, and same day clinical assessment is indicated.
  - If positive end diastolic flow is present, suggest reporting pulsatility index (PI) and its relevant percentile (preferred over alternative ratios such as resistance index (RI) or the systolic to diastolic ratio).
  - A PI >95th percentile indicates increased resistance to flow and is abnormal. See Appendix D for Umbilical Artery Pulsatility Index 12-42 weeks. Same day clinical assessment is indicated.
  - Abnormalities of the umbilical artery Doppler are generally an indication for enhanced fetal surveillance or delivery, and can best be re-assessed and managed by MFM.

PRACTICE POINT

Pay careful attention to technique for Doppler gate size and angle.
Do not perform or report on fetal Doppler if radiologist and/or technician are not skilled and experience in fetal Doppler.
Refer patient to a MFM centre or contact the MFM on-call directly if you need assistance or would like to arrange for fetal Doppler studies.

4. Patient at Risk for Adverse Outcomes Who Requires Urgent Care and Same Day Assessment and Management. Refer to MFM as Appropriate.

- ✓ For the following urgent situations, all warrant:
  - Direct involvement of the physician supervising/performing the ultrasound before the patient is discharged from the imaging facility
  - Communicating abnormal results to the patient (***Note: Advise the patient to be NPO until assessed by their care provider***.)
  - STAT report delivery (same day notification of referring provider)
  - Same day assessment with their maternity care provider or alternatively in the hospital's Labour and Delivery unit

PRACTICE POINT

It is the responsibility of the imaging physician to verify that the referring maternity provider is aware of these urgent results by direct phone call or otherwise, prior to the patient being discharged from the imaging facility.

If this is not possible, the only acceptable alternative is to send the patient directly from the imaging facility to a hospital labour and delivery unit for on-call assessment, notify the unit that the patient is inbound, and copy the report there.

1) Abnormal BPP (6/8 or less when >28 weeks, critical finding is BPP 4/8 or less regardless of gestational age):
    - Typical care would include a same-day NST and possibly further assessment at the hospital's Labour and Delivery Unit (definitely require a same-day assessment if 4/8 or less)
2) Oligohydramnios:
    - Any case with AFI <5 cm or less, SDP <2 cm, absent 2x2 cm pocket on the BPP, or subjectively reduced otherwise (even if BPP 8/8)
3) Fetal growth restriction:
    - Any case with EFW and/or AC <10th percentile, or poor/absent interval fetal growth
4) Abnormal umbilical artery Doppler:
    - Umbilical artery PI >95th percentile, or absent or reversed end diastolic flow (critical finding)
5) Hydrops fetalis (critical finding)
6) Shortened cervical length (at increased risk for spontaneous preterm birth)
    a. EV cervical length less than 25 mm (in GA <32 weeks)
    b. Critical finding if <15 mm (in GA <32 weeks)
    c. Critical finding if there is a presenting umbilical cord
7) A new and significant placental abnormality observed during the ultrasound including a retroplacental or sub-chorionic hemorrhage (suspected placental abruption), a new diagnosis of vasa previa or an antepartum hemorrhage
8) Abnormal Fetal Heart Rate:
    - Tachyarrhythmia (≥180 as an isolated finding, ≥160 if other abnormalities also present)
    - Bradyarrhythmia (≤110)
    - Bradycardia (>110)

- ✓ For these abnormalities of fetal well-being assessment or suspected uteroplacental vascular insufficiency (including abnormal BPP, oligohydramnios, FGR, abnormal Doppler), typical care might include:
  - Same day NST
  - Same day consultation with an obstetrician (if under low-risk care)
  - Clinical assessment in the physician's office or hospital Labour and Delivery Unit
  - Potential transfer to a larger obstetrical centre
  - Betamethasone for fetal lung maturity (if preterm) given only up to 34 weeks (depending on the situation)
  - Term or preterm delivery, or expectant management with close inpatient or outpatient fetal monitoring

MATERNAL FETAL MEDICINE (MGM) IS AVAILABLE PROVINCE-WIDE, ON CALL 24/7 TO SUPPORT BOTH OBSTETRIC IMAGING AND OBSTETRIC CARE PROVIDERS

Call direct to the local MFM unit with questions, or to arrange for urgent MFM assessment:

Northern and Central Alberta Maternal Fetal Medicine Centre	Calgary Alberta Centre for Maternal Fetal Medicine
Phone: 780.735.4813	Phone: 403.289.9269
Fax: 780.735.4814	Fax: 403.210.8381
MFM on call 24 hours: 780.735.4111	MFM on call 24 hours: 403.944.1110

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SUGGESTED CITATION

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GUIDELINE COMMITTEE

The committee consisted of representatives of family medicine, obstetrics and gynecology, diagnostic radiology and maternal fetal medicine.

June 2017

APPENDIX A

Obstetrical history and current pregnancy conditions associated with increased perinatal morbidity/mortality where antenatal fetal surveillance may be beneficial.	
Previous obstetrical history	
Maternal	• Hypertensive disorder of pregnancy • Placental abruption
Fetal	• Intrauterine growth restriction • Stillbirth
Current pregnancy	
Maternal	• Post-term pregnancy (>294 days, >42 weeks) • Hypertensive disorders of pregnancy • Pre-pregnancy diabetes • Insulin requiring gestational diabetes • Preterm premature rupture of membranes • Chronic (stable) abruption • Iso-immunization • Abnormal maternal serum screening (hCG or AFP > 2.0 MOM) in absence of confirmed fetal anomaly • Motor vehicle accident during pregnancy • Vaginal bleeding • Morbid obesity • Advanced maternal age (e.g., ≥35 years of age) • Assisted reproductive technologies
Fetal	• Decreased fetal movement • Intrauterine growth restriction • Suspected Oligohydramnios/Polyhydramnios • Multiple pregnancy • Preterm labour

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APPENDIX B

Figure 3 Birth Weight Percentiles, Female Singleton Live Births with Outliers Removed, Alberta, 2000 to 2009 Combined

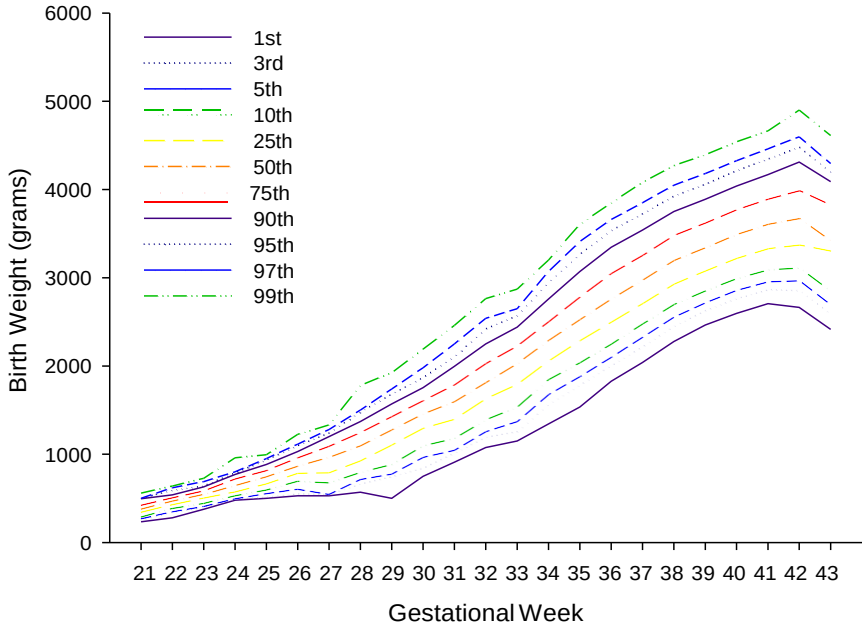

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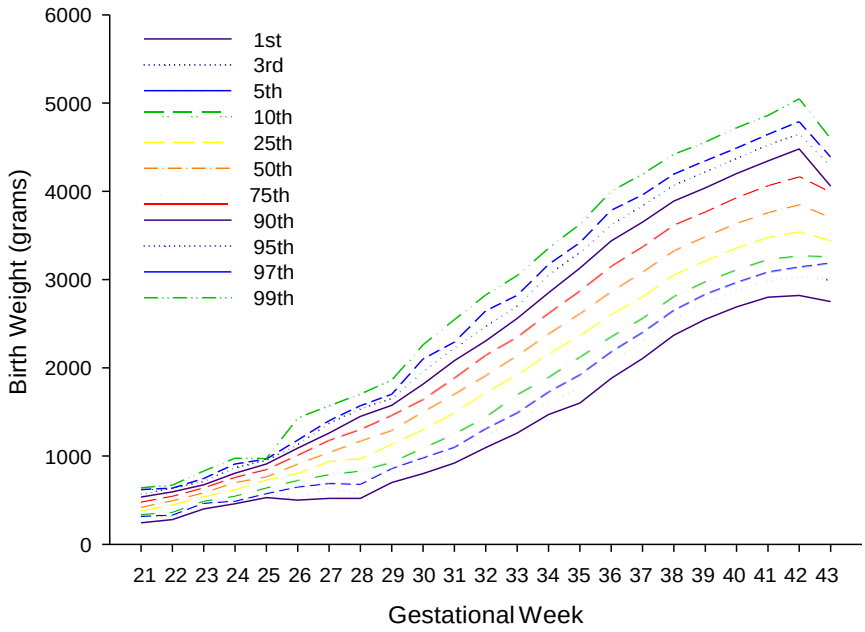
Figure 4 Birth Weight Percentiles, Male Singleton Live Births with Outliers Removed, Alberta, 2000 to 2009 Combined



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APPENDIX C

IMPACT OF BPP SCORE

Perinatal mortality within one week of biophysical profile by BPP score*			
Test Score Result	**Interpretation**	**PNM within 1 week without intervention**	**Management**
10/10 8/10 (normal fluid) 8/8 (NST not done)	Risk of fetal asphyxia extremely rare	1/1000	Intervention for obstetric and maternal factors
8/10 (abnormal fluid)	Probable chronic fetal compromise	89/1000	Determine that there is evidence of renal tract function and intact membranes. If so, delivery of the term fetus is indicated. In the preterm fetus <34 weeks, intensive surveillance may be preferred to maximize fetal maturity.
6/10 (normal fluid)	Equivocal test, possible fetal asphyxia	Variable	Repeat test within 24 hr
6/10 (abnormal fluid)	Probable fetal asphyxia	89/1000	Delivery of the term fetus. In the preterm fetus <34 weeks, intensive surveillance may be preferred to maximize fetal maturity.[20]
4/10	High probability of fetal asphyxia	91/1000	Deliver for fetal indications.
2/10	Fetal asphyxia almost certain	125/1000	Deliver for fetal indications.
0/10	Fetal asphyxia certain	600/1000	Deliver for fetal indications.
**Modified from Manning FA, Dynamic ultrasound-based fetal assessment: The fetal biophysical score[80]*			

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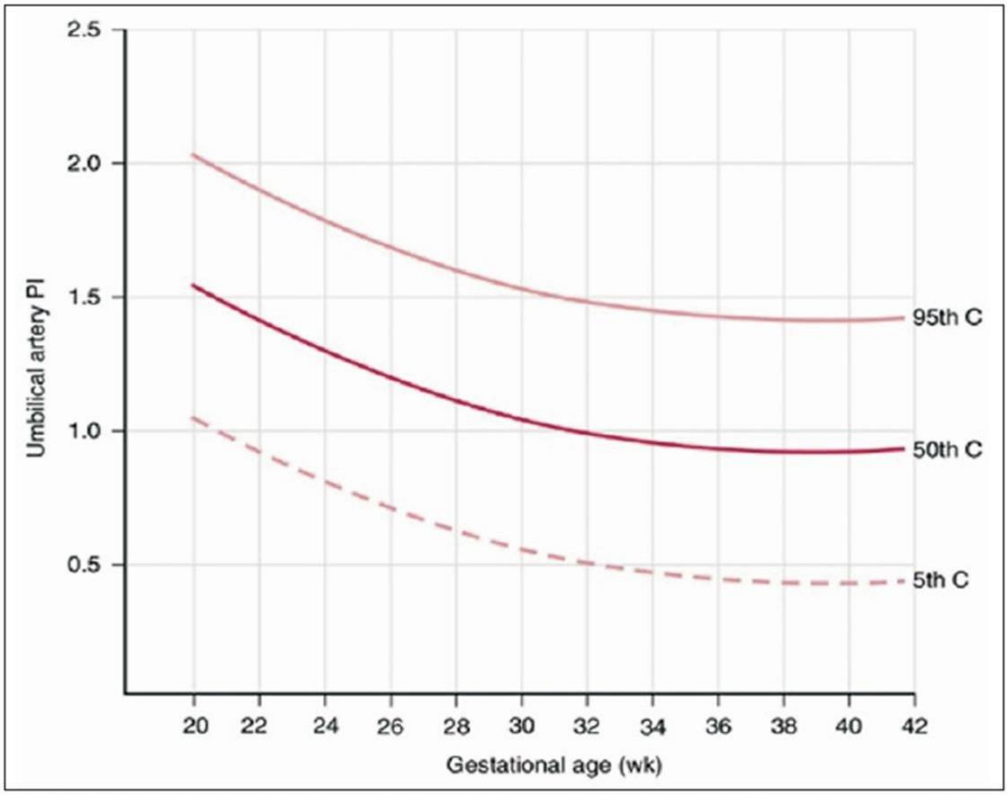
APPENDIX D

Figure 4. Umbilical artery pulsatility Index: 20 to 42 weeks



Umbilical artery pulsatility index (5th, 50th, and 95th percentiles) from a cross-sectional study of 1556 healthy pregnancies at 20 to 42 weeks' gestation. All fetuses were singletons, andgestational age was confirmed by early ultrasound measurements of crown-rump length. Recordings from umbilical artery were madein the absence offetal body breathing movements. The pulsatility index was calculated as (systolic velocity - diastolic velocity/mean velocity). This figure was published in High Risk Pregnancy: Management Options, 3rd edition. James et al. Copyright Elsevier (2006).

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