These guidelines are informational only. They are not intended or designed as a substitute for the reasonable exercise of independent clinical judgment by practitioners, considering each patient’s needs on an individual basis. Guideline recommendations apply to populations of patients. Clinical judgment is necessary to design treatment plans for individual patients.

BACKGROUND

1. Goal of antepartum testing is to reduce the stillbirth rate.
2. There are no randomized controlled trials that demonstrate antepartum testing decreases the risk of fetal death.
3. Incidence of stillbirth occurring in a tested population is defined as a stillbirth that occurs within 1 week of a normal test.
4. Stillbirth rate corrected for lethal congenital anomalies and unpredictable causes of demise
   - Background risk* = 8.7 per 1000 (2519 patients) * uncontrolled
   - NST group = 1.9 per 1000 (5861 tests).
   - CST group = 0.3 per 1000 (12,656 tests).
   - BPP group = 0.8 per 1000 (44,828 tests).
   - Modified BPP = 0.8 per 1000 (54,617 tests).
5. No randomized trials have compared the relative efficacy of one technique of antepartum testing to another.
6. In most clinical situations, no single test is considered superior to any other.
7. No ideal cutoff level for intervention using AFI has yet to be established.

RECOMMENDATION

I. Methods of Fetal Surveillance

A. Fetal Movement Assessment -
   It is unknown whether programs of fetal movement assessment, or kick counts actually can reduce the risk of stillbirth. The population to monitor is also unknown.
   1. It is suggested that patients instructed in fetal movement assessment be considered at risk for still birth. However any obstetrical patient can be instructed in fetal movement assessment.
   2. It is suggested that patients be instructed to monitor fetal movement beginning at 28 to 32 weeks.
   3. The patient is instructed to assess her fetal movements for a period of up to 1 hour, three times a week. Ten movements in 1 hour are considered normal and she may stop counting once this number is reached.
   4. If the patient perceives less than 10 movements in an hour she can continue monitoring up to 2 hours. If she does not meet criteria by the 2-hour time period, she is to notify her physician.

B. Nonstress Test (NST) -
   1. Patient is placed in the lateral tilt position the fetal heart rate is monitored with external transducer.
   2. Ideally the patient should not have smoked recently, because this may adversely affect test results.
   3. The minimum observation time is for a NST is 20 minutes.
   4. The fetus may be monitored for up to 40 minutes or longer to take into account the variations of the fetal sleep-wake cycle.
   5. Nonstress tests results are categorized as follows:
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- **Reactive (normal):** Meets all of the following criteria
  - Two or more fetal heart rate accelerations that peak (but do not necessarily remain) at least 15 beats per minute above baseline and last at least 15 seconds from baseline to baseline but less than 2 minutes in duration within a 20 minute observation period.
  - Fetal heart rate is in the normal range (110 to 160 beats per minute) during a 10 minute segment.
  - There is moderate variability present (amplitude range 6-25 beats per minute).
  - No clinically significant periodic changes are noted.

- **Nonreactive:** defined as a nonstress test that lacks sufficient fetal heart rate accelerations over a 40 minute period.

- **Appropriate for gestational age:** the nonstress test of the noncompromised preterm fetus is frequently nonreactive (Up to 50% from 24-28 weeks and 15% from 28-32 weeks). If the fetal heart rate tracing has fetal heart rate accelerations that do not meet the criteria for reactivity and if there are no periodic changes suggestive of an acidotic fetus (tachycardia, bradycardia, absent, marked or minimal variability, repetitive variable decelerations or late decelerations) this can be considered appropriate for gestational age.

- **Unsatisfactory:** Technical difficulties such as an indeterminate baseline or “broken” tracing.

6. Other observations
- Variable decelerations may be observed in up to 50% of nonstress tests.
- Not clinically significant variable decelerations are described as:
  - Abrupt changes in fetal heart rate (onset to nadir less than 30 seconds).
  - Nonrepetitive and episodic (not associated with uterine activity).
  - Brief (< 30 seconds in duration).
  - Less than 15 beats per minute below baseline.
  - These are not associated with fetal compromise and do not indicate obstetric intervention.
- Repetitive variable decelerations (at least 3 in 20 minutes) have been associated with an increased risk of cesarean delivery or nonreassuring intrapartum fetal heart rate pattern.
- Fetal heart rate decelerations during an nonstress test that persist for 1 minute or longer are associated with a markedly increased risk of both cesarean delivery for nonreassuring fetal heart rate pattern and fetal demise.

7. If there is no reactivity after 10 minutes of observation, vibroacoustic stimulation may be used (see below).
8. A reactive test may be repeated as clinically indicated. A non-reactive test requires additional evaluation to follow immediately with BPP.

C. Vibroacoustic Stimulation -
1. Vibroacoustic stimulation (VAS) of the nonacidotic fetus may elicit fetal heart rate accelerations that appear to be valid in the prediction of fetal well-being.
2. Such stimulation offers the advantage of safely reducing overall testing time without compromising detection of the acidotic fetus.
3. Small variable decelerations occurring immediately after stimulation are quite common and non-pathologic.
4. To perform acoustic stimulation, an artificial larynx is positioned on the maternal abdomen.
5. After at least 10 minutes of non-reactivity, stimulate (“buzz”) the fetus over the vertex:
   - Stimulate for 1-2 second and wait 1 minute
   - If there is no response, this may be repeated up to three times for progressively longer duration up to 3 seconds to elicit fetal heart rate
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D. Amniotic Fluid Index -
1. The Amniotic Fluid Index (AFI) is a semi-quantitative technique used for evaluating amniotic fluid volume\(^4\).\(^5\)
2. The patient is placed in the supine or semi-Fowler’s position. The uterus is divided into 4 quadrants with the linea nigra and the umbilicus serving as the dividing points.
3. The ultrasound transducer is placed along the patient’s longitudinal axis and perpendicular to the floor.
4. Each quadrant is scanned using this technique and the vertical diameter of the largest pocket containing no greater than 50% cord in each quadrant is measured.
5. The sum of the numbers represents the total AFI.
6. Results are defined as:
   - Oligohydramnios: AFI < 5.0 cm (four quadrant) or no single vertical pocket of amniotic fluid greater than 2 cm.
   - Decreased AFI: 5.1 to 8 cm (four quadrants) with no evidence of growth restriction in the fetus this is considered normal.
   - Normal AFI: 8.1 to 24.9 cm.
   - Polyhydramnios: AFI > 25 cm (four quadrant) or single vertical pocket of amniotic fluid greater than 8 cm.
7. AFI in twin pregnancies
   - Two suggested methods for measuring AFI.
     - Modified 4 quadrant AFI using the same technique described above for a singleton pregnancy.
       - Use same definitions for description of AFI as a singleton pregnancy.
     - Identification of two vertical pockets of fluid that are at least 2 cm on either side of the dividing membrane.
       - Normal AFI if the above criteria are met.
       - Decreased AFI requiring follow up defined as less than 2cm vertical pocket in either sac.
       - Increased AFI requiring follow up defined as greater than 8cm vertical pocket in either sac.

E. Biophysical Profile -
1. The Biophysical Profile (BPP) is the combined observation of 5 separate fetal biophysical variables (movement, tone, reactivity, breathing and amniotic fluid volume)\(^6\).
2. Fetal reactivity is assessed by the nonstress test.
3. The remaining 4 variables are assessed with the use of real time ultrasound for a maximum of 30 minutes, or less if the fetus achieves a perfect score.
4. Biophysical profile scoring

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>NORMAL (score = 2)</th>
<th>ABNORMAL (score = 0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fetal Breathing Movements (FBM)</td>
<td>(\geq 1) episode of FBM (or hiccoughs) of (\geq 30) seconds duration</td>
<td>(&lt; 30) seconds of sustained FBM</td>
</tr>
<tr>
<td>Fetal Movements (FM)</td>
<td>(\geq 3) discrete body/limb movements (simultaneous limb and trunk movements are counted as single movement)</td>
<td>(&lt; 2) episodes FMS</td>
</tr>
</tbody>
</table>
### Fetal Tone

- \( \geq 1 \) episode of active extension with rapid return to flexion of fetal limb(s), trunk, or hand
- Either slow extension with return to partial flexion or movement of limb in full extension or absent fetal movement

### Reactive FHR

- \( \geq 2 \) accelerations of \( \geq 15 \) BPM peak amplitude lasting \( \geq 15 \) seconds at the baseline in 20 minutes and decelerations absent
- \(< 2 \) accelerations or accelerations \(< 15 \) BPM peak amplitude or accelerations \(< 15 \) seconds duration in 20 minutes or suspected decelerations

### Amniotic Fluid Index (AFI)

- Single vertical pocket exceeding 2 cm
- No vertical pockets exceeding 2 cm

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5. Interpretation and management (see III.A.)

**II. Protocol for Testing:** Diagnostic Conditions and Frequency

The basic formal testing scheme is the modified biophysical profile (NST/AFI). On occasion an NST alone may suffice. No randomized trials have compared the relative efficacy of one technique of antepartum testing to another. In most clinical situations, no single test is considered superior to any other. Antenatal testing begins at different gestational ages depending on the maternal and/or fetal condition. It is started either when the condition is recognized (e.g., IUGR) or at specific times (e.g., post term). For other conditions it usually begins in the mid third trimester, about 34 weeks (e.g., history of late unexplained IUFD).

The list below should not be considered all-inclusive. It represents suggested indications for antepartum testing based on currently available scientific evidence.

**MATERNAL CONDITIONS (ACOG)**

1. Antiphospholipid syndrome (twice weekly)
2. Hyperthyroidism, poorly controlled (twice weekly)
3. Hemoglobinopathies ie. hemoglobin SS, SC, or S-thalassemia (twice weekly)
4. Cyanotic heart disease (twice weekly)
5. Systemic lupus erythematous (twice weekly)
6. Chronic renal disease (twice weekly)
7. Type 1 diabetes mellitus (twice weekly)
8. Hypertensive disorders (twice weekly)
9. Advanced maternal age greater than 40yrs (twice weekly starting at 37 weeks)

**PREGNANCY RELATED CONDITIONS (ACOG)**

1. Gestational hypertension/preeclampsia (twice weekly)
2. Chronic hypertension (on medications) (twice weekly)
3. Decreased fetal movement (single test)
4. Oligohydramnios (twice weekly until resolves in normal fetus)
5. Polyhydramnios (weekly until resolves)
6. Intrauterine growth restriction (twice weekly at the time of diagnosis)
7. Postterm pregnancy (twice weekly beginning at 41 weeks)
8. Isoimmunization, moderate to severe (twice weekly at the time of diagnosis)
9. Previous fetal demise, unexplained or recurrent risk (weekly 1 week prior to previous loss or 32-34 weeks)
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10. Multiple gestation with significant growth discrepancy of 20-25% or IUGR (twice weekly at the time of diagnosis)
11. Monochorionic/Diamniotic twin pregnancy (twice weekly starting at 32 weeks)

OTHER SUGGESTED INDICATIONS

1. Diabetes Mellitus type I or II good control no end organ damage (twice weekly beginning at 32-34 weeks)
2. Diabetes Mellitus type I or II poor control or end organ damage present (weekly beginning at 26-28 weeks, then twice weekly at 32-34 weeks)
3. Gestational diabetes diet controlled (twice weekly beginning at 40 weeks)
4. Gestational diabetes class A2 on split dose insulin, good control (twice weekly beginning at 36 weeks)
5. Gestational diabetes, any type, non-complaint (twice weekly beginning at 32-34 weeks).
6. Thrombophilia (activated protein C deficiency, factor V Leiden mutation, protein S deficiency) requiring therapeutic anticoagulation or anticoagulation prophylaxis (twice weekly beginning at 32-34 weeks)
7. Monochorionic twin gestation (twice weekly beginning at 32 weeks)
8. Dichorionic twin gestation (twice weekly beginning at 36 weeks)
9. Extreme AMA, defined as greater than 40 years old at estimated date of delivery (twice weekly beginning at 37 weeks)

SUGGESTED GUIDELINES

1. All patients with risk factors for stillbirth should be offered antepartum testing.
2. If indicated, antepartum testing should be initiated for most pregnancies at 32-34 weeks gestation.
3. In certain pregnancies with multiple or particularly worrisome high risk conditions testing may be initiated as early as 26-28 weeks gestation.
4. Antepartum testing should continue for as long as the clinical condition that prompted testing persists. It should be repeated periodically until delivery.
5. Either CST or full BPP should further evaluate all abnormal NST or modified BPP.
6. In the absence of obstetrical contraindications, delivery of the fetus with an abnormal test result may be attempted by induction of labor with continuous fetal monitoring. If repetitive late decelerations are observed, cesarean delivery is generally indicated.
7. For abnormalities in AFI
   a. Decreased AFI below the 5th percentile (5-8 cm)
      i. In a normal fetus this is normal (consider SD ratio)
      ii. In small for gestational age fetus (estimated fetal weight less than 20th percentile for gestational age) consider antepartum testing weekly until resolves (AFI greater than 8 cm) then discontinue testing
   b. Oligohydramnios
      i. Low risk group
         1. Defined as:
            a. Isolated oligohydramnios with 4 quadrant AFI less than 5 cm but greater than 1 cm
            b. Unfavorable cervix
            c. Normal fetal growth
            d. Normal antepartum testing
         2. Recommended Management:
            a. Twice weekly antepartum testing
            b. Await spontaneous labor or induction at 40 weeks gestation.
      ii. High risk group
         1. Defined as:
            a. Post-term pregnancy (gestational age greater than 40 weeks).
            b. Gestational age greater than or equal to 37 weeks by ACOG dating criteria with co-morbidities present.
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c. IUGR
d. Abnormal antepartum testing
e. Chronic hypertension
f. Diabetes
g. Other medical complication (lupus, antiphospholipid antibody syndrome etc)

2. Recommended Management:
   a. Delivery
   c. Polyhydramnios
      i. Recommended Management:
         1. Diabetic screen
         2. Anomaly screen
         3. Twice weekly antenatal testing
      ii. If AFI returns to normal, repeat antepartum testing as clinically indicated
      iii. Note: Polyhydramnios is associated with an increased risk for fetal distress in labor.

DEFINITIONS

1. Oligohydramnios: AFI < 5.0 cm (four quadrant) or no single vertical pocket of amniotic fluid greater than 2 cm.
2. Polyhydramnios: AFI ≥ 25 cm (four quadrant) or single vertical pocket of amniotic fluid greater than 8 cm.
3. DECREASED AFI: 5-8 CM (FOUR QUADRANT) WITH NORMAL FETUS THIS IS NORMAL

III. Follow-Up Guidelines for Abnormal Testing

A. Biophysical Profile
   1. Components (2 points if present, 0 points if absent)
      a. Nonstress test
      b. Fetal breathing movements: One or more episodes of rhythmic fetal breathing movements of 30 seconds or more within 30 minutes
      c. Fetal Movement: Three or more discrete body or limb movements within 30 minutes
      d. Fetal Tone: One or more episodes of extension of a fetal extremity with return to flexion or opening or closing of a hand
      e. Amniotic fluid volume: Single vertical pocket exceeding 2 cm

Biophysical Profile

<table>
<thead>
<tr>
<th>Score</th>
<th>Interpretation</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>8-10</td>
<td>Normal</td>
<td>Repeat testing as clinically indicated</td>
</tr>
</tbody>
</table>
| 6     | Equivocal      | If term pregnancy: generally prompt delivery  
|       |                | If preterm: Repeat test in 24 hours  
|       |                | Consider antenatal steroids if < 34 weeks |
| 4     | Abnormal       | If repeat test is 6 consider delivery versus close monitoring |
| < 2   | Abnormal       | Delivery is indicated if near term  
| Oligo | Abnormal       | If extreme prematurity, individualize care |
|       |                | Delivery irregardless of gestational age |
|       |                | Requires additional follow up. |

SUGGESTED READING
ANTEPARTUM FETAL SURVEILLANCE