The fetal biophysical profile

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INTRODUCTION — The fetal biophysical profile (BPP) is a noninvasive, easily learned and performed procedure for evaluating the fetus for signs of compromise. Ultrasound is used to assess four discrete biophysical parameters: fetal movement, fetal tone, fetal breathing, and amniotic fluid volume. A separate nonstress test of the fetal heart rate can also be performed. Each of the four ultrasound parameters and the nonstress test are given a score of 0 or 2 points (no 1 point), depending upon whether specific criteria are met (table 1). A total score ≥8 implies absence of significant central nervous system hypoxemia/acidemia at the time of testing. A score ≤4 can be a sign of fetal compromise. Ideally, identification of a compromised fetus will enable the provider to perform interventions that prevent adverse fetal sequelae.

This topic will review issues related to the BPP. An overview of antenatal fetal surveillance and information on the nonstress test and the contraction stress test are available separately. (See "Overview of antepartum fetal surveillance" and "Nonstress test and contraction stress test").

INDICATIONS — The American College of Obstetricians and Gynecologists recommends antepartum fetal surveillance with tests such as the BPP for pregnancies at increased risk of antepartum fetal demise [1]. Specific indications for antenatal fetal assessment are discussed separately. (See "Overview of antepartum fetal surveillance", section on 'Indications for fetal surveillance'.)

Although the BPP is typically used for antepartum fetal assessment, it can also be performed intrapartum; however, its clinical utility in the intrapartum setting is unclear [2,3].

PHYSIOLOGIC BASIS OF BIOPHYSICAL MONITORING — All biophysical activities are regulated and controlled by discrete centers in the brain that are sensitive to both local factors and feedback from peripheral sensors. The presence of normal biophysical activity is presumptive evidence that these regulatory centers are intact, while the loss of normal biophysical activity can be a sign of pathologic neuronal suppression from hypoxemia, acidemia, and ischemia. However, the absence or diminution of a given biophysical activity is not always pathologic. Normal suppression of a regulatory center can occur from intrinsic fetal rhythms, such as the deep stage of quiet sleep, or from transplacental passage of drugs that cause general suppression of the brain, such as sedatives and opiates.

The BPP and nonstress test assess five discrete biophysical parameters (table 1) that reflect central nervous system regulatory output and thus indirectly reflect the integrity of the regulatory center. Four of these parameters, fetal breathing movements, generalized fetal movements, fetal tone, and accelerations in the fetal heart rate in response to fetal movements (nonstress test), are acutely affected by fetal hypoxemia and acidemia. Amniotic fluid volume is a nonacute parameter since decreases in amniotic fluid volume occur gradually, in response to redistribution of fetal blood flow in response to chronic uteroplacental vascular insufficiency.

The biophysical parameters for the BPP were based upon their ease of measurement and the ability to evaluate them objectively using universally available equipment. Other fetal biophysical activities (eg, sucking, eye movements, swallowing, micturition) may serve equally well as markers of fetal health, but are not included because measurement is difficult and may be subjective.
The acute parameters function to enhance fetal development, but are not essential to maintaining fetal life. When the fetus is stressed, these biophysical activities may stop or slow down to reduce fetal oxygen requirements. In the human fetus, administration of a short acting curare (e.g., pancuronium) to prevent fetal movement produces an immediate rise in fetal venous PO\textsubscript{2} by as much as 30 percent \cite{4}.

**Fetal movement, tone, breathing, and heart rate acceleration** — When one or more of these acute parameters is normal, the regulatory center is likely to be intact, and pathologic conditions, such as hypoxemia or acidemia, can be reliably excluded. In contrast, when one or more of these acute parameters is abnormal, the possible causes need to be considered. The most common benign cause of absence of one acute parameter is quiet fetal sleep. Since the sensitivity to depth and duration of quiet sleep varies by discrete regulatory center, it is unusual to observe the absence of two or more parameters as a consequence of quiet sleep alone. The more parameters that are absent (i.e., the lower the BPP score), the less likely the change is due to a sleep state. Similarly, the longer the absence of parameters, the more likely the cause is pathologic. Extending the observation period to encompass the usual duration of sleep state cycles (20 to 40 minutes) minimizes the possibility of confusing pathologic with physiologic causes of an absent parameter.

The degree of fall in oxygen concentration necessary to abolish a given central nervous system regulatory center output varies by center. The two most oxygen-sensitive centers are (1) the cardioregulatory neurons, which control the coupling of fetal movement and heart rate acceleration, and (2) the fetal breathing center neurons, which control fetal breathing movements. The centers regulating fetal movement have a higher threshold for hypoxemia than those for fetal breathing or fetal heart rate accelerations; the fetal tone center has the highest threshold. Thus, acute fetal biophysical activities respond to hypoxemia in a predictable, physiologically based cascade: loss of fetal breathing movements and fetal heart rate accelerations, followed by decreased fetal movement, and finally loss of fetal tone. This sequence is of clinical value since it allows for estimation of both the presence and severity of hypoxemia.

The threshold of the various regulatory centers is not absolute, but can adjust over time. This effect is likely a result of adaptive response, which increases local oxygen supply, rather than the result of a true change in neuronal oxygen requirements. Such compensatory responses include increased oxygen extraction, elevated fetal hemoglobin with increased oxygen carrying capacity, and redistribution of blood flow to favor brain perfusion. In some chronic fetal conditions, the acute biophysical parameters may initially disappear and then reappear despite a low PO\textsubscript{2}.

**Amniotic fluid volume** — Fetal urine is the predominant source of amniotic fluid after about 16 weeks of gestation. Fetal urine production is primarily dependent upon renal perfusion, which in turn reflects selective distribution of cardiac output. The fetus responds to sustained hypoxemia by selective redistribution of its cardiac output, with preferential flow directed to the brain, heart, adrenals, and placenta at the expense of all other organ systems \cite{5}. This protective mechanism is initiated by specialized chemoreceptors in the aortic arch and carotid arteries. (See "Physiology of amniotic fluid volume regulation".)

Hypoxemia-induced reflex redistribution of cardiac output away from the kidneys results in diminished fetal urine production, ultimately leading to oligohydramnios and then anhydramnios \cite{6}. Theoretically, a decrease in fetal swallowing, which removes amniotic fluid, could compensate for the decrease in urine production, but fetal swallowing is a vegetative reflex that is very resistant to the effects of hypoxemia.

The time for development of oligohydramnios is usually relatively long. On average, it takes approximately 15 days for a fetus to progress from normal to reduced amniotic fluid volume (in the absence of membrane rupture) and 23 days to develop severe oligohydramnios \cite{6}. However, acute changes in amniotic fluid volume and rapid deterioration of the BPP score have been reported \cite{7}.

**DETERMINING THE BIOPHYSICAL PROFILE SCORE** — As discussed above, the composite BPP score is derived from five fetal parameters: four acute parameters (heart rate accelerations in response to movement [nonstress test], breathing movement, body and limb movement, tone) and one chronic parameter (amniotic fluid volume). Each of these five parameters has been evaluated independently and the normal characteristic...
The scoring method used for each parameter is binary, i.e., the parameter is either normal or abnormal; gradations of abnormality are not used. A normal parameter is assigned a score of two and an abnormal parameter a score of zero. The maximal score is 10/10 and the minimum score is 0/10.

A parameter may be assigned a normal score as soon as it is observed. Since most fetuses will be normal and will demonstrate these biophysical activities, the usual time to achieve a normal BPP score is less than five minutes [9]. Because the acute parameters are subject to fetal sleep-wake cycles, the fetus should be observed continuously for at least 30 minutes before assigning an acute parameter 0 points. This time is based on ultrasound studies of fetuses from uncomplicated pregnancies. In one such study at 36 to 42 weeks of gestation, the mean duration of a fetal sleep (no somatic movements) was about 20 minutes, with an upper range of about 40 minutes [10]. Fetal acoustic stimulation may be used to try to shorten testing time [11].

Monotonous picket-fence breathing or gasping should not be considered normal breathing movements and seizures should not be counted as normal fetal limb movements [12-14]. We base evaluation of amniotic fluid volume on ultrasound measurement of the largest pocket. To score two points, the largest pocket must have a vertical depth of ≥2 centimeters [1]. The horizontal dimension should be at least 1 cm.

### Can the nonstress test be omitted?

— The predictive value of the four ultrasound biophysical parameters (movement, tone, breathing, amniotic fluid volume) is equivalent to that of the four ultrasound parameters plus a nonstress test when the four ultrasound parameters are normal (2 points for each). In a prospective study in which the nonstress test was only performed if the ultrasound score was <8, nonstress tests were performed in 2.7 percent of patients without reducing the predictive value of the test, which significantly reduced the average testing time per patient [15].

A nonstress test should always be performed if any ultrasound monitored parameter is 0.

### Modified biophysical profile

— The modified BPP was developed to simplify the examination and reduce the time necessary to complete testing by focusing on those components of the BPP that are most predictive of outcome. Assessment of both amniotic fluid volume and the nonstress test appears to be as reliable a predictor of long-term fetal well-being as the full BPP [16]. The rate of stillbirth within one week of a normal modified BPP is the same as with the full BPP: 0.8 per 1000 women tested [17]. Since about 90 percent of pregnancies that undergo a modified BPP will have a normal result, only a minority will need to proceed to a full biophysical evaluation, thus saving time and money [17].

### INTERPRETATION

— The author interprets the BPP score as follows:

- **10/10, 8/8 (nonstress test not done), or 8/10 (including +2 points for amniotic fluid)** is a normal test result: The risk of fetal death within one week if the fetus is not delivered is low (0.4 to 0.6/1000 births) [18]. A BPP score of 8/10 by any combination of parameters is as reliable as a score of 10/10 for the prediction of fetal well-being as long as no points are deducted for amniotic fluid volume.

  Fetal death after a normal BPP is often due to an acute and unpredictable insult such as sudden cord prolapse, large fetomaternal hemorrhage, or abruptio placenta.

  A normal score is predictive of the absence of fetal compromise in the setting of high risk factors, such as diabetes mellitus, hypertension, or fetal growth restriction. Before term, this provides reassurance that the benefits of continued intrauterine maturation will not be negated by fetal demise. A change in maternal condition affects this decision. The decision to intervene in a patient with worsening preeclampsia, for example, may depend less on the BPP score and more on maternal risk from continuing the pregnancy. Similarly, the presence of a favorable cervix may prompt delivery despite a normal BPP score when the fetus is at term.

- **6/10 (including +2 points for amniotic fluid)** is an equivocal test result, as a significant possibility of developing fetal asphyxia cannot be excluded. The test is repeated within 24 hours to see if one of the
absent acute variables returns to normal or, if the patient is at or near term, delivery is a reasonable option.

- **6/10 or 8/10 with oligohydramnios (0 points for amniotic fluid)** is an abnormal test, as the risk of fetal asphyxia within one week is 89/1000 with expectant management.

These scores should be interpreted within the context of gestational age (eg, neonatal morbidity and mortality if the fetus is delivered) and maternal and obstetric factors (eg, risk of fetal death related to maternal, fetal, or obstetric disorder if the fetus is not delivered; whether cervix is favorable; maternal risks from continuing the pregnancy). As an example, a low BPP score in a high-risk patient requires the provider to consider the fetal and neonatal risks of expectant management versus delivery and deliver when the balance shifts to greater fetal risk (figure 1).

- **0 to 4/10** is abnormal; the risk of fetal asphyxia within one week is 91 to 600/1000 if there is no intervention. Delivery is usually indicated. (See 'Route of delivery after a low BPP score' below.)

**Factors potentially affecting test results**

- **Antenatal corticosteroids** – Administration of antenatal corticosteroids can be associated with transient fetal heart rate and behavioral changes, but these changes typically return to baseline by day 4 after treatment [19]. The most consistent fetal heart rate change is a decrease in variability on days 2 and 3 after administration [20-24]. Fetal breathing and body movements are also commonly reduced, which may result in a lower BPP score or nonreactive nonstress test [24-27]. These findings should be considered within the total clinical picture when assessing a fetus for possible delivery because of a nonreassuring fetal evaluation (nonstress test or BPP) after corticosteroid administration.

The behavioral changes may reflect a physiologic response of the brain to glucocorticoids. Alternatively, they may be a consequence of a transient increase in fetal vascular resistance and blood pressure, which has been demonstrated in animal studies. Fetal blood flow velocity waveform patterns in the umbilical artery, middle cerebral artery, and ductus venosus do not appear to be affected [26,28,29]. (See "Antenatal corticosteroid therapy for reduction of neonatal respiratory morbidity and mortality from preterm delivery", section on 'Potential fetal side effects'.)

- **Subclinical infection** – The effect of subclinical infection on test results is controversial. Although intra-amniotic infection in a patient with preterm premature rupture of membranes may be associated with a low BPP score in the absence of hypoxemia [30], most studies have not found the BPP score to be a very sensitive method for detecting subclinical infection [31-34]. (See "Preterm premature (prelabor) rupture of membranes", section on 'Fetal monitoring'.)

- **Preterm labor** – Preterm labor may be associated with absence of fetal breathing movements, but absence of fetal breathing movements is not a good predictor of preterm delivery within 48 hours or seven days [35].

- **Fasting** – There are sparse data on the effect of maternal fasting on fetal biophysical activities. A study that performed a BPP one hour after a meal and 10 to 12 hours after abstaining from food and drink in 30 women with uncomplicated pregnancies reported scores of ≥8/10 for all postprandial tests, but two fasting tests were 4/10 and 6/10; both tests rose to 10/10 after the mother ate a meal [36]. Point reductions during fasting were primarily due to nonreactive nonstress tests and inadequate fetal breathing movements. It is difficult to draw any conclusion about the effect of fasting on the BPP score in the clinical setting, given the small size of this study and the absence of indications for antepartum fetal assessment. Some sites give the patient juice or another type of food/drink if a BPP shows inadequate breathing or the nonstress test is nonreactive, but this has not been proven to be effective.

Mild maternal anemia does not appear to affect fetal biophysical activities [37].
EVIDENCE OF EFFICACY — Although the use of biophysical testing schemes to monitor high-risk pregnancies has become routine, this practice pattern has evolved with limited high-quality scientific evidence to support its use [38]. Moreover, there are no randomized trials on which to base recommendations for the best initial testing approach for specific types of high-risk pregnancies, the optimal timing of test initiation, the frequency of testing based on test results, conditions that may affect test results, and the effect of gestational age.

In a 2008 meta-analysis of randomized trials comparing BPP with conventional fetal heart rate monitoring (five trials involving 2974 high risk pregnancies), use of the BPP did not reduce perinatal death or the frequency of low Apgar scores [39]. Three of the trials were of low quality; the two higher-quality studies were small (n = 280 high-risk pregnancies) and results did not exclude the possibility of a small or modest benefit.

Observational studies have reported the BPP is accurate for predicting the absence of significant fetal acidemia [40] and comparable to the contraction stress test [41]. For example, in one observational study including almost 45,000 BPPs, the risk of fetal demise within one week of a normal test result was 0.8 per 1000 women tested (corrected for lethal congenital anomalies and unpredictable causes of demise) [18]. This result compares favorably with all other means of antepartum fetal assessment. In two large observational studies including over 18,000 women, use of the BPP was associated with a 61 to 76 percent reduction in perinatal mortality (corrected) compared with historic controls [42].

In other observational studies, perinatal mortality (gross and corrected) and serious perinatal morbidity (nonreassuring fetal heart rate pattern in labor, low Apgar scores, neonatal seizures, admission to an intensive care unit, hypoxemic-ischemic encephalopathy, intrauterine growth restriction) increased significantly as the last BPP score fell [43,44]. In addition, the cord blood pH of newborns delivered either vaginally or by cesarean had a direct relationship to last BPP score [45]. An inverse relationship between last BPP score and incidence of cerebral palsy has also been observed, and may or may not be related to antepartum asphyxia [figure 4]. Long-term asphyxia leading to adverse neurologic outcomes such as cerebral palsy and intellectual disability appears to be significantly reduced in high-risk patients managed by fetal BPP scoring compared with untested low-risk patients [46].

The advent of ultrasound-guided intrauterine fetal blood sampling (cordocentesis) made it possible to measure the direct and immediate relationship between the BPP score, fetal PO\textsubscript{2}, and fetal pH [47,48]. These studies, which include over 1000 paired observations, reported a direct relationship between the BPP score and mean umbilical venous pH and suggest that, in the individual fetus, the BPP score accurately predicts both the probability and severity of existing acidemia [49,50]. Thus, the score is an accurate proxy for fetal acidosis. In contrast, the relationship between the BPP score and fetal PO\textsubscript{2} is less precise, which is expected since PO\textsubscript{2} varies according to fetal compensatory adaptive responses.

INITIATION AND FREQUENCY OF TESTING — The minimum gestational age for initiating testing should reflect the lower limit that intervention with delivery would be considered. This age is now about 24 weeks of gestation in many centers. Testing may be initiated at this gestational age if clinical conditions suggest fetal compromise this early in gestation is likely; otherwise, testing is initiated when individual clinical circumstances warrant fetal monitoring. Initiating testing at 32 to 34 weeks of gestation is appropriate for most pregnancies at increased risk of stillbirth. (See "Overview of antepartum fetal surveillance", section on 'Timing'.)

A normal BPP score (10/10 or 8/10 without oligohydramnios) is repeated weekly or twice weekly until delivery when the high-risk condition persists and appears stable. Some experts recommend more frequent testing intervals, with individualization based on the high-risk clinical setting [51]. For example, severe growth restriction cause by uteroplacental insufficiency requires very close fetal monitoring. In one study, 48 growth-restricted fetuses <32 weeks of gestation with umbilical artery Doppler pulsatility index <95\textsuperscript{th} percentile underwent BPP daily and nonstress testing three times daily [52]. Ten of 27 fetuses with BPP scores of 8 developed nonreassuring fetal heart rate tracings 3.5 to 24 hours after the BPP, and the repeat BPP score was 2 in all of these fetuses; three died in utero, seven were delivered promptly, and six of these neonates had acideamic umbilical artery blood gases at birth.

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Any significant deterioration in the clinical status (eg, worsening preeclampsia, decreased fetal activity) requires reevaluation, regardless of the amount of time elapsed since the last test.

**ROUTE OF DELIVERY AFTER A LOW BPP SCORE** — The positive predictive value of a low BPP score for intrapartum fetal compromise (eg, a nonreassuring fetal heart tracing, neonatal acidemia, or other markers of neonatal morbidity at the time of delivery) is approximately 50 percent, with a negative predictive value greater than 99.9 percent. The mode of delivery is an obstetric decision based on multiple variables including presentation, cervical findings, and maternal condition. In the absence of an obstetric contraindication, induction of labor with continuous intrapartum fetal heart monitoring is a reasonable management option for most patients.

**SUMMARY AND RECOMMENDATIONS**

- The five fetal parameters used for determining the biophysical profile (BPP) score are heart rate accelerations in response to movement (nonstress test), breathing movement, body and limb movement, tone, and amniotic fluid volume, as described in the table (table 1). (See 'Determining the biophysical profile score' above.)

- A parameter may be assigned a normal score as soon as it is observed. The acute parameters (movement, tone, breathing) are subject to fetal sleep-wake cycles; therefore, the fetus should be observed continuously for at least 30 minutes before the parameter is assigned 0 points. (See 'Determining the biophysical profile score' above.)

- A score of 10/10 or 8/10 without oligohydramnios is reassuring of fetal well-being; 6/10 without oligohydramnios is an equivocal test result and should be repeated within 24 hours if the patient is not delivered; and 0 to 4/10 suggests a high risk of fetal asphyxia within one week if the patient remains undelivered or no therapeutic intervention is undertaken. (See 'Interpretation' above.)

- Scores of 6/10 or 8/10 with oligohydramnios (0 points for amniotic fluid) are abnormal tests, as the risk of fetal asphyxia within one week is 89/1000 with expectant management. These scores should be interpreted within the context of gestational age (eg, neonatal morbidity and mortality if the fetus is delivered) and maternal and obstetric factors (eg, risk of fetal death related to maternal, fetal, or obstetric disorder if the fetus is not delivered; whether cervix is favorable; maternal risks from continuing the pregnancy). A low BPP score in a high-risk patient requires the provider to consider the fetal and neonatal risks of expectant management versus delivery and deliver when the balance shifts to greater fetal risk (figure 1). (See 'Interpretation' above.)

- The minimum gestational age for initiating testing should reflect the lower limit that intervention with delivery would be considered. We repeat a normal BPP score (10/10 or 8/10 without oligohydramnios) weekly or twice weekly until delivery when the high-risk condition persists and appears stable, and more frequently when there is significant deterioration in the clinical status (eg, worsening preeclampsia, decreased fetal activity) or in selected very high-risk settings (severe fetal growth restriction with abnormal Doppler velocimetry. (See 'Initiation and frequency of testing' above.)

- In observational studies, use of the BPP score as part of the management of high-risk obstetric patients has been associated with a significant reduction in perinatal mortality. (See 'Evidence of efficacy' above.)

- The predictive value of the four ultrasound biophysical parameters (movement, tone, breathing, amniotic fluid volume) is equivalent to that of the four ultrasound parameters plus a nonstress test when the four ultrasound parameters are normal (2 points for each). A nonstress test can be omitted if the BPP score is 8/8 after ultrasound alone, but should always be performed if any ultrasound monitored parameter is 0. (See 'Can the nonstress test be omitted?' above.)

- The modified BPP simplifies the examination and reduces the time necessary to complete testing by focusing on those components of the BPP that are most predictive of outcome. Assessment of both
amniotic fluid volume and the nonstress test appears to be as reliable a predictor of long-term fetal well-being as the full BPP. (See 'Modified biophysical profile' above.)

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REFERENCES


Topic 5392 Version 18.0
**Criteria for the biophysical profile test**

<table>
<thead>
<tr>
<th><strong>Nonstress test:</strong> 2 points if reactive, defined as at least 2 episodes of FHR accelerations of at least 15 bpm and at least 15 seconds duration from onset to return associated with fetal movement within a 30-minute observation period.</th>
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<tbody>
<tr>
<td><strong>Fetal breathing movements:</strong> 2 points if one or more episodes of rhythmic breathing movements of ≥30 seconds within a 30-minute observation period.</td>
</tr>
<tr>
<td><strong>Fetal tone:</strong> 2 points if one or more episodes of extension of a fetal extremity or fetal spine with return to flexion.</td>
</tr>
<tr>
<td><strong>Amniotic fluid volume:</strong> 2 points if a single deepest vertical pocket ≥2cm is present. The horizontal dimension should be at least 1 cm.</td>
</tr>
<tr>
<td><strong>Fetal movement:</strong> 2 points if three or more discrete body or limb movements within 30 minutes of observation. An episode of active continuous movement is counted as one movement.</td>
</tr>
</tbody>
</table>

Zero points are assigned for any criteria not met. A score of 10/10, 8/8 (nonstress test not done), or 8/10 (including +2 points for amniotic fluid) is a normal test result. A score of 6/10 (including +2 points for amniotic fluid) is an equivocal test result, as a significant possibility of developing fetal asphyxia cannot be excluded. A score of 6/10 or 8/10 with oligohydramnios (0 points for amniotic fluid) is an abnormal test, and further assessment and correlation with the clinical setting are indicated. A score of 0 to 4/10 is abnormal; the risk of fetal asphyxia within one week is high if there is no intervention, and delivery is usually indicated. Refer to UpToDate topic on the fetal biophysical profile for additional information.

FHR: fetal heart rate; bpm: beats per minute.

Graphic 79813 Version 8.0
**Comparison of neonatal death rates as predicted by gestational age and fetal death rates as predicted by the fetal biophysical profile (BPP) score**

The red line represents the probability of neonatal death by gestational age. For example, the risk of fetal death with a BPP score of 2/10 is approximately 20%. Therefore, when the BPP score is 2/10, the risk of neonatal death is less than the risk of fetal death if the gestational age is greater than 28 weeks. This graph should be used for illustration only because the neonatal survival rate shown here from the University of Manitoba in 1995 will differ from other centers and more contemporary data. However, the predictive accuracy of the BPP score is unlikely to vary among centers.


Graphic 78999 Version 3.0
The relationship between biophysical profile score and perinatal mortality and morbidity

(A) The relationship between the biophysical profile (BPP) score result and the occurrence of various perinatal morbidities. The incidence of fetal distress in labor (FD), cesarean delivery for fetal distress (LSCS-FD), low 5-minute Apgar score, and venous cord blood acidemia exhibit a very significant linear inverse relationship to test score. These data are based on observations made in more than 26,000 high-risk fetuses.

(B) The relationship between the BPP score and perinatal death (PNM), both gross and corrected for fatal anomalies. Unlike morbidity, the mortality rate increases in an inverse exponential fashion as the BPP score decreases.


Graphic 78661 Version 3.0
The relationship between fetal umbilical venous pH (±2 SD) by cordocentesis and the fetal biophysical profile (BPP) score

The correlation was linear, inverse, and very significant ($R^2 = 0.912; p < 0.01$).

SD: Standard deviation.


Graphic 65562 Version 4.0
The relationship between the fetal BPP score and CP is inverse, exponential, and highly significant ($R^2 = -0.096; p < 0.001$). Infants were followed for five years after birth.


Graphic 54595 Version 4.0
Contributor Disclosures

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