Which Ultrasonographic Characteristics Predict Miscarriage Risk?

**TAKE-HOME MESSAGE**

In pregnant patients with gestational age between 6 weeks and 15 weeks and 6 days with threatened abortion, a fetal pulse rate of less than or equal to 110 beats/min indicates a high likelihood of progressing to miscarriage.

**RESULTS**

Fetal bradycardia and relation to miscarriage.

<table>
<thead>
<tr>
<th>Patient Population</th>
<th>No. of Studies (No. of Patients)</th>
<th>Sensitivity (95% CI), %</th>
<th>Specificity (95% CI), %</th>
<th>+ LR (95% CI)</th>
<th>– LR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asymptomatic and vaginal bleeding</td>
<td>10 (1,762)</td>
<td>64.41 (43.62–85.84)</td>
<td>97.84 (94.50–99.17)</td>
<td>31.73 (12.78–78.75)</td>
<td>0.32 (0.16–0.65)</td>
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<tr>
<td>Vaginal bleeding alone</td>
<td>5 (771)</td>
<td>84.18 (42.02–97.50)</td>
<td>95.68 (87.76–98.56)</td>
<td>19.51 (5.44–69.84)</td>
<td>0.16 (0.03–0.91)</td>
</tr>
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</table>

Of the 27 studies that met the inclusion criteria for qualitative analysis, 18 were included for quantitative analysis. Four of these studies had a combination of markers used to predict a viable intrauterine pregnancy. The combination markers that included fetal pulse rate had more diagnostic power, leading the authors to specifically investigate fetal bradycardia. Test characteristics for fetal bradycardia as a sign of miscarriage are shown in the Table. Ten studies reported results of fetal bradycardia in asymptomatic women and patients with vaginal bleeding. Five of these studies included only women with vaginal bleeding. Additionally, 7 studies specified a cutoff value for fetal pulse rate, and the authors took the log diagnostic odds ratio plotted against the cutoff level for each study. Fetal pulse rate less than or
by the authors were studies. Possible sources of bias identi
ing from 79% to 99%. 112 Annals from 17% to 69% and speci
women showed sensitivity ranging from 73% to 88%. Abnormal yolk sac in 3
viability had a sensitivity range of
Crown to rump length was investigated in 5 studies and 1,136 women, showing a sensitiv
ity of 59.81% (95% confidence interval [CI] 48.78% to 69.93%), specificity of 55.68% (95% CI 39.95% to 70.35%), positive likelihood ratio of 1.34 (95% CI 0.91 to 2.00), and negative likelihood ratio of 0.72 (95% CI 0.49 to 1.06). Intrauterine hematoma in women with vaginal bleeding and confirmed fetal viability was also studied, showing sensitivity ranging from 17% to 92% and specificity from 17% to 83%.

Difference in mean gestational sac diameter and crown to rump length in 2 studies with 349 women with confirmed fetal viability had a sensitivity range of 39% to 96% and specificity range of 73% to 88%. Abnormal yolk sac in 3 studies with 605 asymptomatic women showed sensitivity ranging from 17% to 69% and specificity ranging from 79% to 99%.

Possible sources of bias identified by the authors were studies including women with uterine malformation or medical conditions that could contribute to miscarriage, including fetal or chromosomal abnormalities, unspecified exclusion criteria, no clear differentiation between viable pregnancy and miscarriage before the study, and variable sonographers.

**Commentary**

Vaginal bleeding during pregnancy is a common reason for patients to present to emergency departments (EDs), resulting in approximately 500,000 ED visits per year. 1 This can be a great source of anxiety for patients concerned about their own health because of pain and bleeding, but also the health of the fetus in a desired pregnancy. Heavy bleeding appears to be more closely associated with increased rate of miscarriage; however, a significant percentage of these patients do carry the pregnancy to term. 2,3 Additional objective findings such as ultrasonography can help providers give patients evidence-based guidance.

This review offers evidence that a fetal pulse rate of less than 110 beats/min has a high likelihood (likelihood ratio >30) of progressing to a miscarriage and that the patient may benefit from repeated ultrasonography in 7 to 10 days. Pulse rate cutoffs of greater than 134 beats/min at 7 weeks and greater than 158 beats/min at 8 weeks may be useful as well; however, considering variability in pregnancy dating based on last menstrual period, ultrasonography, or other methods, this may not be as useful in an ED setting.

This systematic review included pregnant women up to 15 weeks and 6 days of gestation because early pregnancy assessment units in the United Kingdom assess patients up to this gestational age. This is a significant limitation of the study design because miscarriage prediction is likely different for a patient who has vaginal bleeding at 6 or 15 weeks' gestation. Patients who were 12 to 15 weeks pregnant were likely a minority of the cohort, given that only 3 of the 10 studies included patients with greater than 12 weeks of gestation. In addition, the authors self-reported the inability to perform a meta-analysis on combination markers, which was their initial primary aim.

Despite the study limitations, we believe the high specificity of bradycardia for prediction of miscarriage is a useful marker for emergency physicians to more accurately counsel patients, manage expectations, and ensure referral for repeated ultrasonography within 7 to 10 days. 4