

RECENT DEVELOPMENTS IN FIRST TRIMESTER ULTRASOUND

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First trimester ultrasound has been augmented in recent years by a better understanding of the significance of a number of sonographic findings, an improved ability to diagnose structural anomalies, and a broader variety of interventional procedures.

1. Embryonic Heart Rate at 6-7 Weeks of Gestation

With transvaginal ultrasound, the embryonic heartbeat can be visualized beginning at approximately 6.0 weeks gestation [1-4], and its rate can be measured via M-mode sonography. The mean heart rate in early pregnancy increases progressively from approximately 100-120 bpm at 6.0 weeks to 145-170 at 9.0 weeks, after which it declines slowly for the rest of the first trimester [5-9]. The heart rate in an individual embryo/fetus less than 10 weeks gestational age varies little from measurement to measurement, so that reliable information about heart rate can be obtained from a single measurement [10].

a. Slow Heart Rate

Embryos with slow heart rates prior to 7.0 weeks have a poor short-term prognosis, with a high chance of demise before the end of the first trimester [8, 11-16]. In particular, when compared to embryos with normal heart rates, the likelihood that an embryo will survive the first trimester is lower when the heart rate is <100 bpm prior to 6.3 weeks or <120 bpm at 6.3-7.0 weeks gestation. Below these cutoffs, the slower the heart rate the worse the prognosis for first trimester survival [13]:

Prognosis	GA 6.2 Weeks (CRL < 5 mm)	GA 6.3-7 Weeks (CRL 5-9 mm)
Dismal (~0% Survival Rate)	<80 bpm	<100 bpm
Poor (~50% Survival Rate)	80-89 bpm	100-109 bpm
Fair	90-99 bpm	110-119 bpm
Normal	100 bpm	120 bpm

The long-term prognosis among first trimester survivors of a slow early heart rate, on the other hand, is fairly good. If an embryo with a slow early heart rate survives the first trimester, its likelihood of subsequent pregnancy loss is approximately 2%, no higher than if its early heart rate had been normal. That is, death following a slow embryonic heart rate at 7.0 weeks gestation is likely to occur quickly — within the first trimester — or not at all. However, the frequency of structural anomalies (cardiac and other) is increased in first trimester survivors of a slow early heart rate. In particular, a pregnancy complicated by a slow heart rate at 7.0 weeks gestation has at least twice the risk of anomalies than one with a normal early heart rate [17].

These findings support the following approach when a slow embryonic heart rate is seen in the early first trimester. A 1-2 week followup sonogram should be obtained and, unless demise is diagnosed, another scan should be performed in the late first trimester. If the fetus is still alive at this time, the parents should be told that the likelihood of subsequent demise is now low, but that the risk of anomalies is elevated, and a sonogram at approximately 18 weeks to evaluate for fetal structural anomalies should be performed.