# Ultrasound Evaluation of the First Trimester

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**KEYWORDS**

• Ultrasound • Pregnancy • First trimester • Ectopic pregnancy • Fetal anatomy

**KEY POINTS**

- In a woman with a positive pregnancy test, any intrauterine saclike fluid collection seen on ultrasound is highly likely to be a gestational sac.
- Sonographic criteria for definite pregnancy failure (ie, miscarriage) include nonvisualization of cardiac activity in an embryo whose crown-rump length is at least 7 mm, or nonvisualization of an embryo in a gestational sac whose mean sac diameter is at least 25 mm.
- Diagnosis of ectopic pregnancy should be based on visualization of an extraovarian mass in a woman with a positive pregnancy test; the concept of a pseudogestational sac is not helpful and may be misleading.
- A variety of fetal anatomic structures and fetal anomalies can be identified in the first trimester via transvaginal sonography.

## INTRODUCTION

The first trimester of pregnancy is a 3-month span of remarkable growth and development. The embryo, microscopic in size near the beginning of this period, transforms into a fetus approximately 80 mm in length with identifiable features and internal organs by the end. (Note: by convention, the term *embryo* is used until 8–10 weeks' gestation and *fetus* is used thereafter.)

Ultrasound has undergone major advances since its first use in pregnancy approximately 50 years ago.[1] As the technology progressed from bistable to gray scale and static to real-time, and since transvaginal, Doppler, and 3-dimensional sonography were introduced, the applications of ultrasound in pregnancy have exploded.[2] This article reviews the use of ultrasound in the first trimester.

## NORMAL SONOGRAPHIC APPEARANCE OF FIRST TRIMESTER PREGNANCY

During the first 3 weeks after conception, the gestational sac of the developing pregnancy is generally too small to be seen on ultrasound. Because conception occurs approximately 2 weeks after a woman's last menstrual period (LMP) and gestational age corresponds to time since LMP, this means that the pregnancy is not generally visible on ultrasound before a gestational age of 5 weeks.[3]

When the gestational sac is first identifiable on transvaginal ultrasound at approximately 5 weeks' gestation, it appears as a round or oval intrauterine fluid collection 2 to 3 mm in diameter (**Fig. 1**). It is located in the central echogenic portion of the uterus, which corresponds to the decidualized endometrium (also termed *decidua*). In some cases, this fluid collection is surrounded partly by 2 echogenic rings, which are thought to represent 2 layers of decidua: the decidua parietalis and capsularis. The double-ringed appearance has been termed the *double sac sign* of early intrauterine pregnancy.[4] In other cases, the gestational sac is eccentrically located on one side of a thin white line that corresponds to the collapsed uterine cavity. This appearance has been termed the *intradecidual sign*.[5] In many cases, however, the early gestational sac appears as a small, featureless,

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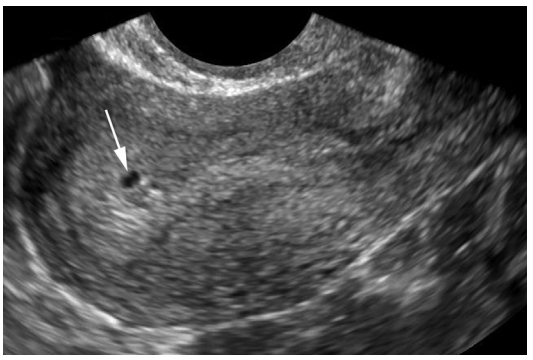

Fig. 1. A 5-week intrauterine pregnancy. Sagittal transvaginal view of the uterus shows a 5-week gestational sac, which appears as a fluid collection (*arrow*) with rounded edges, 3 mm in maximum diameter, located in the central echogenic portion of the uterus. Follow-up scan 7 weeks later showed a normal-appearing 12-week pregnancy, including a fetus with cardiac activity.

saclike structure without either of these signs.[6] Thus, the absence of a double sac sign or intradecidual sign does not exclude an intrauterine pregnancy. In fact, any saclike structure in the mid-uterus in a woman with a positive pregnancy test result is highly likely to represent an intrauterine pregnancy.[6]

At approximately 5.5 weeks' gestation, the gestational sac has grown to approximately 6 mm in diameter and a small thin-walled circular structure, the yolk sac, is seen within it (**Fig. 2**).[3] The embryo itself is first visible on transvaginal ultrasound at approximately 6 weeks' gestation (**Fig. 3**), at which time the gestational sac is 10 mm in diameter.[7] At that point, the embryo appears as a small structure at the edge of the yolk sac, 1 to 2 mm in length, and usually demonstrates

Fig. 2. A 5.5-week intrauterine pregnancy. Sagittal transvaginal view of the uterus shows a 5.5-week gestational sac, which appears as an intrauterine fluid collection (*arrowheads*) containing a yolk sac (*arrow*) and no visible embryo. Follow-up scan 4 weeks later showed a normal-appearing 9.5-week pregnancy, including a fetus with cardiac activity.

the flickering motion of cardiac activity. The embryonic length, termed the *crown-rump length* (CRL), grows progressively to 5 mm at 6.5 weeks, 10 mm at 7.0 weeks, and approximately 80 mm by the end of the first trimester.[8,9]

For the first 1 to 2 weeks after it appears on ultrasound, the embryo is a featureless structure without identifiable body parts. By 8 weeks' gestation, the head can be seen separate from the body and the limb buds are visible. At that point, the relative sizes of the body parts differ considerably from those of the newborn: the head is bigger in relation to the body and the limbs are very short. From then until the end of the first trimester, the body proportions become progressively more similar to those of a neonate.

At 8 to 10 weeks, a round hypoechoic structure can be seen within the fetal head (**Fig. 4**), which represents the developing rhombencephalon (or hindbrain), an anatomic structure in the brain that comprises the medulla, pons, and cerebellum.[10]

At approximately 10 to 13 weeks, an echogenic structure is seen protruding from the anterior abdominal wall (**Fig. 5**).[11] This sonographic finding, termed *physiologic bowel herniation*, corresponds to a stage in the normal embryologic development of the gestational tract in which the intestine temporarily extends into the base of the umbilical cord.

Beginning at approximately 10 weeks' gestation, a hypoechoic space can be seen in the posterior fetal neck. Termed the *nuchal translucency*, it is located just internal to the posterior skin surface and measures approximately1 to 2 mm in diameter in the normal fetus (**Fig. 6**).[12]

By approximately 12 weeks' gestation, many internal fetal anatomic structures can be imaged, especially with transvaginal sonography.[13] Among the structures that can be seen are the choroid plexus (**Fig. 7**) and other brain components; face; cardiac chambers and outflow tracts; stomach; bladder; spine; and extremities.

## DIAGNOSIS OF FIRST TRIMESTER ABNORMALITIES

### *Early Pregnancy Failure ("Miscarriage")*

The sonographic appearance of a normal intrauterine pregnancy follows a predictable pattern during the 5- to 7-week period. Any substantial deviation from this pattern raises concern that the pregnancy has already, or will soon, fail ("miscarry"). An important aspect of ultrasound in early pregnancy is distinguishing between the abnormal sonographic findings that are definitive for pregnancy failure and those that are suspicious but not definitive, requiring follow-up testing to establish a definitive diagnosis.