

## First Trimester

### 1. Other Names:

- N/A

### 2. Definition /Location:

- It can be defined as 12 weeks after the first day of the last menstrual period (Curry-Tempkin p.297 2/ 2/3).
- It begins with fertilization which occurs within the distal fallopian tube 1 or 2 days after ovulation (Hagen-Ansert, p.984, 1/3/5).
- The follicle that one surrounded the ovum hemorrhages and collapses to form the corpus luteum which will secrete progesterone and some estrogen (Hagen-Ansert, p.984, 2/1/1-3).
- The fertilized ovum is referred to as a zygote. (Hagen-Ansert, p.984, 2/2/1).
- The zygote undergoes rapid cellular division to form the 16-cell morula (Hagen-Ansert, p.984, 2/2/1).
- Further cell proliferation brings the morula to the blastocyst stage, which contains trophoblastic cells and the “inner cell mass,” which forms the embryo. (Hagen-Ansert, p.984, 2/2/2).
- The blastocyst typically enters the uterus 4 to 5 days after fertilization, with implantation occurring 7 to 9 days after ovulation (Hagen-Ansert, p.984, 2/2/3).
- During implantation, proteolytic enzymes produced by the trophoblasts erode endometrial mucosa and maternal capillaries, resulting in a primitive blood exchange network between mother and conceptus (Hagen-Ansert, p.984, 2/2/4).
- When implantation is complete, the trophoblast goes on to form primary villi, which initially circumvent the early gestational sac (Hagen-Ansert, p.984, 2/3/1).
- Within the conceptus, the inner cell mass matures into the bilaminar embryonic disc, the future embryo, and the primary yolk sac (Hagen-Ansert, p.984, 2/3/2).
- At approximately 23 days menstrual age, the primary yolk sac is pinched off by the extra embryonic coelom, forming the secondary yolk sac (Hagen-Ansert, p.984, 2/3/3).
- The secondary sac is the yolk sac seen sonographically throughout the first trimester (Hagen-Ansert, p.984, 2/3/4).
- The amniotic and chorionic cavities also develop and evolve during this period of gestation (Hagen-Ansert, p.984, 2/3/5).
- The embryonic phase is between weeks 6 through 10 (Hagen-Ansert, p.984, 2/4/1).
- It is during this phase that all major internal and external structures begin to develop. (Hagen-Ansert, p.984, 2/4/2).
- Although the organ function remains minimal, the cardiovascular system is the first organ to develop rapidly, with the initial heart beat between 5½ and 6 weeks (Hagen-Ansert, p.984, 2/4/3).

- The embryo's appearance changes from the flat, disc configuration to a C-shaped structure, and it develops a humanlike appearance (Hagen-Ansert, p.984, 2/4/4).
- During this period of embryogenesis the crown-rump length (CRL) develops rapidly, measuring 30 mm by the end of the 10<sup>th</sup> week (Hagen-Ansert, p.984, 2/4/5).
- The last 2 weeks of the first trimester (weeks 11 and 12 constitute the beginning of the fetal period (Hagen-Ansert, p.984, 2/1/1).
- At this time there is rapid continued growth of the organs. It is also noted that during this period of time, the fetal head is disproportionately larger than the rest of the fetus, constituting one half of the crown-rump length (Hagen-Ansert, p.984, 2/1/2).
- As the fetal body grows, the body growth accelerates and this relative proportionality becomes less pronounced (Hagen-Ansert, p.984, 2/1/3).

### 3. Ultrasound Appearance:

- Early in the trimester, the gestational sac will appear as an anechoic, fluid-filled chorionic cavity surrounded by the echogenic trophoblastic ring (Tempkin p.215, 1/ 2/1).
- The echogenic embryo and the yolk sac may be visualized within the gestational sac (Tempkin p.215, 1/2/3).
- The yolk sac disappears between the 10<sup>th</sup> and 12<sup>th</sup> weeks of the first trimester (Tempkin p.215, 1/2/4).
- Fetal cardiac activity may be visible as early as 5 weeks and 2 days with a transvaginal examination and is usually demonstrable before 6 weeks by transabdominal examination (Tempkin p.215, 1/ 3/1).
- The embryonic heart will appear small and pulsatile and may be noticeable as a pulsation within a thickened wall of the yolk sac even before the embryo is clearly visible (Tempkin p.215, 1/3 /2-3).
- Later in the 1<sup>st</sup> trimester the echogenic cranium, abdomen, and fetal limbs can be visualized (Tempkin p.215, 1/ 4/1).

### 4. Normal size range(s):

- During the 5<sup>th</sup> week 1-2 mm sac (Hagen-Ansert p.987, c2/p2/ s1).
- The gestational sac size grows at a predictable rate of 1 mm a day in early pregnancy (Hagen-Ansert p.988, c1/p3/s4).

### 5. Pertinent lab Data: (Curry-Tempkin, p. 318, "Laboratory Values")

**hCG:** An hCG of 2000 is the level at which a sac will be seen in most normal early pregnancies.

- **Alpha-Fetoprotein (AFP):** Found in maternal blood and amniotic fluid. Elevated levels indicate fetal abnormalities or defects.
- **Triple Marker Screening (AFP, uE3, hCG):** Abnormal levels of alpha-fetoprotein (AFP), unconjugated estriol (uE3), and human chorionic gonadotropin (hCG) are indicators of certain embryonic/fetal abnormalities, possible multifetal

gestations, and combined with maternal age, screening markers for Down syndrome.

**6. Patient Prep:** (Tempkin, p. 219, “Patient Prep”).

**Transabdominal Patient Prep**

- Ultrasound evaluation of the first trimester is performed with the patient in the supine position. Other positions include right lateral decubitus or left lateral decubitus.
- Full urinary bladder.
- 32-40 ounces of clear fluid should be ingested 1 hour before the exam and finished within a 15-20 minute time period.
- If for any reason the patient cannot have fluids, sterile water can be used to fill the bladder through a Foley catheter.

**Endovaginal Patient Prep**

- Explain the examination to the patient. Inform the patient that the exam is virtually painless, that the inserted transducer feels like a tampon, and the exam is necessary for an accurate diagnosis. Verbal or written consent is required, and the exam should be witnessed by a female health care professional. Note that the initials of the witness should be included as part of the film labeling (Tempkin, p. 201, “Patient Prep”).
- Empty urinary bladder.
- The transducer may be inserted by the patient, sonographer, or physician.
- The patients position depends on the transducer design so ideally having a gynecological examining table and the ability to put the patient in the lithotomy position is optimal.
- Another option is positioning the patient at the end of the examining table or stretcher with the hips elevated by a pillow or foam cushion.

**7. Transducer:** (Tempkin, p. 219, “Transducer”).

**Transabdominal Transducer**

- 3.0 MHz or 3.5 MHz.
- 2.5 MHz for very large patients. 5.0 MHz for thinner patients or earlier gestational ages.
- Sector, curvilinear, and linear transducers may be required for an adequate examination. It is not unusual to use two or even three transducers for an obstetric ultrasound exam.

**Endovaginal Transducer**

- 5 MHz to 7.5 MHz.
- Apply gel to the end of the transducer, then cover it with a condom or sheath. Make sure there are no air bubbles at the tip, then apply additional gel to the outside of the condom before insertion. If infertility is a consideration, then water or nonsporicidal gel may be used (Tempkin, p. 201, “Transducer”).

## **8. Protocol:**

- The uterus and adnexa should be evaluated for the presence of a gestational sac. If the gestational sac is seen, its location (intrauterine or extrauterine) should be noted. The presence or absence of a yolk sac and an embryo should be noted. The crown-rump length is the most accurate measurement of gestational age during the first trimester and should be recorded when an embryo is present (Hagen-Ansert, p. 974, 1/1/1).
- Presence or absence of cardiac activity should be reported (Hagen-Ansert, p. 974, 1/2/1).
- Fetal number should be documented. Count only the embryo and yolk sac to determine multiple pregnancies. The membrane structure and the number of amniotic and chorionic membranes should be documented in all multiple pregnancies. The chorionicity is most reliably documented during the first trimester (Hagen-Ansert, p. 974, 1/3/1).
- Evaluation of the uterus, adnexal structures, and cul-de-sac should be performed. It is important to document the texture of the ovaries and presence of corpus luteum or other adnexal masses; look for inhomogeneous uterine texture that may represent leiomyomatous growth that may be stimulated by the hormonal changes of pregnancy (Hagen-Ansert, p. 974, 2/1/1).

## **9. Image Reference:**

- Diagram illustrating normal conception (Hagen-Ansert, p. 984, fig.43-1).
- Growth demonstration (Hagen-Ansert, p. 984, fig.43-2).
- Blastocyst implanting the decidualized endometrium (Curry-Tempkin p.300, fig.17-3).
- At 5 weeks gestational age (Curry-Tempkin p.301, fig.17-4).
- Between 7 and 8 weeks gestational age (Curry-Tempkin p.301, fig.17-5).

## **10. References:**

- Curry, R.A. and Tempkin, B.B. (2004). Sonography: Introduction to normal structures and function (2<sup>nd</sup> ed.). St. Louis, MO: Saunders.
- Hagen-Ansert, S.L. (2006). Textbook of diagnostic ultrasonography (6<sup>th</sup> ed.) (Vol. 2). St. Louis, MO: Mosby.
- Tempkin, B.B. (1999). Ultrasound scanning: Principles and protocols (2<sup>nd</sup> ed.). Philadelphia, PA: Saunders.