

The purpose of this content is to provide Emergency Medicine clinicians with an online instructional resource for limited bedside transvaginal ultrasound. This procedure is indicated for any woman in early pregnancy who presents to the ED with abdominal pain and/or vaginal bleeding. The teaching module will take users through the setup, technique, and findings in early pregnancy.

## Gestation

### 4-5 weeks gestation

The gestational sac appears; this is the first sonographic finding of an IUP.

- It is an echogenic ring, with a tiny central hypoechoic area, only a few millimeters in size.
- It grows about 1 mm per day.
- The menstrual age in days can be estimated by adding 30 days to the sac size in mm.
- True gestational sacs implant into the endometrial lining and are eccentric to the endometrial canal; it does not deform the midline stripe
- Can be confused with a pseudogestational sac ([click to view image](#)), therefore it is not an accurate indicator of an IUP.

### 5 week gestation

- The gestational sac can be identified in the uterine fundus as an oval or circular anechoic structure. An echogenic ring will develop around it, known as the double decidual sign or “double ring sign”.
- Pseudosacs do not show a double decidual sign, however this stage is still inadequate to be called a definitive IUP.
- [Click to view image](#)

### 5-6 weeks gestation

- The yolk sac becomes visible. It is the first structure to be seen inside the gestational sac.
- It is a symmetric circular thin walled echogenic structure at the edge of the gestational sac.
- The yolk sac is a critical landmark identifying a true gestation sac, and is the first definitive evidence of IUP.
- [Click to view image](#)

### 6 week gestation

- The embryo or “fetal pole” is first seen as a thickening on the margin of the yolk sac. It is a distinct structure from the yolk sac.

- Cardiac activity may be detected as a regular flutter in the embryo.
- Any embryo >5mm should have cardiac activity.

## 7 week gestation

- Embryo will be about 12 mm long; the head will be clearly distinguished.
- Soon after limb buds will start to appear.

## Atlas of Abnormal Findings

### Intrauterine fetal demise

- This clip shows a large embryo without cardiac activity.
- Cardiac activity should be seen in any embryo >5 mm and any gestational sac >16.
- Notice also the irregular shape of the gestational sac.

### Pseudogestational sac

- This clip shows both an ectopic pregnancy in the adnexa as well as a pseudogestational sac in the uterus.
- These sacs are found in approximately 20% of ectopic pregnancies.
- They are located directly in the endometrial cavity, not eccentrically implanted like a normal gestational sac.
- They do not exhibit the double decidual sign, and do not contain a yolk sac or embryo.

### Subchorionic hemorrhage

- Common cause of vaginal bleeding in the first trimester without miscarriage.
- Common sonographic abnormality.
- Crescent shaped fluid collection adjacent to the gestational sac.
- The size of the hemorrhage is the most important predictor of pregnancy failure.
- [Click to view image](#)

### Pelvic free fluid

- In the sagittal plane, always scan down to the cervix to visualize the posterior cul-de-sac. This is where free fluid will be seen.
- Small to moderate amounts of fluid may be found in the healthy female pelvis depending on the point in the menstrual cycle.
- When an ectopic pregnancy is of concern, a significant amount of free fluid raises the concern for rupture.
- Free fluid is graded in thirds along the posterior wall of uterus: <1/3 mild, up to 2/3 moderate, >2/3 significant

## Anembryonic pregnancy

- Otherwise known as a “blighted ovum”.
- May appear as a normally shaped gestational sac, greater than 20mm, without an embryo. Also can present with irregularly shaped borders.
- When small, the sac cannot be distinguished from the early normal pregnancy.
- [Click to view image](#)

## Adnexal mass

- Limited bedside ultrasound cannot be used to rule out an ectopic pregnancy; it can only be used to rule in an IUP.
- Although ectopic pregnancies occur everywhere from the cervix to the upper abdomen, 97 percent occur in the fallopian tube.

## Multiple gestation Adnexal mass

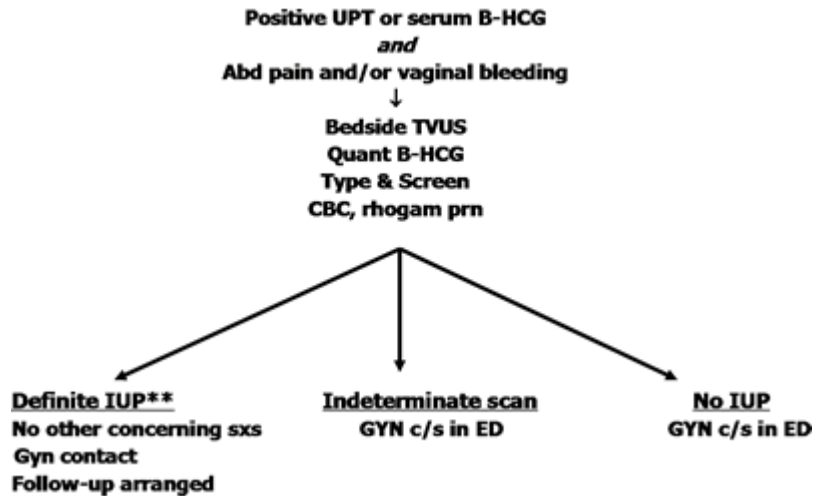
- This clip shows monoamniotic twins

What limited ultrasound WILL do:

- Identify intrauterine implantation
- Confirm ongoing pregnancy in the setting of vaginal bleeding and pain (“threatened abortion”).
- Establish gestation age when the menstrual history is inadequate

What limited ultrasound will NOT do:

- Evaluate pelvic organs outside of the uterus
- Identify uterine pathology
- Definitively identify an ectopic gestational sac
- Evaluate fetal health outside of fetal heart rate determination



\*Patients with history of fertility treatment not enrolled in this pathway. \*\*IUP defined as minimum of Gestational Sac + Yolk Sac and/or fetal pole (CRL) with cardiac activity.

- Patient should empty her bladder before the transvaginal scan is performed.
- Patient should be supine, positioned in lithotomy stirrups if possible; otherwise pelvis should be elevated with blankets while patient's legs are flexed. This will allow adequate room for transducer manipulation.
- Transvaginal probe should be correctly attached to ultrasound machine. Marker dot should correlate to left side of monitor screen.
- Place sterile conducting gel on end of the probe. Cover probe with sheath. Eliminate air bubbles in the conducting gel.
- Use water based lubricant on the outside of the sheath to lubricate before insertion into the vagina.

## Transvaginal Ultrasound Scanning: Sagittal and Transverse Views

### Sagitta

**Technique:** Start watching the screen as soon as the probe is past the introitus; the probe does not have to be inserted all the way to the cervix in order to visualize the uterus. The marker dot is pointed towards ceiling. This produces a longitudinal image of the uterus. The entire endometrial midline stripe should be seen, which is hyperechoic in comparison to the surrounding myometrium. Uterus must be scanned from fundus to cervix by slowly moving the probe in and out. Scan from side to side to visualize entire uterus

**Tips:** The marker dot is pointed towards ceiling. To visualize the cervix, posterior uterus, and cul de sac, pull probe back a few centimeters and aim probe tip towards the floor. If uterus is not immediately seen, it might be anteverted. Aim probe tip upward

toward the abdominal wall to visualize. If the uterus is retroverted, point the probe tip toward the floor. The fundus will be projected to the right side of the screen instead of the left. Sweep probe right to left to complete views of the entire uterus.

## Transverse view

**Technique:** Keeping probe inserted in the vagina, rotate the probe 90 degrees to patient's right. This will give a transverse image of the uterus. Scan up and down to explore entire uterus.

**Tips:** The marker dot is pointed towards the patient's right side. To help with visualization, may use free hand to palpate abdominal wall and bring structures closer to the field of view. This is the best view to visualize the adnexa, located anterior and medial to the internal iliac vessels. Try sweeping the transducer from left to right at the level of the uterine fundus. They are spongy, ovoid in appearance, with scattered anechoic follicles.

## Limited Bedside Transvaginal Ultrasound

- Crown rump length is a simple way to date a pregnancy, and can be used as soon as an identifiable embryo is seen.
- The yolk sac is not included in the measurement.
- Technique:
- Make sure the machine is in "OB" mode in the patient information screen.
- Scan the uterus in either the sagittal or transverse plane. Freeze an image of the maximal embryo length.
- Push "calcs" and select CRL.
- Push "select" and use touch pad to place one caliper at one end of the embryo.
- Push "select" again to place another caliper at the other end of the embryo.
- The machine will calculate a date that is accurate to within 5 to 7 days.

## Calculate FHR

- In early pregnancy the naked eye is best at detecting cardiac activity. It is usually seen by 6 weeks, and any embryo >5mm in length should have cardiac activity.
- To calculate the fetal heart rate, M mode is used.
- Technique:
  - Make sure the machine is in "Ob" mode on the patient information screen.
  - Push "M mode". A vertical line will appear on the screen.
  - Use the touch pad to place the line over the flicker of the beating heart.
  - Push "M mode" again.
  - Along the lower screen a series of wavy lines will appear. Freeze a frame of these lines.
  - Push "calcs" and select FHR
  - Push "select" and place one caliper at the peak of one wave.

- Push “select” again to place another caliper at the peak of the next wave.
- The machine will calculate the FHR at the bottom of the screen.

## Correlation of Gestational Age, b-HCG level, and TVUS findings

Gestational age	B-HCG (mIU/ml)	TVUS findings
4.5-5 weeks	<1,000	Gestational sac
5 weeks	1,000-2,000	Gestational sac + DDS*
5-6 weeks	>2,000	Yolk sac** (+/- fetal pole)
6 weeks	10,000-20,000	Embryo with cardiac activity
7 weeks	>20,000	Embryonic torso/head

\*\*DDS = double \*DDS = double decidual sign

\*\*First definitive evidence of IUP

### Tips:

- B-HCG of 1,500 is considered the discriminatory zone, i.e. minimum quantitative level of HCG at which intrauterine pregnancy should be seen by ultrasound.
- Abnormal gestation or embryonic demise if:
  - Gestational sac > 10 mm without a yolk sac
  - Gestational sac > 18 mm without a fetal pole
  - Fetal pole > 5 mm without cardiac activity
- If the B-HCG is > 1500 and no GS is seen
  - Ectopic pregnancy
  - Completed abortion
- If the B-HCG is < 1500 and the uterus is empty
  - Early normal pregnancy
  - Ectopic pregnancy
  - Completed abortion
- Serial B-HCG value in 48 hours
  - Live IUP: doubles
  - Completed abortion: decreases
  - Ectopic pregnancy: stable or small rise