

# How to perform and interpret a first trimester transabdominal point-of-care ultrasound

## CASE PRESENTATION

A previously healthy 31-year-old gravida 1, para 0, presents to the ED for the evaluation of vaginal bleeding. The patient took a home pregnancy test that was positive and notes that her last menstrual period was 8 weeks prior to her presentation to the ED. The pregnancy is spontaneous and desired; however, she has had intermittent vaginal spotting, soaking four pads since yesterday. She takes a prenatal vitamin but has no other prescribed medications.

On physical examination, she is well appearing with normal vital signs, including a blood pressure of 135/94 mm Hg and heart rate of 84 beats per minute. Her abdomen is non-tender with normal bowel sounds without rebound or guarding. On pelvic examination, her cervical os is closed with a small amount of blood in the vaginal vault.

Intravenous access was obtained; laboratory evaluation shows a normal haemoglobin of 13.3 g/dL, platelets of 208 k/uL and an international normalised ratio of 1.0. Her blood type is O+, and she has a beta-human chorionic gonadotropin of 147 411 mIU/mL. A first trimester abdominal point-of-care ultrasound (POCUS) was performed to evaluate for the presence of an intrauterine pregnancy.

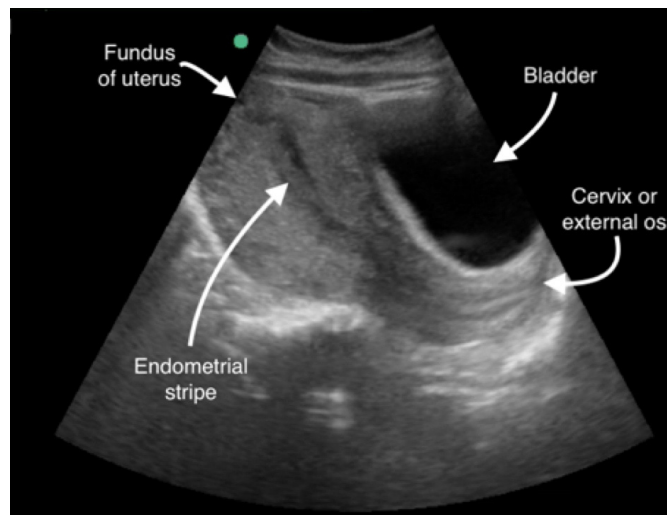
## WHAT ARE THE INDICATIONS FOR PERFORMING A FIRST TRIMESTER POCUS?

The primary indication for performing a first trimester POCUS is to evaluate for the presence of an intrauterine pregnancy.<sup>1</sup> In the first trimester of a spontaneous pregnancy, the confirmation of an intrauterine pregnancy on ultrasound makes an ectopic pregnancy sufficiently unlikely since the rate of heterotopic pregnancy is very low.<sup>2</sup> In contrast, in an assisted pregnancy or a pregnancy resulting from in vitro fertilisation, the risk of a heterotopic pregnancy increases from as low as 1/10 000 to as high as 1/100 pregnancies.<sup>2-4</sup> Any patient who is undergoing assisted fertility warrants additional work-up for the presence of a heterotopic pregnancy despite a confirmed intrauterine pregnancy.<sup>2-4</sup>

## WHICH TRANSDUCER IS BEST SUITED FOR PERFORMING A FIRST TRIMESTER TRANSABDOMINAL POCUS?

The location of a pregnancy may be assessed via a transabdominal or transvaginal ultrasound. This article is focused on the transabdominal examination, which is generally performed prior to, and may obviate the need for, a transvaginal examination. It is worth noting that first trimester transvaginal POCUS enables the visualisation of intrauterine contents earlier than with the transabdominal examination, and thus, more accurate gestational dating.<sup>5</sup> In certain situations, a provider may be unable to visualise the necessary structures from a transabdominal approach to confidently make the diagnosis of an intrauterine pregnancy and may need to continue on to perform a transvaginal examination.

To perform a first trimester transabdominal POCUS, patients are supine. A full bladder will improve visualisation of pelvic structures by acting as an acoustic window. A low frequency transducer with a large convex footprint, such as the curvilinear transducer, is ideal. The phase array transducer, also a low



**Figure 1** First trimester transabdominal POCUS using the curvilinear transducer reveals a sagittal view of the uterus, fundus of the uterus, endometrial stripe, cervix and bladder. POCUS, point-of-care ultrasound.

frequency transducer, can be used but has a smaller sonographic window making it less ideal. Finally, in select cases, there are reports illustrating the transabdominal use of the high frequency linear transducer to confirm the presence of an intrauterine pregnancy that cannot be visualised using a lower frequency transducer. High frequency transducers have a narrow depth of field but higher resolution that may obviate the need for first trimester transvaginal POCUS.<sup>6</sup>

## WHAT VIEWS SHOULD BE ACQUIRED TO ASSESS FOR AN INTRAUTERINE PREGNANCY IN A FIRST TRIMESTER TRANSABDOMINAL POCUS?

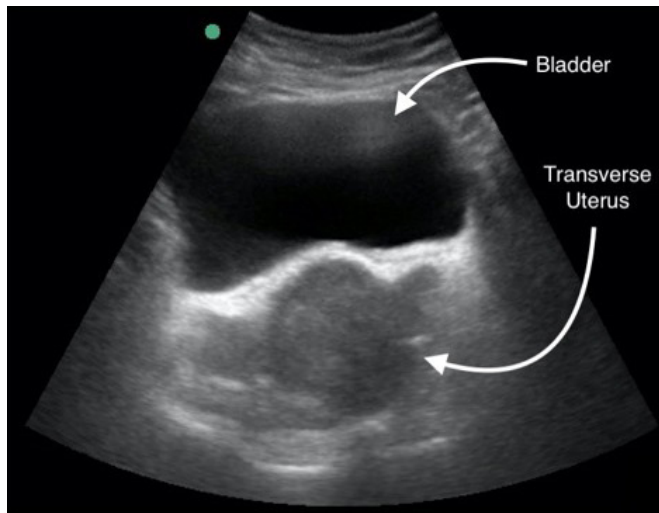
The uterus should be evaluated in both the longitudinal (sagittal) and transverse (axial) orientations. Using a low frequency ultrasound transducer in the longitudinal orientation placed just superiorly to the pubic symphysis with the indicator directed towards the patient's head, the first sonographic view identifies the uterus in a sagittal plane (figure 1). The provider should locate and then trace the cervix to the endometrial stripe, which is represented as a line running longitudinally through the uterus. The endometrial stripe may be hypoechoic or hyperechoic, depending on the intrauterine contents.

Next the provider should rotate their transducer 90° with the indicator directed towards the patient's right side. With the low frequency transducer immediately superior to the pubic symphysis and angled down into the pelvis, the provider will obtain a transverse view of the uterus (figure 2). In both views, the provider should fan from one side of the uterus to the other: from left to right in the sagittal view and from the fundus of the uterus down through the cervix in the transverse view. This will allow complete visualisation of intrauterine contents.

## HOW DO YOU INTERPRET FIRST TRIMESTER TRANSABDOMINAL POCUS?

The goal of first trimester transabdominal POCUS is to evaluate for the presence of an intrauterine pregnancy. Visualisation of an endometrial fluid collection, intradecidual sign, double decidual sac and chorionic rim signs make the diagnosis of an intrauterine pregnancy highly likely but are not definitive for the diagnosis.<sup>7</sup>

A gestational sac can be seen as early as 4.5–5 weeks of gestational age and is represented sonographically as a hypoechoic



**Figure 2** First trimester transabdominal POCUS using the curvilinear transducer reveals a transverse view of the uterus and bladder. POCUS, point-of-care ultrasound.

fluid collection eccentrically embedded in the endometrium. A yolk sac can often be visualised at gestational week 5–6.<sup>8</sup> The yolk sac is a circular hyperechoic or bright white structure with an anechoic or black centre found within the gestational sac. At approximately 6 weeks' gestation, a fetal pole can be visualised in association with the yolk sac, and fetal heart motion can be detected.<sup>8</sup>

The American College of Emergency Physicians (ACEP) recommends that a yolk sac or fetal pole is visualised before an intrauterine pregnancy can be definitively diagnosed.<sup>9</sup>

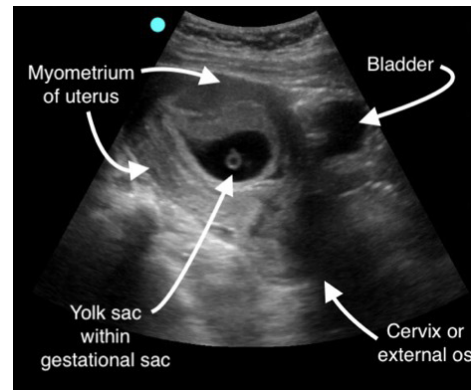
### WHAT IS THE INTERPRETATION OF THIS PATIENT'S ULTRASOUND?

#### How to integrate the first trimester transabdominal POCUS findings into clinical practice?

A positive first trimester pregnancy test should prompt a provider to perform a first trimester transabdominal POCUS to evaluate for the presence of an intrauterine pregnancy.

In a stable patient with a desired, spontaneous, pregnancy, if the first trimester POCUS shows an intrauterine pregnancy, defined as a yolk sac or fetal pole within the gestational sac, then the risk of an ectopic pregnancy is sufficiently unlikely. The provider should obtain laboratory testing and diagnostics as needed to assess the patient's clinical presentation. Additionally, the provider should counsel on first trimester pregnancy: although there is an association between first trimester bleeding and adverse outcome, there is no known effective intervention, and the likelihood of an adverse outcome is low [figures 3–5](#).<sup>10</sup>

If the diagnosis of an intrauterine pregnancy cannot be made because a yolk sac or fetal pole is not definitively found on examination, then the diagnosis is a pregnancy of unknown location and the provider must consider further evaluation for the pregnancy's location. Importantly, the lack of a definitive intrauterine pregnancy could be secondary to early pregnancy (not yet visualised on first trimester transabdominal POCUS) among other diagnoses such as ectopic pregnancy, missed abortion or other abnormal pregnancy. When an intrauterine pregnancy cannot be made via a transabdominal ultrasound, a transvaginal ultrasound must be performed.

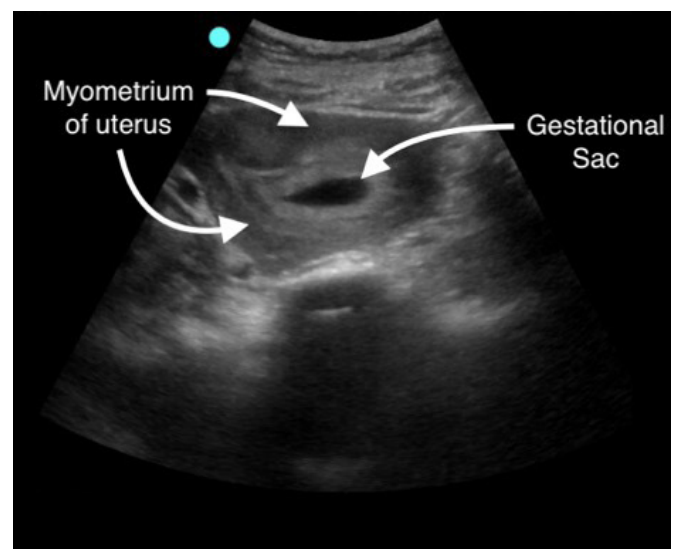


**Figure 3** A first trimester transabdominal POCUS with the curvilinear transducer shows a sagittal view of the patient's uterus, cervix and bladder anteriorly. The uterus contains a circular yolk sac within an anechoic filled gestational sac. POCUS, point-of-care ultrasound.

Ultimately, the provider must incorporate the POCUS findings into creating a safe and thoughtful disposition for a patient without definitive evidence of an intrauterine pregnancy.

### WHAT ARE SOME PITFALLS OF PERFORMING FIRST TRIMESTER TRANSABDOMINAL POCUS?

The importance of being able to identify the presence, or absence, of an intrauterine pregnancy cannot be overstated as misinterpretation can have grave implications. Performing POCUS is a skill that is operator dependent and, ultimately, the responsibility of the treating provider.<sup>11</sup> Prior to performing POCUS, a provider's training should be consistent with their specialty and institution guidelines.<sup>11</sup> Although defining the myriad of guidelines is beyond the scope of this manuscript, the American Institute of Ultrasound in Medicine (AIUM) recommends that providers in an emergency setting have either: (1) completed ultrasound training as defined by ACEP or (2) have pursued continued medical education (CME) in POCUS and either completed a minimum of



**Figure 4** A first trimester transabdominal POCUS with a curvilinear transducer shows a transverse view of a uterus. At this level, the yolk sac is not visualised, and only the gestational sac is seen, which alone cannot confirm an intrauterine pregnancy. POCUS, point-of-care ultrasound.



**Figure 5** At a different level of the uterus, a first trimester transabdominal POCUS with a curvilinear transducer shows the measurement of a fetal pole within a gestational sac measuring a crown-rump length of 1.89 cm. POCUS, point-of-care ultrasound.

150 ultrasound examinations or have confirmation of skills by a departmental ultrasound director.<sup>12</sup> For providers in other clinical settings, AIUM recommends either: (1) completion of training that included at least 150 ultrasound studies or (2) a combination of CME with completion of 150–300 total ultrasound studies (or at least 25 per application used).<sup>12</sup>

Specifically, it is important to consider the below common pitfalls:

#### **PITFALL #1: A GESTATIONAL SAC ALONE IS NOT DIAGNOSTIC OF AN INTRAUTERINE PREGNANCY**

For first trimester POCUS, a gestational sac alone is not adequate to diagnose an intrauterine pregnancy.<sup>9</sup> In order to definitively diagnose an intrauterine pregnancy, a yolk sac or a fetal pole must be identified within a gestational sac. This is an important distinction. Although there is a time interval when the gestational sac will not have a visible yolk sac, the provider must consider the competing diagnosis of a pseudogestational sac. A pseudogestational sac, a sac without an echogenic rim that tends to be in the middle of the uterine cavity, is formed when intrauterine fluid is surrounded by a decidual reaction and can be seen in up to 10% of ectopic pregnancies.<sup>13</sup> Thus, because of the possibility of a pseudogestational sac, a gestational sac alone is not sufficient to make the diagnosis of an intrauterine pregnancy.

#### **PITFALL #2: MISIDENTIFYING AN ECTOPIC PREGNANCY AS INTRAUTERINE**

The uterus sits deep within the pelvis and can be difficult to visualise on POCUS. Depending on the gestational age and the size of the uterus, the provider may have to place the transducer superior to the pubic symphysis and angle the transducer downward into the pelvis to visualise relevant structures. The operator must confirm that what they are visualising is in fact intrauterine. This is achieved by initially visualising the uterus in the longitudinal plane, viewing the cervix connect to the endometrial stripe and then fanning from side to side to visualise all intrauterine contents.

#### **PITFALL #3: NOT PERFORMING A TRANSVAGINAL ULTRASOUND WHEN UNABLE TO MAKE A DEFINITIVE DIAGNOSIS FROM A TRANSABDOMINAL STUDY**

Confirmation of an intrauterine pregnancy on a transabdominal study should be the first step in the assessment of an intrauterine

pregnancy; however, if the provider is unable to confirm the pregnancy from a transabdominal approach, a transvaginal ultrasound should be performed.

#### **CASE CONCLUSION**

With a closed cervical os and a first trimester transabdominal POCUS showing a definitive intrauterine pregnancy, ectopic pregnancy was deemed unlikely. The patient was counselled regarding her diagnosis of threatened abortion, advised to watch for continued or increased vaginal bleeding and instructed to return for increased pain, increased bleeding, light headedness, dizziness or syncope. She was discharged from the ED with plan for expectant management as an outpatient with routine obstetric and gynaecological follow-up.

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