

INTRODUCTION

We recommend a stepwise approach to the basic obstetric ultrasound examination in the second and third trimester of pregnancy, which applies a structured and standardized method of ultrasound examination that is simple to learn and is geared towards the identification of major findings, which have direct impact on the wellbeing of the mother and fetus. This stepwise approach includes six steps, which we believe should be part of the basic ultrasound examination in the second and third trimester of pregnancy. These six steps are designed to assess fetal presentation and lie, the presence of fetal cardiac activity, the number of fetuses within the uterus, the adequacy of the amniotic fluid, the localization of the placenta and pregnancy dating/estimation of fetal weight (**Table 10.1**). The term basic obstetric ultrasound has been used by various national and international organizations to define an ultrasound examination; the components of which include a review of fetal anatomy. The six steps described in this chapter are designed to identify risk factors in pregnancy, which require planning for prenatal care and delivery in a facility that is equipped and staffed to deal with these findings. **This approach is primarily intended for the low-resource (outreach) setting as the six steps described hereby are relatively easy to learn, do not require sophisticated equipment and can identify the “high-risk” pregnancy.** The inclusion of basic fetal anatomy is a step that requires more expertise and is generally not warranted in the initial introduction of ultrasound in the outreach settings, given the lack of resources to care for fetuses with major congenital malformations. This however does not preclude adding a step for major fetal malformations by ultrasound when the facility is capable of caring for neonates with these findings.

This chapter describes the sonographic approach that should be employed for each of the six steps of the basic ultrasound examination in the second and third trimester of pregnancy. Images and video clips are used to describe and illustrate each step.

TABLE 10.1

Stepwise Standardized Approach to the Basic Obstetric Ultrasound Examination in the Second and Third Trimester of Pregnancy

- Fetal lie and presentation
- Fetal cardiac activity
- Number of fetuses in the uterus
- Adequacy of amniotic fluid
- Localization of the placenta
- Fetal biometry

STEP ONE: FETAL LIE AND PRESENTATION IN THE UTERUS

The lie of the fetus in the uterus is defined by the orientation of the fetal spine to the maternal spine. A longitudinal lie is defined when the fetal spine is in parallel orientation to the maternal spine. A transverse lie is defined when the fetal spine is in a transverse orientation to the maternal spine, and an oblique fetal lie is defined when the fetal spine is in an oblique orientation to the maternal spine. Determining the lie of the fetus by ultrasound therefore requires obtaining a mid-sagittal plane of the fetal spine (**Figure 10.1**), which is a technically difficult plane to acquire for the novice ultrasound examiner. We therefore recommend that the fetal lie be inferred from determining the fetal presentation. If the fetal presentation is cephalic or breech, a technically easy step to determine by ultrasound, then a longitudinal fetal lie can be inferred. If neither a cephalic nor a breech presentation is noted in the lower uterine segment on ultrasound, an oblique or a transverse fetal lie should then be suspected and an attempt for a confirmation of such should be done by obtaining a mid-sagittal plane of the fetal spine (**Figure 10.1**) and assessing the orientation of the fetal spine to the maternal spine.

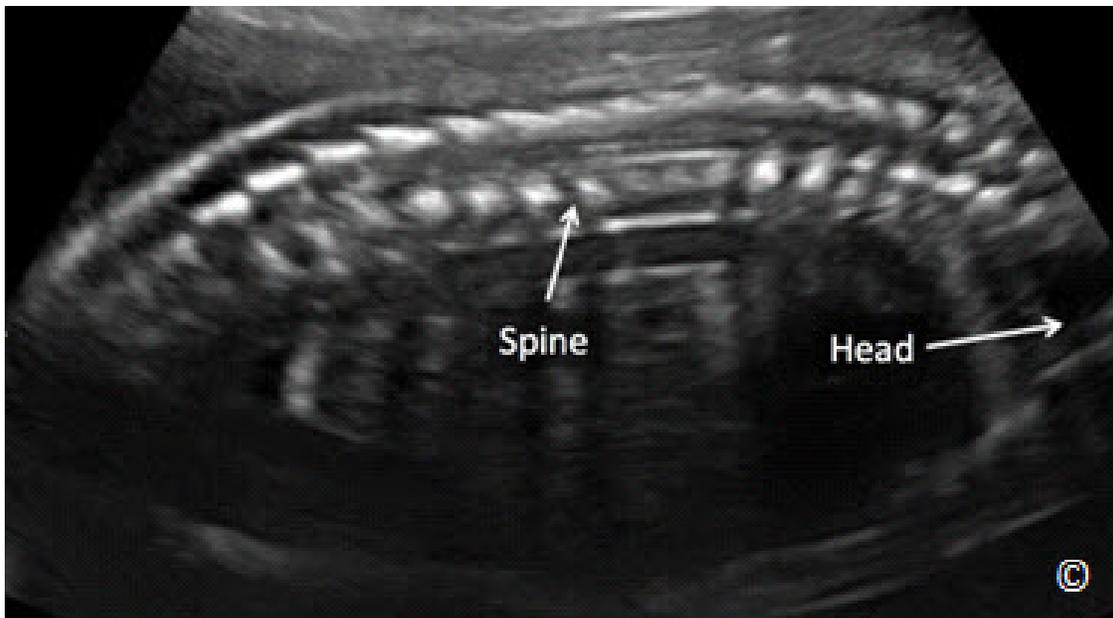


Figure 10.1: Mid-Sagittal view of the fetal spine (labeled) by ultrasound in the late second trimester of pregnancy. This plane is used to determine fetal lie in the uterus. The location of the fetal head is noted for orientation purposes. See text for details.

Step One-Technical Aspect of Determining Fetal Presentation in the Uterus

Place the transducer transversely in the lower abdomen just above the symphysis pubis as shown in **Figures 10.2** and **10.3**, and angle inferiorly towards the cervix as shown in **Clip 10.1**. The

presence of a fetal head on the ultrasound monitor confirms a cephalic presentation (**Figure 10.4**) and the presence of fetal buttocks confirms a breech presentation (**Figure 10.5**). Note that the presence of either a cephalic or a breech presentation implies a longitudinal lie of the fetus. If neither cephalic nor breech fetal parts are seen in the lower uterine segment on step one (**Figure 10.6**), further evaluation is needed to assess for an abnormal fetal lie. Note that the presence of a placenta previa is commonly associated with abnormal fetal presentation and lie.



Figure 10.2: Initial transducer placement for determining fetal presentation (step 1). Note the placement transversely in the lower abdomen just above the symphysis pubis. Uterine fundus is labeled. This picture is taken from the patient's left side.



Figure 10.3: Initial transducer placement for determining fetal presentation (step 1). Note the placement transversely in the lower abdomen just above the symphysis pubis. This represents the same transducer placement as in **Figure 10.2**, imaged from a different angle. Uterine fundus is labeled

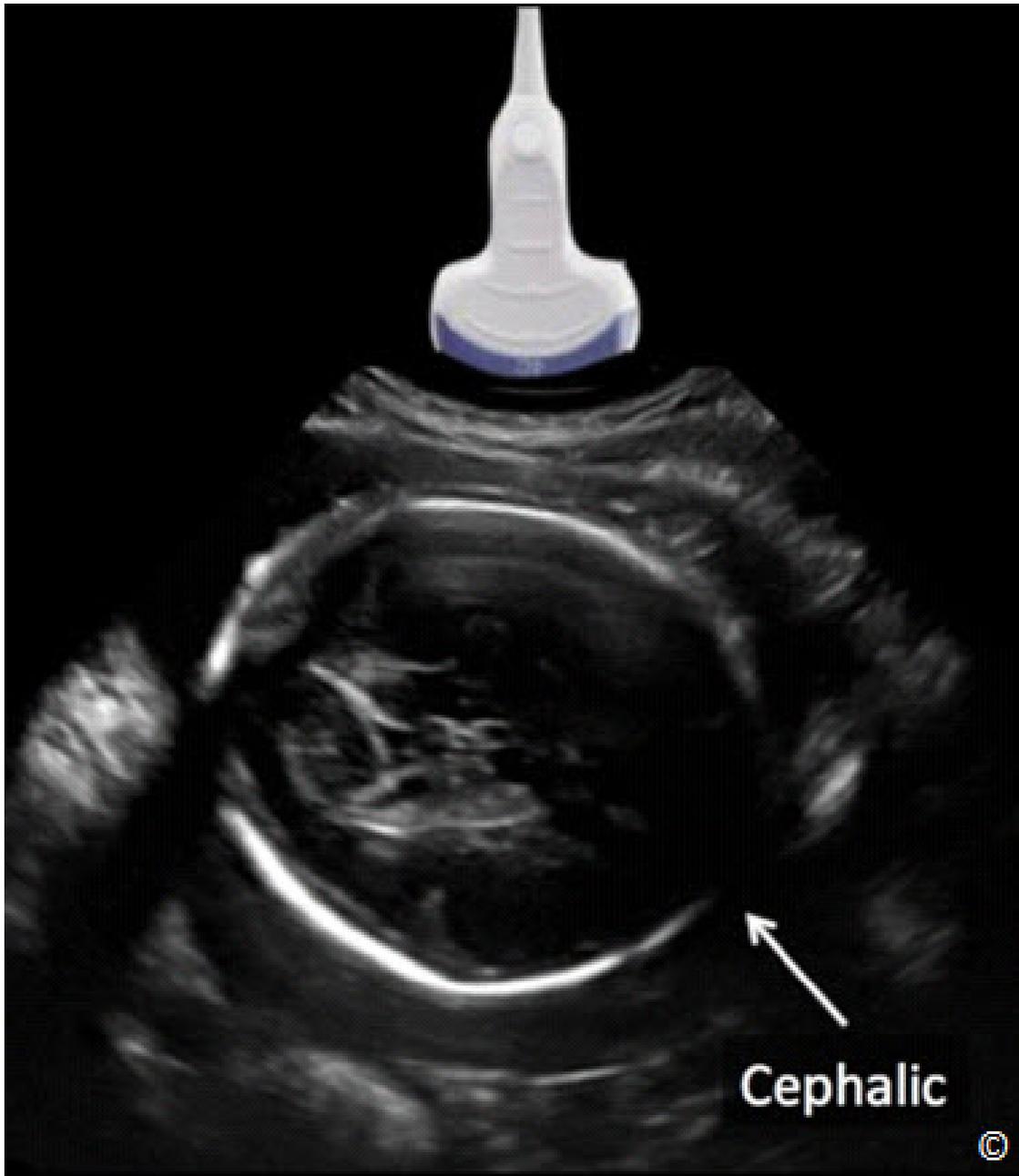


Figure 10.4: Step 1: determining fetal presentation. Note the transverse orientation of the transducer. This figure shows a cephalic presentation. See text for details.

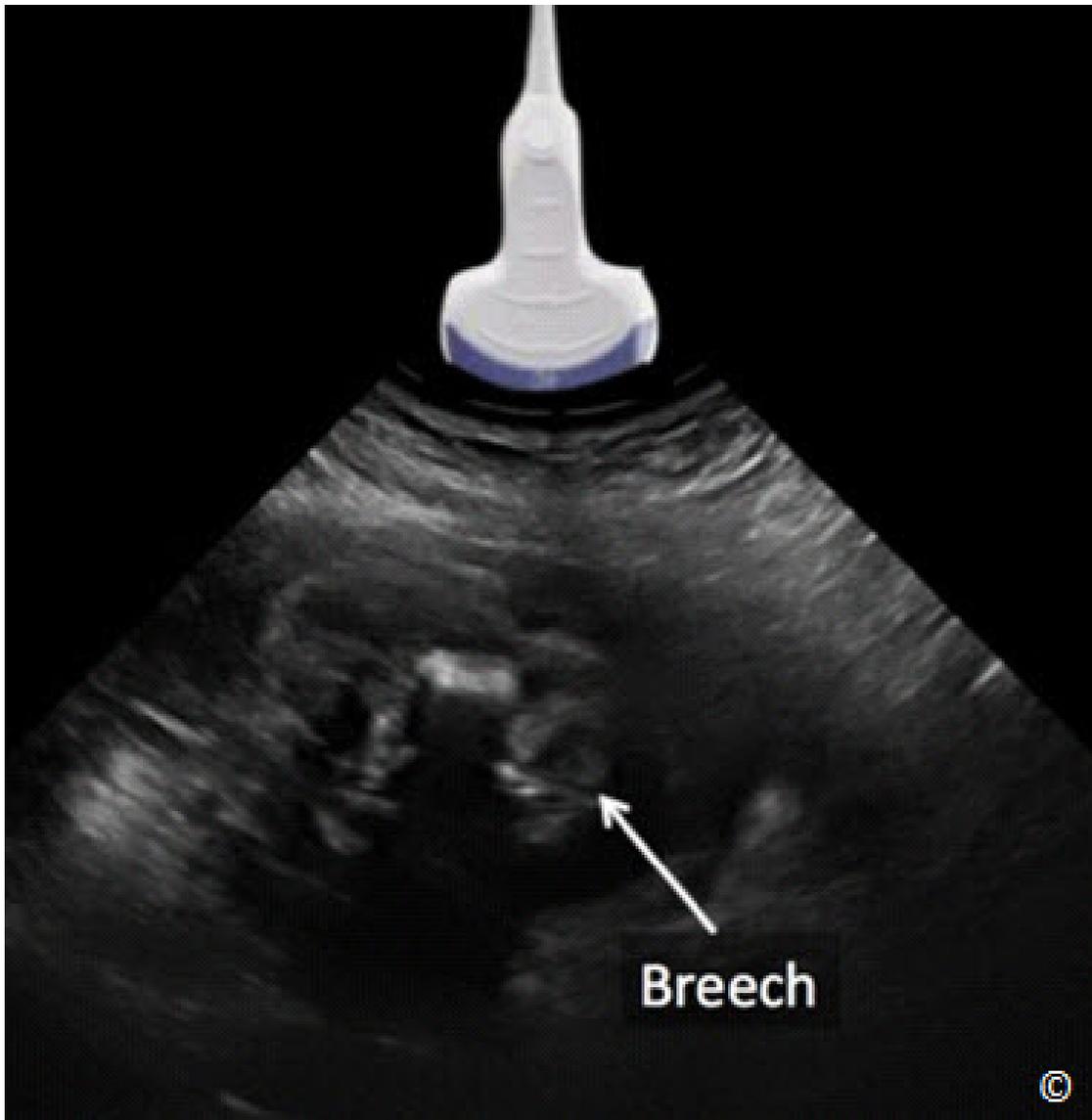


Figure 10.5: Step 1: determining fetal presentation. Note the transverse orientation of the transducer. This figure shows a breech presentation. See text for details.

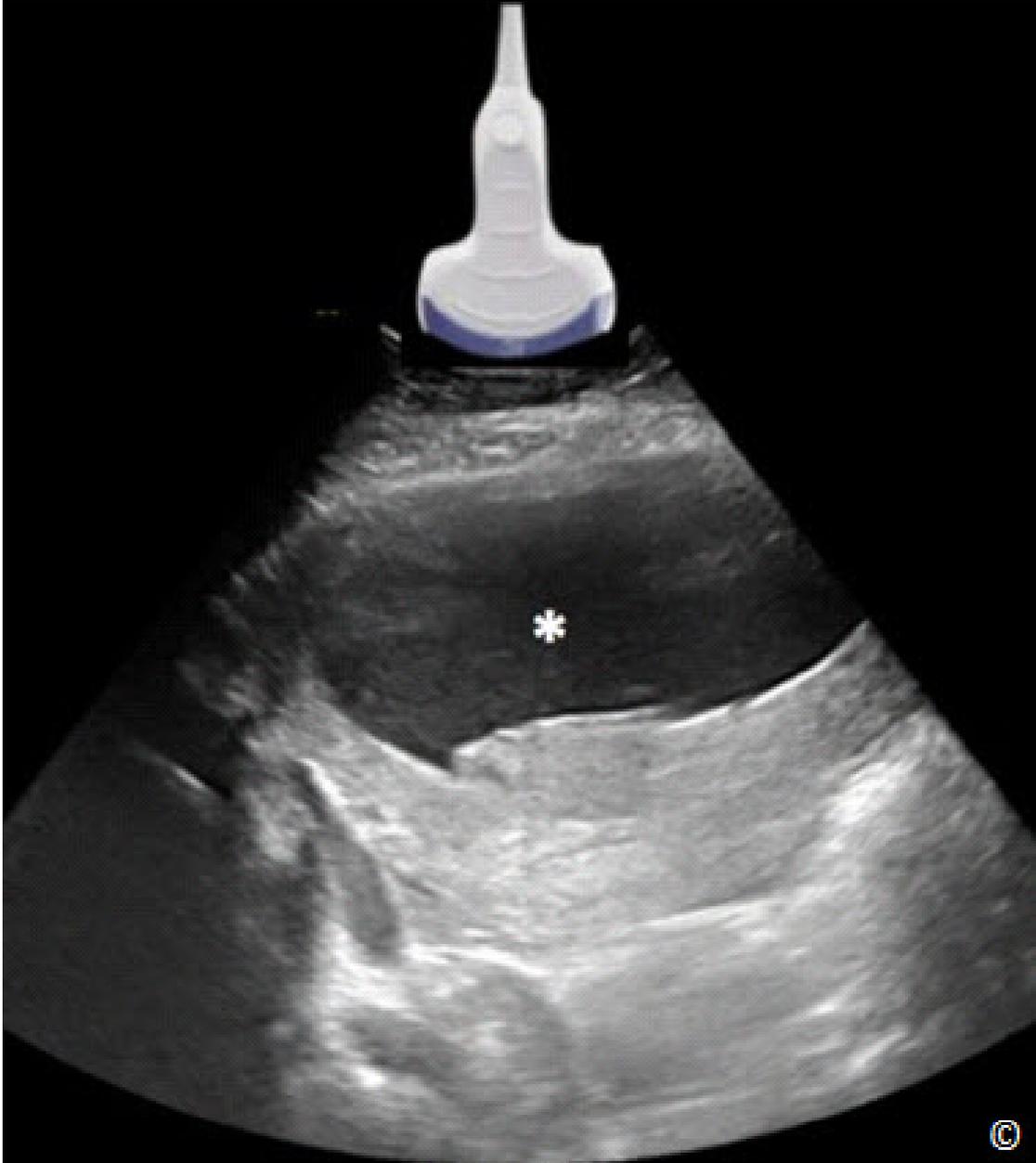


Figure 10.6: Step 1: determining fetal presentation. Note the transverse orientation of the transducer. This figure infers the presence of a transverse or oblique fetal lie given that no fetal presenting parts (asterisk) are noted. See text for details.

STEP TWO: FETAL CARDIAC ACTIVITY

Confirming fetal viability by noting the presence of fetal cardiac activity should be an essential component of the obstetric ultrasound examination and performed in the early steps of the examination. In the second and third trimester of pregnancy, this is easily accomplished by the visualization of the movements of the heart on ultrasound. Color Doppler, if available on the ultrasound equipment, can help in identifying the moving heart but is not an essential part of this step, as the heart motion can be easily imaged on real-time grey scale ultrasound. Documentation of fetal cardiac activity can be performed by saving a movie (cine-loop) clip of the moving heart on the hard drive of the ultrasound equipment or by using M-Mode. M-Mode, which stands for Motion mode, is an application that is available on most ultrasound equipment. When M-Mode is activated, a line appears on the ultrasound screen, which detects any motion along its path and can be moved by the track ball. By placing the M-Mode line across the cardiac chambers, motion of the cardiac chambers can thus be documented and a still image reflecting cardiac activity can be printed (**Figure 10.7**) and stored for documentation. See chapters 1 and 2 for more details.

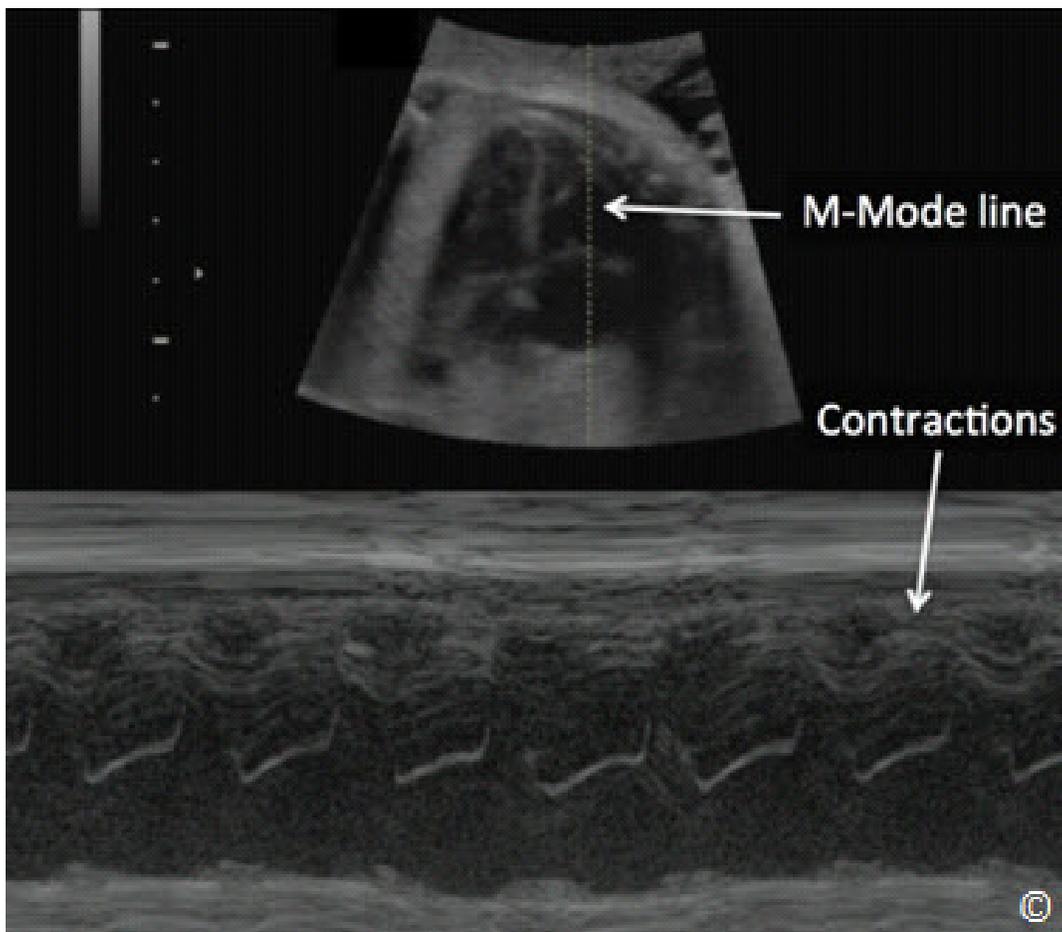


Figure 10.7: M-Mode documenting fetal cardiac activity in the second trimester of pregnancy. Note the M-Mode line (labeled) intersecting the cardiac chambers and note the presence of cardiac chamber contractions (labeled) in the tracing section. See text for details. Chapters 1 and 2 provide more information on M-Mode.

STEP TWO - TECHNICAL ASPECT OF DETERMINING FETAL CARDIAC ACTIVITY

Place the transducer transversely in the lower abdomen just above the symphysis pubis as shown in **Figures 10.1** and **10.2**, and slide superiorly in the mid-abdomen towards the umbilicus while maintaining the transverse orientation of the ultrasound transducer as shown in **Clip 10-2**. Fetal cardiac activity can be seen along the path of the transducer in the majority of ultrasound examinations. If fetal cardiac activity is not seen following the steps outlined here, slide the ultrasound transducer from the mid-abdomen to the right and/or the left lateral abdomen while maintaining the transverse orientation as shown in **Clip 10.3**. These steps show cardiac activity when present, in almost all fetal presentations.



STEP THREE-NUMBER OF FETUSES IN THE UTERUS

One of the most important benefits of ultrasound in obstetrics is in its ability to identify the presence of twins or higher order multiple pregnancy. Twin pregnancy is associated with an increased risk of preterm delivery, preeclampsia, abnormal labor and growth restriction (see chapter 7). By identifying twin pregnancy prenatally, pregnancy surveillance can be initiated and planning for delivery can be optimized which may significantly minimize the risk for pregnancy complications.

The diagnosis of a twin pregnancy in the second and third trimester is commonly first suspected when 2 fetal heads are seen in the uterine cavity during the ultrasound examination. Confirming the presence of twins is thus dependent on the identification of 2 separate fetal bodies within one uterus. A dividing membrane is seen when twin pregnancy is of the dichorionic-diamniotic or dichorionic-monoamniotic twin type. When two fetal heads are seen on ultrasound within the uterine cavity, the presence of a dividing membrane confirms the presence of a multiple pregnancy (**Figure 10.8**).

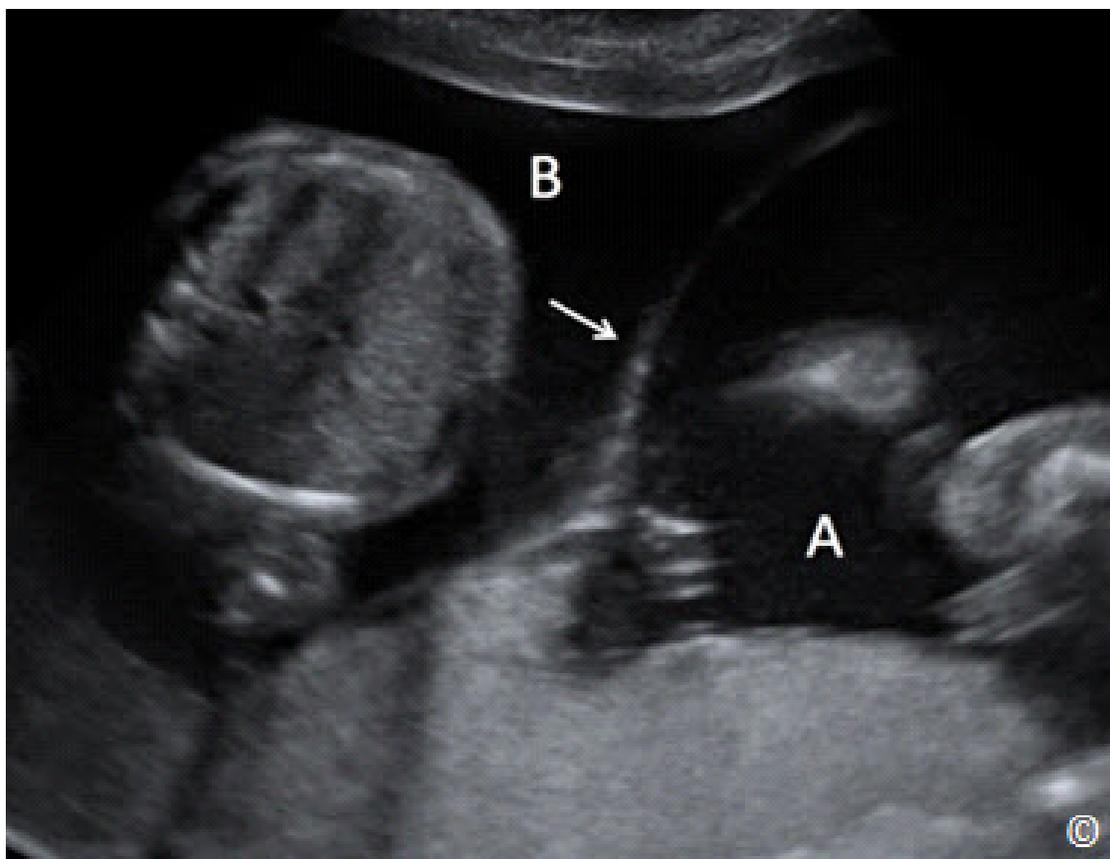


Figure 10.8: Transabdominal ultrasound of a twin pregnancy showing a thick dividing membrane (arrow) confirming the presence of twins. A and B denote the locations of gestational sacs for twin A and twin B respectively.

Step Three-Technical Aspect of Identifying the Number of Fetuses in the Uterus

The technical aspect of identifying the number of fetuses within a uterus is dependent upon mapping the entire uterine cavity by ultrasound in a systematic and standardized way, looking for the number of fetal heads (crania) within the uterus. If more than one fetal head is identified, confirmation of the presence of twins should then be performed. Mapping the uterus by ultrasound involves scanning the uterus in its entirety both in a longitudinal and transverse approach.

Technique for mapping the uterine cavity by ultrasound, searching for 2 fetal heads, involves imaging the uterine cavity from a transverse (part 1) and sagittal (part 2) orientations as follows: start by placing the transducer in a transverse orientation in the right lower abdomen as shown in **Figure 10.9** and slide the transducer superiorly towards the upper right abdomen while maintaining the transverse orientation (**Figure 10.10** and **Clip 10.4**). Repeat these steps in the mid and left abdomen in similar fashion as the right abdomen (**Figure 10.10** and **Clip 10.4**).

Place the transducer in a sagittal orientation in the right upper abdomen as shown in **Figure 10.11** and slide the transducer towards the left upper abdomen while maintaining the sagittal orientation as shown in **Figure 10.12** and **Clip 10.5**. Repeat these steps in the lower abdomen in similar fashion to the upper abdomen as shown in **Figure 10.12** and **Clip 10.5**. Look for the presence of more than one fetal head, which indicates the presence of a multiple pregnancy. When a false diagnosis of twins is made by ultrasound, a common source of error involves imaging a single fetal head from multiple angles. This error occurs when the ultrasound transducer is oblique and not maintained in a perpendicular orientation to the abdomen (floor) as shown in **Figures 10.9** to **10.12**. It is therefore important to maintain the ultrasound transducer in a perpendicular orientation to the floor while performing this technique. When the presence of a second fetus is suspected, provide confirmation of twin pregnancy by the identification of two separate bodies and a dividing membrane when present. Imaging both fetal heads or bodies in a single image when feasible, is proof of a twin pregnancy.



Figure 10.9: Initial transverse transducer placement for determining number of fetuses in uterine cavity (step 3-part 1). Note the transverse placement in the right lower abdomen. Uterine fundus is labeled.

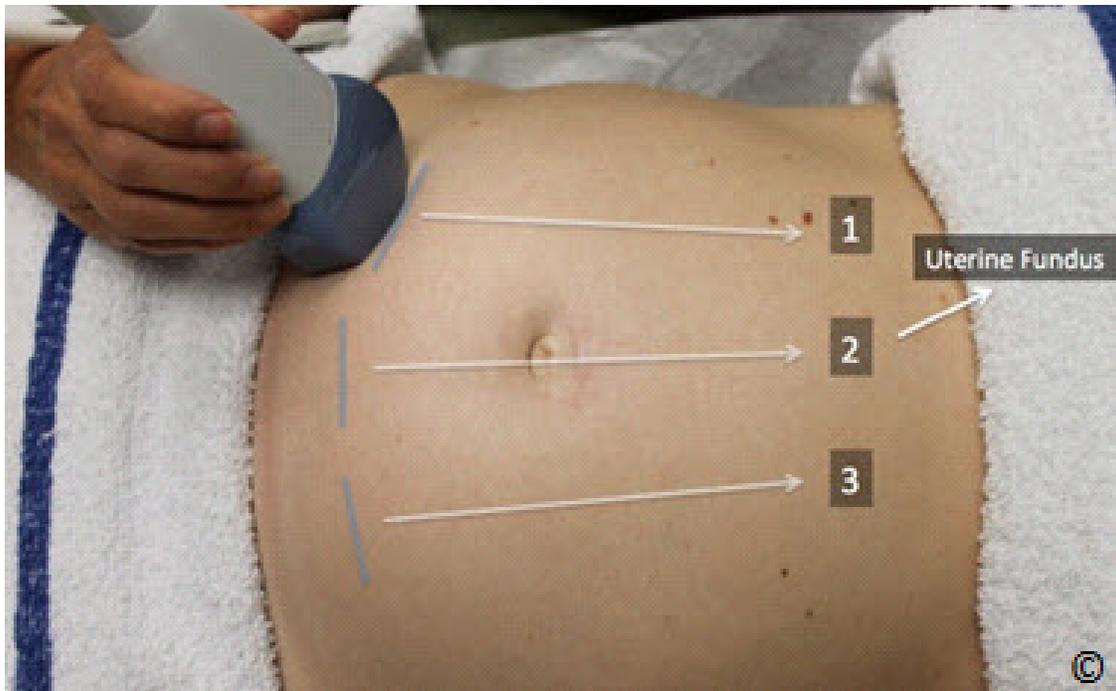


Figure 10.10: Transverse transducer movement for determining number of fetuses in uterine cavity (step 3- part 1). Note that the uterine cavity is scanned inferiorly to superiorly along tracks 1, 2 and 3, while maintaining the perpendicular orientation of the transducer to the floor. Uterine fundus is labeled.

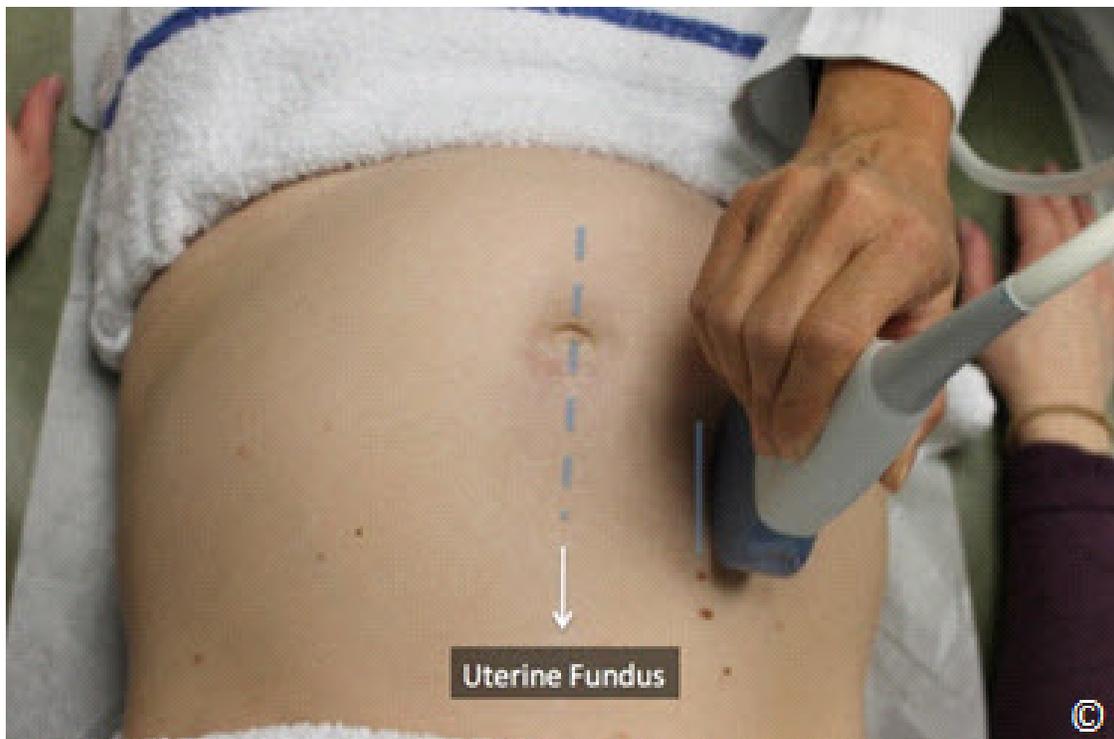


Figure 10.11: Initial sagittal transducer placement for determining number of fetuses in uterine cavity (step 3-part 2). Note the sagittal placement in the right upper abdomen and the perpendicular orientation of the transducer to the floor. Uterine fundus is labeled.

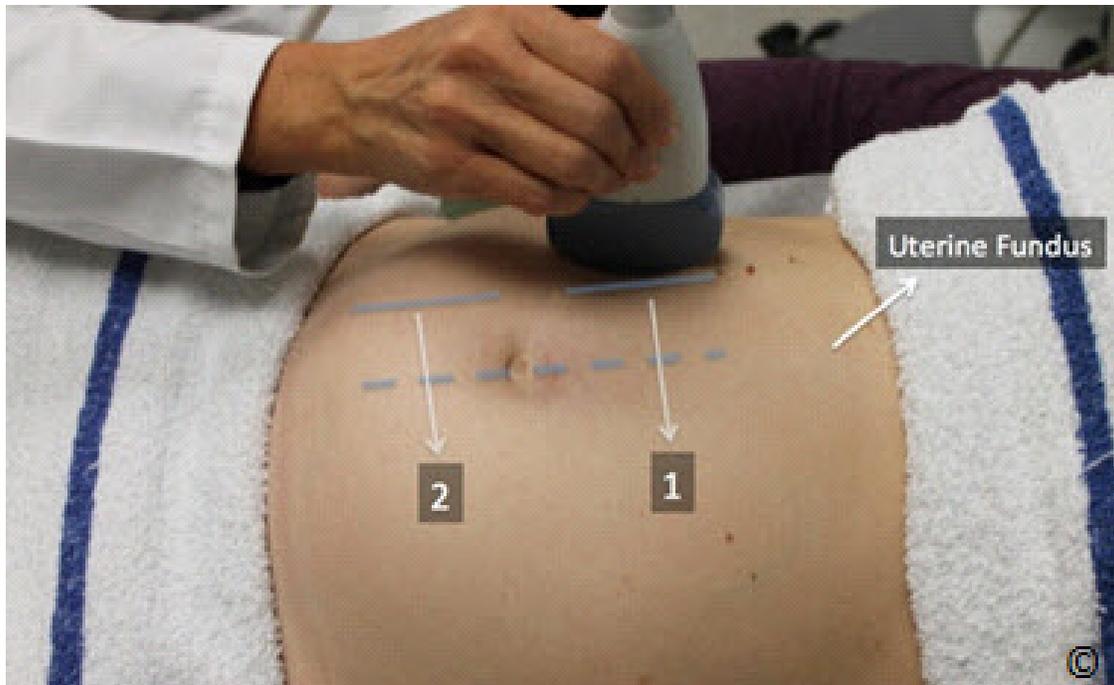


Figure 10.12: Sagittal transducer movement for determining number of fetuses in uterine cavity (step 3-part 2). Note that the uterine cavity is scanned from right to left along tracks 1 and 2 while maintaining the transducer perpendicular to the floor. Uterine fundus is labeled.

Step Four: Placental Localization in the Uterus

The presence of abnormal placental implantation such as placenta previa increases the risk of maternal hemorrhage before, during and after delivery. Ultrasound is the most optimal imaging modality for the diagnosis of placental abnormalities and the diagnosis of placenta previa by ultrasound is one of the most important benefits of incorporating ultrasound in prenatal care. Detailed description of placenta previa and its associated pregnancy complications are outlined in chapter 8. This section deals with the technical aspect of placental localization by ultrasound.

Step Four-Technical Aspect of Placental Localization in the Uterus

Place the transducer in the sagittal orientation in the right upper abdomen, just above the uterine fundus and scan longitudinally towards the lower right abdomen as shown in (Figure 10.13). Repeat the same steps in the mid and left abdomen as shown in (Figure 10.13 and Clip 10.6). It is important to start at the fundus of the uterus and ensure that you see the fundal contour of the uterus at the beginning of this step in order not to miss a fundal placenta. Look for the placenta on ultrasound and determine its location on the uterine wall. The placenta can be located in the fundal, anterior, posterior, right lateral, or left lateral uterine walls (Figures 10.14 – 10.18 respectively). When the placenta is on the posterior uterine wall, shadowing may occur from the

fetus especially in the third trimester, which makes placental imaging suboptimal. This can be overcome by placing the transducer on the lateral aspect of the abdomen as shown in **Figures 10.19** and **10.20**. The lower placental edge should be assessed and its relationship to the lower uterine segment and the cervix should be evaluated and documented. If the lower placental edge is noted to be in the lower uterine segment (**Figure 10.21**) and suspected to be close to or covering the cervix, a transvaginal ultrasound is recommended in order to confirm the presence or absence of placenta previa. The diagnosis of a placenta previa is best performed by the transvaginal ultrasound approach.

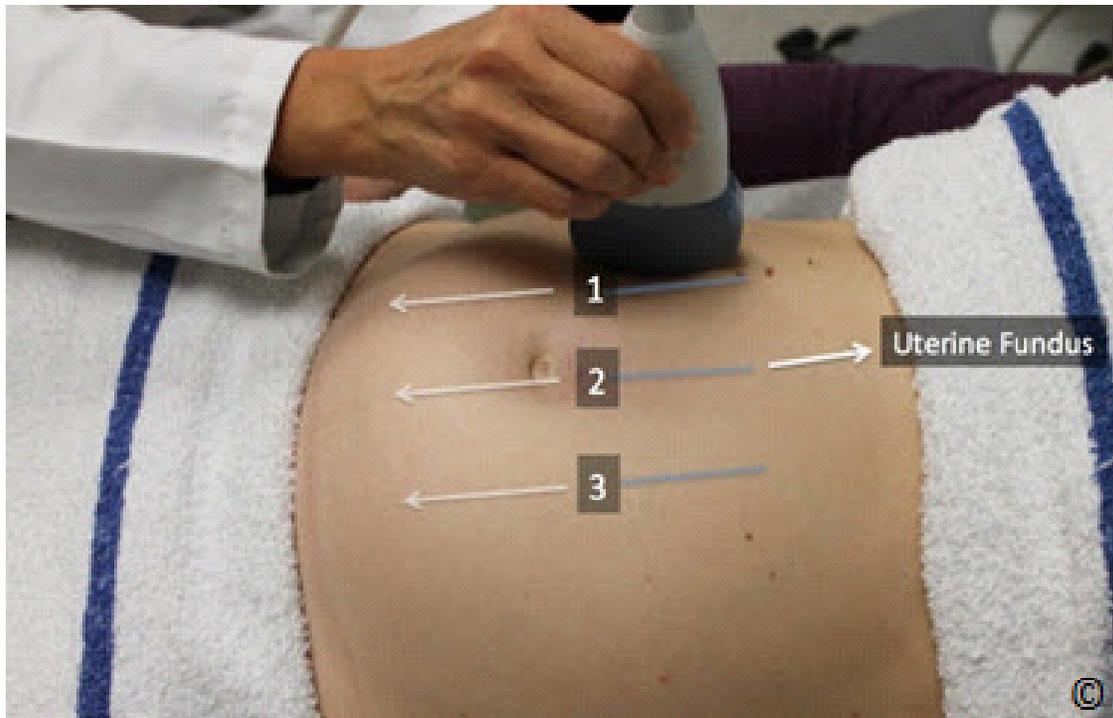


Figure 10.13: Sagittal transducer movement for determining placental localization (step 4). Note that the uterine cavity is scanned from superior (fundal region) to inferior along tracks 1, 2 and 3 while maintaining the transducer perpendicular to the floor. Uterine fundus is labeled.



Figure 10.14: Fundal placenta (labeled) shown on ultrasound obtained from a sagittal view of the uterus. The uterine fundus is labeled. See text for details.

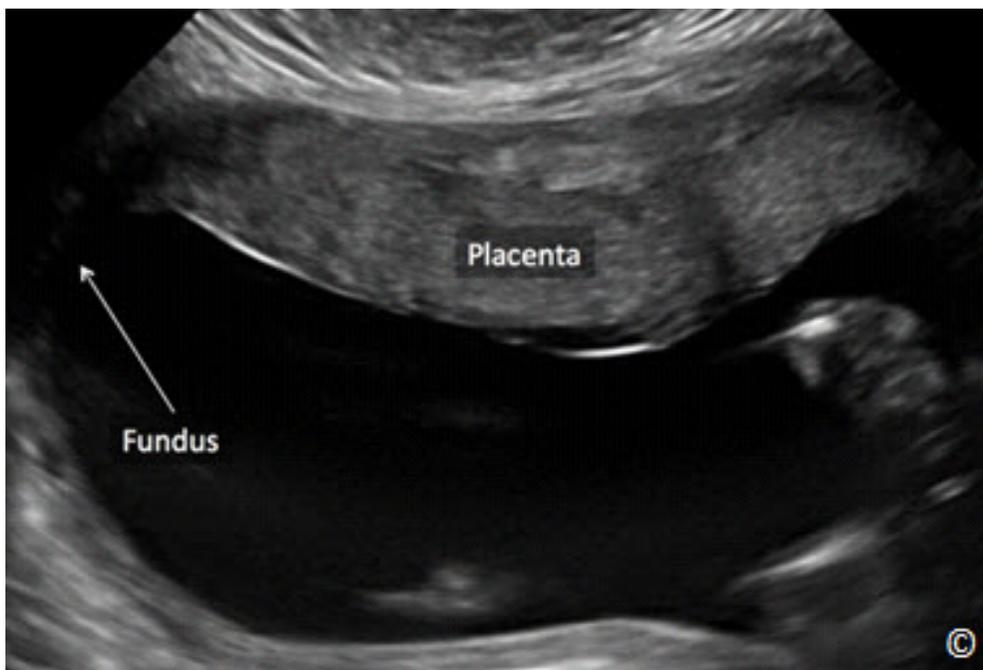


Figure 10.15: Anterior placenta (labeled) shown on ultrasound obtained from a sagittal view of the uterus. The uterine fundus is labeled. See text for details.

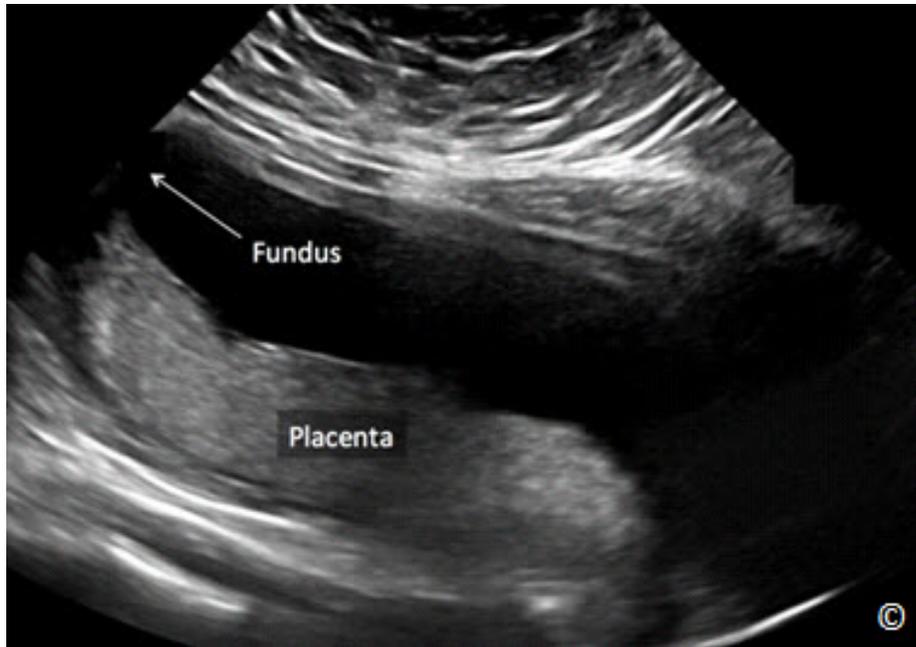


Figure 10.16: Posterior placenta (labeled) shown on ultrasound obtained from a sagittal view of the uterus. The uterine fundus is labeled. See text for details.

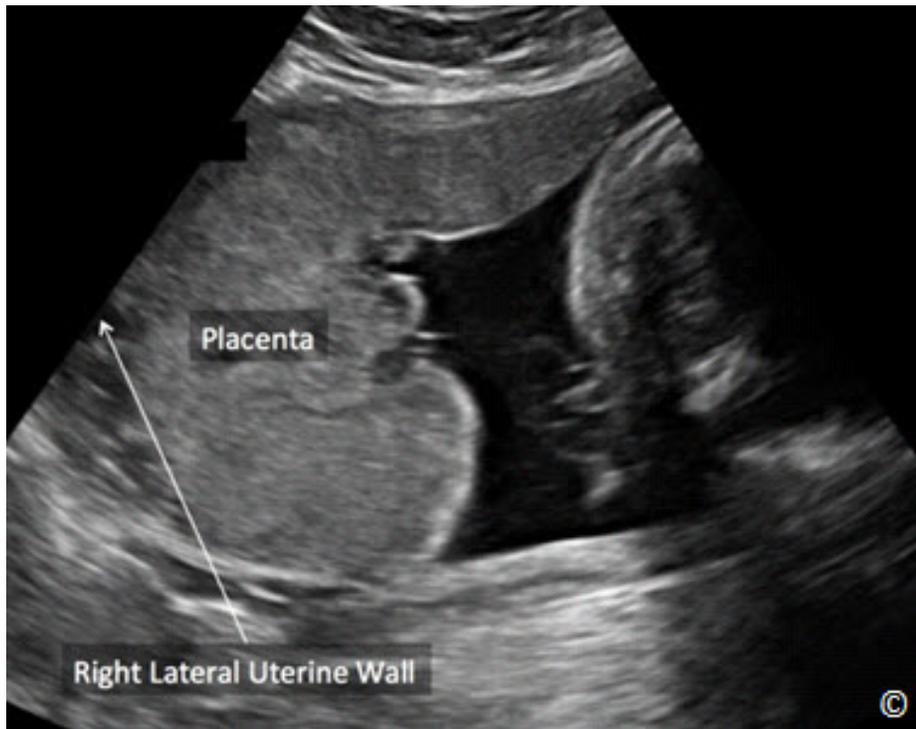


Figure 10.17: Right lateral placenta (labeled) shown on ultrasound obtained from a sagittal view of the uterus. Right lateral uterine wall is labeled. See text for details.



Figure 10.18: Left lateral placenta (labeled) shown on ultrasound obtained from a sagittal view of the uterus. Left lateral uterine wall is labeled. See text for details.



Figure 10.19: Ultrasound imaging of the uterus from the lateral aspect of the abdomen for placental localization in the third trimester when fetal shadowing obstructs view and the placenta is on the posterior uterine wall. The uterine fundus is labeled.



Figure 10.20: Ultrasound imaging of the uterus from the lateral aspect of the abdomen for placental localization in the third trimester when fetal shadowing obstructs view and the placenta is on the posterior uterine wall. Note the orientation of the transducer, almost lateral to the floor. This represents the same transducer placement as in figure 10.19, imaged from a different angle. The uterine fundus is labeled.

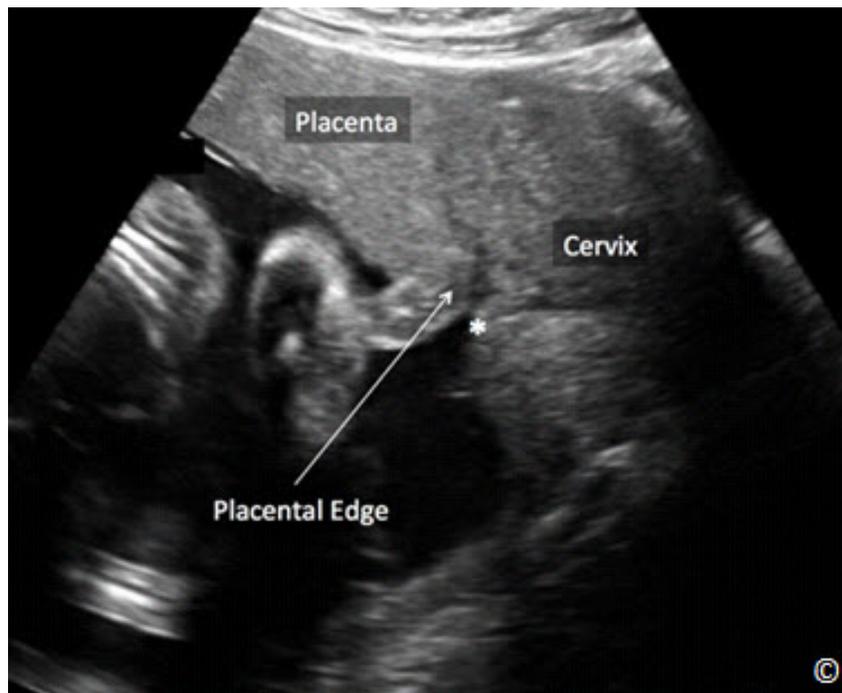


Figure 10.21: Placenta (labeled) shown on transabdominal sagittal ultrasound to be reaching the lower uterine segment, in close proximity to the cervical internal os (asterisk - labeled). A transvaginal ultrasound is indicated for accurate localization of placental edge. See text for details.

STEP FIVE: AMNIOTIC FLUID ESTIMATION

Estimation of amniotic fluid is an important part of the ultrasound examination. Several techniques for estimation of amniotic fluid have been proposed during the ultrasound examination including a subjective assessment, single deepest maximal vertical pocket (MVP) and amniotic fluid index (AFI). We recommend the use of the MVP technique as it is easy to learn and has been shown to have a lower false positive diagnosis for oligohydramnios in randomized studies (1). The term oligohydramnios (decreased amniotic fluid), which is defined by a MVP of less than 2 cm (**Figure 10.22**), is associated with genitourinary abnormalities in the fetus, premature rupture of the membranes, uteroplacental insufficiency and postterm pregnancy. Oligohydramnios has been linked to increased rates of perinatal morbidity and mortality (2). The term polyhydramnios or hydramnios (increased amniotic fluid), which is defined by a MVP of equal to or greater than 8 cm (**Figure 10.23**), is often idiopathic but can be associated with gestational diabetes, isoimmunization, fetal structural or chromosomal abnormalities or complicated multiple pregnancy. More discussion on ultrasound and amniotic fluid assessment is present in chapter 9.

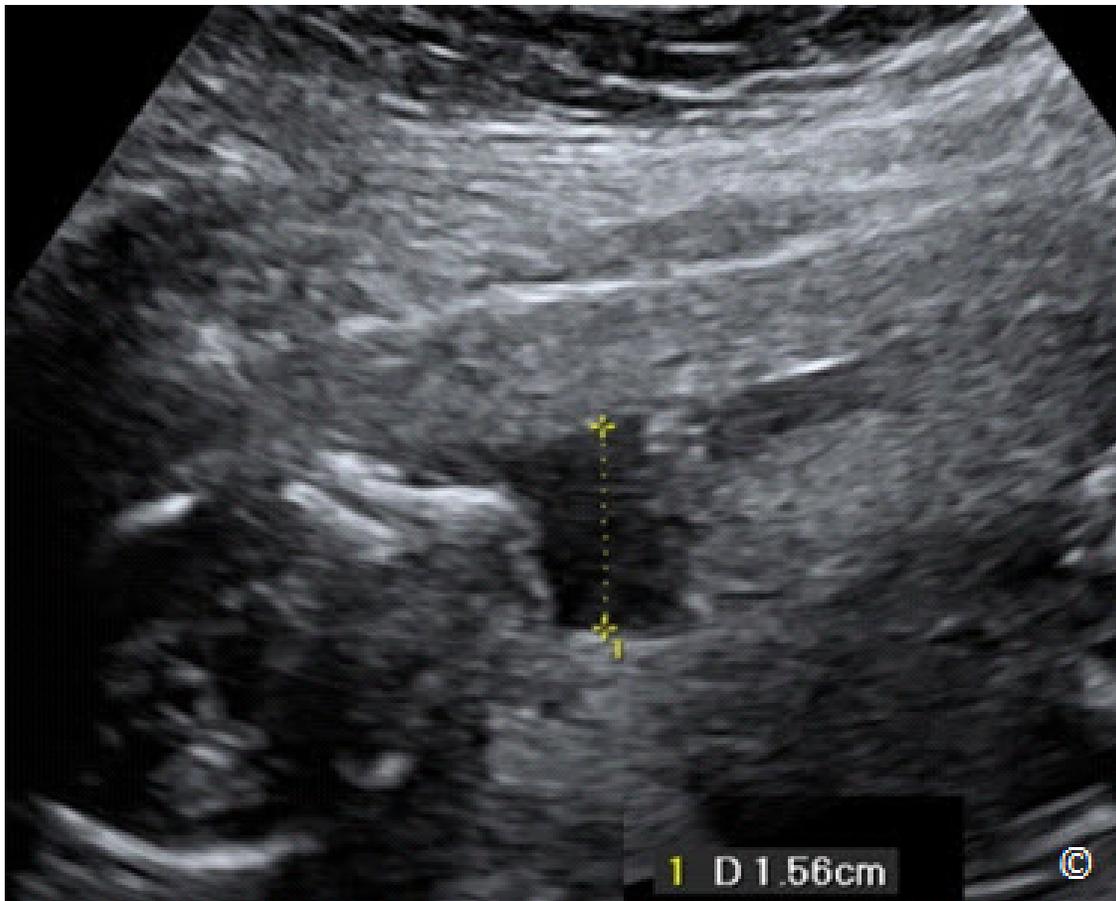


Figure 10.22: Oligohydramnios noted on ultrasound with a maximal vertical pocket (MVP) of 1.5 cm.

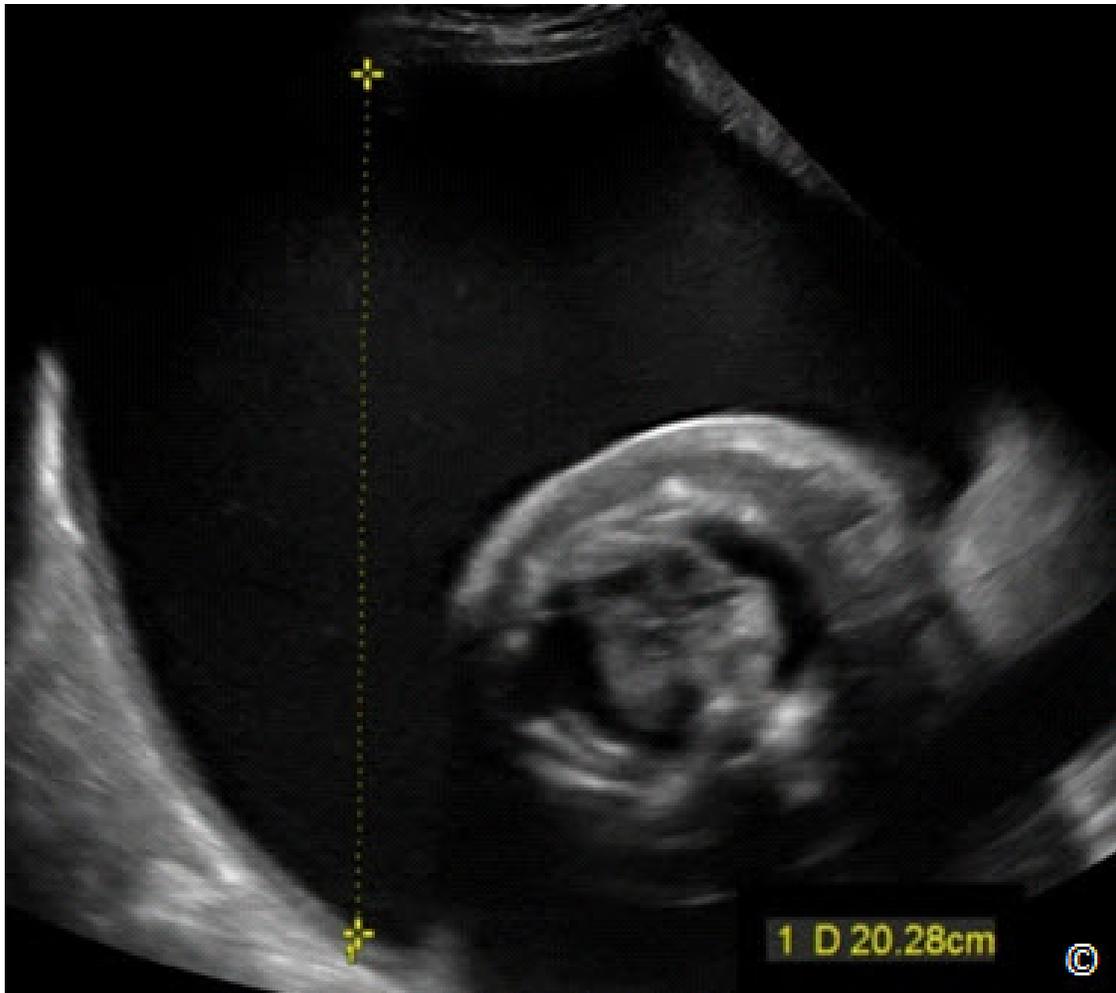


Figure 10.23: Polyhydramnios noted on ultrasound with a maximal vertical pocket (MVP) of 20.2 cm. Note the presence of fetal hydrops.

Step Five-Technical Aspect for Amniotic Fluid Estimation

The estimation of amniotic fluid using the MVP involves finding the single deepest pocket of amniotic fluid in the amniotic cavity on ultrasound examination, free of cord and fetal parts, and then measuring the greatest vertical dimension with the ultrasound transducer in sagittal orientation and perpendicular to the floor. In order to be a measurable pocket on ultrasound, the width of the pocket must be at least 1 cm.

This step requires mapping of the uterine cavity initially in order to identify the location of the MVP. Mapping of the uterus is performed by scanning the entire amniotic cavity with the transducer in sagittal orientation and perpendicular to the floor (**Figure 10.24** and **10.25** and **Clip 10.7**). When the deepest pocket is identified, measurement is performed by placing the calipers in a straight vertical line avoiding any cord or fetal parts in the image as shown in **Figure 10.22** and **10.23**.



Figure 10.24: Accurate transducer orientation for amniotic fluid measurement for the Amniotic Fluid Index (AFI) or the Maximal Vertical Pocket (MVP) methods. Note that the ultrasound transducer is in sagittal orientation and is perpendicular to the floor.

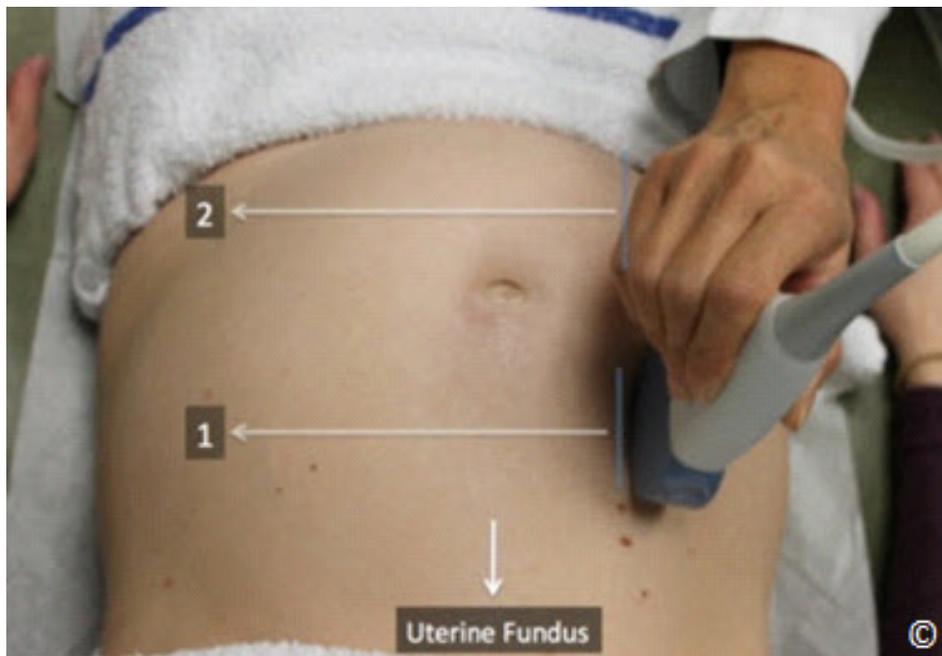


Figure 10.25: Sagittal transducer movement for amniotic fluid assessment (step 5). Note that the uterine cavity is scanned from right lateral to left lateral along tracks 1 and 2, while maintaining the transducer in sagittal orientation and perpendicular to the floor. Uterine fundus is labeled.

STEP SIX- FETAL BIOMETRY

The final step (step 6) in the basic obstetric ultrasound evaluation in the second and third trimester includes fetal biometric measurements. Fetal biometric measurements of the biparietal diameter, head circumference, abdominal circumference and femur length have been discussed in details in chapter 5 and 6, including estimation of fetal weight and the technical aspect of each measurement. The reader should review these chapters for more detailed information on this subject.

CLIP 10.1



CLIP 10.2



CLIP 10.3



CLIP 10.4





CLIP 10.5



CLIP 10.6





CLIP 10.7



References:

- 1) Chauhan S, Doherty D, Magann E, Cahanding F, et al. Amniotic fluid index vs. single deepest pocket technique during modified biophysical profile: A randomized clinical trial. *Am J Obstet Gynecol* 2004; 191:661-8.
- 2) The Cochrane Collaboration. Amniotic fluid index versus single deepest vertical pocket as a screening test for preventing adverse pregnancy outcome. 2009; Issue 3, pp (1 – 31).