American College of Radiology
ACR Appropriateness Criteria®
Second and Third Trimester Vaginal Bleeding

Variant 1: **Second and third trimester vaginal bleeding. Painless bleeding. Initial imaging.**

Procedure	Appropriateness Category	Relative Radiation Level
US duplex Doppler pelvis	Usually Appropriate	O
US pregnant uterus transabdominal	Usually Appropriate	O
US pregnant uterus transvaginal	Usually Appropriate	O
US cervix transperineal	May Be Appropriate	O

Variant 2: **Second and third trimester vaginal bleeding. Painful bleeding. Initial imaging.**

Procedure	Appropriateness Category	Relative Radiation Level
US duplex Doppler pelvis	Usually Appropriate	O
US pregnant uterus transabdominal	Usually Appropriate	O
US pregnant uterus transvaginal	Usually Appropriate	O
US cervix transperineal	May Be Appropriate	O

Variant 3: **Second and third trimester vaginal bleeding. Suspicion of or known placental previa, low-lying placental, or vasa previa. Initial imaging.**

Procedure	Appropriateness Category	Relative Radiation Level
US duplex Doppler pelvis	Usually Appropriate	O
US pregnant uterus transabdominal	Usually Appropriate	O
US pregnant uterus transvaginal	Usually Appropriate	O
US cervix transperineal	Usually Not Appropriate	O

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Summary of Literature Review

Introduction/Background

Vaginal bleeding, or bleeding per vaginam, in the second and third trimesters of pregnancy is less common than in the first trimester but can similarly arise from an array of etiologies [1,2]. These diagnoses can widely range from having vaginal bleeding for no identifiable reason—seen in approximately half of those with vaginal bleeding in pregnancy [3]—to being the normal and expected bleeding with term labor, to having serious potential consequences for both the mother and fetus [4]. Although history and physical examination can identify many causes of vaginal bleeding, imaging, particularly with ultrasound (US), is the mainstay for making accurate diagnoses and for emergent guidance of management, which in the second and third trimesters may lead to hospitalization and/or delivery. Imaging is further critical to the evaluation of those with second and third trimester vaginal bleeding as digital pelvic examination should be avoided until diagnoses such as placenta previa, low-lying placenta, and vasa previa have been excluded.

The outcome of pregnancies with vaginal bleeding in the second and third trimesters depends on the precise etiology for the bleeding. Expected physiologic bleeding is seen with miscarriage and cervical change with labor. Bleeding accompanying miscarriage, which occurs in the first half of pregnancy, is common. As the cervix prepares for labor, there is frequently vaginal bleeding, termed the "bloody show" that typically precedes labor. Pathologic vaginal bleeding can be seen in a variety of cases including bleeding from the cervix with preterm labor, bleeding from placenta previa, vasa previa, placental abruption, or uterine rupture. The bleeding from any of these entities can lead to adverse perinatal and maternal outcomes, including the risk of death. Rare causes of bleeding include those arising from the cervix, such as cervicitis or cervical polyp, and the vagina, such as a laceration; these typically can be elucidated by the history and physical examination, though at times ultrasound may identify a polyp in the endocervical canal. Placental abruption affects approximately 1% of pregnancies, but US diagnosis is much less common and likely identifies, at most, 50% of cases of abruption though likely many fewer [5]. US imaging is vitally important as a central abruption is associated with worse perinatal outcome than a marginal separation of the placenta [6]. The most common diagnosis made is that of placenta previa, affecting approximately 1 in 200 pregnancies at delivery [7,8]. Vasa previa is much less frequent, affecting approximately 1 in 2,500 to 1 in 5,000 deliveries [8-10]. Uterine rupture is rare but can occur most commonly in patients with prior cesarean delivery or other uterine surgery. Vaginal bleeding can also occur with placental attachment disorder/placenta accreta spectrum; however, this is covered further in the ACR Appropriateness Criteria® topic on "Suspected Placenta Accreta Spectrum Disorder" [11].

Transabdominal US is the mainstay of obstetrical imaging; however, transvaginal US is particularly helpful given the not uncommon frequency with which cervical-related causes of second and third trimester vaginal bleeding occurs [12-14]. Furthermore, transvaginal US has been shown to be both accurate and safe for the diagnosis of placenta previa, as covered in more detail in the ACR-ACOG-AIUM-SMFM-SRU Practice Parameter for the Performance of Standard Diagnostic Obstetrical Ultrasound [15]. There has been literature documenting the utility of transperineal US (or translabial US) especially for evaluation of the cervix [16]; however, optimal visualization of the cervix occurs with closer approximation of the cervix, such as with real-time evaluation using transvaginal US [17] and as covered further in the ACR Appropriateness Criteria® topic on "Assessment of Gravid Cervix" [18].

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In the setting of premature rupture of membranes, there is a paucity of evidence on whether the introduction of the transvaginal probe may be associated with an increased risk of chorioamnionitis. Carlan et al [19] in a randomized trial of 92 patients did not find any associated increased risk. Nonetheless, caution should be applied in this setting.

Special Imaging Considerations

Transrectal US is a useful technique and is generally well tolerated when transvaginal and transperineal US are either unsuccessful or declined [20,21].

Initial Imaging Definition

Imaging at the beginning of the care episode for the medical condition defined by the variant. More than one procedure can be considered usually appropriate in the initial imaging evaluation when:

- There are procedures that are equivalent alternatives (ie, only one procedure will be ordered to provide the clinical information to effectively manage the patient's care)

OR

- There are complementary procedures (ie, more than one procedure is ordered as a set or simultaneously in which each procedure provides unique clinical information to effectively manage the patient's care).

Discussion of Procedures by Variant

Variant 1: Second and third trimester vaginal bleeding. Painless bleeding. Initial imaging.

US Cervix Transperineal

The literature is sparse with regard to defined indications for the use of transperineal US or translabial US among those with painless vaginal bleeding. In current US use, if transabdominal US demonstrates an open cervix with bulging membranes or if the history and physical examination suggests ruptured membranes, then transperineal US might be considered. If transabdominal US is inconclusive and transvaginal US is declined by the patient, transperineal US or transrectal US may be useful for making an accurate diagnosis.

US Duplex Doppler Pelvis

Although Doppler velocimetry US is an adjunct to any of the other procedures for evaluation of painless vaginal bleeding, it can be invaluable for identification of pathologic entities such as vasa previa [22]. Vessels overlying the internal cervical os can be subtle and challenging to diagnose without optimal imaging conditions, and the use of color and spectral Doppler velocimetry US can be essential for making accurate diagnoses and distinguishing fetal from maternal vessels especially with the presence of fetal arterial vessels.

US Pregnant Uterus Transabdominal

The primary goal of transabdominal US in the setting of painless bleeding is to exclude pathologic etiologies for the bleeding. Impending miscarriage or early labor can typically be excluded via history and physical examination. The most common etiologies for painless vaginal bleeding would be placenta previa, and, less commonly, vasa previa [23]. Transabdominal US is the preferred initial imaging procedure as a screening tool for placenta previa [24]. This evaluation should include visualization of the placenta, the inferior placental margin, the placental umbilical cord insertion, and the cervix from the external os to the internal os. Any vessels overlying the internal cervical os should be specifically excluded. Transabdominal visualization of the lower uterine segment and cervix can be suboptimal because of inadequate urine in the bladder of from shadowing from the maternal symphysis pubis.

US Pregnant Uterus Transvaginal

Transvaginal US is frequently necessary for evaluation of painless vaginal bleeding, especially if transabdominal US is inconclusive or inadequate. As with transabdominal US, the evaluation should include visualization of the placenta if identifiable, the inferior placental margin, the cervix from the external os to the internal os, and the identification of any vessels overlying the internal cervical os. The evaluation should also include a measurement of the distance from the leading placental margin to the internal cervical os or the distance that the placenta crosses the internal cervical os [13]. In fact, in the second trimester, transvaginal US is predictive of placenta previa at delivery if the placenta crosses the internal cervical os by ≥15 mm [25], and an overlap of 25 mm or more at 20 to 23 weeks' gestation was associated with an exceptional risk for cesarean delivery [25,26]; a repeat sonographic evaluation later in pregnancy was suggested in these cases [21].

Variant 2: Second and third trimester vaginal bleeding. Painful bleeding. Initial imaging.

Painful vaginal bleeding in the second and third trimesters includes an additional range of etiologies than that seen with painless vaginal bleeding, such as placental abruption, which is more commonly associated with abdominal pain. History and physical examination are vital for assessing for miscarriage or labor, whether term or preterm. Term labor would not necessarily prompt the need for imaging if the history and physical examination are consistent with this diagnosis. Should history and physical examination suggest miscarriage or preterm labor, evaluation would include an evaluation of the viability of the fetus and a detailed assessment of the cervix from external os to internal os, especially to assess cervical length. The bladder should not be overfilled to minimize the likelihood of falsely elongating the cervical length. Also, knowing the placental location will allow the clinician to know if it is safe to examine the patient's cervix digitally to assess for preterm labor.

US Cervix Transperineal

The literature is sparse in regard to defined indications for the use of transperineal US among those with painful vaginal bleeding. In current US use, if transabdominal US demonstrates an open cervix with bulging membranes or if the history and physical examination suggests ruptured membranes, then transperineal US might be considered. If transabdominal US is inconclusive and transvaginal US is declined by the patient, transperineal US may be useful for making an accurate diagnosis.

US Duplex Doppler Pelvis

Although Doppler velocimetry US is an adjunct to any of the other procedures for evaluation of painful vaginal bleeding, it can be invaluable for identification of pathologic entities like placental abruption. An acute clot within the uterus can have an echogenicity similar to that of the placenta; therefore, a placental abruption can be difficult to diagnose, especially prior to organization of the clot [5]. Identification of an area of interest contiguous with the placenta but with no blood flow as documented using color or power Doppler US could suggest the presence of an acute clot as seen with placental abruption. Although color or power Doppler US appears to be helpful with the diagnosis of placental abruption, spectral Doppler US of the fetal arterial vessels appears to be less helpful [27].

US Pregnant Uterus Transabdominal

Transabdominal US assessment is the preferred initial procedure for this evaluation and for assessment of the placenta. As in those with painless vaginal bleeding, an evaluation for placenta previa and vasa previa is indicated. The placenta is also comprehensively evaluated to assess its location, the presence of any clot as seen with placental separation in placental abruption, the placental location, and the presence of any vessels overlying the internal cervical os [23,24]. Although US is not sensitive for the diagnosis of placental abruption, the identification of a placental abruption is associated with worse perinatal outcomes [28]. The uterus should be evaluated for signs of uterine rupture, especially among those with a history of prior cesarean delivery. Although uterine rupture is typically a clinical diagnosis, imaging might be helpful in certain cases. Any disruption of the myometrium would suggest a uterine rupture. A threshold of 2.5-mm thickness of the lower uterine segment has been shown to be predictive of uterine dehiscence [29].

US Pregnant Uterus Transvaginal

Transvaginal US is frequently necessary for evaluation of painful vaginal bleeding especially if transabdominal US is inconclusive or inadequate. As with transabdominal US, the evaluation should include visualization of the placenta if identifiable, the inferior placental margin, the presence of any clot within the uterus, the continuity of the myometrium, the cervix from the external os to the internal os, and the identification of any vessels overlying the internal cervical os. Although a transvaginally identified short cervix is well known to be related to preterm delivery, associated vaginal bleeding significantly increases the risk of preterm delivery [30]. Evaluation of the lower uterine segment, the uterine isthmus [31], during transvaginal US can predict bleeding during pregnancy and delivery among those with placenta previa [32].

Variant 3: Second and third trimester vaginal bleeding. Suspicion of or known placental previa, low-lying placental, or vasa previa. Initial imaging.

US Cervix Transperineal

To our knowledge, there is currently a paucity of literature to support the use of transperineal US for the initial evaluation of placenta previa, low-lying placenta, or vasa previa [33].

US Duplex Doppler Pelvis

Although Doppler velocimetry US is an adjunct to transabdominal US and transvaginal US for evaluation of known or suspected placenta previa, low-lying placenta, or vasa previa, it can be invaluable for identification of pathologic

entities like vasa previa. Vessels overlying the internal cervical os can be subtle and challenging to diagnose without optimal imaging conditions, and the use of Doppler velocimetry US can be essential for making this diagnosis [7,34]. Furthermore, spectral Doppler may play an important role in distinguishing fetal arterial vessels from maternal vessels when overlying the internal cervical os.

US Pregnant Uterus Transabdominal

Evaluation of second or third trimester vaginal bleeding with known or suspected placenta previa, low-lying placenta, or vasa previa initially involves transabdominal US. The placenta is comprehensively evaluated to assess its location, the inferior placental margin and how far the placenta lies from the internal os or how far the placenta overlaps the internal cervical os [35], the placental umbilical cord insertion, and the cervix, especially of the internal os. If present, any vessels overlying the internal cervical os should be searched for and identified. If, during transabdominal US at 18 to 20 weeks' gestation, the placenta is ≥2 cm from the internal cervical os, follow-up evaluation of the placenta is not necessary [36,37]. The later in gestation that a placenta previa is diagnosed, the more likely it will remain a placenta previa at delivery; however, even with a scan at 32 to 35 weeks' gestation, only 73% of placenta previas persist at delivery [38]. Twins are also at a 40% increased risk for placenta previa than singletons, highlighting the need to be vigilant in this population [39]. Other risk factors for placenta previa include increasing maternal age, parity, prior cesarean delivery, prior spontaneous abortion, and maternal tobacco use [40,41]. A low-lying placenta that is <2 cm from the internal cervical os has a <2% chance of remaining low-lying at delivery; nonetheless, these patients whose placentas remain low are at increased risk for cesarean delivery [42].

US Pregnant Uterus Transvaginal

Transvaginal US is frequently necessary for evaluation of known or suspected placenta previa, low-lying placenta, or vasa previa, especially if transabdominal US is inconclusive or inadequately demonstrates the internal cervical os and inferior placental margin. As with transabdominal US, the evaluation should include visualization of the placenta if identifiable, the inferior placental margin, the cervix from the external os to the internal os, and the identification of any vessels overlying the internal cervical os. Among those with placenta previa, a shortening cervix is associated with an increased risk for emergency cesarean delivery [43], and a transvaginal cervical length of <35 mm was associated with an increased risk of preterm cesarean delivery due to massive hemorrhage [44]. As placenta previa and low-lying placenta can resolve over gestation, vasa previa has been reported to resolve in 5.8% to 23.8% of cases [45,46].

Summary of Recommendations

- **Variant 1:** US pregnant uterus transabdominal, US duplex Doppler pelvis, and US pregnant uterus transvaginal are usually appropriate for the initial imaging of painless second and third trimester vaginal bleeding. These procedures are complementary (ie, more than one procedure is ordered as a set or simultaneously where each procedure provides unique clinical information to effectively manage the patient's care).
- **Variant 2:** US pregnant uterus transabdominal, US duplex Doppler pelvis, and US pregnant uterus transvaginal are usually appropriate for the initial imaging of painful second and third trimester vaginal bleeding. These procedures are complementary (ie, more than one procedure is ordered as a set or simultaneously where each procedure provides unique clinical information to effectively manage the patient's care).
- **Variant 3:** US pregnant uterus transabdominal, US duplex Doppler pelvis, and US pregnant uterus transvaginal are usually appropriate for the initial imaging of second and third trimester vaginal bleeding with suspicion of or known placenta previa, low-lying placental, or vasa previa. These procedures are complementary (ie, more than one procedure is ordered as a set or simultaneously where each procedure provides unique clinical information to effectively manage the patient's care).

Supporting Documents

The evidence table, literature search, and appendix for this topic are available at https://acsearch.acr.org/list. The appendix includes the strength of evidence assessment and the final rating round tabulations for each recommendation.

For additional information on the Appropriateness Criteria methodology and other supporting documents go to www.acr.org/ac.

Safety Considerations in Pregnant Patients

Imaging of the pregnant patient can be challenging, particularly with respect to minimizing radiation exposure and risk. For further information and guidance, see the following ACR documents:

- ACR–SPR Practice Parameter for the Safe and Optimal Performance of Fetal Magnetic Resonance Imaging (MRI) [47]
- ACR-SPR Practice Parameter for Imaging Pregnant or Potentially Pregnant Adolescents and Women with Ionizing Radiation [48]
- ACR-ACOG-AIUM-SMFM-SRU Practice Parameter for the Performance of Standard Diagnostic Obstetrical Ultrasound [15]
- ACR Manual on Contrast Media [49]
- ACR Guidance Document on MR Safe Practices: 2013 [50]

Appropriateness Category Names and Definitions

Appropriateness Category Name	Appropriateness Rating	Appropriateness Category Definition
Usually Appropriate	7, 8, or 9	The imaging procedure or treatment is indicated in the specified clinical scenarios at a favorable risk-benefit ratio for patients.
May Be Appropriate	4, 5, or 6	The imaging procedure or treatment may be indicated in the specified clinical scenarios as an alternative to imaging procedures or treatments with a more favorable risk-benefit ratio, or the risk-benefit ratio for patients is equivocal.
May Be Appropriate (Disagreement)	5	The individual ratings are too dispersed from the panel median. The different label provides transparency regarding the panel's recommendation. "May be appropriate" is the rating category and a rating of 5 is assigned.
Usually Not Appropriate	1, 2, or 3	The imaging procedure or treatment is unlikely to be indicated in the specified clinical scenarios, or the risk-benefit ratio for patients is likely to be unfavorable.

Relative Radiation Level Information

Potential adverse health effects associated with radiation exposure are an important factor to consider when selecting the appropriate imaging procedure. Because there is a wide range of radiation exposures associated with different diagnostic procedures, a relative radiation level (RRL) indication has been included for each imaging examination. The RRLs are based on effective dose, which is a radiation dose quantity that is used to estimate population total radiation risk associated with an imaging procedure. Patients in the pediatric age group are at inherently higher risk from exposure, because of both organ sensitivity and longer life expectancy (relevant to the long latency that appears to accompany radiation exposure). For these reasons, the RRL dose estimate ranges for pediatric examinations are lower as compared with those specified for adults (see Table below). Additional information regarding radiation dose assessment for imaging examinations can be found in the ACR Appropriateness Criteria® Radiation Dose Assessment Introduction document [51].

Relative Radiation Level Designations		
Relative Radiation Level*	**Adult Effective Dose Estimate Range**	**Pediatric Effective Dose Estimate Range**
O	0 mSv	0 mSv
☢	<0.1 mSv	<0.03 mSv
☢☢	0.1-1 mSv	0.03-0.3 mSv
☢☢☢	1-10 mSv	0.3-3 mSv
☢☢☢☢	10-30 mSv	3-10 mSv
☢☢☢☢☢	30-100 mSv	10-30 mSv
*RRL assignments for some of the examinations cannot be made, because the actual patient doses in these procedures vary as a function of a number of factors (eg, region of the body exposed to ionizing radiation, the imaging guidance that is used). The RRLs for these examinations are designated as "Varies."		

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