Special Report of the Society for Maternal-Fetal Medicine Placenta Accreta Spectrum Ultrasound Marker Task Force: Consensus on definition of markers and approach to the ultrasound examination in pregnancies at risk for placenta accreta spectrum

Scott A. Shainker, DO, MS; Beverly Coleman, MD, FACP; Ilan E. Timor-Tritsch, MD; Amarnath Bhide, MRCOG, MD; Bryann Bromley, MD; Alison G. Cahill, MD, MSCI; Manisha Gandhi, MD; Jonathan L. Hecht, MD, PhD; Katherine M. Johnson, MD; Deborah Levine, MD; Joan Mastrobattista, MD; Jennifer Phillips, MD; Lawrence D. Platt, MD; Alireza A. Shamshirsaz, MD; Thomas D. Shipp, MD; Robert M. Silver, MD; Lynn L. Simpson, MD; Joshua A. Copel, MD; Alfred Abuhamad, MD; On behalf of the Society for Maternal-Fetal Medicine

The Society for Maternal Fetal Medicine (SMFM), American Institute of Ultrasound in Medicine (AIUM), American College of Radiologists (ACR), and Gottesfeld Hohler Memorial Society (GOHO) endorse this document. The American College of Obstetricians and Gynecologists (ACOG) and International Society of Ultrasound In Obstetrics and Gynecology (ISUOG) support this document. The Society of Radiologists in Ultrasound (SRU) approves this document.

Placenta accreta spectrum includes the full range of abnormal placental attachment to the uterus or other structures, encompassing placenta accreta, placenta increta, placenta percreta, morbidly adherent placenta, and invasive placentation. The incidence of placenta accreta spectrum has increased in recent years, largely driven by increasing rates of cesarean delivery. Prenatal detection of placenta accreta spectrum is primarily made by ultrasound and is important to reduce maternal morbidity associated with the condition. Despite a large body of research on various placenta accreta spectrum ultrasound markers and their screening performance, inconsistencies in the literature persist. In response to the need for standardizing the definitions of placenta accreta spectrum markers and the approach to the ultrasound examination, the Society for Maternal-Fetal Medicine convened a task force with representatives from the American Institute of Ultrasound in Medicine, the American College of Obstetricians and Gynecologists, the American College of Radiology, the International Society of Ultrasound in Obstetrics and Gynecology, the Society for Radiologists in Ultrasound, the American Registry for Diagnostic Medical Sonography, and the Gottesfeld-Hohler Memorial Ultrasound Foundation. The goals of the task force were to assess placenta accreta spectrum sonographic markers on the basis of available data and expert consensus, provide a standardized approach to the prenatal ultrasound evaluation of the uterus and placenta in pregnancies at risk of placenta accreta spectrum, and identify research gaps in the field. This manuscript provides information on the Placenta Accreta Spectrum Task Force process and findings.

Key words: accreta, cesarean, increta, maternal morbidity, maternal mortality, placenta accreta spectrum, percreta, previa

Introduction
Placenta accreta spectrum (PAS), encompassing the terms placenta accreta, placenta increta, placenta percreta, morbidly adherent placenta, and invasive placentation, includes the full range of abnormal placental attachment to the uterus or other structures. There has been a dramatic rise in the incidence of PAS over recent years.\textsuperscript{1} This rise is most notably driven by increasing rates of cesarean delivery. The risk is highest in the presence of placenta previa and previous cesarean deliveries.\textsuperscript{1,2}
PAS is associated with a marked increase in maternal morbidity and mortality. The morbidity is primarily related to massive hemorrhage with associated organ damage, cesarean hysterectomy, and need for critical care resources.1,2 Prenatal detection of PAS allows for mobilization of multidisciplinary care teams and surgical planning, which reduces maternal morbidity.3–8 Furthermore, the ability to correctly stratify the risk of PAS, including decreasing the risk with a “normal” ultrasound, reduces the possibility of iatrogenic complications associated with planned premature delivery, preoperative invasive procedures, and patient and provider anxiety.

The prenatal detection and risk stratification for PAS are primarily made by ultrasound. However, ultrasound is an operator-dependent imaging modality with substantial variability in image quality among providers. Furthermore, placental location and challenging imaging conditions, including elevated body mass index (BMI) or posterior placentation, may impede the sonographic detection of PAS markers. There has been limited consensus on the optimal approach to the ultrasound evaluation of patients at risk of PAS, such as the appropriate timing of screening, need for transvaginal ultrasound (TVUS) imaging, use of color and pulsed Doppler, angle of placental insonation, and equipment settings.

Despite a large body of literature on various PAS ultrasound markers and their screening performance, important inconsistencies in screening results persist. This is primarily because of the retrospective design of most studies, lack of standardized definitions of PAS markers, lack of agreement on the optimal gestational age for assessment, and inconsistencies in the approach to the ultrasound evaluation of the placenta.9 Furthermore, patients’ priori risks have a significant influence on the positive predictive value (PPV) of PAS markers. Recent data have shown that these markers are frequently present in women at low risk for PAS.10

In response to the need for standardizing the definitions of PAS markers and the approach to the ultrasound examination, the Society for Maternal-Fetal Medicine (SMFM) convened a task force with the goals of assessing PAS sonographic markers on the basis of available data and expert consensus, providing a standardized approach to the prenatal ultrasound evaluation of the uterus and placenta in pregnancies at risk of PAS, and identifying research gaps in the field. This manuscript provides information on the PAS Task Force process and outcomes.

**Procedure**

SMFM invited representatives from the American Institute of Ultrasound in Medicine (AIUM), American College of Obstetricians and Gynecologists (ACOG), American College of Radiology (ACR), International Society of Ultrasound in Obstetrics and Gynecology (ISUOG), Society for Radiologists in Ultrasound (SRU), American Registry for Diagnostic Medical Sonography (ARDMS), and Gottesfeld-Hohler Memorial Ultrasound Foundation (GOHO) to the PAS Task Force (Table 1). The PAS Task Force was organized into 4 subcommittees: first-trimester markers, placental lacunae, uteroplacental interface, and uterovesical interface, which also included miscellaneous markers (cervical invasion, placental bulge, and exophytic mass). Each subcommittee was chaired by a PAS Task Force member and included at least 2 additional members. The authors S.A.S. and A.A. participated on all 4 subcommittees. Each subcommittee performed a detailed literature review of respective markers. This included the definitions of each marker, indication for the examination, reported diagnostic accuracy of each marker, gestational age at assessment, and optimal ultrasound approach for evaluation.3,7,11–42 The task force held a face-to-face meeting in December 2018 in Boston, MA, to review each subcommittee’s findings and recommendations. Expert consensus opinion was obtained when available data could not provide clear definitions for each PAS marker and/or the optimal approach for screening. In addition, research gaps were noted.

| TABLE 1 |
| Task force participating members and societies |
| Alfred Abuhamad | SMFM, Co-Chair |
| Scott A. Shainker | SMFM, Co-Chair |
| Beverly Coleman | ACR |
| Ilan E. Timor | GOHO |
| Amamath Bhide | ISUOG |
| Bryann Bromley | AIUM |
| Alison G. Cahill | ACOG |
| Joshua A. Copel | GOHO |
| Manisha Ghandi | ACOG |
| Jonathan L. Hecht | SMFM |
| Katherine M. Johnson | SRU |
| Joan Mastrobattista | AIUM |
| Jennifer Philips | SMFM |
| Lawrence J. Platt | GOHO |
| Alirez A. Shamshirsaz | GOHO |
| Thomas D. Shipp | ARDMS |
| Robert M. Silver | SMFM |
| Lynn L. Simpson | SMFM |

ACOG, American College of Obstetricians and Gynecologists; ACR, American College of Radiologists; AIUM, American Institute of Ultrasound in Medicine; ARDMS, American Registry for Diagnostic Medical Sonography; GOHO, Gottesfeld-Hohler Memorial Society; ISUOG, International Society of Ultrasound in Obstetrics and Gynecology; SMFM, Society for Maternal-Fetal Medicine; SRU, Society of Radiologists in Ultrasound.

Literature Review

As outlined in a recent Obstetrics Care Consensus, ultrasound is the primary screening modality for PAS.7 Ultrasound markers of PAS can be seen early in the first trimester, although historically screening is predominantly performed in the second and third trimesters of pregnancy. The ultrasound marker with the strongest association with PAS is a persistent placenta previa at the time of delivery, in the setting of a previous cesarean delivery.5,43 Other classic sonographic markers of PAS include the presence of placental lacunae (Figure 1), loss of the retroplacental hypoechoic zone (Figure 2), thinning of the retroplacental myometrium (Figure 3), hypervascularity of the uterovesicle or retroplacental space (Figure 4), extension of placental tissue into the uterus and/or bladder, and placental bridging vessels (Figures 5 and 6).11,39–41,44–46 The presence of excessive color Doppler flow in the retroplacental space along with abnormal placental bridging vessels has also been associated with PAS (Figure 6).6,7,46,47

Task force members identified several significant limitations to the current literature on this subject. Most studies are retrospective in design, lack control “low-risk” comparison groups, and do not provide clear definitions of the PAS markers being studied, which limits the ability to make comparisons among studies and combines many of the reported diagnostic performance statistics.9 It is important to note that most studies were designed to highlight associations between ultrasound markers and PAS; thus, results cannot be inferred to reflect on the diagnostic and predictive accuracy of these markers. Furthermore, most of the studies included cases with surgically or histologically confirmed placenta accreta, making it difficult to extrapolate information regarding the validity of PAS markers in the first-trimester ultrasound.

First Trimester

Several PAS ultrasound markers have been described in the first trimester. The prevalence and type of markers of PAS in
the first trimester vary between the early first trimester of pregnancy (6–9 weeks of gestation) and the later first trimester of pregnancy (11–14 weeks of gestation). In a patient with a previous cesarean delivery, implantation of a gestational sac in the lower uterine segment on ultrasound early in the first trimester is one of the most common markers for PAS in the first trimester. A cesarean scar pregnancy (CSP), defined as a gestational sac implanted in the lower uterine segment within or in close proximity to the cesarean scar, markedly increases the risk of PAS (Figures 7 and 8). When a gestational sac is implanted within a cesarean scar “niche,” extraterine extension of placental tissue and the need for hysterectomy is substantially increased. Histopathologically, a CSP is not distinguishable from that of second trimester PAS, suggesting that they represent a continuum in the pathogenesis of the disease. In 1 study of 68 patients with prenatally identified PAS confirmed at delivery and a technically adequate ultrasound examination between 6 and 9 weeks of gestation, all were noted to have a low implantation of the gestational sac.

In the late first trimester, a low implantation of the gestational sac is identified in approximately 28% of patients with PAS (Figure 9). This is explained by the growth of the gestational sac toward the fundal portion of the endometrium as the pregnancy progresses. If the placenta is anterior and under the cesarean scar, it can remain anchored to the cesarean scar significantly raising the risk of PAS.

In a recent systematic review and meta-analysis evaluating the first-trimester detection of PAS in high-risk women, a gestational sac implanted in close proximity to a uterine scar was identified in 82.4% of women (95% confidence interval [CI], 85.8–95.7) with confirmed PAS. However, the sensitivity of this finding in the same analysis was found to only be 44% (95% CI, 21.5–69.2), highlighting the limitations of assessing the risk in the first trimester.

Other markers that have traditionally been described in the second and third trimesters have also been identified in the late first trimester and are variably associated with PAS. The definitions of the individual markers have been inconsistent but include the presence of placental lacunae, an abnormal bladder interface, uterovesicular hypervascularity, and loss of the retroplacental clear zone. This last marker is particularly helpful in
determining the extent of PAS, carrying a sensitivity of 84.3% and diagnostic odds ratio (DOR) of 23.8 (95% CI, 10.6–57.2). For cases that were ultimately determined to be placenta percreta at the time of delivery, the sensitivity of this marker was 92.1% with a DOR of 20.4 (95% CI, 6.0–108.7). Placental lacunae and posterior bladder wall interruption or abnormalities were also noted in the late first trimester in cases of percreta, each with sensitivities between 80% and 90%. Anterior placentation at the first-trimester sonographic evaluation is more common in women with PAS at delivery. Similar to findings in the second and third trimesters, the presence of multiple PAS markers in the first trimester increased the diagnostic accuracy.

**Second and Third Trimesters**

**Placental lacunae**

The presence of placental lacunae has been commonly reported in association with PAS. Often described as numerous, large, and irregular echolucencies within the parenchyma of the placenta, placental lacunae should raise the concern for underlying PAS. Previous studies in PAS differ substantially in the definition of lacunae with regard to the required size, number, and presence of blood flow in lacunae. Lacunar blood flow has been described as low-velocity flow in some reports, although others report turbulent high-velocity flow. Finberg and Williams, in their 1992 seminal work on ultrasound markers of PAS, proposed a placental lacunae vascular space grading system, with grade 0 indicating no placental lacunae, grade 1+ including placentas with 1 to 3 small lacunae, grade 2+ containing 4 to 6 larger and irregular lacunae, and grade 3+ describing a placenta with many large and “bizarre-appearing” lacunae throughout (Figure 1). Grade 3+ should raise a high degree of concern for PAS. Yang et al investigated the association of lacunae with maternal complications in 51 pregnancies at risk of PAS, with previous cesarean delivery and persistent placenta previa. The authors found that the need for cesarean hysterectomy and maternal complications positively correlated with the number of lacunae. Furthermore, the absence of lacunae in pregnancies with placenta previa and previous cesarean delivery is a reassuring sign with negative predictive values (NPV) ranging from 88% to 100% for PAS.

**Abnormal uteroplacental interface**

Abnormal uteroplacental interface has been described as loss of the retroplacental hypoechoic zone, myometrial thinning, and increased vascularity on color Doppler. There is substantial variation in the definition and statistical performance of the loss of the retroplacental hypoechoic zone for predicting PAS. The classic definition of myometrial thinning is a retroplacental myometrial thickness of <1 mm. However, only 50% of cohort studies of PAS...
provided a working definition of this marker. In addition, myometrial thinning is often seen in advancing gestation and can be more pronounced in women with previous cesarean delivery. This marker can be iatrogenically produced and/or exaggerated with undue transducer pressure, highlighting the need to minimize transducer pressure on the abdomen when examining the placenta.

**Uterovesical interface**

Uterovesical interface markers include bridging vessels, increased vascularity between the uterus and bladder, and interruption of the bladder wall. Bridging vessels represent neovascularity atop the uterine serosa and frequently within the uterovesical interface, depending on placental position. The color Doppler finding of neovascularity is found in most cases of PAS and reflects the engorged myometrial vessels in the area of placation. The hypervascular uterovesicle interface also reflects the dilation of the uteroplacental vasculature and the chaotic vascular growth and flow within this space. Sensitivity and specificity of hypervascular uterovesical interface are variably reported as ranging from 11% to 100% and 36% to 100%, respectively. Bladder varicosities are often seen in the absence of PAS and in the setting of placenta previa. In addition, hypervascularity of the lower uterine segment and/or cervix can be seen in placenta previa without PAS, highlighting the difficulty in assessing this marker. Interruption of the echogenic bladder wall, especially with placental tissue, is a clear marker of PAS as it represents an extension of placental tissue beyond the uterus (Figure 6). Engorged vessels in the uterovesical
interface may result in ultrasound echo dropout, thus mimicking placental extension into the uteroplacental interface.47

Miscellaneous markers
There are numerous other miscellaneous markers for PAS that have been described. Of these, placental bulge, exophytic placental mass, and cervical vascular extension were reviewed by the committee. The placental bulge is described as a deviation of the uterine serosa, away from the expected planes, changing the uterine contour (Figures 5, 6, and 10).13,23,47 In a small study comparing ultrasound and magnetic resonance imaging (MRI) features that may predict placental invasion, the placental bulge was found to have a specificity of 88%, highlighting this marker as a reassuring sign when absent.23 An exophytic mass represents a protrusion of placental tissue outside the uterus and is diagnostic of placenta percreta when seen. Similarly, the absence of this finding is reassuring, as it carries an 80% to 100% specificity, albeit with a maximal sensitivity of 42%.23,34,61 In 1 systematic review of PAS, only cases of placenta increta and placenta percreta had a placental bulge or an exophytic mass, highlighting their relative rarity in clinical practice.46 Vascular cervical extension is defined by placental extension into the cervix involving at least the inner one-third, best seen on TVUS. This marker performs poorly, however, as it was identified in greater than 50% of the time in a low-risk cohort without PAS.10

Combined markers
When ultrasound markers are combined, their performance improves substantially, yielding a sensitivity of 81.1% (95% CI, 69—94), specificity of 98.9% (95% CI, 98—100), PPV of 90.9% (95% CI, 82—100), and NPV of 97.5 (95% CI, 96—99).18 Thinning of the myometrium and loss of the retroplacental clear zone seem to have the highest interobserver agreements.13 Most data regarding the predictability of PAS ultrasound markers have been derived in single centers with a relatively high volume of PAS cases. The true

FIGURE 8
Ultrasound markers commonly seen in cesarean scar pregnancy

Transvaginal ultrasound in grayscale imaging (A) and color Doppler imaging (B) of a cesarean scar implantation (arrow) and bulging of the bladder line (arrowheads). Shainker. Special Report of the SMFM: Definition of markers and ultrasound examination in pregnancies at risk of PAS. Am J Obstet Gynecol 2021.

FIGURE 9
Low implantation pregnancy

A, TVUS at 11 weeks of gestation in grayscale imaging in a pregnancy with low implantation of the gestational sac. Note that the placenta is covering the internal os (arrow) of the cervix (C). B, TVUS at 11 weeks of gestation in color Doppler imaging in a pregnancy with low implantation of the gestational sac. Note the presence of an extensive vascularity extending into the cervix (C).

sensitivity of these markers in the community setting remains unknown.

**Existing Consensus Guidelines**

The European Working Group on Abnormally Invasive Placenta (EW-AIP) and the International Federation of Gynecology and Obstetrics (FIGO) developed language outlining various PAS ultrasound markers and suggested standardized definitions for each.40,41 The EW-AIP established a list of 11 PAS ultrasound markers (6 in 2-dimensional [2D] grayscale, 4 in 2D color Doppler, and 1 in 3-dimensional [3D] power Doppler). This was derived from the analysis of 23 manuscripts reviewed by an expert panel. The panel placed importance on defining each PAS marker without ambiguity but did not report on their predictive values.41 The recent FIGO consensus guidelines for PAS prenatal screening and diagnosis listed the EW-AIP 11 markers along with their definitions. These guidelines did not recommend using certain markers over others, and acknowledged that none carries 100% sensitivity and specificity. The FIGO consensus guidelines also commented on the role of a CSP as the first-trimester precursor to PAS.40 Taking these published definitions into account, we reviewed the general utility of each ultrasound marker and utilized the these published definitions when possible and appropriate. We also attempted to consolidate some ultrasound PAS markers to simplify language and streamline definitions.

**Ultrasound Approach and Definitions of Placenta Accreta Spectrum Markers**

**General considerations**

We recommend starting the assessment with transabdominal imaging to obtain an overview of placental location and start assessing the regions of concern. TVUS is strongly recommended for the assessment of PAS. Transvaginal imaging optimizes resolution and allows for a detailed assessment of the lower uterine segment, posterior bladder wall, and cervix. The bladder should be partially full. Color Doppler should be utilized to assess for vascularity and placental extension into the uterine wall and surrounding structures. The transducer should be adjusted to operate at the highest clinically appropriate frequency, realizing that there is a trade-off between resolution and beam penetration.65 Ultrasound image magnification should be performed to enhance the visualization of target regions. When assessing the retroplacental region, perpendicular orientation of the angle of insonation and applying minimal transducer pressure are recommended. Given the continuum of disease from CSP to PAS, screening for PAS should begin early in the first trimester and continue throughout the pregnancy until practitioners have concluded whether there is sonographic concern for PAS.

**First trimester**

In the first trimester, a detailed evaluation of the uterus is necessary to determine the location of the gestational sac or placenta (depending on gestational age) in reference to the bladder, internal os, and cesarean scar. When performing TVUS, the maternal bladder should be partially filled, enough to allow for a sonographic window, without overfilling, which can result in distortion of the uterovesical interface. The target area should be magnified to occupy at least one-half of the ultrasound image, and focal zones should be appropriately placed. After 10 weeks of gestation, color Doppler can be used to assess for the presence of hypervascularity and lacunae; when possible, color Doppler should be limited to the placental region and not overlap the fetus. The definition of first-trimester PAS markers and the proposed ultrasound approach are presented in Table 2 and Box 1, respectively.

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**TABLE 2**

Definitions of placenta accreta spectrum markers in the first trimester of pregnancy

<table>
<thead>
<tr>
<th>Marker</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cesarean scar pregnancy</td>
<td>Gestational sac implantation in part or totally within the cesarean scar.</td>
</tr>
<tr>
<td></td>
<td>Gestational sac may have a teardrop or triangular shape.</td>
</tr>
<tr>
<td>Low implantation pregnancy</td>
<td>Gestational sac located close to the internal cervical os (up to 8 6/7 weeks of gestation) and/or placental implantation located posterior to a partially filled maternal bladder (up to 13 6/7 weeks of gestation).</td>
</tr>
</tbody>
</table>

Second and third trimesters
The antenatal diagnosis of PAS is most often made in the second and third trimesters of pregnancy. Classic sono-
graphic markers of PAS are typically described in women
with anterior placenta previa and previous cesarean
deliveries.6,7
Table 3 lists the proposed definitions of PAS ultrasound
markers in the second and third trimesters of pregnancy.
Other than placenta previa, placenta lacunae are
frequently described as classic ultrasound markers of
PAS. Lacunae can often be found in low-risk non-PAS
pregnancies; however, when present in women with risk
factors, they carry the highest sensitivity of all 2D gray-
scale markers.10,66 When lacunae are large, numerous,
and with irregular borders, their association with PAS is
increased.10 Lacunae tend to congregate near the area of
placental invasion; thus, the presence of lacunae blood
flow on grayscale and color Doppler is also associated
with PAS.
Sonographic assessment of the uteroplacental inter-
face includes evaluation of the loss of the retroplacental
hypoechoic zone and thinning of the retroplacental
myometrium.5,9,13,39,46,47 The uteroplacental interface is
often inferior to the posterior bladder wall. Similar to
other PAS markers in women with an anterior placenta
and previous cesarean delivery, the uteroplacental
interface is best seen utilizing a combination of trans-
abdominal and transvaginal imaging with a partially fil-
led bladder.
The uterine contour is optimally evaluated when the
placenta is anterior, utilizing a partially filled bladder as the
acoustic window. This marker, often referred to as the
“placental bulge,” can be seen on both transabdominal and
transvaginal imaging. The bulge does not always reflect a
“through-and-through” defect of the uterine wall; rather, it
highlights the area of scar dehiscence and thinning of the
myometrium in areas of PAS.12,46,67 Although this finding
has not been correlated specifically with increased
morbidity or mortality, its presence raises the concern for
extrauterine placental extension (placenta percreta). Color
Doppler is often helpful to determine the extent of vascular
invasion.
Bridging vessels are defined as vessels, identified on
color Doppler, that extend from the placenta across the
myometrium and/or beyond the uterine serosa. This has
been considered as one of the “classic markers” of PAS
over the years but has lacked consistency in its de-
inition.6,8 Typically seen running perpendicular to the
long axis of the uterus, bridging vessels are often
associated with the presence of a placental bulge with
placental tissue extending beyond the uterine serosa.51
Unlike other markers that can often be seen in cases
without PAS, this marker is rarely seen in cases without
PAS.10
It is important to note that the placenta is a 3D
structure, and thus, comprehensive sonographic
assessment is required in pregnancies at risk of PAS. This
is best performed by obtaining several parasagittal and
transverse planes of the placenta during the ultra-
sound examination. Special attention should be given to
the retroplacental area and the lower segment and cer-
vical regions. This is best achieved with a combined
transabdominal and transvaginal approach. Table 4
presents the sonographic approach in the second and
third trimesters of pregnancy.

Discussion
This document, endorsed by AIUM, SMFM, ACR, and
GOHO, supported by ACOG and ISUOG, and approved
by SRU, with ARDMS participating in the development
and production of the document, presents a
consensus-based approach to ultrasound examination
and assessment of PAS. Pregnancies with PAS are at a
significantly increased risk of maternal and fetal mor-
bilidades and mortalidades. Prenatal detection of PAS re-
duces pregnancy complications and improves
outcomes.1,7,8,43 Several PAS markers have been
identified and studied. There has been an effort to
standardize the definitions of PAS markers, with the
ultimate goal of improving risk stratification by

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**BOX 1**

**Approach to ultrasound examination in the first trimester of pregnancy**

- Transvaginal ultrasound is recommended in early pregnancy, and transabdominal ultrasound may be performed when appropriate.
- Detailed evaluation of the uterus in the midsagittal plane to document the gestational sac (up to 8 6/7 weeks of gestation) and/or the placental location (up to 13 6/7 weeks of gestation).
- Documentation should include reference to the position of the sac and/or placenta relative to the bladder, cesarean scar (if present), and internal cervical os.
- Color Doppler imaging using a low-velocity scale, low wall filter and high gain to maximize detection of flow (adjusting as needed for body habitus and other clinical factors).9
- Evaluate shape of gestational sac (up to 8 6/7 weeks of gestation).
- Imaging should be performed with a partially filled maternal bladder.
- The area of interest should be magnified so that it occupies at least half of the ultrasound image with the focal zone at an appropriate depth.

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*Color Doppler should be limited to the areas of interest and avoid the embryo or fetus whenever possible.*

ultrasound resulting in improved prenatal detection and thus positively impacting pregnancy outcomes. This task force, assembled by SMFM with representation from multiple societies and organizations, provides definitions for PAS markers along with a standardized approach to the ultrasound examination in pregnancies at risk of PAS.

It is important to recognize that the proposed definitions of PAS markers are based on the current literature, along with expert opinion when data are lacking. As ultrasound technology advances with improved tools, the detection of abnormal placental invasion and vasculature should be greatly enhanced. Advancement in ultrasound technology may render the definitions of some existing PAS markers obsolete. An example is the current definition of abnormal placental vasculature. Emerging ultrasound technology has resulted in significant improvements in the sonographic detection of low-velocity vascular flow. Accordingly, this may result in difficulty differentiating normal from abnormal placental flow.

It is also important to note that many of the markers presented in this document have been studied in women with previous cesarean deliveries and placenta previa. In women without these risk factors, however, the markers are seen often and typically in the absence of PAS. As such, the
recommended ultrasound approach to women without these risk factors remains largely unknown and is an area of great interest.

There are several limitations of ultrasound in detecting PAS. Ultrasound is an operator-dependent imaging modality and, thus, is highly dependent on the skills of the examiner performing the ultrasound. The detection rates will depend on placental location and maternal imaging conditions that impact sono- graphic visualization of markers. A standardized approach to the performance of the ultrasound examination along with consensus-based definitions of PAS markers will result in more consistency in diagnosis and allows for the evaluation of markers across centers to improve diagnostic performance. Despite optimizing a systematic approach to ultrasound examination for PAS markers, inherent limitations of ultrasound may diminish detection rates. These include posterior placenta, with limited sound penetration and resolution; elevated maternal BMI; and uterine leiomyomata. The task force also identified research gaps for sonographic markers of PAS (Box 2). We hope that future research will use the definitions hereby provided along with a standardized approach to the ultrasound examination to facilitate data comparison. In addition, although the scope of this task force was focused on ultrasound examination, we hope similar efforts are made in the future to provide guidance on the use of MRI for the evaluation of PAS.

As PAS has become more prevalent, the need for agreement on the definitions of ultrasound markers and sonographic approach to the patient at risk of PAS is crucial. This document provides necessary steps toward consistency in the definitions of PAS markers and the approach to diagnosis. Accurate antenatal diagnosis is paramount in optimizing maternal and fetal outcomes. Further work will be needed to measure the impact of the proposed standardized definitions, along with the approach to ultrasound examination.

REFERENCES


All authors and Committee members have filed a conflict of interest disclosure delineating personal, professional, and/or business interests that might be perceived as a real or potential conflict of interest in relation to this publication. All conflicts have been resolved through a process approved by the Executive Board. SMFM has neither solicited nor accepted any commercial involvement in the development of the content of this publication.

This document has undergone an internal peer review through a multilevel committee process within SMFM. This review involves critique and feedback from the SMFM Publications and Document Review Committees and final approval by the SMFM Executive Committee. SMFM accepts sole responsibility for the document content. SMFM publications do not undergo editorial and peer review by the American Journal of Obstetrics & Gynecology. The SMFM Publications Committee reviews publications every 18 to 24 months and issues updates as needed. Further details regarding SMFM publications can be found at www.smfm.org/publications.

SMFM has adopted the use of the word “woman” (and the pronouns “she” and “her”) to apply to individuals who are assigned female sex at birth, including individuals who identify as men and nonbinary individuals who identify as both genders or neither gender. As gender-neutral language continues to evolve in the scientific and medical communities, SMFM will reassess this usage and make appropriate adjustments, as necessary.

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