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Modified Delphi study of ultrasound signs associated with placenta accreta spectrum

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CONTRIBUTION

What are the novel findings of this work?

Using a structured Delphi process informed by a systematic review, we found that targeted detailed sonography looking for most established standardized ultrasound signs of placenta accreta spectrum (PAS) and involvement of the cervix is recommended for the prenatal evaluation of pregnant patient with a high risk of PAS.

What are the clinical implications of this work?

Pregnant women with a high probability of PAS at birth should be referred to experienced ultrasound operators. Prenatal evaluation should include a TVS confirming the precise position of the placenta and anatomy of the cervix. New ultrasound signs that can be obtained with routine ultrasound equipment should be included in future clinical research.

ABSTRACT

Objective To determine, by expert consensus, through a modified Delphi process the role of standardized and new ultrasound signs in the prenatal evaluation of patients at high-risk of placenta accreta spectrum (PAS).

Method A systematic review of articles providing information on the ultrasound imaging signs or markers associated with PAS was performed before the development of questionnaires for the first round of the Delphi process. Only peer-reviewed original research studies in the English language describing one or more new ultrasound signs for the prenatal evaluation of PAS were included. A three-round consensus building Delphi method was then conducted under the guidance of a steering group. The Steering group included nine experts who invited an international panel of experts in obstetric ultrasound imaging and evaluation of patients at high-risk of PAS. Strong consensus was defined as a 70% agreement between participants.

Results The systematic review identified 15 articles describing eight new ultrasound signs for the prenatal evaluation of PAS. A total of 35 external experts were approached, of whom 31 agreed and entered the first round. Thirty external experts (97%) and seven experts from the steering group completed all three rounds. A consensus was reached that a prior history of Caesarean deliveries, myomectomy or PAS should be the indication for detailed PAS ultrasound assessment. The panellists also reached a consensus that seven of the 11 conventional signs of PA, namely i) loss of the “clear zone”, ii) myometrial thinning, iii) bladder wall interruption and the presence of a placental bulge, iv) exophytic mass, v) uterovesical hypervascularity, vi) placental lacunae and vii) bridging vessels should be included in the examination. A consensus was not reached for any of the eight new signs identified by the systematic review. For other ultrasound features that increase the probability of PAS at birth, the panellists reached a consensus for the finding of an anterior placenta previa or a placenta previa with cervical involvement. Only the quantification of placental lacunae using an existing score obtained a strong consensus. For predicting surgical outcome in patients with a high probability of PAS at delivery, a consensus was obtained for i) loss of the “clear zone”, ii)

bladder wall interruption, iii) the presence of placental lacunae and iv) a placenta previa involving the cervix.

Conclusions We have confirmed the continued importance of eight established standardised ultrasound signs of PAS, highlighted the role of TVS in evaluating the placental position and anatomy if the cervix, and identified new ultrasound signs that may become useful in the prenatal evaluation and management of patients at high-risk of PAS at birth.

INTRODUCTION

Placenta accreta spectrum (PAS) occurs when the gestational sac implants and the definitive placenta develops within a uterine scar area[1,2]. The loss and remodelling of the normal uterine wall structure following surgery allows the extravillous trophoblast (EVT) to reach and contribute to the transformation of large peripheral uterine arteries under the scar area[3]. Continuous high-pressure arterial intervillous flow is probably the main factor for the increase in fibrinoid deposition at the utero-placental interface with progressive distortion of the above cotyledonary[4]. Loss of parts of the physiological placental detachment uterine site is associated with high maternal morbidity and sometimes mortality due to massive obstetric haemorrhage (MOH), in particular, when the surgeon is unaware and attempts to detach the accreta area manually at delivery[5].

Prenatal diagnosis of PAS is associated with reduced haemorrhagic morbidity at delivery[6]. Tabsh et al[7] were the first in 1982 to describe the ultrasound features of a case of placenta increta with grey-scale imaging (GSI). A decade later, using colour Doppler imaging (CDI), Chou et al[8] first reported on the changes in the utero-placental circulation associated with PAS. There has been considerable variability in the ultrasound equipment used and signs and diagnostic criteria used for the perinatal evaluation of PAS[9] and in particular of its most common form i.e. placenta previa accreta[10]. In 2016, the European Working Group on abnormally invasive placenta (EW-AIP) proposed to standardize the ultrasound signs identified up to February 2013[11].

Over the last decade, new ultrasound signs of PAS have been reported in the international literature. Thus, we conducted a survey using a modified Delphi methodology including a systematic review to gain expert consensus on the role of old and new ultrasound signs in the prenatal evaluation and management of patients at high-risk of PAS at birth. This technique was selected because it has been used widely to generate robust consensus in healthcare research[12].

METHODS

Systematic literature review

A systematic review of articles providing data on ultrasound imaging signs or markers associated with PAS was performed before the development of the questionnaires for the first round of the Dephi procedure as suggested by Sinha et al[12]. PubMed, Google Scholar, and MEDLINE were searched for studies published between our last systematic review[9] that ended on the 30th of March 2016 and the 31st of May 2022. The search protocol was designed *a priori* by E.J. and A.B and completed in compliance with the guidelines for "Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA)[13]. The overall search strategy was inclusive of MeSH (Medical Subject Headings) headings for the following terms "placenta accreta" OR "placenta increta" OR "placenta percreta" OR "abnormally invasive placenta" OR "morbidly adherent placenta" OR "placenta adhesive disorder". We combined these with terms related to "sonography", "ultrasound imaging", "new ultrasound sign" "grey-scale imaging (GSI)", three-dimensional (3D) ultrasound and "colour Doppler imaging (CDI)". Searches were performed in the title and abstract fields. The reference lists of selected studies were manually searched for additional eligible papers. Only peer-reviewed original research studies in the English language describing one or more new ultrasound sign for the prenatal evaluation of PAS were included. Exclusion criteria included reviews, opinions, letters, protocols, conference proceedings, articles published after 31st May 2022 and non-human studies.

Steering group and expert panel

The Steering group included nine experts; EJ and ZA designed the questionnaire and 7 members provided valuable feedback. The decision was made that EJ and ZA will not participate in the Delphi process but other seven members remain eligible.

Thirty-five additional experts were invited by email subsequently after recommendation by their colleagues on the steering group. Potential participants were sent study information including an invitation letter and a copy of the protocol by email.

Each member of the steering group were asked to provide the name of up to 4 experts defined as clinicians with at least 10 years' experience in obstetric ultrasound imaging including PAS who had published at least one recent article on the use of ultrasound imaging in prenatal evaluation of PAS and/or have an affiliation with a national or international organization dedicated to improving the diagnosis and management of PAS. The final list included individuals who replied to our invitation, citing interest in their involvement. Once prospective panellists agreed to participate in the study, their email addresses were added to the final participant list for survey distribution and were invited to be listed as collaborators on a future publication. All responses to the questionnaires received through an independent third-party email to ensure anonymity.

Overall, the final panel included 37 experts from 21 different countries, including four from low and middle-income countries (LMICs). Recruitment and the three rounds of Delphi questionnaires were completed over a 3-month period between August and November 2022.

Delphi rounds

A three-round Delphi consensus method was performed to identify the ultrasound signs or markers of PAS and evaluate the use of these signs in future clinical research studies. The questionnaires for the three rounds were developed by E.J. and Z.A., reviewed and agreed by the steering panel. These questions concerned: (1) clinical and sonographic criteria used to define patients at high-risk of PAS at birth; (2) relevance of each ultrasound sign in the prenatal evaluation of patients at high-risk of PAS at birth; (3) optimal gestational age to assess for signs suggesting PAS during the second half of pregnancy; (4) relevance of various established ultrasound techniques available on standard ultrasound machine such as transvaginal ultrasound (TVS), CDI, pulsed Doppler ultrasound and 3D (Doppler) ultrasound and new ultrasound techniques in acquiring old and new ultrasound signs associated with

PAS; and (5) value of established and new ultrasound signs and other ultrasound features in the prenatal assessment and evaluation of surgical outcomes in patients at high-risk of PAS at birth.

After the first round, the answers for each question from all experts were analysed and corresponding data were used to develop questionnaires for the second and third rounds. All experts who agreed to participate in the Delphi procedure were invited to participate in the second and third rounds only if they had replied to the first questionnaire. Experts were given 10 days to provide their final responses to each questionnaire. A single reminder was sent if no response was received within two weeks.

A consensus was predefined as proportion of agreement of $\geq$70 %. The rate of agreement (RoA), where RoA = (agreement − disagreement)/ (agreement + disagreement + unsure) × 100 was calculated for the third questionnaire.

In round 1 questionnaire, participants were asked to: i) identify demographic and clinical characteristics that are associated with a higher risk of PAS at birth, and in whom a detailed PAS ultrasound assessment is indicated; ii) to select the ultrasound signs that should be included in the routine mid-trimester scan mid-gestation scan report of high-risk patients based on risk factors and/or placental appearance; and iii) to select second or third trimester non-PAS ultrasound features that increase the probability of PAS at birth. Participants who completed questionnaires in round 1 were invited to participate in rounds 2 and 3.

In round 2, the participants were asked to select the optimal gestational age at which to identify ultrasound signs associated with PAS and to determine which signs should be quantified. Participants were also asked to provide suggestions on how to quantify the different signs. Only ultrasound signs that reached an agreement of $\geq$ 70% in round 1 were included in round 2.

In round 3, the participants were sent a single questionnaire which focused on ultrasound signs of PAS and other features to be used for future clinical research on predicting surgical outcomes in patients with a high probability of PAS at birth. This questionnaire

included ultrasound signs of PAS from round 1 that that did not reach a strong agreement but could be obtained with standard ultrasound equipment.

RESULTS

Literature search

The initial search identified 1248 articles with cross-referencing providing an additional three studies, making a total of 1251 potentially relevant articles. After exclusion of duplicates and the two articles that were not available, 880 remained. On screening titles and abstracts, a further 793 were excluded, as the data they reported were not relevant. 87 studies remained, which were obtained for full text review. An additional 72 articles were excluded after full review, leaving 15 studies describing eight new ultrasound signs for the prenatal evaluation of PAS[14-28]. The process of selection of these articles is summarized in Figure S1. The characteristics of studies identified by the systematic review are presented in Table S1.

Delphi procedure

A total of 37 experts (7 experts from the steering group and 30 external experts) completed of all three rounds of the Delphi questionnaires.

Delphi study round 1

A consensus was reached for three of the 11 demographic and clinical characteristics used to identify high-risk patients in whom detailed PAS ultrasound assessment is indicated. These included a prior surgical history of ≥1 CDs, myomectomy, or prior PAS (Table S2). Seven of the 11 established standardised ultrasound signs[11] reached a consensus ≥70% among the panellists, including the loss of the "clear zone" (hypoechoic retroplacental zone), myometrial thinning and bladder wall interruption and the presence of a placental bulge, exophytic mass, uterovesical hypervascularity, placental lacunae and bridging vessels (Table 1). None of the eight new signs identified in the present systematic review[14-28] reached a predefined consensus threshold as ultrasound findings that increase the probability of PAS at birth. In addition, the panel was queried about second or third trimester ultrasound findings that are not specific for PAS i.e. placental position, placental thickness, anatomy of the cervix, multiple pregnancies and abnormal fetal growth, yet still may increase the probability of PAS at birth (Table S3). A consensus was obtained for the presence of an anterior placenta previa, as

defined by a placental edge < 0.5cm from the internal os or the placenta completely covering it [29] and a placenta previa with cervical involvement.

Delphi study round 2

No consensus was reached among the panellists regarding the optimal gestational age at which to identify the different ultrasound signs associated with PAS that reached a consensus in round 1 (Table S4). Four experts recommended the 11-14 scan period. There was a consensus to quantify the presence of placental lacunae (Table 2). The method of choice to quantify placental lacunae for 26 of the 37 (70.3%) of the panellists was the score proposed by Finberg and Williams[30]. Quantitative methods were also proposed for measuring the size of area of the loss of "clear zone", myometrial thinning, bladder wall interruption, placental bulge, uterovesical hypervascularity and bridging vessels (Table 2). One expert suggested to use the scores recently proposed by Del Negro et al[31] for the loss of the "clear zone", bladder wall interruption and uterovesical hypervascularity.

Delphi study round 3

Table 3 displays the RoA among experts regarding the role of the standardised ultrasound signs that reached a strong consensus in round 1, new signs identified by the systematic review that can be obtained on regular ultrasound equipment and other ultrasound features that may predict surgical outcome at delivery. A consensus was obtained for loss of the "clear zone", bladder wall interruption, the presence of placental lacunae, and placenta previa involving the cervix i.e. covering partially or completely the inner os of cervix.

DISCUSSION

Main findings

Strong agreements were found for seven of the 11 standardised TAS signs currently used in the prenatal evaluation of patients at a high-risk of PAS at birth. The panel also agreed that TVS evaluation of the lower segment could contribute to both prenatal management and in predicting surgical outcomes. By contrast, none of eight new ultrasound signs associated with PAS identified in the systematic review were endorsed by more than 70% of panellists, perhaps due to technical limitations in the availability of a specific software on routine ultrasound equipment and/or limited prospective data on their use.

Comparison with other studies

TAS descriptors of PAS proposed by the EWAIP were developed in 2014 during a meeting of 29 European health care professionals and basic scientists with an interest in abnormal placentation. They used the antenatal ultrasound signs of PAS identified in a systematic review of 23 studies published before the 7th of February 2013[32]. Our modified Delphi process involved 37 experts in obstetric ultrasound imaging and included the evaluation of the risk factors of PAS, both PAS TAS and standardised TVS signs and the possible quantification and gestational age at which signs are best identified. We also evaluated the role of new ultrasound signs that can be obtained with regular ultrasound equipment in determing surgical outcomes.

The vast majority of PAS cases are now found in patients with at least one prior CDs, presenting with placenta praevia[5,10,33,34] and targeted ultrasound screening protocols for these patients improves perinatal outcomes[35]. We obtained a consensus for patients with a previous history of CD, myomectomy, or (prior) PAS (Table S2) and for the presence of an anterior placenta previa and a placenta previa with cervical involvement on TVS (Table S2). Pregnant patients with a history of prior CD or PAS, presenting with an anterior low-lying/placenta previa at the routine mid-pregnancy scan should be systematically referred to a specialist unit with expertise in the imaging of abnormal placentation[36]. The panel also advised screening for PAS

in patients with prior myomectomy, however, the risk of PAS after myomectomy is low [37] and only 9 cases of myomectomy scar pregnancies have been reported[38].

There are limited data on the evolution and changes of ultrasound signs associated with PAS with advancing gestation[3,39-44]. A multivariate analysis found that true positives cases of PAS were more likely to present after 16 weeks with loss of clear zone, myometrial thinning, irregular bladder wall, placental lacunae, and vascular abnormalities on CDI[40]. Only a few of the panellists, recommended their evaluation at 11-14 weeks gestation (Table S4). The panel also advised measuring the corresponding surface area (Table 2). These signs are likely to be more pronounced in the third trimester, in particular in patients with prior multiple CDs. Twenty-seven recommended a quantitative assessment for placental lacunae and use the lacunae score of Finberg and Williams[30]. The definition of what constitutes subplacental or utero-vesical "hypervacularity" remains elusive. Haidar et al, using Virtual Organ Computer-Aided Analysis (VOCAL) software to calculate the vascularization index of subplacental blood flow in high-risk patients at 28-32 weeks found that it can predict PAS at birth[45]. These new scores and index systems require independent evaluation and validation by other researchers to be recommended for clinical use.

The systematic review identified eight new ultrasound signs of PAS at birth (Table 1). Three of these signs require ultrasound techniques and/or software that are not available on routine ultrasound machines, limiting their widespread use in practice. A recent report by the Society for Maternal-Fetal Medicine (SMFM)[46], indicates that most studies on the prenatal ultrasound evaluation of PAS are retrospective in design and lack control "low-risk" comparison groups. Twelve of the 15 studies identified in the present systematic review had the same methodologic characteristics (Table S1) indicating the need for further prospective case-control studies.

Strengths and limitations

Our study had several strengths. The Delphi method used in our study is a well-established process used for obtaining group consensus on complex topics and it avoids situations where

the group is dominated by the views of a few individuals[12,47]. We included international experts in obstetric ultrasound from different nationalities and diverse expertise to ensure multiple participant views would be captured. Some of the new ultrasound signs included in the questionnaire of the first round were obtained from articles published recently and thus may not have tested by most of the panellists limiting the generalizability of our results.

Future perspectives

Overall, PAS is a clinic-pathologic diagnosis and prenatal imaging can only provide an estimation of the probability of finding abnormal attachment of one or more placental cotyledons to the uterine wall at birth. Ultrasound imaging can also contribute to the pre-operative evaluation of patients with a high-probability of PAS[21,24,25,31,48-52]. Abnormalities of utero-placental circulation[21,24,49,52] on TAS and short cervical length on TVS[48,50] increase the odds of intra-operative complications. Major disruptions of uterine wall architecture such as those found associated with placental bulge, are also more strongly associated with intra-partum hemorrhage than the findings of accreta villous tissue[52]. Our panellists reached a consensus for loss of the "clear zone", bladder wall interruption and the presence of placental lacunae and a placenta previa involving the cervix in predicting surgical outcomes (Table 3). A consensus was reached for the presence of a placenta previa with involvement of the cervix i.e partially or completely covering the cervix (Table S3) and 25 out of 37 panellists identified intracervical lakes as a new ultrasound sign to be reported in patients at high-risk of PAS (Table 1). These findings highlight the pivotal role of TVS in the prenatal evaluation of PAS.

Conclusions

Using a robust consensus technique, supported by a systematic review, we found that established standardised ultrasound signs continue to be used worldwide in evaluation of patients at high-risk of PAS and we highlighted the role of TVS. Further research should include large, prospective, multicentre, international cohorts followed longitudinally with clear

definitions of ultrasound signs that can be obtained with regular ultrasound equipment in the screening of patients at high-risk of PAS.

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Table 1: Ultrasound signs to be reported at the mid-gestation scan in pregnant patients at high risk of PAS based on clinical risk factors and/or placental ultrasound appearance.

ULTRASOUND DESCRIPTION	n/Yes (%)
Loss of the "clear zone" (hypoechoic retroplacental zone)[11] **GSI**: Loss or irregularity of the normal hypoechoic plane in the uterine wall underneath the placental bed.	35 (95%)
Myometrial thinning[11] **GSI**: Myometrial thickness <1mm or undetectable.	28 (76%)
Bladder wall interruption[11] **GSI**: Partial or complete interruption, loss or irregularity of the bladder wall or of the hyperechoic line between uterine serosa and bladder lumen.	33 (89%)
Placental bulge[11] **GSI**: 'Ballooning' of the uterus containing the placenta into the surrounding pelvic structure.	33 (89%)
Exophytic mass[11] **GSI**: Focal area of the myometrium where the placenta appears to protrude outside the uterine wall.	25 (67%)
Uterovesical hypervascularity[11] **CDI**: Striking amount of colour Doppler signal seen in placental bed of a low-lying/placenta previa and bladder wall demonstrating multidirectional flow and aliasing artefact.	33 (89%)
Subplacental hypervascularity[11] **CDI**: Striking amount of colour Doppler signal seen in placental bed demonstrating multidirectional flow and aliasing artefact.	22 (60%)
Placental lacunae[11] **GSI & CDI**: Large, irregular hypoechoic (without a hyperechogenic halo) intra-placental spaces located above large feeder vessels, giving the placenta a "moth-eaten" appearance (containing turbulent flow).	36 (97%)
Lacuna feeder vessel(s)[11] **CDI**: Large vessel(s) located under a lacuna(e)	25 (67%)
Bridging vessels[11] **CDI**: Vessels appearing to extend from placenta bed, across uterine wall into bladder or other pelvic organs.	28 (76%)
Intraplacental hypervascularity[11] **3D CDI:** Complex, irregular arrangement of numerous placental vessels, exhibiting tortuous courses and varying calibres.	21 (57%)
High acoustic Radiation Force Impulse (ARFI) Elastography scores[14,15,19,28] **GSI/Virtual Touch Quantification (VTQ):** Shear-wave elastography (SWE) velocity evaluation of placental stiffness (mean > 1.92 m/s).	1 (3%)
Obliteration of the retroplacental clear space (tramline appearance)[16,17,20,25] **3D and 3D color volumes/4D volume rendering ultrasound (Crystal vue/realistic vue)**: "Partial obliteration" is defined as a loss of some or part of the uterine-bladder interface and "full obliteration" as when both interfaces were interrupted.	17 (46%)
Missing decidual signal[18,23] **Superb microvascular imaging (SMI):** Absence of Doppler signals under the basal plate and obliterated myometrium.	3 (8%)
Intracervical lakes[22] **TVS-CDI**: Tortuous hypervascularised anaechoic spaces within the cervix.	25 (68%)
Rail sign[24]	14 (38%)

CDI: 2 parallel enlarged vessels over the uterovesical junction and bladder mucosa, with interconnecting bridging vessels perpendicular to both.	
Increased parametrial vascularity[21] **CDI:** Complex, irregular arrangement of vessels, exhibiting tortuous courses and varying calibres in the parametrial region.	14 (38%)
Pulsatile vessel at the posterior bladder wall[26] **CDI:** Pulsatile arterial vessels with low RI at the posterior bladder wall.	12 (32%)
Non-tapered placental edge[27] **GSI:** Presence of a blunt or wide amount of trophoblast at the placental edge in sagittal plane	3 (8%)

GSI= Grey scale imaging; CDI= Color Doppler imaging; 3D= 3-dimension; TVS= Transvaginal sonography; TAS= Transabdominal sonography; PSV= peak-systolic velocities

Table 2: Ultrasound signs associated with a high probability of PAS that should be quantified and how

ULTRASOUND STANDARDISED QUANTITATIVE DESCRIPTION	Yes, there should be a quantitative assessment n (%)	No need for quantitative assessment n (%)
Loss of the 'clear zone'	4 (11%)	33 (89%)
Myometrial thinning	19 (51%)	18 (49%)
Bladder wall interruption	5 (14%)	32 (87%)
Placental bulge	7 (19%)	30 (81%)
Uterovesical hypervascularity	13 (35%)	24 (65%)
Placental lacunae	27 (73%)	10 (19%)
Bridging vessels	15 (41%)	22 (60%)

Recommended quantitative assessment methods

Loss of the 'clear zone' (4 experts)

- TAS measurements of the area size (n= 2) and describe them as focal (< 5cm in length) and diffuse (> 5cm in length) (n= 1).
- Use a score proposed by Del Negro et al[31]: 0= present; 1= irregular; 2= absent (n=1).

Myometrial thinning (17 experts)

- TAS measurement of the residual myometrial thickness (RMT) made perpendicular to the long axis of the uterus and measured at the thinnest site with cut-off proposed of < 1 mm (n= 9); < 2.5 mm (n= 1); and < 3 mm (n= 1).
- TVS measurements of RMT at 5 cm from the cervix internal os (n= 1).
- Average of three RMT measurements at different levels between the cervix internal os and top of the bladder (n= 1).
- RMT ratio between scar area and intact myometrium outside (n= 2).
- TAS measurements of the area size (n= 2).

Bladder wall interruption (4 experts)

- TAS measurements of the area size (n= 3).
- Use a score[31]: 0= line clear and complete; 1= line vague or irregular; 2= line lost (n=1).

Placental bulge (6 experts)

- TAS measurements of the area size (n= 4) with less than 2 cm of bulge length and <1 cm protrusion into the partially/full filled bladder; 2-5 cm in bulge length and 1-3 cm protrusion into the bladder; > 5 cm of bulge length regardless of "depth" of protrusion into the bladder (n= 1).
- Evaluation of location: above bladder; below the level of the cervix internal os or towards the parametrial (n= 1)

Uterovesical hypervascularity (2 experts)

- TAS CDI measurements of the surface area of confluence (3D) or greatest linear 2D (n= 1).
- Use a score[31]: 1= increased flow, presence of numerous vessels, tortuous; 2 = multidirectional flow or presence of bridge vessels (n= 1).

Placental lacunae (27 experts)

- TAS & TVS score proposed by Finberg and Williams[30]: 0= none; 1+= 1-3; 2+= 4-6; 3+=>6 (n= 26).
- Measurements of the lacunae size > 20 mm (n= 1).

Bridging vessels (10 experts)

- TAS count of number of vessels (n= 7) and measurements of the surface area (n= 1).
- Measurements of PSV (n= 2).

CDI= Color Doppler imaging; 3D= 3-dimension; TVS= Transvaginal sonography; TAS= Transabdominal sonography; PSV= peak-systolic velocities

Table 3: Proposed ultrasound signs and features for future research in predicting surgical outcomes in patients with a high-probability of PAS at birth (n= 37)

ULTRASOUND STANDARDISED DESCRIPTION	YES	NO	Unsure	RoA (%)
Loss of the 'clear zone'	30	4	3	70%
Myometrial thinning	25	5	7	54%
Bladder wall interruption	34	2	1	87%
Placental bulge	28	5	4	62%
Subplacental/Uterovesical hypervascularity	27	5	5	60%
Placental lacunae	30	4	3	70%
Lacuna feeder vessel(s)	14	10	13	11%
Bridging vessels	28	4	5	65%
Lacuna feeder vessel(s) PSV ≥ 41 cm/s	11	12	14	-3%
Intracervical lakes	22	7	10	41%
Rail sign	6	15	16	-24%
Cervical length/Funnelling	11	16	10	-14%
Placenta previa reaching but not covering internal os	24	11	2	35%
Placenta previa with cervical involvement	34	1	2	89%

RoA= Rate of agreement.