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Editorial

Pro forma for ultrasound reporting in suspected abnormally invasive placenta (AIP): an international consensus

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Accurate antenatal diagnosis of an abnormally invasive placenta (AIP), allowing multidisciplinary management at the time of delivery, has been shown to improve maternal and fetal outcomes[1–3]. AIP can be predicted as early as in the first trimester, by identifying cases of suspected Cesarean scar pregnancy (CSP), as there is evidence that CSP in the first trimester and AIP in the second and third trimesters may represent different stages of a similar pathology[4]. Grayscale ultrasonography, with or without color Doppler and performed both transabdominally and transvaginally, has been used widely for antenatal screening and diagnosis of AIP. Many signs have been suggested, with reports varying as to their sensitivity and specificity[5]. Most of these 'signs' are poorly defined and, consequently, it is difficult to assess which are the most robust. To address this, the European Working Group on AIP (EW-AIP) have produced a consensus proposal to standardize the ultrasound descriptions used to define each sign, published in this issue of the Journal[6].

We assembled an international group of experts in the field with the specific aim of reaching an agreement regarding a standardized means of reporting ultrasound assessment of suspected AIP. If adopted by sonographers, clinicians and researchers worldwide, such a pro forma may facilitate better communication, and better evaluation of our diagnostic performance, in cases of suspected AIP.

The group of international experts comprised an e-mail discussion group ($n = 50$) led by Jose Palacios Jaraquemada, members of the EW-AIP ($n = 19$) and members of the ISUOG (International Society of Ultrasound in Obstetrics and Gynecology) Clinical Standards Committee ($n = 7$). Each expert was asked to participate in a survey which involved completion of an online questionnaire to indicate what they believed should be included in the pro forma for reporting ultrasound assessment of suspected AIP.

The online questionnaire, created using Survey Monkey, included risk factors known to be associated with AIP and all commonly reported ultrasound signs and definitions related to the diagnosis of AIP[5–11]. Ultrasound signs were divided into three subgroups according to modality: grayscale ultrasound, color Doppler and three-dimensional (3D) power Doppler. Each ultrasound sign in each subgroup had between one and six associated definitions reported in the published literature.

To each selected demographic characteristic and ultrasound sign we assigned three options: (i) definitely include in report; (ii) include optionally in report and (iii) do not include in report. The definitions for each ultrasound sign were also assigned three options: (i) include; (ii) do not include and (iii) unsure. Participants were also asked whether clinical interpretation and relevance of the ultrasound findings should be included in the report. Options for preferred method of reporting clinical interpretation included: (i) give probability of clinically significant AIP, (ii) state whether manual removal of placenta should be attempted, and (iii) give free text description to provide guidance to the local team. There was the opportunity to provide free text comments for each section. A reminder to complete the questionnaire was sent out after 2 weeks, and we allowed 4 weeks for a response.

All demographic characteristics and ultrasound signs for which >50% respondents selected 'definitely include in report' were incorporated into the standardized report, while those for which >50% respondents selected 'do not include in report' were excluded. For each ultrasound sign, the definitions for which >50% of respondents selected either 'include' or 'unsure' were kept for further evaluation. A second questionnaire was created for such items requiring further evaluation, in which respondents could specify first and second choice for definition of the ultrasound sign, and included additional suggestions from the free text comments, such as assessment for suspected parametrial involvement. For confirmation, we distributed a third and final round of the survey, with three domains, addressing: demographic and risk factors, ultrasound signs and clinical interpretation. At this round, consensus was sought from all participants that the ultrasound signs previously agreed on should be defined using the standardized descriptors proposed by the EW-AIP[6].

There were 42 respondents in the first round of the survey (response rate, 55%). For all of the demographic characteristics, placental location and grayscale ultrasound parameters, and for all but one color Doppler parameter, >50% of respondents chose 'definitely include in report'. Only seven respondents thought that 3D power Doppler volumes should definitely be included and thus this criterion was excluded. All

but one respondent agreed that clinical interpretation should be included in the standardized report. The preferred option for reporting clinical relevance was as probability of clinically significant AIP. There were also suggestions to include reporting of assessment of parametrial involvement and the extent of AIP ('focal' or 'diffuse'), which were included as options in subsequent rounds.

In the second round, 28 (37% of the original group) responded. All demographic characteristics suggested additionally in this round were selected by a clear majority as to be definitely included in the report. In the third and final round (response rate, 42% of the original group ($n = 32$)), agreement was obtained from all respondents regarding the description of ultrasound signs, and the majority (87%) preferred categorization of clinical relevance for significance of AIP into high, intermediate or low risk.

We propose that, when performing an ultrasound scan for suspected AIP, this set of ultrasound signs should always be reported. (See ultrasound report on next page, also supplied in pdf format online.) Using these standardized descriptors and this reporting pro forma should facilitate a systematic approach to the assessment of this rare condition. This should allow better comparison between diagnostic centers and enable prospective multicenter evaluation of the diagnostic performance of each sign, or combination of signs, for prediction of AIP, thus reducing the risk of serious perinatal complications and maternal morbidity.

We propose that, at present, 3D color Doppler should not be included in the standardized reporting of suspected AIP. However, centers with experience in this ultrasound modality should continue to evaluate it and report it optionally. This pro forma can also be further adapted for local use to include other findings, such as location of cord insertion and placenta, to assist in planning the operative technique for management of AIP.

The consensus to include clinical interpretation of ultrasound findings was somewhat unexpected. The panel felt that such interpretation is important in order to allow better planning of the intrapartum management within a multidisciplinary team. The current proposal is to have three different levels of suspected risk. It is anticipated that cases of low risk will receive standard care. How best to incorporate the other two levels of risk into clinical pathways will depend on local circumstances, maternal view on future fertility and surgical and critical-care expertise.

Members of the Ad-hoc International AIP Expert Group

The Ad-hoc International AIP Expert Group comprised: Zarko Alfirevic, Michael A. Belfort, Amar Bhide, Thorsten Braun, Pavel Calda, Giuseppe Cali, Gihad Chalouhi, Kinga Chalubinski, Frederic Chantraine, Min Min Chou, Sally Collins, Ekaterini Domali, Ana Espinosa, Tullio Ghi, Markus Gonser, Jorge Hamer, Irene Hoesli, Andrew D. Hull, Eric Jauniaux, Boon H. Lim, Phillip Lim, Shigeki Matsubara, Felipe Moretti, Donal O'Brien, Per Olofsson, Jose Palacios-Jaraquemada, Pedro Pinto, Steve Robson, Loïc Sentilhes, Jin-Chung Shih, Alexandros Sotiriadis, Vedran Stefanovic, Minna Tikkanen, Ilan Timor-Tritsch, Boris Tutschek, Heleen van Beekhuizen, Oliver Vasilj, Constantin von Kaisenberg and Katharina von Weizsaecker.

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A sample pro forma is shown on next page

An electronic version of the pro forma is provided in the online version of this article.

SUSPECTED ABNORMALLY INVASIVE PLACENTA (AIP)

Ultrasound report

Demographics and Risk Factors

Date: _ _/_ _/ _ _ _ _ Gestational age: _ _ weeks _ days

Parity ☐ Mode of conception: Spontaneous ☐ IVF ☐

Number of previous CS ☐ Number of classical CS ☐

Number of previous surgical evacuations (including TOP) ☐

Was Cesarean scar pregnancy suspected/diagnosed in first trimester? Yes ☐ No ☐ Not known ☐

Previous uterine surgery (e.g. myomectomy, endometrial ablation) Yes ☐ No ☐ Not known ☐

History of AIP Yes ☐ No ☐ Not known ☐

Placenta previa on ultrasound Yes ☐ No ☐ Not known ☐

If yes: Anterior placenta previa < 2 cm from internal os ☐ Covering internal os ☐

Posterior placenta previa < 2 cm from internal os ☐ Covering internal os ☐

Ultrasound Signs

Cervical length (without funnel or placental tissue)			**mm**
Grayscale ultrasound parameters and definition	**Yes**	**No**	**Unsure**
Loss of 'clear zone' *- Loss, or irregularity, of hypoechoic plane in myometrium underneath placental bed ('clear zone')*			
Myometrial thinning *- Thinning of myometrium overlying placenta to <1mm or undetectable*			
Abnormal placental lacunae *- Presence of numerous lacunae including some that are large and irregular, often containing turbulent flow visible on grayscale imaging*			
Bladder wall interruption *- Loss or interruption of bright bladder wall (hyperechoic band or 'line' between uterine serosa and bladder lumen)*			
Placental bulge *- Deviation of uterine serosa away from expected plane, caused by abnormal bulge of placental tissue into neighboring organ, typically bladder; uterine serosa appears intact but outline shape is distorted*			
Focal exophytic mass *- Placental tissue seen breaking through uterine serosa and extending beyond it; most often seen inside filled urinary bladder*			
Color Doppler ultrasound parameters and definition	**Yes**	**No**	**Unsure**
Uterovesical hypervascularity *- Striking amount of color Doppler signal seen between myometrium and posterior wall of bladder; this sign probably indicates numerous, closely packed, tortuous vessels in that region (demonstrating multidirectional flow and aliasing artifact)*			
Subplacental hypervascularity *- Striking amount of color Doppler signal seen in placental bed; this sign probably indicates numerous, closely packed, tortuous vessels in that region (demonstrating multidirectional flow and aliasing artifact)*			
Bridging vessels *- Vessels appearing to extend from placenta, across myometrium and beyond serosa into bladder or other organs; often running perpendicular to myometrium*			
Placental lacunae feeder vessels *- Vessels with high-velocity blood flow leading from myometrium into placental lacunae, causing turbulence upon entry*			
Parametrial involvement	**Yes**	**No**	**Unsure**
- Suspicion of invasion into parametrium			

Clinical Significance of Ultrasound Findings

Probability of clinically significant AIP High ☐ Intermediate ☐ Low ☐

Extent of AIP Focal ☐ Diffuse ☐