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Accuracy of Intracervical Blood Lakes as an Ultrasonic Marker of Placenta Accreta in Patients with Placenta Previa

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Abstract

Background: **Placenta accreta spectrum disorder (PASD) describes an abnormal trophoblastic invasion of part or all the placenta into the myometrium. This study introduces a new ultrasonic sign, intracervical blood lakes (ICL) which are defined as tortuous anechoic spaces within the cervix, which appear to be hypervascular on color Doppler, which can be considered as the consequence of massive trophoblastic invasion of the uterine cervix leading to an intracervical disruption process.** ***Aim:*** **To evaluate the diagnostic accuracy of ICL in predicting the presence of PASD.** ***Subjects and Methods:*** **This was a prospective cohort study of 100 women with placenta previa at ≥ 24 weeks of gestation, who were referred to the Obstetrics and Gynecology Department, Suez Canal University Hospital, Ismailia, Egypt from August 2021 to September 2022. The presence of ICL was evaluated by trans-vaginal ultrasound at 24 and 35 weeks of gestation. Follow-up of patients till delivery was done to explore the accuracy of this sign in predicting major postpartum hemorrhage at the time of Cesarean section and the need for Cesarean hysterectomy (CH).** ***Results:*** **Cervical lakes had the highest specificity of (98.39%) in the second trimester and (95.16%) in the 3rd trimester for detection of accretions with overall diagnostic accuracy of 67% during the second trimester and 80% in the third trimester.** ***Conclusion:*** **ICL are associated with PASD representing a marker of deep villus invasion, and its incorporation into ultrasound examination may increase the diagnostic accuracy for prediction of CH and major postpartum hemorrhage in women with placenta previa.**

Keywords: Intracervical blood lakes (ICL), Placenta accreta spectrum disorder (PASD), placenta previa, color Doppler.

Introduction

Placenta accreta spectrum disorder (PASD) describes an abnormal trophoblastic invasion of part or all of the placenta into the myometrium of the uterine wall[1], Also it describes a clinical situation where the placenta does not detach spontaneously after delivery and cannot be forcibly removed without causing massive and potentially life-threatening bleeding[2]. It necessitates cesarean delivery and is considered a major risk factor for postpartum hemorrhage leading to morbidity and mortality of the mother and neonate. The underlying cause of placenta previa is unknown. There is, however, an association between endometrial damage and uterine scarring[3]. The risk factors that correlate

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with placenta previa are advanced maternal age, multiparity, smoking, prior suction and curettage, assisted reproductive technology, history of cesarean section(s), and prior placenta previa[4]. Ultrasound (US) represents the gold standard for antenatal evaluation of women at risk for PAS disorder, while magnetic resonance imaging is performed to define the depth and topography of placental invasion, particularly in cases of posterior low-lying placenta[5]. However, a significant proportion of cases with PAS disorder still remain undiagnosed before surgery[6] and there is large heterogeneity in the reported diagnostic performance of ultrasound in detecting PASD[7], So a multitude of ultrasound signs for PAS disorder have been reported, but it is yet to be ascertained which one can provide the optimal combination of sensitivity and specificity[8]. This study introduces a new ultrasonic sign intracervical blood lakes (ICL) which represents an independent predictor of placenta percreta and its incorporation into ultrasound examination will increase the diagnostic accuracy for prediction of CH and major postpartum hemorrhage in women with placenta previa or low-lying placenta. Intracervical blood lakes are defined as tortuous anechoic spaces within the cervix, which appear to be hypervascular on color Doppler. It can be considered as the consequence of massive trophoblastic invasion of the uterine cervix leading to an intracervical disruption process. On these grounds, the introduction of new imaging signs for PAS disorders as intracervical lakes seems to be important to improve the performance of ultrasound in identifying women affected by the most severe types of these conditions, in order to minimize the risk of adverse maternal and fetal outcome. The aim of the current study is to evaluate the diagnostic accuracy of a new ultrasound sign, intracervical blood lakes, in predicting the presence of PAS disorder and delivery outcome in patients with placenta previa.

Patients and Methods

A prospective clinical cohort study was conducted in the Obstetrics and Gynecology In-patient department, Outpatient clinic, and Emergency department in Suez Canal University Hospital, from August 2021 to September 2022. The study included women with placenta previa at gestational age ≥24 weeks who were referred to the Obstetrics and Gynecology Department, Suez Canal University Teaching Hospitals. *Inclusion criteria:* Gestational age ≥24 weeks diagnosed by combined trans-abdominal and trans-vaginal ultrasonography as placenta previa. *Exclusion criteria:* Patients with bleeding disorders or on anticoagulant therapy. Over distended uterus as multiple gestations or polyhydramnios. All patients who were included in my study after informed consent, underwent full assessment in the form of: History taking including Personal, Present, Past, Obstetric, Contraception, and Menstrual history. General examination: For assessment of the patient's general condition and vital data, including: (Pulse, blood pressure, and temperature). Abdominal examination for assessment of fundal level, previous abdominal scars, and presence of uterine contractions. Ultrasound examination: Using (MINDRAY, DC 60) ultrasound machine including Trans-abdominal 2D ultrasound which was done to assess fetal viability, placental location, gestational age and amniotic fluid index, and, Trans-vaginal ultrasound and placental bed Doppler were done to determine the exact site of the placenta and suggest its degree of invasion. Follow-up of those patients till delivery was done by trans-abdominal ultrasound in each antenatal visit and by trans-vaginal ultrasound at 24 and

35 weeks of gestation. Laboratory investigation in the form of complete blood count, blood group, and bleeding profile were measured pre-operatively. Before delivery, all patients of the study were informed about possible complications and the possibility of cesarean hysterectomy (CH) with written informed consent and preparation of at least 4 units of cross-matched red blood cells and 4 units of fresh frozen plasma. All patients in the study underwent cesarean section and the final diagnosis of PAS disorder was made intraoperative as follows: 1) In women who underwent a hysterectomy, the standard reference for PAS disorder was the histopathological assessment performed by a pathologist blinded to the ultrasound and surgical findings. 2) In women who did not undergo hysterectomy, the presence of PAS disorder at the time of Cesarean delivery was defined according to the grading system modified by the International Federation of Gynecology and Obstetrics (FIGO)[8].

Statistical Analysis

Data were coded and entered into the computer statistical program. All statistical analyses were performed using the Statistical Package for Social Science (SPSS) version (25). (T) Test was used for normally distributed quantitative variables while the Mann-Whitney test was used for quantitative variables that were not normally distributed. Chi-square and Fisher's exact tests were used for qualitative variables. A p-value of <0.05 was considered statistically significant.

Results

Our study included one hundred women with antenatal diagnosis of placenta previa or low-lying placenta (Figure 2). Regarding baseline characteristics of the studied sample, the mean age of the patients was 31.11 ± 5.56 years. About 70% of the females came from urban areas and the majority of them were housewives (81%). Moreover, the majority of the sample had at least one previous cesarean section (88%). About 50% of the patients with a history of abortion had at least one previous dilation and curettage procedure after abortion. In Table 1 and by Using transvaginal ultrasound, cervical lakes were present in 7 patients in the second trimester where 5 out of 7 of the ICL were lying anterior. Meanwhile, in the third trimester, cervical lakes were present in 24 patients where 18 out of 24 of the ICL were lying anterior. In 55% of patients, there was one or more signs of accretion on 2D ultrasound where the most reported sign was Placental lacunae which were reported in 40% of patients (Table 2). Our study results show that accretion was statistically significantly associated with higher gravidity (p=0.013), previous cesarean section (p=0.003), and previous D&C (0.04). Common presentations of patients with accretion were lower abdominal pain, vaginal bleeding, and decreased fetal movements. About 19 % had a history of chronic illness and about 3% of the patients had a history of previous abdominal surgery. However, there is no statistically significant difference between the two groups regarding any of their clinical characteristics (Table 3). Regarding operative findings, patients with accretion had significantly higher duration of operation (p<0.001) and intraoperative blood loss (p<0.001) and subsequently more frequency of blood transfusion (p<0.001). Moreover, patients with accretion had significantly higher intra and post-operative complications (p<0.001) (Table 4). Our study showed that patients with accretion had significantly higher ICL in the second and third trimesters compared to those

with no accretion (p<0.001). Moreover, using 2D ultrasound, the most frequent features of accretion were the thinning of myometrium (86.8%) and the crossing of blood vessels (84.2%) (Table 5). Regarding the diagnostic indices of sonographic findings for the detection of accretions, cervical lakes had the highest specificity of 98.39% in the second trimester and 95.16% in the third trimester for the detection of accretions if combined with at least one of the typical US features of accretion, with overall diagnostic accuracy of 80% in the third trimester.

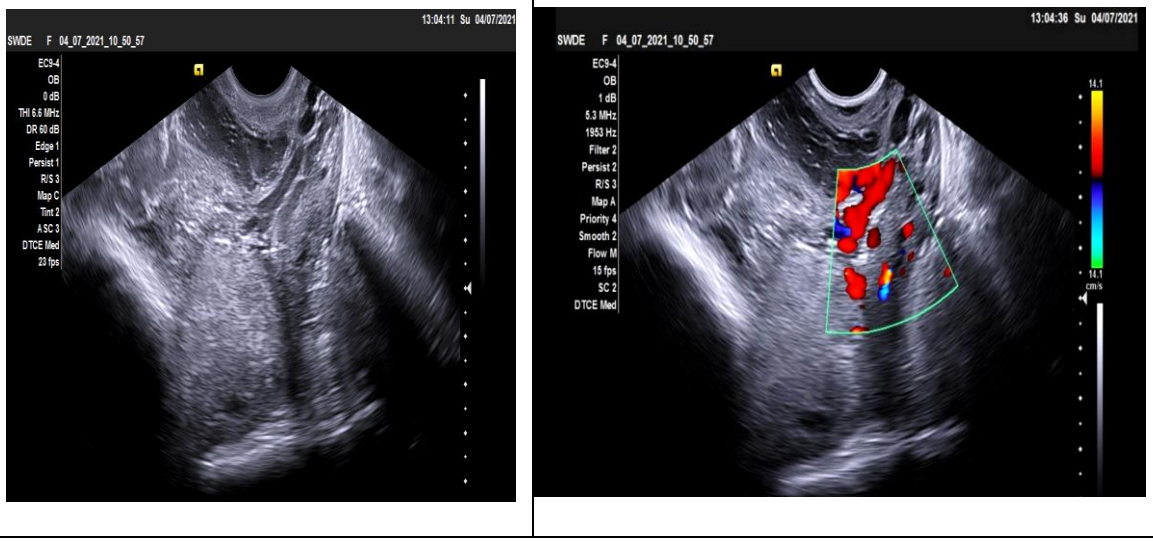

Figure 1: ICLs within the cervix

ICLs are located within the anterior and posterior walls of the cervix "left image" displaying internal vascularity on color Doppler "right image". Also, the placenta is seen completely covering the internal os.

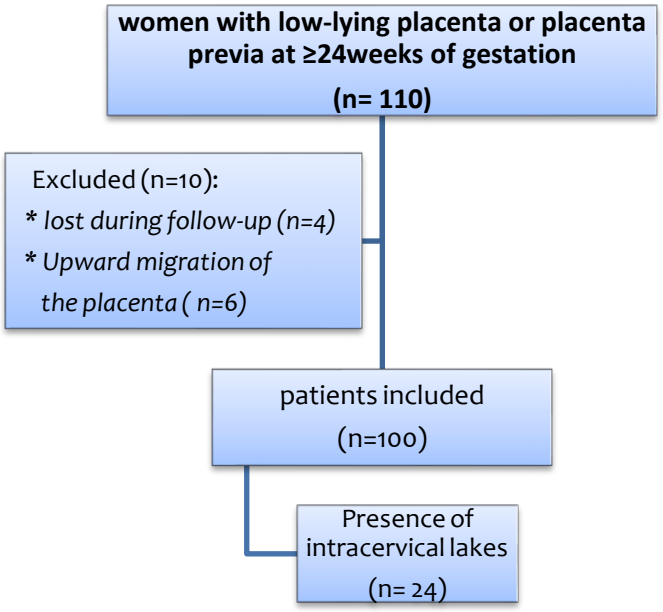

Figure 2: Flowchart showing the inclusion of 110 women

(6 cases with upward placental migration were excluded, and 4 cases were lost in follow-up).

Moreover, the presence of at least one US sign of accretion or more had a sensitivity of 100% with a specificity of 72.58% and overall accuracy of 83% for the prediction of accretions. Meanwhile, the top accurate findings of accretions using sonography were the thinning of the myometrium (90%) and the crossing of blood vessels (88%) (Table 6).

Table 1: Baseline characteristics of the studied population

Variables	n = 100 (%)
Age (years), mean ± SD	31.11 ± 5.56
Address	
Urban	70 (70)
Rural	30 (30)
Occupation	
Housewife	81 (81)
Working	19 (19)
Gravidity, median (IQR*)	4 (2-5)
Previous cesarean section	
No	12 (12)
Yes	88 (88)
*median (IQR)**	2 (3 – 4)
Abortion	
No	56 (56)
Yes	44 (44)
D&C (after abortion)	
No	14 (31.8)
Yes	30 (68.2)
*Once**	15 (50)
*Twice**	9 (30)
*Three-time**	6 (20)

*Data are presented as n (%), *IQR: interquartile range: 25th to 75th*

Discussion

The purpose of this study was to evaluate the diagnostic accuracy of a new ultrasound sign "intracervical blood lakes" in predicting the presence of PAS disorder and delivery outcome in patients with placenta previa. In our study, the mean age of the patients was (31.11 ± 5.56 years). Similarly, Di Pasquo et al. study which included women with prenatal diagnosis of placenta previa or low-lying placenta, found that the median maternal age was 33.0[9]. This could be explained by that women aged 34 years or older had a two to three times higher risk of placenta previa in relation to women < 20 years old[10,11]. In the current study, the majority of the participants were housewives (81%). This was in line with Abdulla and Ghafel who found that the majority of the sample (71.2%) were housewives, and 22.4% of them were government employees[12]. In this study, accretion was statistically significantly associated with previous cesarean section (p=0.003). This was also in line with Abdulla and Ghafel[12] who stated that regarding the mode of previous delivery, the highest percentage (100%) of the study sample had a previous history of CS. delivery. About 44 of the patients had a history of abortion and 30 patients of them had at least one previous dilation and curettage procedure after abortion. This is in line with previous studies which found an association between placenta previa following miscarriages[13]. Using the US we found that cervical lanes were present in 7 patients in the second trimester where 5 out of 7 of the ICL were lying anterior. Meanwhile, in the third trimester, cervical lakes were present in 24 patients where 18 out of 24 of the ICL were lying anterior. In 55% of patients, there were one or more signs of accretion on 2D ultrasound where the most reported sign was placental lacunae which was reported in 40% of patients. In concordance with Di Pasquo et al. who reported that among women with a prenatal diagnosis of placenta previa or low-lying placenta, the presence of ICL was noted in 50 (15.1%) patients, and in 43 of these, other typical ultrasound signs of PAS disorder were present [9]. Salman et al also found that PAS signs were found in 51 cases of the110 studied cases and ICL were found in 26 cases of the studied cases where all cases with ICL had positive PAS sign[14]. So, our study explores that, patients with accretion had significantly higher ICL in the

second and third trimesters compared to those with no accretion (p<0.001). Moreover, using 2D ultrasound, the most frequent features of accretion were the thinning of myometrium (86.8%) and the crossing of blood vessels (84.2%).

Table 2: Features of accretions using combined TAUS and TVUS

Variables	100 (%)
Cervical lakes, n (%)	
2nd-trimester scan:	
Absent	93 (93)
Present	7 (7)
Location of cervical lakes, n (%)	
Anterior	5 (71.4)
Anterior and posterior	2 (28.6)
3rd-trimester scan:	
Absent	76 (76)
Present	24 (24)
Location of cervical lakes, n (%)	
Anterior	18 (75)
Anterior and posterior	6 (25)
2D US features of accretions in 3rd trimester	
Presence of accretion signs (≥1 sign)	
No	45 (45)
Yes:	55 (55)
Thinning of myometrium	38 (69)
Loss of retro placental space	37 (67)
Placental lacunae	40 (73)
Crossing blood vessels	38 (69)

Data are presented as n (%)

Similarly to Di Pasquo et al[9] who found that women with ICL associated with at least one typical ultrasound sign of PAS disorder had a significantly higher incidence of major postpartum hemorrhage (*P*<0.001), CH (*P*<0.01) and placenta percreta (*P*<0.01) compared to the groups of women without signs of PAS disorder and those with typical ultrasound signs of PAS disorder but no ICL. The presence of both ICL and at least one typical sonographic sign of PAS disorder yielded a higher prediction of these complications compared with the presence of typical sonographic signs of PAS disorder alone. In this scenario, ICL can be considered as the consequence of the massive trophoblastic invasion of the uterine cervix leading to an intracervical disruption process. Together with the lower uterus and upper vagina[15]. Also, Calì et al. stated that assessing the trophoblastic invasion of this area is crucial to planning an appropriate surgical strategy[16]. As almost 90% of women diagnosed prenatally with placenta previa accreta have an elective or emergency CH; however, an emergency peripartum hysterectomy is associated with considerable morbidity and mortality[6]**.** Given the overall low specificity and PPV of ultrasound for diagnosis of placenta percreta and prediction of CH, ICL could be used as a second-step ultrasound sign in patients with at least one typical sonographic sign of PAS disorder[5]**.** In the present study, regarding the diagnostic indices of sonographic findings for the detection of accretions. Cervical lakes had the highest specificity of (98.39%) in the second trimester and (95.16%) in the 3rd trimester for the detection of accretions with an overall

diagnostic accuracy of 67% during the second trimester and 80% in the third trimester especially if combined with at least one typical ultrasound sign of accretion.

Table 3: Patients with and without accretions regarding their obstetric history

Variables	With accretion (n=38)	Without accretion (n=62)	Test value	p-value
Age (years), mean ± SD	32.58 ± 3.21	31.21 ± 6.3	962	0.125 [a]
Gravidity, median (IQR*)	5 (3-6)	4 (1-5)	837	**0.013** [a]
Previous cesarean section				
No	0 (0)	12 (19.4)	8.4	**0.003** [c]
Yes	38 (100)	50 (80.6)		
Abortion				
No	18 (47.4)	38 (61.3)	1.8	0.17 [b]
Yes	20 (52.6)	24 (38.7)		
D & C after abortion				
No	5 (11.3)	9 (20.5)	6.5	**0.04** [b]
Yes	15 (39.5)	15 (24.2)		
Clinical presentation				
Lower abdominal pain	10 (26.3)	20 (32.2)	0.4	0.75 [a]
Vaginal bleeding	20 (52.6)	30 (48.4)	0.17	0.68 [a]
Decreased fetal movement	20 (52.6)	13 (21)	0.9	0.19 [a]
Amniotic fluid leakage	5 (13.2)	6 (9.7)	0.29	0.59 [a]
History of chronic illness				
No	29 (76.3)	52 (83.9)	1.7	0.23 [a]
Yes	9 (23.7)	10 (16.1)		
History of previous abdominal surgery				
No	35 (92.1)	62 (100)	5.1	0.53 [b]
Yes	3 (7.9)	0		

[a]p-values are based on Mann Whitney U test. Statistical significance at P < 0.05
[b] p-values are based on Chi-square test. Statistical significance at P < 0.05
[c] p-values are based on Fisher Exact test. Statistical significance at P < 0.05
Data are presented as n (%).

Moreover, the presence of at least one US sign of accretion or more had a sensitivity of 100% with a specificity of 72.58% and an overall accuracy of 83% for the prediction of accretions. In line with our results, Di Pasquo et al. found that the sensitivity, specificity, PPV, and NPV of ICL for the detection of placenta percreta were 35.1%, 91.0%, 58.0%, and 83.0% Compared with the group with placenta previa or low-lying placenta without ultrasound signs of PAS disorder, the presence of at least one typical sonographic sign of PAS disorder was associated with a specificity 60.7 for placenta percreta. The presence of at least one typical sonographic sign of PAS disorder in combination with ICL had a specificity of 89.3 for placenta percreta[9]. Similarly, a recent prospective study by Salman et al. reported that, regarding the diagnostic characteristics of US findings in predicting percreta, One of the PAS signs had high sensitivity 92.2% & NPV 98.3%, and moderate other diagnostic characteristics. While the presence of intracervical blood lakes added to any of PAS signs, did not markedly decrease sensitivity at 90.5% and NPV at 97.6%, but markedly increased other diagnostic characteristics with a specificity of 92.1%[14]. In this study, it was found that regarding the operative characteristics among the studied sample, the

mean time of operation was 1.95 ± 1.22 hrs. with an average intraoperative blood loss of 1.5 (1–2) L, with <50% of patients having a blood transfusion. 79% of patients with confirmed accretions in traoperatively had CH and some patients had complications including postoperative ICU admission (23%) and bladder injury (13%).

Table 4: Patients with and without accretions regarding their operative findings

Variables	With accretion (n=38)	Without accretion (n=62)	Test value	p-value
Duration of operation, mean ± SD	2.89 ± 0.72	1.36 ± 1.08	127	**<0.001** [a]
Estimated blood loss, median (IQR)	3 (3 – 4)	1 (1 – 2)	132	**<0.001** [a]
Blood transfusion				
No	0 (0)	44 (71)	48.1	**<0.001** [b]
Yes	38 (100)	18 (29)		
Amount of transfusion (units), median (IQR)				
RBCs	3 (3 – 4)	1 (1 – 2)	145	**<0.001** [a]
Plasma	4 (3 – 4)	1 (0 – 1)	248	**<0.001** [a]
Trimming of the lower uterine segment				
No	30 (78.9)	62 (100)	14.2	**<0.001** [c]
Yes	8 (21.1)	0 (0)		
Cesarean hysterectomy				
No	8 (21.1)	62 (100)	69.9	**<0.001** [b]
Yes	30 (78.9)	0 (0)		
Complications				
Bladder injury				
No	27 (71.1)	60 (96.8)	13.7	**<0.001** [c]
Yes	11 (28.9)	2 (3.2)		
Intra & post-partum hemorrhage				
No	13(34.2)	60(96.8)	22.9	**<0.001** [c]
Yes	25(65.8)	2(3.2)		
Postoperative ICU admission				
No	17 (44.7)	60 (96.8)	36.1	**<0.001** [b]
Yes	21 (55.3)	2 (3.2)		
Death				
No	37 (97.4)	62 (100)	1.6	0.38 [c]
Yes	1 (2.6)	0 (0)		

[a]p-values are based on Mann Whitney U test. Statistical significance at P < 0.05
[b] p-values are based on Chi-square test. Statistical significance at P < 0.05
[c] p-values are based on Fisher Exact test. Statistical significance at P < 0.05
Data are presented as n (%).

Only one patient had died (1%), she was 35 years old and presented with a history of recurrent attacks of hematuria. Intraoperative, there was marked bloody intra-peritoneal collection, and a ruptured uterus and bladder were found. Intra-operative blood loss was severe leading to irreversible hypovolemic shock and death. This is explained by Fonseca and de Campos as maternal mortality in PAS disorders is largely a consequence of massive bleeding, coagulopathy, and multi-organ failure[17]. Earlier reports on maternal mortality in the setting of PAS disorders estimated mortality rates of around 7%, reaching 30% in the absence of antenatal diagnosis. Recent data sug

gest that rates in the range of 0.05% are achievable when prenatal diagnosis and multi-professional expert management are available.

Table 5: Patients with and without accretions regarding their ultrasound features				
Variables	With accretion (n=38)	Without accretion (n=62)	Test value	p-value
Cervical lakes, n (%)				
2nd-trimester scan				
Present	6 (15.8)	1 (1.6)	12.3	**0.001** [a]
Absent	32 (84.2)	61 (98.4)		
3rd-trimester scan				
Present	21 (55.3)	3 (4.8)	51.5	**<0.001** [b]
Absent	17 (44.7)	59 (95.2)		
2D US features of accretions in 3rd trimesrer, n (%)				
≥1 US signs of accretions				
Present	38 (100)	17 (27.4)	50	**<0.001** [b]
Absent	0 (0)	45 (72.6)		
Thinning of myometrium				
Present	33 (86.8)	5 (8.1)	62	**<0.001** [b]
Absent	5 (13.2)	57 (91.1)		
Loss of retroplacental space				
Present	28 (73.7)	9 (14.5)	35.4	**<0.001** [b]
Absent	10 (26.3)	53 (85.5)		
Placental lacunae				
Present	27 (71.1)	13 (21)	24.6	**<0.001** [b]
Absent	11 (28.9)	49 (79)		
Crossing blood vessels				
Present	32 (84.2)	6 (9.7)	55.5	**<0.001** [b]
Absent	6 (15.8)	56 (90.3)		

[a] *p-values are based on Fisher Exact test. Statistical significance at P < 0.05*

[b] *p-values are based on Mann Whitney U test. Statistical significance at P < 0.05*

Table 6: Diagnostic indices of sonographic findings for detection of accretions					
	Sensitivity	Specificity	PPV*	NPV*	Accuracy
≥1 US signs of accretions + 2nd trimester ICL	15.79%	98.39%	85.71%	65.59%	**67%**
≥1 US signs of accretions + 3rd trimester ICL	55.26%	95.16%	87.50%	77.63%	**80%**
≥1 US signs of accretions	100%	72.58%	69.09%	100%	**83%**
Thinning of myometrium	86.84%	91.94%	86.84%	91.94%	**90%**
Loss of retro placental space	73.68%	85.48%	75.68%	84.13%	**81%**
Placental lacunae	71.05%	79.03%	67.5%	81.67%	**76%**
Crossing blood vessels	84.21%	90.32%	84.21%	90.32%	**88%**

***** *PPV, positive predictive value; NPV, negative predictive value.*

Mortality rates are mostly dependent on the depth and extension of invasion, the availability of antenatal diagnosis, and the ability to plan management in an expert center[17]. Our study found that the prevalence of accretion among the studied patients after pathological assessment of specimens after cesarean hysterectomy was 30%, which was lower than Di Pasquo et al. study in which the incidence of PAS

among women with a prenatal diagnosis of placenta previa or low-lying placenta that was 53.0% (176/332)[9], and also lower than Maged et al. who found that among 100 women with low lying placenta directly implanted over uterine scar, there was 63% incidence of placenta accrete[18]. The main strengths of this study include the evaluation of different clinical outcomes and the assessment of ultrasound images in the prenatal diagnosis of PAS disorders. The unblinded assessment of ICL and the lack of evaluation of the inter-observer variability of the explored signs represent the major weaknesses of the present study. Inclusion of only women affected by placenta previa, or low-lying placenta represents another limitation of the study, as a significant proportion of PAS disorders have been shown to occur in women with no recognizable risk factors for these anomalies. In this scenario, the findings from this study apply only to women presenting with placenta previa or low-lying placenta. In addition, this study didn't include a comparison between the accuracy of diagnosis of PAS disorders using intracervical blood lakes seen by transvaginal ultrasound and signs seen by MRI. Furthermore, we did not perform a longitudinal assessment of the changes in the ICL following the first diagnosis, and the absence or presence of the sign was not reassessed on the images collected at subsequent ultrasound examinations before delivery. Finally, given the lack of a prospective protocol for the pathological assessment of cervical vascularization, we were unable to correlate the sonographic assessment of ICL with any histological measure of neovessel formation.

Conclusion

Intracervical blood lakes are associated with placenta accreta spectrum disorder in women with placenta previa, which potentially represents a marker of deep villus invasion, and the presence of intracervical blood lakes is an independent predictor of placenta percreta and its incorporation into ultrasound examination may increase the diagnostic accuracy for prediction of CH and major postpartum hemorrhage in women with placenta previa. The study recommends that All women with known risk factors for placenta accreta should be thoroughly investigated using gray-scale ultrasound and color Doppler for the presence of intra-cervical blood lakes as a strong ultrasonic marker of placenta accreta. Early diagnosis and close follow-up of patients with any type of PASD improves maternal health and decreases maternal mortality rates associated with PASD because, early prediction of these cases allows for planned delivery at a well-equipped hospital with an experienced obstetric team including other surgical specialists, such as urologists and vascular surgeons, where blood transfusion and intensive care are available, also it allows for the availability of senior staff to perform the delivery with a better outcome for the mother and the fetus. Further studies are recommended for evaluation of the competency of this new ultrasound sign as a marker of deep villous invasion causing placental accretion and for evaluation of its importance to be added to prenatal ultrasound criteria of diagnosis of placenta accreta spectrum disorders.

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