ORIGINAL SHORT ARTICLE

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Evaluation of new ultrasound parameters in the diagnosis of placenta accreta spectrum in placenta previa

Valoración de nuevos parámetros ecográficos en el diagnóstico del espectro de placenta acreta en la placenta previa

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ABSTRACT

Objective: To determine placenta previa accreta using ultrasound anatomical features and Doppler flowmetry profile. Methodology: Descriptive, prospective, cohort, longitudinal study. The European Working Group on Abnormally Invasive Placenta (EW-AIP) classification was used. Institution: Hospital Nacional del Sur de EsSalud, Arequipa, Peru. Participants: Pregnant women at high obstetric risk with diagnosis of placenta previa, 20-40 weeks of gestation with diverse parity and history of cesarean section. Results: Out of 90 patients with a diagnosis of placenta previa in 2022 and 2023, 12 patients with suspected accretism were selected by ultrasound assessment and Doppler flowmetry. Maternal age, number of gestations, history of uterine curettage, previous cesarean section and greater number of cesarean sections were statistically significant, with the second and third cesarean section presenting 21.1 and 9.6 times more risk of accretism, respectively. Ultrasonographic criteria were loss of the clear zone, irregular oval placental lacunae, disruption of the bladder wall, placental heterogenicity and hyperechogenicity, hyperechogenic and irregular chorionic plaque, hypervasculature of the bladder and subplacental wall, nutritional vessels and hypervascularized placental lacunae. The peak flow velocity of 52.3 cm/sec was highly significant for placental accreta vs. 26.0 mL/sec in placentas previa with no signs of accreta. Doppler flow velocity above 50 cm/sec presented higher risk of placenta accreta and decreased maternal survival. Conclusion: In the study, the ultrasound findings of a) placental heterogenicity and hyperechogenicity, b) hyperechogenic and irregular chorionic plaque, and c) Doppler flowmetry quantified with the maximum velocity were useful in predicting placental accretency.

Key words: Placenta accreta, Placenta previa, hyperechogenicity, Chorion, Ultrasonography, Doppler

RESUMEN

Objetivo. Determinar el acretismo de la placenta previa mediante las características anatómicas ecográficas y el perfil de la flujometría Doppler. Metodología. Estudio descriptivo, prospectivo, de cohortes, longitudinal. Se usó la clasificación *European Working Group on Abnormally Invasive Placenta* (EW-AIP). Institución: Hospital Nacional del Sur de EsSalud, Arequipa, Perú. Participantes. Gestantes de alto riesgo obstétrico (ARO) con diagnóstico de placenta previa, 20 a 40 semanas de gestación, diversa paridad y antecedente de cesárea. Resultados. De 90 pacientes con diagnóstico de placenta previa de los años 2022 y 2023 se seleccionó 12 pacientes con sospecha de acretismo mediante valoración ecográfica y flujometría Doppler. La edad materna, el número de gestaciones, antecedente de legrado uterino, cesárea previa y mayor número de cesáreas tuvieron significación estadística, presentando la segunda y tercera cesárea 21,1 y 9,6 veces más riesgo de acretismo, respectivamente. Los criterios ecográficos fueron la pérdida de la zona clara, lagunas placentarias irregulares ovaladas, interrupción de la pared vesical, heterogeneidad e hiperecogenicidad placentaria, placa corial hiperecogénica e irregular, hipervasculatura de la pared vesical y subplacentaria, vasos nutricionales y lagunas placentarias hipervascularizadas. La velocidad máxima de flujo de 52,3 cm/seg fue altamente significativa para acretismo placentario frente a 26,0 cm/seg en placentas previas sin signos de acretismo. La velocidad de flujo Doppler por encima de 50 cm/seg presentó mayor riesgo de acretismo y disminución de la sobrevida materna. Conclusión. En el estudio, los hallazgos ecográficos de a) heterogeneidad e hiperecogenicidad placentaria, b) placa corial hiperecogénica e irregular, y c) flujometría Doppler cuantificada con la velocidad máxima fueron útiles para predecir acretismo placentario.

Palabras clave. Placenta accreta, Placenta previa, corion, Ultrasonografía Doppler

Introducción

Placental accreta is an obstetric public health problem that affects maternal and neonatal health. Evidence shows that placenta accreta spectrum (PAS) is an iatrogenic condition due to the excessive increase in cesarean sections[1,2].

Its pathophysiology is not known with certainty. It is described as a product of placental implantation in an anatomical area of the uterus with altered cellular and molecular mechanisms, in areas with deficient or dysfunctional decidualization or in a previous traumatic incisional scar from procedures such as cesarean sections, uterine curettage or myomectomies[3,4].

The degree of placental invasion does not depend on gestational age[3]. However, low implantation of the gestational sac in the lower uterine segment over a previous cesarean scar is the typical appearance of early placental accreta. The average thickness of the lower uterine segment in patients with previous cesarean section can reach 7 mm and abnormal vascular lakes appear in the first trimester of gestation[4].

The patient's personal and pathologic history are pillars of orientation to suspect placenta accreta, such as age, multiparity, number of cesarean sections, myomectomies, uterine curettage, retained placenta and intramniotic infections[4-6].

Early diagnosis and referral to high complexity hospitals could prevent catastrophic situations due to the multidisciplinary management of this morbid condition. Early ultrasound evaluation can guide the diagnosis by identifying loss of clear space or retroplacental hypoechogenic line, thinning and irregularity of the segment wall in an area of previous scarring, the presence of intraplacental vascular lacunae, hypervascularity and increased flow in these defective areas[4,6,7].

The problem of placental accretism arises when the abnormally implanted placenta is forcibly separated from the uterine wall, causing potential maternal morbimortality due to massive hemorrhage, blood polytransfusion, uterine rupture, injury to adjacent organs (bladder, ureter, intestine, neurovascular structures of the retroperitoneum) and prematurity. It increases the risk of hysterectomy and triples the risk of blood loss[4,6].

The aim of the present study was to determine accretism in placenta previa by means of anatomical ultrasound features and Doppler flowmetry profile.

Material and methods

This was a descriptive, prospective and longitudinal study conducted at the Carlos Alberto Seguin Escobedo Hospital of the EsSalud Healthcare Network of Arequipa, Peru, between January 2021 and December 2023. The study included high-risk pregnant women with a diagnosis of placenta previa referred to the hospital from hospitals of lower complexity throughout southern Peru (Arequipa, Moquegua, Tacna, and Puno).

Pregnant women with a diagnosis of placenta previa were evaluated with ultrasound and followed up until the end of pregnancy. Patients with suspected placenta previa were scheduled for cesarean section and hysterectomy, after counseling and authorization of the patient.

The assessment of accretism was made according to four parameters:

1. Clinical history, through obstetric history of curettage or cesarean section,

2. Ultrasound findings based on unified descriptors suggested by The European Working Group on Abnormally Invasive Placenta (EW-AIP)[7], adding three more variables in the present study: a) placental heterogenicity and hyperechogenicity, b) chorionic plaque with a depulid, hyperechogenic and irregular appearance, and c) Doppler flowmetry quantified with maximum velocity. A Toshiba usxm-A500A, 2016 ultrasound machine was used.

3. Intraoperative findings such as hypervascularity of the segment and its degree of invasion into the bladder, absence of cleavage plane, impossibility of complete manual extraction of the placenta.

4. Pathological anatomical findings.

The scheduled patient was admitted to the operating room with bladder catheter number 18, triple channel, prior consultation with Urology and with blood globular packs in reserve. The sur-

gical procedure consisted of a median vertical incision approximately 8 cm below the xiphoid appendix up to the pubic symphysis, exposure of the entire pregnant uterine body, longitudinal fundal incision of the uterine body, extraction of the product, plication and section of the umbilical cord without traction of the placenta, which remained inside the uterine cavity, hysterorrhaphy of the fundal cruciate zone and then hysterectomy according to conventional technique. In some cases, the presence of the urologist was required. In the immediate postoperative period, the patients were transferred to the intensive care unit due to hemodynamic and hematological alterations.

Results

For the analysis, out of a total population of 102 patients referred with a diagnosis of placenta previa, 90 women were selected who met the criteria for placenta previa, of whom 12 had the ultrasound criteria for suspected placenta accreta. Accretism showed an incidence of 13% for the present work.

Maternal age for placenta previa ranged between 16 and 44 years and for placental accretism between 25 and 37 years.

Table 1 shows the distribution of patients at risk of accretism according to age, where 91.7% were older than 30 years and 8.3% were 30 years or younger.

According to the number of gestations, 8.3% of the patients at risk of accretism were primigravid and 91.7% were multigestational.

The history of previous cesarean section in patients at risk of accretism was present in 41.7%, with three cesarean sections 25%, and with a history of curettage 75%.

According to the analysis, pregnant women with a history of second and third cesarean section had 21.1 and 9.6 times more risk of having accreta, respectively (p<0.05).

On ultrasound assessment (Table 2), the loss of the clear zone of placental insertion for patients with suspected accretism was 41.7%, there were non-circular oval placental lacunae with irregular borders in 75.0%, disruption of the bladder wall in 50.0%, placental heterogenicity and hyperechogenicity in 66.7%, chorionic plaque with a depulid, hyperechogenic and irregular appearance in 75%, uterovesical hypervascularization in 58.3%, subplacental hypervascularization in 50.0%, nutritional vessels and hypervascularized placental lacunae in 66.7%, intraplacental hypervasculature in 50%, and maximum flow velocity of 52.3 cm/sec.

Table 1. Obstetric history related to placental accreta with placenta previa.

Obstetric history	Placental accretism				x 2	95% CI	p
	Cases		Controls				
	N°.	%	N°.	%	OR		
Age							
>30	11	91.7	62	79.5	1	0.34-23.64	0.316
<=30	1	8.3	16	20.5	2.84		
Pregnancies							
Primigesta	1	8.3	17	21.8	1.18	0.04-2.71	0.278
Multigesta	11	91.7	61	78.2	0.33		
History of cesarean section							
Yes	11	91.7	28	35.9	13.17	2.41-160.21	0.000
No	1	8.3	50	64.1	19.64		
First cesarean section							
Yes	3	25	26	33.3	0.33	0.17-2.67	0.565
No	9	75	52	66.7	0.67		
Second cesarean section							
Yes	5	41.7	2	2.6	22.17	4.23-166.42	0.000
No	7	58.3	76	97.4	21.14		
Third cesarean section							
Yes	3	25	0	0	20.17	5.21-17.94	0.000
No	9	75	78	100	9.67		
Curettage							
Yes	9	75	37	47.4	3.16	0.84-13.22	0.075
No	3	25	41	52.6	3.32		

Statistical analysis showed that the loss of the clear zone, non-circular oval placental lacunae with irregular borders, disruption of the bladder wall, placental hyperechogenicity and heterogeneity, chorionic plaque with a depulid, hyperechogenic and irregular appearance, utero-bladder hypervascularization as well as subplacental hypervascularization, nutritional vessels and intraplacental hypervascularization had a statistically significant relationship with placental accretency (p<0.05). And the flowmetry represented by the maximum velocity found in the Doppler study with sweeping of the entire pla-

Table 2. Ultrasound assessment of placental accreta with placenta previa.

Ultrasound assessment	Spectrum of placenta accreta				X2	IC 95%	p
	Cases		Controls				
	N°.	%	N°.	%	OR		
Loss of the light zone							
Yes	5	41.7	10	12.8	6.23	1.29-18.29	0.0.13
No	7	58.3	68	87.2	4.86		
Placental oval lacunae, non-circular, irregular borders							
Yes	9	75.0	0	0.0	65.0	8.89-81.26	0.000
No	3	25.0	78	100	27.0		
Bladder wall disruption							
Yes	6	50.0	3	3.8	24.61	4.97-125.85	0.000
No	6	50.0	75	96.2	25.00		
Placental and heterogeneous hyperechogenicity							
Yes	8	66.7	9	11.5	26.37	5.33-99.20	0.000
No	4	33.3	69	88.5	23.00		
Hyperechogenic and irregular chorionic plaque (depulid appearance)							
Yes	9	75.0	10	12.8	24.14	4.71-88.33	0.000
No	3	25.0	68	87.2	20.40		
Uterovesical hypervasculature							
Yes	7	58.3	8	10.3	17.31	3.14-47.77	0.000
No	5	41.7	70	89.7	12.25		
Subplacental hypervasculature							
Yes	6	50.0	11	14.1	8.75	1.66-22.32	0.003
No	6	50.0	67	85.9	6.09		
Nutritional vessels, placental lacunae, hypervascularity							
Yes	8	66.7	2	2.6	43.27	11.98-481.95	0.000
No	4	33.3	76	97.4	76.00		
Intraplacental hypervasculature							
Yes	6	50.0	8	10.3	12.51	2.27-33.67	0.000
No	6	50.0	70	89.7	8.75		
Maximum placental artery flow velocity (cm/sec)							
Yes	52.32 ± 2.18		26.06 ± 2.52		t=38.02	24.79-27.73	0.000
No							
TOTAL	12	100	78	100			

centa was 52.3 for accreta versus 26.0 in placentas previa without signs of accreta, a difference that was statistically significant (p<0.05).

Table 3 shows the Cox regression for risk of accretency and patient survival, where it is evident that patients with a velocity of up to 53.4 cm/sec had a risk of accretency of 1.0 with a survival probability of 33.3%. However, women with a Doppler flow velocity of 54.8 cm/sec had an increased risk of accretism of 2.4 and the probability of survival decreased to 8.3%.

Figure 1 shows the Cox regression according to flow velocity in relation to survival, in which it

Table 3. Cox regression for the risk of accretism and patient survival.

Speed	Baseline cumulative risk	In the mean of covariates		
		Survival	Standard error	Accumulated risk
49.4	0.087	0.917	0.076	.087
49.8	0.182	0.833	0.103	.182
49.9	0.288	0.750	0.119	.288
50.4	0.405	0.667	0.129	.405
51.3	0.539	0.583	0.135	.539
51.8	0.693	0.500	0.136	.693
52.7	0.875	0.417	0.133	.875
53.4	1.099	0.333	0.125	1.099
54.3	1.386	0.250	0.113	1.386
54.4	1.792	0.167	0.094	1.792
54.8	2.485	0.083	0.063	2.485

can be seen that with a Doppler flow velocity between 40 and 50, the risk of accretism is approximately 1. However, if the Doppler flow velocity increases to more than 50, survival decreases (the higher the velocity, the probability of survival decreases and the risk of accretism increases).

Discussion

Placental accretism is a complex multifactorial event, poorly understood, silent and astonishing for its surprising complications that notably deteriorate maternal and fetal health with deleterious results[8,9].

Accretism is constituted by a diseased placenta from implantation, whose biomolecular qualities show neoproliferative characteristics similar to cancer as described by Weinberg and Hannahan. These include induction of angiogenesis[8,9],

Figure 1. Cox hazard regression plot, flow velocity in relation to survival.

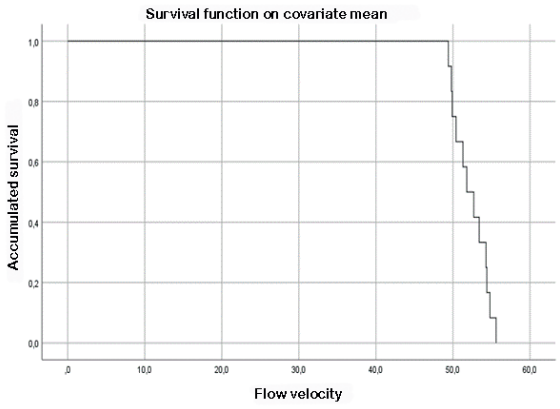


Figure 2. Irregular hyperechogenic chorionic plaque.

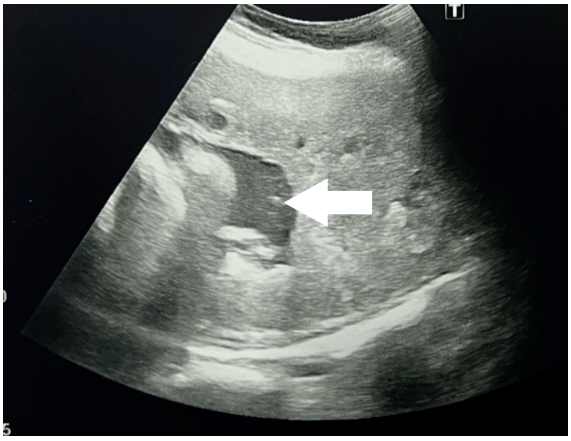


Figure 3. Placental hyperechogenicity and heterogenicity, hyperechogenicity of the chorionic plate.

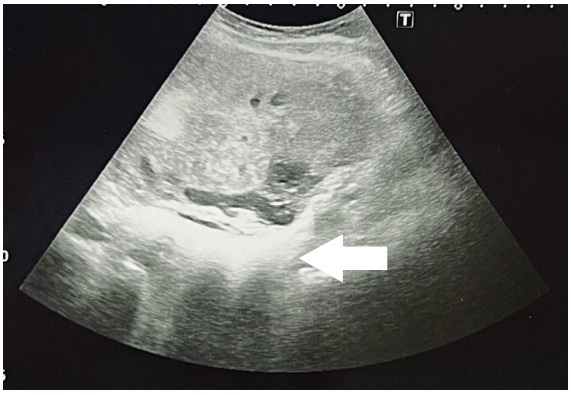
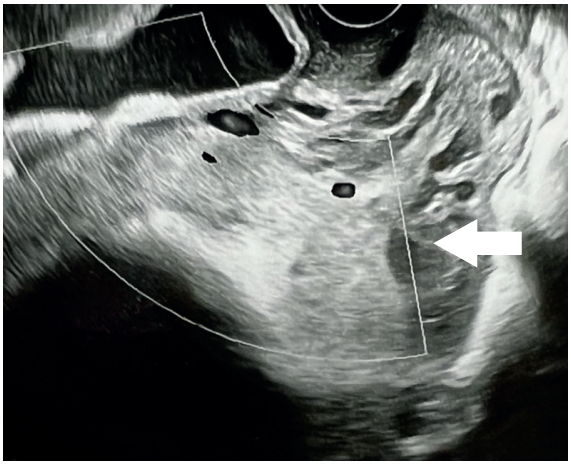


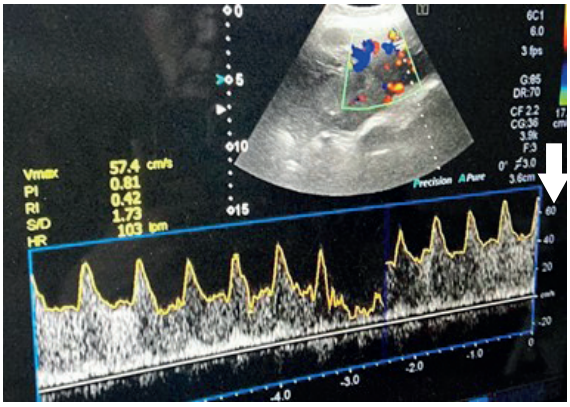
Figure 4. Irregular oval placental lacunae.



sustained proliferative signaling[8,9], resistance to cell death, immune resistance[10,11]. Local processing of E-cadherin may be an important molecular mechanism controlling the invasive phenotype of placenta accreta[12,13].

Placenta percreta shows telomere alterations and changes in the expression of several senescence markers that could be related to altered

Figure 5. Doppler flowmetry measurement.



maturation of the invading trophoblast[14]. The incidence of placenta accreta spectrum shows a progressive increase compared to past decades[15] and its frequency is evident in hospital medical practice, an undoubtedly iatrogenic consequence and currently a public health problem.

Early ultrasound diagnosis makes the difference in the prognosis of these patients. Screening with a good clinical history and early ultrasound diagnosis determine the prognosis of these patients[16].

The most striking ultrasound findings are the abnormal location of the placenta, hyperechogenicity and gray-scale heterogeneity in various placental areas, placental parenchyma very different from what we are used to when we observe normoinsert placentas[17]. On the other hand, anatomical modifications of the basal plate and the chorionic plate can be evidenced in the ultrasound, product of a neoproliferative process that affects the whole placenta in a focal, partial or total form[18]. And the accompanying shadow is the presence of vascular lacunae with irregular borders, which not only have manifestations in the gray scale but, rather, in the increased flow in the placenta when measured with Doppler flowmetry. These findings are suggestive of accretism[18,19].

The evidence of the results show that, in addition to the variables used in the European Working Group on Abnormally Invasive Placenta[7], a classification that is approximately eight years old, the variables added in our study were three: placental hyperechogenicity and heterogeneous, chorionic plaque with a depulid and irregular hyperechogenic appearance, and the maximum flow velocity (cm/sec), which denote

a significant statistical difference as a contribution in the diagnosis of accretism. On the other hand, the critical point of placental flowmetry has been determined as a risk factor for accretism and prognosis of patient survival[18,19].

In the treatment of placental accreta there are various modalities, including conservative or radical treatment such as hysterectomy, treatments that obey the individual circumstances and idiosyncrasies of the patients. The standardized multidisciplinary treatment approach in patients with morbidly adherent placenta, including accreta, increta and percreta, is associated with less maternal morbidity than when such an approach is not used[20]. Undoubtedly, the management of these patients should be in high complexity hospitals that have blood product resources, blood bank, intensive care unit, among others. However, the golden rule continues to be early diagnosis and timely transfer of these patients, since due to their complexity, management should be multidisciplinary and multidisciplinary[21,22].

Our study has some limitations, such as firstly the retrospective design performed in a single hospital center, incomplete medical records and bias in the identification of medical records with propensity to selection bias. Second, patients were not randomly selected, and baseline information may be unbalanced and biased. Third, ultrasound signs may be affected by human or technical factors. Fourth, the sample size was small, and the pregnancy and neonatal outcomes of the patients were not analyzed.

Conclusions

Ultrasound determination of heterogeneous placental hyperechogenicity, irregular hyperechogenic chorionic plaque (depulid appearance) and peak Doppler flow velocity (cm/sec) represent useful parameters of contribution to the diagnosis of placental accreta.

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