International Journal of Medical Arts

Volume 5, Issue 2, February 2023

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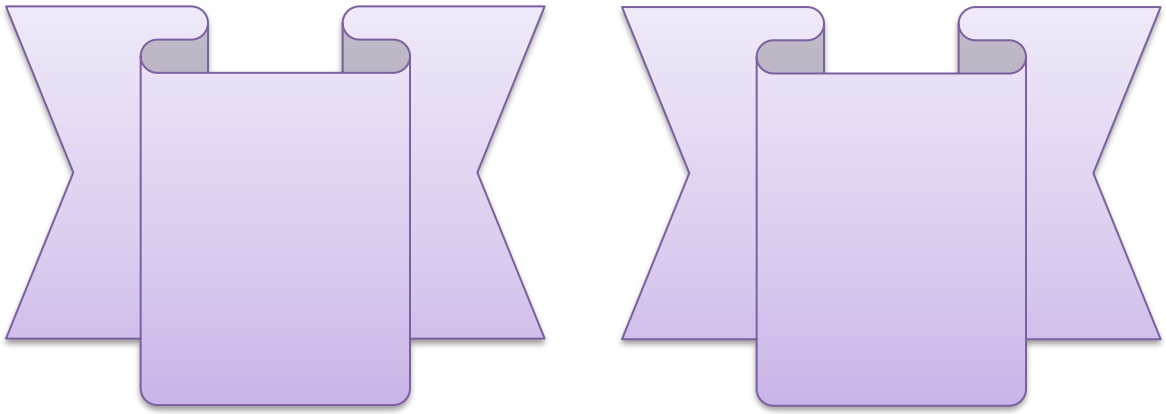

Print ISSN: 2636-4174

Online ISSN: 2682-3780

Available online at Journal Website
https://ijma.journals.ekb.eg/
Main Subject [Gynecology and Obstetrics]

Original Article

The Role of Ultrasound in Prediction of Intraoperative Blood Loss in Cases of Placenta Accreta Spectrum Disorders

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Article information

Received: 16-11-2022

Accepted: 18-04-2023

DOI: 10.21608/IJMA.2023.174323.1555

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Citation: El-Sayed M, Midan MF, Abd Elrehim EI. The Role of Ultrasound in Prediction of Intraoperative Blood Loss in Cases of Placenta Accreta Spectrum Disorders. IJMA 2023 February; 5 [2]: 3039-3044. doi: 10.21608/IJMA.2023.174323.1555.

ABSTRACT

Background: Placenta accreta spectrum [PAS] is one of the most dangerous complications in pregnancy after cesarean section, with high perinatal mortality. The first-line imaging methods employed in the evaluation of placenta accrete include grey scale and Doppler scanning.

Aim of the work: To evaluate the efficacy of grey-scale ultrasound, 2D color Doppler, and 3D power Doppler sonographic markers in predicting major intraoperative blood loss for cases diagnosed with placenta accreta spectrum [PAS] disorders.

Patients and Methods: The day before an expected delivery and hysterectomy, 59 women with PAS were examined for several sonographic indicators of placental invasion. After that, the women were split into two groups, group A [small hemorrhage, less than 2000 ml], and group B [major hemorrhage, greater than 2000 ml], and the results were examined.

Results: In major group participants had higher number of previous CS as well as Gravidity, while gestational age in both groups were insignificantly different. We found significant higher US finding in Major group in all US parameter. The mean PAS score was 13.3 ± 3.2. The minor group had a mean of 10.9 ± 3.7, while the major group had a mean of 16.9 ± 3.9, with a significant difference between the two groups.

Conclusion: When there are PAS abnormalities present, the use of 2D color Doppler and 3D power Doppler can aid in the prediction of severe bleeding. Placental lacuna, hypoechoic regions, and bridging vessels were the key predictors.

Keywords: Abnormally invasive placenta; Accreta; Blood loss; Placenta accreta spectrum

INTRODUCTION

Abnormally invasive placenta [AIP] is a serious obstetric condition that includes abnormalities such as placenta accrete, increate, and percreta. These aberrant placentation abnormalities might cause considerable neonatal and maternal morbidity and death. The condition is distinguished by invasive placentation, which is linked to fatal hemorrhage [1]. Adherent placenta accreta happens if chorionic villi connect firmly to myometrium, placenta increta occurs when they penetrate the myometrium, and placenta percreta happens if placental invasion reaches the uterine serosa or nearby tissues like the urinary bladder [2].

The first-line imaging methods employed in the evaluation of placenta accrete include grey scale and Doppler scanning. Sonography has a relatively high sensitivity to discover placenta accrete prenatally; study results indicative of placenta accreta included loss of hypoechoic clear zone retro-placentally, decline of the bladder wall-uterine interface, appearance of placental lacunae, and hypervascularity of interface between uterine serosa and wall of bladder [3, 4]. Only a few studies have attempted to explore the feasibility and diagnostic performance of an ultrasound-based scoring system in assessing the presence and severity of PAS discords.

The aim of this study is to detect grey-scale ultrasound and 2D color Doppler value as a tool for forecasting amount of intraoperative hemorrhage in cases of pregnant women diagnosed with placenta accreta spectrum disorder.

PATIENTS AND METHODS

Study design and setting: A prospective cohort study included 59 pregnant women with previous history of CS who were admitted to the Obstetrics and Gynecology department at Al-Azhar University hospitals of Damietta for delivery with GA between 34 and 35 week and were diagnosed by US as PAS through presences of placental lacuna, bridging vessels, hypoechoic areas and other criteria.

Study population: The participates were divided into two groups. Group A: This group included the minor hemorrhage patients; Group B: This group included women with major hemorrhage.

Inclusion criteria

Age of child-bearing period [18 - 40 years], history of at least one previous cesarean section, patient with no history of previous abdominal exploration for non-gynecological causes.

Exclusion criteria

Those with coagulopathies, multifetal gestation, or spontaneous placental separation, as well as women with moderate to severe anemia.

Ethical Considerations

Before beginning field work, the Research Ethics Committee of Al-Azhar University's Faculty of Medicine authorized the study protocol. All patients provided written informed permission.

Study procedures

Ultrasound assessment

All patients were imaged by ultrasound machine type voluson p8 and voluson s10. Then 2D color Doppler, and 3D power Doppler sonographic markers were examined. Grey scale US was done to our patient to confirm: placental location, degree of accretion through detecting number of lacunae, measurement of the retro placental space, remaining myometrium, bladder invasion, presence or absence of hypoechoic area, presence or absence of bridging vessels. Between 34 and 36 weeks of gestation were the time of this scan. We employed the 2D greyscale ultrasonography markers "Loss of the clear zone," "Abnormal placental lacunae," "Bladder wall disruption," "Myometrial thinning," "Placental bulge," and "Focal exophytic mass." Additionally, 2D Color Doppler markers were employed for diagnosis, including "Uterovesical hypervascularity," "Subplacental hypervascularity," and "Bridging vessels" [5]. The participating women signed informed consent forms after receiving counselling about their disease, the treatment plan, and any potential side effects. Table 1 provides an explanation of the PAS score in detail.

Table 1: Scoring of PAS by US [5]

Ultrasound and Clinical Signs	Score = 0	Score = 1	Score = 2
Placental lacunae	Not seen	2–3, regular ≤2 cm	4–6, irregular, 4 cm
Hypoechoic retroplacental space ["clear zone"]	Present	Irregular	Absent
Myometrial thinning	Myometrium > 1 mm	Myometrium < 1 mm	Absent
Hyperechoic uterus–bladder interface [bladder line]	Line clear and complete	Line vague or irregular	Line lost
Focal exophytic mass and/or placental bulge	Absent	-	Present
Utero-vescical hypervascularity	Absent	Increased	Multidirectional flow with bridging vessels
Prior Caesarean section	1	2	≥3
Placental relationship with internal cervical os	-	Low-lying	Previa
Subplacental hypervascularity	Normal	Increased with numerous vases, tortuous	Bridging vessels with perpendicular course
Diffuse or focal turbulent flow in the lacunae	Absent	Focal turbulent flow	Diffuse turbulent flow with feeding vessels

Before surgery, a complete medical history, general and systemic examination, laboratory investigations [CBC, liver function test, kidney function test, INR and electrolytes] were evaluated for all patients.

Intra-operative: All enrolled patients underwent scheduled elective surgery no later than 36+6 weeks of gestation. Firstly, we confirmed the degree of accretion by visualizing the placental location in invading the uterine wall, bulging of lower uterine segment. The intraoperative blood loss was assessed by the following three ways: suction apparatus, towel and taps and third space. Twenty fifty patients underwent modified cesarean hysterectomy done by the same technique and the same surgical team, with a multidisciplinary team approach involving consultant obstetricians, consultant anesthesiologists, an on-call urologist, and an on-call vascular surgeon which was always maintained as described by **Hussein *et al.*** [6]. Restrictive transfusion threshold [Hb 7-8 g/dL] of red blood cells was recommended to target Hb concentration of 7-9 g/dL during active bleeding.

Post-operative management: Intensive hemodynamic monitoring in the early postoperative period was provided in an intensive care unit setting to ensure hemodynamic and haemorrhagic stabilization. Postoperative complications were monitored including the degree of blood loss, potential for multiorgan damage, and the need for supportive efforts.

Statistical Analysis: SPSS Software [version 20] were used to perform statistical analysis of patients' data. According to data distribution, descriptive data were expressed as either means with standard deviation or median with ranges. Frequency distributions were used to describe categorical variables. Independent sample t-test were used to detect differences in the means continuous variables and chi-square test were used in cases with low expected frequencies. P value <0.05 are considered significant. Univariate and multivariate logistic regression was done to detect independent predictors of major hemorrhage.

RESULTS

This study included 59 patients with PAS. Participants were divided into two group as regard to amount of blood loss, participants with blood loss more or less than 2500 were recorded into major and minor group respectively. And minor group were formed of 33 [55.9%] of cases and major group of 26 [44.1%] of cases.

Table [2] shows the basic and obstetric characteristics of the included patients. The mean age of the participated groups was 32.3 ± 4.2 years and the mean gestational age was 34.9 ± 1.9 weeks. we found a significant difference between major and minor groups regarding the mean age as it was 29.9 ± 2.8 among the minor group while it was 34.5 ± 7.4 among the major group [p-value= 0.005]. The number of previous CS has a mean of 3.3±1.2. The minor group had a mean of 2.8 ± 1.05 and the minor group was 3.9±1.2 with a significant difference between the two groups [p-value= 0.001].

Table [3] shows the ultrasound findings among the included patients. When it comes to

the US findings, there was a significant difference between the two groups regarding the placental lacunae presence, myometrial thinning, vessels bridging, hypoechoic area, flow in lacunae [p-value= 0.001].

The mean PAS score was 13.3± 3.2. The minor group had a mean of 10.9±3.7, while the major group had a mean of 16.9±3.9, with a significant difference between the two groups [table 4].

Table [5] shows the perioperative assessment of the included patients. The median blood loss cases in the minor group were 11 and 10 cases among the major group. There was a significant difference between the major and the minor groups regarding the preoperative hemorrhage but no significant difference regarding the postoperative hemorrhage [p-value= 0.65 and 0.019, respectively]. The operative time in our study was 76.5 min. Moreover, there was a statically between the two groups there was a significant difference [P-value = 0.001].

Table [6] demonstrates the use of logistic regression to identify which ultrasonography marker acts as a reliable predictor of significant bleeding. The following sonographic markers corresponded to the ORs for significant bleeding: 'number of lacunae > 4′ OR 3.8 95% CI [1.0–13.8] [p = 0.047]; 'Flow in lacuna' OR 9.8 95% CI [1.1–88.0] [p = 0.024]; 'Hypochaotic areas OR 11.8 95% CI [1.2–95.0] [p = 0.03]; 'Myometrial thickening OR 13.7 95% CI [3.1–90.3] [p = 0.001]; and 'presence of bridging vessels OR 2.8 95% CI [1.2–7.2] [p = 0.005].

Table [2]: Comparison of Demographic and obstetric data in study group

	Total		minor		Major		P value
	Mean	SD	Mean	SD	Mean	SD	
Age	32.3	4.2	31	4.2	34.04	3.6	**0.005***
BMI	31.9	5.7	29.9	2.8	34.5	7.4	**0.002***
Gravidity	5.07	1.8	4.5	1.8	5.8	1.7	**0.007***
Number of Cs	3.3	1.2	2.8	1.05	3.9	1.2	**0.001***
Gestational age	34.9	1.9	34.6	2.4	35.1	1.3	0.6

Table [3]: Comparison of US finding of study group

		Total		Minor		Major		P Value
		No.	%	No.	%	No.	%	
Placental lacunae	**Not seen**	0	0	0	0	0	0	**0.001***
	2-3	22	37.3	22	100	0	0	
	4-6	37	62.7	11	29.7	26	70.3	
Myometrial thinning	**>1**	43	72.9	33	76.7	10	23.3	**0.001***
	<1	6	10.2	0	0	6	100	
	Absent	10	16.9	0	0	10	100	
Vessels bridging	**Absent**	19	32.2	19	100	0	0	**0.001***
	Increased	20	33.9	13	65	7	35	
	Bridging	20	33.9	1	5	19	95	
Hypoechoic area	**Present**	26	44.1	26	100	0	0	**0.001***
	Irregular	14	23.7	7	50	7	50	
	Absent	19	32.2	0	0	19	100	
Flow in lacunae	**absent**	18	30.5	18	100	0	0	**0.001***
	focal	22	37.3	15	68.2	7	31.8	
	diffuse	19	32.2	0	0	19	100	
Penetration of blood vessels	**Absent**	26	44.1	19	73.1	7	26.9	**0.018***
	Present	33	55.9	14	42.4	19	57.6	
Bulging of LS	**Absent**	18	30.5	16	88.9	2	11.1	**0.001***
	Present	41	69.5	17	41.5	24	58.5	

Table [4]: Comparison of PAS score between studied groups

	Total		minor		Major		P value
	Mean	SD	Mean	SD	Mean	SD	
PAS	13.3	3.2	10.9	3.7	16	3.9	**0.001***

Table [5]: Comparison of perioperative finding in study group

	Total		minor		Major		P value
	Mean	SD	Mean	SD	Mean	SD	
Amount of blood loss	2183.5	1256.7	1321.2	501.1	3276.9	1057.3	**0.001***
Amount of blood transfusion	2222.03	1552.5	1260.6	647.4	3442.3	1512.1	**0.001***
Time of procedure	76.5	35.1	60.9	23.7	96.4	37.5	**0.003***
Hemoglobin pre	11.1	1.06	11.07	1.2	10.9	0.9	**0.65**
Hemoglobin post	8.8	1.7	9.2	1.1	8.2	2.2	**0.019***

Table [6]: Logistic Regression to detect ultrasound markers as an independent predictor of major hemorrhage

	OR	CI		P value
		Upper	Lower	
Number of Lacuna	3.8	1.1	13.8	**0.047***
Hypochaotic areas	11.8	1.2	95.0	**0.03***
Myometrial thickening	13.7	3.1	90.3	**0.001***
Presence of bridging vessels	2.8	1.2	7.2	**0.005***

DISCUSSION

Our aim was to detect the value of grey-scale ultrasound and 2D color Doppler as a tool for predicting the amount of intraoperative blood loss in cases of pregnant women diagnosed with placenta accreta spectrum disorder.

The mean age of the participated groups was 32.3 ± 4.2 years and the mean gestational age was 34.9 ± 1.9 weeks. This is similar to **Cali *et al.*** [7] where maternal age at diagnosis was 31.6 ± 5.6 years and mean gestational age at birth was 35.6 ± 1.7 weeks.

We found a significant difference between major and minor groups regarding the mean age as it was 29.9 ± 2.8 among the minor group while it was 34.5 ± 7.4 among the major group [p-value= 0.005]. However, the mean gestational age did not have a significant difference between the two groups [p-value= 0.6]. This comes in contrast with previous reports where a significant difference was found [7-8]. This may be attributed to different geographical area and inclusion criteria of the mentioned studies.

The total mean number of parities was 5.07±1.8; however, **Hussein *et al.*** [6] has a smaller parity mean [3.07 ± 1.1]. Moreover, the median number of parities was 5 in the minor group and 6 in the major group with a significant difference between the two groups [p-value= 0.007]. This comes in agreement with **Watthanasathitnukun *et al.*** [8], where a significant difference was found [p-value <.001]. However, **Zhou *et al.*** [9] did not find a significant difference. This similarity may be attributed to the fact that increased parities is a major risk factor for placenta accrete.

Regarding the number of previous CS, it has a mean of 3.3±1.2, while it was 2.80 ± 0.78 in the study of **Hussien *et al.*** [6] study. Regarding the difference between the two groups, the minor group had a mean of 2.8 ± 1.05 and the minor group was 3.9±1.2 with a significant difference between the two groups [p-value= 0.001]. This comes in agreement with the previous done study by **Cali *et al.*** [7] who also found a significant difference between the two groups regarding the number of parities. However, **Watthanasathitnukun *et al.*** [8] did not find a significant difference between the two groups [p-value= 0.874]. This similarity may be attributed to the fact that previous CS is one of the major risk factors for placenta accrete.

When it comes to the US findings, there was a significant difference between the two groups regarding the placental lacunae presence, myometrial thinning, vessels bridging, hypoechoic area, flow in lacunae [p-value= 0.001]. This comes in agreement with **Hussien *et al.*** [6] where the p-value for the placental lacunae presence, myometrial thinning, vessels bridging, hypoechoic area, flow in lacunae was: 0.043, 0.063, 0.001, 0.020, and 0.048, respectively.

The mean PAS score was 13.3± 3.2. The minor group had a mean of 10.9±3.7, while the major group had a mean of 16.9±3.9, with a significant difference between the two groups. Also, **Watthanasathitnukun *et al.*** [8] found a significant difference between the two groups.

Regarding the amount of blood transfusion, the mean amount of blood transfusion was 2222.03±1552.5 ml. This comes in agreement with **Hussien *et al.*** [6] where the mean amount of blood transfusion was 2.68 ± 1.88. This similarity in the findings may be attributed that both studies have been conducted in Egypt, making it more applicable to have a similar population and available facilities. Moreover, the mean amount of blood transfused to the minor group was 1260.6 ± 647.4, while it was 3442.3 ± 1512.1 to the major group with a significant difference between the two groups. Similarly, **Watthanasathitnukun *et al.***, where there was a significant difference between the two groups [p-value= 0.001] [8]. This similarity in the findings may be explained by the fact that placenta accrete patients tend to have an urgent need for blood transfusion due to massive blood loss.

The operative time in our study was 76.5 min which is much less than the previous described by **Cali *et al.*** [7] where they had a mean operative time of 104.6 ± 60.5 min. moreover there was a statically significant difference between the two group [P-value = 0.001]. This also comes in agreement with the previous literature [9, 10].

Despite the obtained results, the current study has some limitations. This study is a single center study. Also, the duration of follow up was relatively short. This should be taken into consideration in further studies.

Conclusion: We found a difference between massive hemorrhagic group and minor hemorrhagic group regarding the ultrasound findings which may indicate that using Common 2D grey scale and color Doppler ultrasonography signals can be helpful in situations with PAS to improve pre-operative care.

Recommendations and implication for future work: A multicentric studies with a greater sample size is needed to support our findings. A longer follow-up is required to determine the diagnostic utility of sonography in the effective identification of placenta accrete spectrum. Further prospective trials are required to develop and verify a newly precise ultrasound grading method.

Conflict of Interest and Financial Disclosure: None.

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International Journal of Medical Arts

https://ijma.journals.ekb.eg/
Print ISSN: 2636-4174
Online ISSN: 2682-3780