THIRD TRIMESTRIC ULTRASOUND DIAGNOSIS OF PLACENTA ACCRETA SPECTRUM AND CORRELATION OF THE FINDING WITH FIGO GRADING SYSTEM

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Abstract

Objective: This study aimed to evaluate the correlation between ultrasound criteria for diagnosis of Placenta Accreta Spectrum (PAS) with intra-operative FIGO grading to ensure accurate prenatal US diagnosis.

Design: Descriptive Prospective cohort study.

Setting: Kasr Al-Ainy maternity Hospital - Fetal Medicine Unit.

Subjects and methods: Sixty-four women in 3rd trimester of pregnancy diagnosed with low lying anterior placenta and had previous one or more cesarean deliveries were included. All patients were examined by ultrasound for criteria of abnormal placental implantation according to standardized description proposed by European Working group on PAS few days before the scheduled elective C.S. Then FIGO grading was done intra-operative followed by pathological confirmation of hysterectomy specimen. The main outcome was the correlation between prenatal ultrasound criteria of PAS and intra-operative FIGO grading of PAS are then histopathological confirmation was done.

Results: A strong correlation was found between the presence of ultrasound placental lacunae (CC 0.429, P<0.001), loss of clear zone (CC 0.652, P <0.001) and myometrial thinning (CC 0.498, P <0.001) with intra-operative FIGO grading. While ultrasound Placental bulge (CC 0.265, P = 0.034) and Bladder wall interruption (CC 0.367, P 0.003) were moderately correlated with intra-operative FIGO grading.

Conclusion: The surgical outcome and intraoperative FIGO grading are strongly correlated with the presence of placental lacunae, loss of clear zone and myometrial thinning and moderately correlated with Placental bulge

and Bladder wall interruption ultrasound criteria.

Synopsis: The surgical outcome and intraoperative FIGO grading are strongly correlated with the presence of placental lacunae, loss of clear zone and myometrial thinning and moderately correlated with placental bulge and bladder wall interruption in prenatal ultrasound.

Introduction

Placenta accreta spectrum (PAS) -previously named morbidly adherent placenta- is a serious condition caused by the presence of abnormal placental adhesion and invasion of the myometrium because of defective fibrinoid or Nitabuch layer [1].

The frequency of PAS is progressively increasing over time. It was reported as 1 in 20,000 births in 1951, 1 in 2500 births in the 1980s [2]. and reached 1 in 533 between1982 to 2002 [3].

The presence of low-lying placenta and prior cesarean delivery are considered the main risk factors for PAS [4]. The risk of development of PAS in women with low lying placenta is 3%, 11%, 40%, 61%, and 67%, after 1,2,3,4 and 5 or more cesarean deliveries, respectively [5].

FIGO classified PAS into 3 grades according to the presence of clinical criteria at vaginal delivery and at laparotomy and microscopic examination of placental bed into grade 1 (placenta adherenta or creta), grade 2 (Increta) and grade 3 (Percreta) which is further subdivided into 3a,3b and 3c categories [6].

PAS is associated with life-threatening bleeding (both intra- and post-operative) that usually requires additional surgical interventions including hysterectomy or vascular ligation. PAS is associated with high risk of maternal morbidity and mortality, massive blood transfusion, maternal ICU admission and prolonged hospital costs and stay [7]

The reduction of maternal morbidity and mortality is dependent on antenatal diagnosis of PAS and arrangement the management carried by a multidisciplinary team (MDT) at level III/IV maternal care facility [8,9]

The antenatal diagnosis of PAS is usually carried though ultrasonography combined with Doppler color mapping and if needed through MRI [10]

Ultrasonographic criteria include the presence of placental lacunae, the loss of retroplacental clear zone, serosa–bladder interface interruption, myometrial thinning (< 1 mm), bridging vessels, uterovesical vascularity, and the presence of exophytic placental extension [11].

The overall accuracy of ultrasound and individual ultrasonographic criteria varies among different studies. Some reported high accuracy reaching 100 % [12] while other studies reported a much lower accuracy [9].

Aim of the work

The aim of this study is to evaluate the accuracy of 3rd trimester ultrasound in diagnosis of PAS.

Material and methods

This is a prospective cohort study conducted between June 2020 and June 2021 at Cairo University Maternal-Fetal Medicine Unit (CAIMFM) - Kasr Al-Ainy Teaching Hospital. The Study included 64 Pregnant women, in the third trimester, with history of one or more previous cesarean sections, low lying placenta or placenta previa, who were admitted to the Obstetrics and Gynecology department-Kasr El- Aini yospital-Cairo University. The diagnosis of placenta previa was based on the presence of placental tissue covering the internal os and low lying placenta was diagnosed when placenta was

< 2cm from the internal os but did not cover it. Exclusion criteria were multiple pregnancy, posterior placenta and those who refused to participate in the clinical research. All participating women signed an informed written consents after explanation of the study aim, design, risks, and benefits.

All participants were subjected to evaluation through comprehensive history, general and abdominal examination followed by routine laboratory investigations.

A very precise ultrasound was done to all participants few days prior to CS. The following ultrasound items were examined: fetal viability, amniotic fluid assessment, fetal biometrics, fetal presentation, expected fetal weight & location of placenta. Next step was looking for Ultrasound criteria of placenta accreta according to EW group on PAS which include:

1. Loss of retroplacental clear zone (The hypoechoic plane in the myometrium behind the placental bed is lost).

2. Abnormal placenta lacunae (Presence of multiple variable sized lacunae with irregular wall and turbulent flow in grey-scale imaging).

3. Myometrial thinning (Decreased thickness of myometrium overlying the placenta to <1 mm or undetectable).

4. Bladder wall interruption (Loss of all or part of the hyperechoic band between the uterine serosa and the bladder lumen).

5. Placental bulge (Abnormal bulge of the placenta into neighbouring organ usually the bladder with intact serosa).

6. Focal exophytic mass (Placental tissue is seen usually inside the urinary bladder with interrupted uterine serosa).

Both ultrasound and Doppler examinations were done using Voluson E 10 GE (Korea) equipped with a 4–7 MHz curvilinear transabdominal probe with the mother in slight left tilted supine position to avoid supine hypotension with partially full bladder to allow optimum uterine serosa and bladder wall visualization.

FIGO grading was done to assess and categorizes placental adherence or invasion at delivery. Intraoperative finding according to FIGO grading system include:1-Placental tissue seen, 2- Placental separation with uterotonics, 3- Manual removal of placenta, 4- Clear surgical plane between the bladder and the uterus and 5-Involvement of parametrium.

Finally, diagnosis was confirmed by histopathologic examination of hysterectomy specimen.

The main outcome was the correlation between prenatal ultrasound criteria of AIP and intra-operative FIGO grading of AIP then histopathological confirmation was done.

Statistical analysis

Data were statistically described in terms of mean + standard deviation (+SD), median and range, or frequencies (number of cases) and percentages when appropriate. Numerical data were tested for the normal assumption using Kolmogorov Smirnov test.

Comparison of numerical variables between the study groups was done using Kruskal Wallis test. For comparing categorical data, Chi-square (X^2) test was performed. Exact test was used instead when the expected frequency is less than 5. Correlation between various variables was done using Spearman rank correlation. Two-sided p values less than 0.05 was considered statistically significant. All statistical calculations were done using computer program IBM SPSS (Statistical Package for the Social Science; IBM Corp, Armonk, NY, USA) release 22 for Microsoft Windows.

The Correlation Coefficient used to measure the strength of association between two variables; above 0.4 consider strong, 0.2-0.4 moderate and below 0.2 weak.

Sample size calculation was based on correlation between ultrasound criteria of abnormal placental implantation according to standardized description proposed by EW group and intraoperative FIGO grading of AIP. According to the individual data extracted from a prior publication [13], the coefficient of determination between ultrasonographic criteria and FIGO clinical staging of placenta accreta to be able to detect a correlation coefficient of 0.4 with 80 % power setting type 1 error probability to 0.05. Sample size calculation was done using G*Power software version 3.1.2 for MS Windows, Franz Faul, Kiel University, Germany. If you changed the detected correlation coefficient to 0.3, the sample will be 64 cases.

Results

The mean maternal age at diagnosis was 32.92+/-4.172 and the mean gestational age at delivery was 35+/-1.7.

Nine patients (14.1%) showed no ultrasound criteria of PAS, 7 of them were found to be FIGO grade1 and 2 were FIGO grade 2. All the nine patients were treated conservatively and didn't need hysterectomy nor blood transfusion. 55 patients (85.9 %) showed one or more ultrasound criteria of PAS. 49 (89 %) of them managed by hysterectomy; 14 (28.5 %) had 2 Ultrasound criteria, 30(61.2 %) had 3 ultrasound criteria, 3 (6.1 %) had 4 Ultrasound criteria and 2(4 %) had 5 Ultrasound criteria. (10.9 %) patients showed only 1 ultrasound criterion of PAS; 4 of them were found to be FIGO grade 1 and 2 were FIGO Grade 2. All of them were managed conservatively with no need for hysterectomy.

Ultrasound loss of retroplacental clear zone was found in 51 patients (79.7%), 1 of them was FIGO grade 1(2%), 6 were grade 2(11.8%), 37 were FIGO grade 3(72.5%), 3 were FIGO grade 4(5.9%) and 4were FIGO grade 5(7.8%). Ultrasound preserved retroplacental clear zone was found in13 patients (20.3%); 10 of them were FIGO grade 1(76.9%), 1was FIGO grade 2(7.7%) and 2 were FIGO grade 3(5.1%), Non were FIGO grade4 or 5.

Ultrasound placental lacunae was found in 44 patients (68.8%), 4 of them were FIGO grade 1 (9.1%), 3 were FIGO grade 2 (6.8%), 30 were FIGO grade 3 (68.2%), 3 were FIGO grade 4 (608%) and 4 were FIGO grade 5 (9.1%). Ultrasound placental lacunae was not found in 20 patients (31.3%), 7 of them were FIGO grade 1(35.0%), 4 were FIGO grade 2 (20.0%), 9 were FIGO grade 3 (45.0%), Non were FIGO grade 4 or 5.

Ultrasound bladder wall interruption was found in 4 patients, 1 was FIGO grade 3(25.0%), 1was FIGO grade 4(25.0%) and 2 were FIGO grade 5(50.0%). Non were FIGO grade 1 or 2. Ultrasound bladder wall interruption was not found in 60 patients (93.0%), 11 were FIGO grade 1(18.3%), 7 were FIGO grade 2 (11.7%), 38 were FIGO grade 3 (63.3%), 2 were FIGO grade 4 (3.3%) and 2 were FIGO grade 5 (3.3%).

Ultrasound myometrial thinning was found in 51 patients (79.7%), 3 were FIGO grade 1(5.9%), 6 were FIGO grade 2(11.8%), 35 were FIGO grade 3(68.6%), 3were FIGO grade 4(5.9%) and 4were FIGO grade 5(7.8%). Ultrasound myometrial thinning was not found in 13 patients (20.3%), 8 were FIGO grade 1(61.5%), 1 was FIGO grade 2(7.7%), 4were FIGO grade 3(30.8%).Non were FIGO grade 4 or 5.

Ultrasound placental bulge was found in 6 patients (9.4%), 1 was FIGO grade 2(16.7%), 2 were FIGO grade 3 (33.3%), 1was FIGOgrade 4(16.7%) and 2 were FIGO grade 5(33.3%). Non were FIGO grade 1. Ultrasound placental bulge was not found in 58 patients (90.6), 11 were FIGO grade 1(19.0%), 6 were FIGO grade 2(10.3%), 37 were FIGO grade 3(63.8%), 2 were FIGO grade 4(3.4%) and 2 were FIGO grade 5(3.4%).

Non of the studied patients showed focal exophytic mass and so correlation with FIGO grading could not be done.

When correlating ultrasound finding with intraoperative FIGO grading (Table:1) strong correlation was found with loss of clear zone, ultrasound placental lacunae and myometrial thinning; correlation coefficient was 0.652, 0.429 and 0.498 respectively. While moderate correlation was found with ultrasound bladder wall interruption and placental bulge; correlation coefficient was 0.367 and 0.265 respectively. Correlation couldn't be assessed for ultrasound focal exophytic mass as none of our patients showed this finding.

Table (1): Correlation Coefficient calculation using Spearman rank correlation

			FIGO Grading
Spearman's rho	US-loss of clear zone	Correlation Coefficient	0.652
		p value	0.000
		N	64
	US-placental lacunae	Correlation Coefficient	0.429
		p value	0.000
		N	64
	US-bladder wall interruption	Correlation Coefficient	0.367
		p value	0.003
		N	64
	US-myometrial thining	Correlation Coefficient	0.498
		p value	0.000
		N	64
	US-placental bulge	Correlation Coefficient	0.265
		p value	0.034
		N	64

Discssion

Main Findings:

64 women with placenta previa or low lying anterior placenta and previous 1 or more CS scar were included in this study, 55 (85.9%) of them were diagnosed as having PAS by US criteria proposed by EW group. 51 (92.7%) patients showed loss of ultrasound clear zone, 44(80%) showed placental lacunae, 4 (7.2%) showed bladder wall interruption, 51 (92.7%) showed myometrial thinning and 6 (10.9%) showed ultrasound placental bulge. Non showed ultrasound focalexophytic mass.

When correlating ultrasound finding with intraoperative FIGO grading strong correlation was found with loss of clear zone, ultrasound placental lacunae and myometrial thinning; correlation coefficient was 0.652, 0.429 and 0.498 respectively. While moderate correlation was found with ultrasound bladder wall interruption and placental bulge; correlation coefficient was 0.367 and 0.265 respectively. Correlation couldn't be assessed for ultrasound focal exophytic mass as none of our patients showed this finding.

Ultrasound diagnosis of PAS according to the criteria proposed by the EW- group have good -ve predictive value as all patients who had no or only one ultrasound criteria were treated conservatively and didn't need hysterectomy nor blood transfusion. While those with 2 or more ultrasound findings were found to be FIGO 3 or more and did hysterectomy which means that the number

of ultrasound findings correlates with the severity of invasion.

PAS ultrasound signs are due to destruction of the uterine wall till the serosa because of the placental tissue reaching the deep uterine circulation. Adherent and invasive placentation may coexist in the same placental bed. This is why it's difficult to differentiate between adherent and invasive placenta using ultrasound signs. Correlation of operative finding (FIGO grading) with prenatal ultrasound finding is essential to improvescreening, diagnosis and management of PAS [14].

Only a few studies have attempted to explore the feasibility and diagnostic performance of ultrasound in assessing the presence and severity of PAS disorders in correlation with the intraoperative clinical staging suggested by FIGO.

Cali G.et al., 2019 studied 259 women with placenta previa and reported that the ultrasound scoring system including clear zone loss, interrupted bladder wall, placental lacunae, increased vascularity of both uterovesical zone and the parametrium correlated with the clinical staging suggested by FIGO. They found that increased severity of the ultrasound stage of PAS disorders was associated with increased blood loss, need for blood transfusion, operative time and post operative hospital stay[15].

Cali G. et al., 2018 studied 210 women with placenta previa and previous CS scar and aimed to confirm the accuracy of Ultrasound in diagnosing myometrial invasion in PAS disorders. They found that Ultrasound is highly accurate in diagnosing placental invasion when applied to a population with high risk for PAS. The use of three ultrasound signs was associated with a better specificity for placenta percreta [16].

Tovbin J. et al., 2016 reported that a scoring system including the number of placental lacunae and the presence of bladder wall interruption had a high diagnostic performance for PAS disorders allowing for adequate antenatal assessment. Its helpful for patients counseling and delivery planning with multidisciplinary team approach [17].

Eric J. et al., 2021 found that proper prenatal diagnosis, especially accurate differentiation between abnormal placental adherence & invasion is mandatory for proper management. Histopathologic confirmation of diagnosis is the golden standard for PAS. This system may also improve management outcome data by allowing the development of targeted screening protocols for women at high risk of PAS [18].

Zachry B. et al., 2019 discussed the ultrasound appearance and sensitivity in evaluating cases of suspected PAS. Ultrasound was found to be very sensitive and specific with several sonographic features that when present, raise the diagnosis of PAS. Ultrasound remains the best imaging tool for the assessment of PAS with MRI shown to have a complementary role when used appropriately [19].

Strength and limitations:

The prospective data collection, large sample size and confirmation of diagnosis by histopathological examinations represent the major strengths of this study. Finally, all cases affected by PAS were managed by the same multidisciplinary team and treated with hysterectomy, thus reducingbias related to the operator's experience and type of surgical approach adopted.

The main limitation of the study is some patients who were diagnosed as focal accreta by ultrasound (1 or 2 ultrasound criteria) did not do hysterectomy and thus there was no pathological confirmation of the diagnosis.

Another limitation was the inability to estimate the correlation of ultrasound focal exophytic mass and FIGO grading as none of our patients showed ultrasound focal exophytic mass.

Conclusion

In this study we conclude that the ultrasound finding of PAS as proposed by the EW-group correlates with the intraoperative FIGO clinical grading system and surgical outcome. Antenatal ultrasound diagnosis of PASshows both good positive and negative predictive values.

We recommend using ultrasound for prenatal assessment of women who are at high risk of having PAS disorders being accurate, relatively inexpensive and widely available imaging modality and therefore should be the first line for the diagnosis of PAS disorder.

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