Ultrasound Screening of Placenta Accreta Spectrum in Early Pregnancy

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Abstract

Placenta accreta spectrum (PAS) is associated with serious complications. Early recognition may lead to enhanced care, counseling and more favorable pregnancy outcomes. To evaluate the role of first trimester ultrasound in early prediction of PAS and subsequent management. This is a case-control study of 60 pregnant women with uterine scars and early pregnancy sonographic signs of placenta accreta, who were delivered at Beni-Suef University Hospital. Based on the presence of morbidly adherent placenta (MAP) at the time of delivery, subjects were divided into two groups. Sonographic findings and outcomes were compared in both groups. At Caesarean section, 32/60 patients (53.3%) had evidence of MAP. Older age, higher parity and number of previous sections were significantly associated both with the presence of MAP and with the requirement for Caesarean-Hysterectomy. During first trimester scan, bridging vessels and low gestational sac were the most common findings (n=35 & 34 respectively). All sonographic findings were significantly associated with the presence of MAP. Using weighted OR model, thin myometrium and lacunae had significant independent associations with MAP (p=0.02 & 0.008 respectively). Regarding third trimester scans, sonographic evidence of placenta accreta was present in all patients with MAP at C.S. and only 29% in those without (100% sensitivity, 71% specificity; p=0.001). Post-partum hemorrhage and transfusion requirement were present in 36 cases (60%), including 94% oi cases of MAP (p=0.001). Pelvic devascularization, hysterectomy and ICU admission only occurred in those with MAP. Early sonographic assessment of pregnancies with previous cesarean delivery or uterine surgery can predict the presence of MAP disorder and improve the surgical outcome.

Keywords: Placenta accreta, Placenta accrete spectrum, Placenta previa, Ultrasound.

1. Introduction

Placenta accreta spectrum (PAS) encompasses different degrees of abnormal placental adhesion and invasion to the uterus and/or surrounding structures [1]. Placenta increta and percreta represent 15% and 20% of PAS respectively [2]. Owing to the possibility of massive maternal blood loss and organ invasion, overinvasive placentation is linked to hysterectomy, damage of organs, lengthy hospitalizations as well as maternal and fetal mortality [3]. When preserving fertility is an issue, conservative alternatives to hysterectomy may be considered. In these cases, appropriate counseling and due consideration of risks in relation to benefit are required [2]. Despite advances in antenatal diagnosis, many cases remain undiagnosed, with negative consequences on maternal outcomes [4]. Ultrasonography is the major imaging technique in obstetrics as well as the primary method for antenatal recognition of PAS. Diagnosis usually made towards the end of pregnancy. Sonographic signs during ate pregnancy include exophytic zones and large sonolucent areas within the placenta.

Loss of the retropacental hypoechoic myometrial zone with reduced myometrial thickness beyond 4mm could also denote abnormal placental adherence. The interface between the uterine serosa and the bladder may show thinning, disruption and hypervascuarity upon Doppler study. Blood flow in the placental lacunae shows turbulence [5]. Although dedicated ultrasound and MRI having improved antenatal diagnosis, between one half and two thirds of cases remain undiagnosed, resulting in poorer maternal outcomes [4]. Sonographic features of PAS have also described as early as the first trimester. The early ultrasonographic findings include low gestational sac, hypoechoic placental regions, irregular placental-myometrial interface and placenta praevia [6]. Early detection of PAS provides opportunities for optimizing perinatal management as well as effective patient counseling considering implications for antenatal course and delivery [6]. The aim of this study is to evaluate the role of first trimester ultrasound in early prediction of PAS and subsequent management.

2. Patients and Methods

This is a case-control study of 60 pregnant women with uterine scars and early pregnancy sonographic signs of placenta accreta. Consecutive patients presenting for antenatal care and fulfilling the inclusion criteria were enrolled from Beni-Suef University hospital in the period between May 2020 and January 2022. From 78 initial enrollments, 18 did not complete follow up until delivery. Those who completed were divided into two groups based on the presence (group I) of morbidly adherent placenta at the time of delivery or absence thereof (group II). Sonographic findings and outcomes were compared in both groups.

2.1. Ethical Considerations

The study was conducted in accordance with the declaration of Helsinki. The protocol was approved by the research ethics committee of Beni-Suef faculty of medicine. Patients were counselled and informed consents were obtained. Privacy of patients and their personally identifiable information were maintained.

2.2. Inclusion Criteria

a- Pregnant women with history of uterine scar as cesarean section or myomectomy.
b- 1st trimester ultrasound; at 8-13 weeks gestation, showing at least one of the early markers for placenta accrete.

2.3. Exclusion Criteria

Caesarean scar pregnancy, abortion before 24 weeks gestation or lack of follow up till delivery.

2.4. Patients were Subjected to

A. Medical and obstetric history and examination
B. First trimester ultrasonography using a 2D ultrasound system" Toshiba Xario 200" equipped with a 4–8-MHz trans-abdominal transducer and a 12 MHz transvaginal transducer with available color Doppler. This included routine scans and examination for evidence of placenta accrete; including:
1. Low implantation of the gestational sac, defined as a gestational sac implanted in the lower third of the uterus between 8 and 10 weeks or primarily occupying the lower uterine segment .
2. low-lying placenta, defined as the edge reaching to or within 2 cm from the internal cervical os in the cases of anterior placenta and reaching or covering the internal cervical os in the cases of posterior placenta , both with or without thin myometrium and/or bridging vessels.
3. Presence of anechoic areas within the placenta with or without doppler flow demonstrated.
4. Irregular placental-myometrial interface .

The ultrasound scan was performed transabdominally unless there were technical problems impairing visualization, in which case transvaginal sonography was also carried out.
C. Routine antenatal care. The same operator and equipment as the initial scan performed ultrasound for assessment of placental localization and signs of AIP at 28-34 weeks. For each patient, the whole placenta was scanned in a systematic fashion using both gray-scale ultrasound and color flow mapping. The placenta is imaged with a sufficient bladder volume to clearly visualize the serosa–bladder interface, and the angle of insonation will be kept as low as possible, the placenta was scanned to know if it was persistent placenta previa or placental migration occurs and become normally situated. For cases of persistent placenta previa, we recorded the presence or absence of the following features.

- On *gray-scale ultrasound imaging*: we consider the presence of at least one of the following characteristics to indicate placenta accrete spectrum.
1. Complete loss of the retroplacental sonolucent zone.
2. Thin myometrium.
3. Thinning or disruption of the hyperechoic uterine serosa–bladder interface.
4. Presence of focal exophytic masses invading the urinary bladder.
5. Presence of abnormal placental lacunae [7].
- Likewise, the diagnosis of placenta accreta is regarded as positive when any one of these *color Doppler* criteria is present:
1. Diffuse or focal lacunar flow pattern.
2. Hypervascularity of the uterine–bladder interface with abnormal blood vessels linking the placenta to the bladder.
3. Markedly dilated vessels over the peripheral subplacental region [8].
D. Patients delivered by Caesarean section following standard preoperative assessment, anesthesia, and surgical, postoperative and multidisciplinary procedures. The presence of surgical complications, postpartum hemorrhage, and the need for other interventions, NICU admission and maternal outcomes noted.

2.5. Statistical Analysis

Data were analyzed using IBM SPSS (Statistical Package for the Social Sciences) for Windows, Version 23.0. Armonk, NY: IBM Corp.). Categorical data were presented using numbers and percentages and were compared using Chi Square tests with Monte Carlo corrections when needed. Numerical data were presented using means and standard deviations. The independent sample t-test was used to compare means. Sensitivities and specificities were reported as appropriate. Logistic regression was used to further judge independent predictors of MAP. P values less than 0.05 were considered significant. Sample size was adequate to a power of 80% at an alpha error of 0.05.

3. Results and discussion
3.1. Results

The mean age (±SD) of the patients was 30±4.7 years with gravidity between 2-8 and parity 1-6 (table 1). They were delivered by Caesarean section at 33-39 weeks gestation (mean±SD 37.3±1.1). At the operation, 32 patients (53.3%) had evidence of morbidly adherent placenta (group I), while 28 did not have (fig 1). As shown in table 1, those with MAP were significantly older in age with higher gravidity, parity and number of previous sections. Ultrasonographic findings are shown in table 2. Bridging vessels and low gestational sac were the most common early findings (n=35 & 34 respectively). Lacunae, loss of interface and thin myometrium were present in a significant minority (n=27-29). All were significantly more common in group I patients with MAP. Using weighted OR model, thin myometrium and lacunae had significant independent

associations. Regarding third trimester scans, all patients in group I and only 29% in group II had sonographic evidence of placenta accreta; achieving 100% sensitivity and 71% specificity (AUC 0.875, p=0.001). Post-partum hemorrhage and transfusion requirement were present in 36 cases (60%), including most patients in group I (94%). Bladder injury occurred in 11 cases while no patient suffered intestinal injury. Pelvic devascularization, hysterectomy and ICU admission only occurred in group I. No maternal mortality occurred in either group. Neonatal ICU admission was not significantly different between groups (table 3). Maternal risk factors for hysterectomy are shown in table 4.

3.2. Discussion

PAS disorders have become a significant life-threatening obstetrical issue due to increased incidence from 0.12 to 0.31% in the last 30 years and the reported mortality of approximately 7.0%. Accurate diagnosis and multidisciplinary management strategies are required before CS to reduce the risk of morbidity. Early suspicion and diagnosis of placenta accreta in the first trimester provides an ample opportunity to counsel the patient about potential antepartum and intrapartum complications, allow for appropriate surveillance and provide information for the patient to make informed decisions about the remainder of the pregnancy. Ultrasonograhy towards the end of the first trimester was proposed to predict the presence of MAP in women at risk for this condition. The findings of this study demonstrate the diagnostic accuracy of ultrasound for early prediction of PAS. Routine first trimesteric ultrasound done to all pregnant women fulfilling the inclusion criteria, and those who had at least one ultrasonography marker suggesting PAS recorded. The 1st trimesteric ultrasound findings were (Low implanted GS, lacunae, thin myometrium, retroplacental hypervascularity and placenta – myometrium interface). All patients recorded were subjected to third trimester ultrasound assessment of the placenta (whether it was persisting placenta previa with signs of accrete) and the final diagnosis of MAP was done after delivery. All first trimester u/s findings were significantly associated with the presence of morbid adherence; lacunae and thin myometrium were the main independent risk factors.

Concerning the presence of lacunae, our study agreed with Abinader et al. [9] where Placental lacunae were present in 18/21 (85.7%) cases and 7/46 (15.2%) controls (OR 33.4; 95% CI 7.7-144.4; P < 0.001). Also Ballas et al [6] describe the finding of lacunae in the first trimester of patients with diagnosed PAS. Unlike Rac et al. [10] who suggested that these spaces are seen infrequently and at a similar frequency in women with and without PAS at delivery. In the present study, bridging vessels were in agreement with Abinader et al. [9]; who reported lower uterine segment (uterovesical, subplacental and/or intraplacental) hypervascularity present in 14/14 (100%) of cases and only 1/12 controls (P < 0.001). Also Ladella et al. [11] noted that abnormal placentation was suspected when an early ultrasound revealed increased vascularity at the interface between the placenta and the uterine wall. Regarding Low GS, our study agreed with Naji et al. [12] who assessed the relationship between the location of the gestational sac and the internal cervical os at 12 weeks of

gestation and found that, for cases in which the sac crossed the CS, the pregnancy resulted in placenta previa and postpartum hemorrhage. Comstock et al. [8], in a small series of women with previous CS and confirmed PAS disorder, reported that anterior low implantation of the gestational sac was the most common finding on first-trimester ultrasound; the same findings were reported in a study by Ballas et al [6].

Unlike Rac et al. [10], who concluded that not all gestational sacs that implant in the lower uterine segment lead to PAS. In such cases, a normal thick myometrium was noted anterior to the gestational sac. Also Georgios et al. [13] concluded that A finding of placental implantation within the scar niche has high positive predictive value for placenta accreta spectrum. Regarding placenta myometrial interface, our results agreed with Abinader et al. [9] who reported an abnormal uteroplacental interface only in PAS cases, at a rate of 17/20 (85.0%) (P < 0.001). Thin myometrium was also reported by Rac et al. [10] who stated that measurement of the smallest myometrial thickness on first-trimester ultrasound improved significantly the detection rate of morbidly adherent placenta. The ability of a third-trimester scan showing a low-lying placenta with signs of accreta to predict morbid adherence at the time of delivery is high; with 100% sensitivity and 72% specificity. Morbid adherence was significantly associated with post-partum hemorrhage, bladder injury and the need for hysterectomy and/or pelvic devascularization. The increased mortality and healthcare burden of MAP has been previously reported. The absence of mortalities in the current series likely reflects adequate obstetric and sportive management; however, the seriousness of the condition still shown by that half of patients with MAP required post-partum ICU admission; with additional medical care and costs.

As previously reported in the literature, those with older age, higher parity and more previous C.S. delivery had higher risk of MAP. Accordingly, they had higher rates of complications and need for hysterectomy at the time of delivery. These risk factors should warrant screening and appropriate planning of antenatal care and delivery in well-equipped and staffed centers. Patients with one or more 1st trimester ultrasound criteria of PAS should stratified as high risk and examined by ultrasound later in 2nd and 3rd trimester. All patients with persistent placenta previa should delivered at tertiary hospital and patients should counseled about possible morbidities. Regarding limitations, ultrasonography is an operator-dependent procedure with increased need for standardization of signs and techniques across studies Collins et al. [14]. Moreover, variability in eventual diagnosis of MAP D'Antonio et al. [15] and outcome measurement based on the need for interventions such as ICU admission and hysterectomy; which may be decided differently in different protocols at different centers are recognized by the authors. In conclusion, this study demonstrates that early sonographic assessment of pregnancies with previous cesarean delivery or uterine surgery can predict the presence of MAP and surgical outcome. The findings of this study highlight the need for large prospective studies aimed at exploring whether first-trimester screening for PAS disorders can improve the prenatal diagnostic accuracy and surgical outcome in women at risk for a PAS disorder.
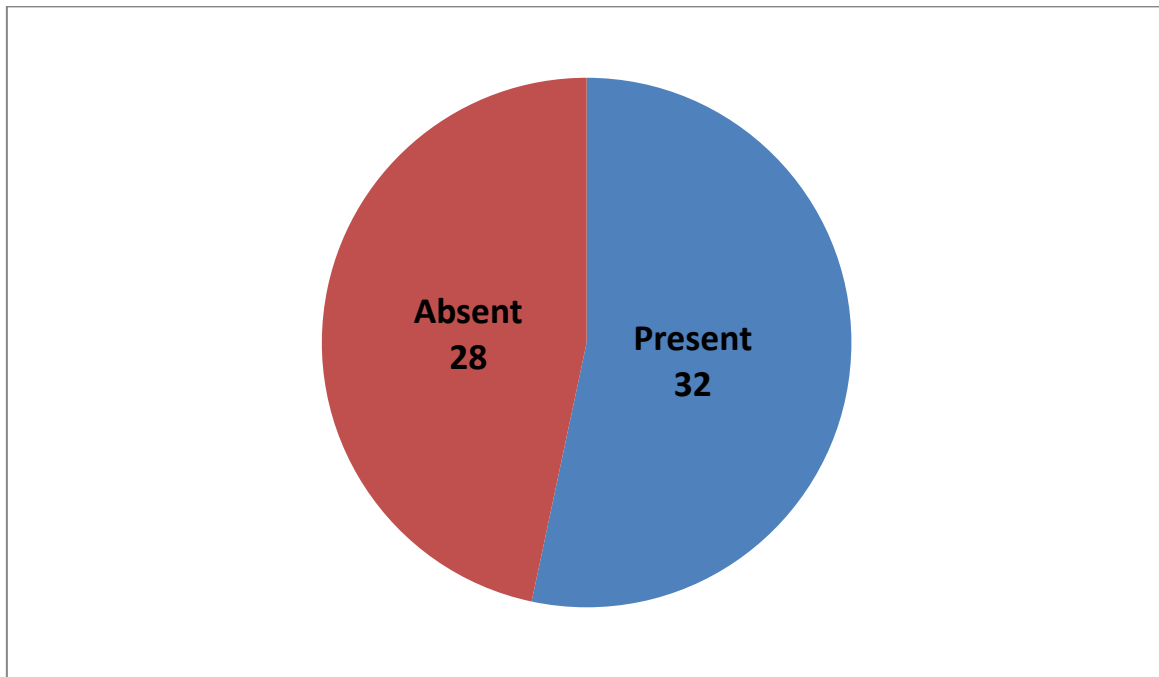
Figure 1. The intraoperative presence of morbidly adherent placenta. The placenta was morbidly adherent in 32 cases (53.3%) at Caesarean section

Table 1: Baseline maternal characteristics and relation to morbid adherence

	All cases (n=60)		Group I (n=32)*	Group II (n=28)*	P value
	Range	Mean±SD			
Age at labor	20-40	30.0±4.7	31.3±5.1	28.4±3.8	0.016
Gravidity	2-8	4.2±1.2	4.7±1.3	3.6±0.9	0.001
Parity	1-6	2.9±1.1	3.3±1.2	2.5±0.9	0.003
Number of CS	1-6	2.6±1.2	3.1±1.2	2.1±1.0	0.001

* Group I: those with morbidly adherent placenta. Data expressed as means±SD

Table 2: Association between ultrasonographic findings and morbid adherence conditions

Findings	Group I (n=32)		Group II (n=28)		P value	Sensitivity %	Specificity %	AUC (Asymptotic Sig.)[a]	Weighted OR model [b]		
	No	%	No	%					B	Wald	Sig
Low gestational sac	24	75	10	35.7	0.002	75	64.3	0.696 (0.009)	0.35	0.035	0.851
Lacunae	21	65.6	6	21.4	0.001	65.6	78.6	0.721 (0.003)	18.213	0	0.008
loss of interface	25	78.1	2	7.1	0.001	78.1	92.9	0.855 (0.001)	0.292	0.018	0.893
Bridging vessels	28	87.5	7	25	0.001	87.5	75	0.813 (0.004)	1.664	0.302	0.583
Thin myometrium	28	87.5	1	3.6	0.001	87.5	96.4	0.92 (0.002)	3.38	5.416	0.020
3rd trimester signs of accreta	32	100	8	28.6	0.001	100	71.4	0.875 (0.001)			

(a) Under the nonparametric assumption; Null hypothesis: true area = 0.5
(b) Constant -39.98 (sig 0.997).This model showed that the presence of lacunae and thin myometrium were independently associated with the development of morbid adhesions

Table 3: Association between operative and postoperative circumstances and morbid adherence condition

Outcomes	Group I (n=32)		Group II (n=28)		P value
	No	Percentage	No	Percentage	
Post-partum hemorrhage	30	93.8%	6	21.4%	0.001
Transfusion	30	93.8%	6	21.4%	0.001
Bladder injury	9	28.1%	1	3.6%	0.011
Pelvic devascularization	7	21.9%	0	0.0%	
Caesarean-Hysterectomy	29	90.6%	0	0.0%	
ICU admission	17	53.1%	0	0.0%	
NICU admission	3	9.4%	5	17.9%	0.325

Table 4: Association between hysterectomy and baseline characteristics

CS hysterectomy		N	Mean	Std. Deviation	p value
Age at labour	Negative	31	28.548	3.5948	0.014
	Positive	29	31.517	5.3494	
Gravidity	Negative	31	3.710	.9016	0.001
	Positive	29	4.724	1.3065	
Parity	Negative	31	2.548	.8884	0.008
	Positive	29	3.310	1.2278	
Number CS	Negative	31	2.194	1.0139	0.004
	Positive	29	3.069	1.2227	

4. Conclusions

The findings of this research suggest that early sonographic screening of pregnancies with a history of caesarean birth or uterine surgery may accurately predict the ultrasonography stage of PAS disease and the surgical outcome of the pregnancy. Despite the outcomes of this investigation, large prospective studies needed to determine if prenatal screening for PAS diseases during the first trimester might enhance the accuracy of prenatal diagnosis and surgical outcome in women at risk for a PAS condition. At 11-14 weeks, ultrasonography may be used to assist determine the risk of PA and the need for a specialized follow-up. Early identification of individuals at risk for PA may help to improve the perinatal outcome of the condition.

Conflict of interest
Nil

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