

# Accuracy and Prognostic Value of Early Appearance of Ultrasonographic Findings of Placenta Accrete

Original  
Article

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## ABSTRACT

**Objective:** Study the value of early appearance of ultrasonographic findings of placenta accrete and its relation to the accuracy of diagnosis with its impact on prognosis.

**Methods:** Prospective cohort study, by ultrasound examination of 55 women in the duration of the study (14 months) all suffering from the presence of low lying placenta with previous uterine scar between 12-20 weeks gestation. The main outcome is to predict placenta accrete and its related complications.

**Results:** 55 cases were included. The most common sign was loss of retroperitoneal space ( 31 cases – 56%) and focal lacuna (24 cases – 44%), they are the most sensitive early sign ( sensitivity 55.26%) , while thinning of myometrium is the least sensitive sign ( 13.16%) , while thinning myometrium , presence of diffuse lacunae and tornado sign are the most specific reaching 100% ,while loss of retroperitoneal space was the least specific ( 41.18%) , so the most accurate is the presence of focal lacunae (63.64%) , while thinning of the myometrium is the least accurate (40%).

**Conclusion:** The use of ultrasound in evaluation of placenta accrete between 12-20 weeks is very beneficial and could be used with variable degrees of accuracy.

**Key Words:** Early diagnosis, lacuna, placenta accrete, thinning of myometrium, tornado flow.

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## INTRODUCTION

Despite the noticeable increase in the incidence of placenta accrete with accompanied increase in the researches focused on it but still the debates in its management including the diagnostic method remains unsettled yet<sup>[1]</sup>.

The preoperative diagnosis of placenta accrete is still lack of the required accuracy, even with the advances in the available diagnostic modalities, but still the preoperative diagnosis has many falsies<sup>[2]</sup> so in many cases for sure diagnosis the obstetricians depends on the intraoperative findings<sup>[3]</sup>.

Nowadays the uses of gray scale ultrasound and Doppler ultrasound has upper hand over MRI as a method for diagnosis and evaluation of placenta accrete, as beside it has many advantages over MRI including availability and a lower cost, it is also has higher accuracy than MRI<sup>[4]</sup>.

The use of gray scale ultrasound with Doppler ultrasound in diagnosis of placenta accrete is dependent on

the appearance of many ultrasonographic findings which are Thinning of the myometrium underneath the placenta, Loss of the retroplacental “clear space,” and Protrusion of the placenta and may reach to the serosa of the bladder<sup>[5]</sup>. While by the use of Doppler ultrasound the findings which could be used are: placental lacunae either diffuse or focal, presence of tornado flow, Increased peri-uterine vascularity between uterus and urinary bladder and markedly dilated peripheral subplacental vascular channels<sup>[6]</sup>.

But not all these ultrasonographic findings may appear except in late pregnancy, or may not appear at all, and also all of these findings differ in its time of appearance throughout the course of pregnancy and differ in its sensitivity and specificity , which leads to decreasing accuracy of diagnosis<sup>[7]</sup>.

And because the studying of these ultrasonographic findings reveals different timing in its appearance, which may be related to severity of the condition and also may be a prognostic factor for placenta accrete, so evaluation of early appearance of these ultrasonographic findings is required.

## METHODS

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### *Study design*

prospective cohort study

### *Setting*

Tanta university hospital

### *Timing of the study*

14 months

### *Cases selection*

The cases will be selected from the females whom attending Tanta university hospital,

They are selected according to the following criteria:

1. Gestational age of pregnancy 12-20 weeks.
2. All patients had anterior low lying placenta or placenta previa with history of previous Cesarean section.

And they are excluded if the patient has vaginal bleeding which affect general condition of the female

### *Sample size calculation*

The sample size was calculated using Epi-Info 7 specific program.

### *Methods*

- Written consent taken from all patients submitted to the study with clarification of the methods, value and hazards of the study.
- Detailed history taking from all patients
- The following methods will be undertaken to all patients

### **History taking**

Full history taking including personal , menstrual , past and family history with special inquiry about obstetric history

### **Clinical examination**

Full general, systemic and pelvic examination.

### **First Abdominal and transvaginal U/S examination with Doppler study**

It is done to the female at 10-18 weeks gestation Using Siemens Acuson X300 premium edition ultrasound

Ultrasound was done using the curvi-linear transducer (at frequency 3–5 MHz) it is done with the patient's bladder full.

The placenta was assessed for the following gray-scale sonographic diagnostic criteria :

1. Thinning of the myometrium underneath the placenta
2. Loss of the retroplacental "clear space,"
3. Protrusion of the placenta and may reach to the serosa of the bladder, (interruption of bladder line).

The placenta was assessed also for the following Signs of placenta accrete by color Doppler study:

1. Diffuse irregularly shaped placental lacunae (vascular spaces) within the placenta,
2. Focal irregularly shaped placental lacunae (vascular spaces) within the placenta
3. Turbulent flow, tornado sign
4. increased peri-uterine vascularity between uterus and urinary bladder , interphase hypervascularity with abnormal blood vessels linking the placenta to the bladder
5. Markedly dilated peripheral subplacental vascular channels with pulsatile venous-type flow over the uterine cervix.

### **Re evaluation of the patients**

Re evaluation of patients is required for appearance of new ultrasonographic diagnostic criteria which was not appeared in the first scan

The timing of appearance of each sign will be reported and marked to be analyzed later on

### **Cesarean section**

Cesarean section will be done later on according to maternal and fetal condition

Intraoperative observation of the degree of placental adhesion

Operative complications as bladder injury, atony or blood transfusion and postpartum complications as shock, sepsis or second operation if presented was recorded

Correlate operative data with the sonographic findings by suitable Statistical methods.

### Outcome

The ultrasonographic criteria will be evaluated for the following outcomes:

- Intraoperative diagnosis of placenta accrete
- Degree of placenta accrete
- Operative result for evaluation for prognosis of placenta accrete: timing of termination, duration of operation, surgical complications, need for blood transfusion, ICU admission, failure of conservative management

### Ethical approval

This study was approved by local ethical committee of Tanta University before the start of this study, All patients were informed about study design, interventions, and risks. All patients signed written consent. Privacy and security were maintained all over the duration of study.

There were no unexpected risks during the course of research.

## RESULTS

55 cases were included in this study, their age range was 21-41 years (mean  $30.8 \pm 4.811$ ), all were previous cesarean section (1-4 previous cesarean scars) as shown in (Table 1).

**Table 1:** Show the demographic data of the studied patients, time of termination of pregnancy and duration of operation

	Mean	Standard deviation	Range
Age	30.8	4.811	21-41
No. of CS	1.927	0.988	1-4
Gravidity	3.673	1.415	2-8
Parity	2.2	1.069	1-4
Time of termination	37.38	0.842	36-39
Duration of operation	59.782	21.576	35-108

Early Antenatal gray scale ultrasound of all cases showed that only 34 cases showed signs of placental adhesive disorders (62% of cases) and the most common appeared sign was loss of retroperitoneal space (31 cases – 56%), thinning of the myometrium appeared in only 5 cases (9%) and no case had the sign of protrusion inside the bladder. (Table 2).

**Table 2:** Show early antenatal ultrasound and Doppler study of studied cases, need of blood transfusion and rate of complications

Ultrasound	Loss of retro placental 31 (56%) Thinning of scar 5 (9%) Protrusion 0 (0%) No 21 (38%)
Doppler	Focal lacuna 24 (44%) Diffuse lacuna 16 (29%) Tornado 8 (15%) Periuterine vascularity 0 (0%) No 15 (27%)
Accrete	No 17 (31%) Accrete 16 (29%) Incerete 14 (25%) Percrete 8 (15%)
Blood transfusion	No 26 (47%) 1 16(29%) 2 8 (15%) 3 5 (9%)
Intrapartum Complications	Bladder 13 (24%) Hysterectomy 9 (16%)
Postpartum complications	No 28 (51%) Sepsis 13 (24%) ICU 11 (20%) Atony 5 (9%)

While by early Doppler study of the cases, 40 cases showed signs of placental adhesive disorders (73% of all cases) and the most common appeared sign was focal lacuna (24 cases – 44%), diffuse lacuna appeared in 16 cases (29%), and tornado sign appeared in 8 cases (15%), and no case showed increased periuterine vascularity between bladder and the uterus. (Table 2).

By follow up of the cases during termination of pregnancy, 17 cases showed no placental adhesive disorders (31%) and the other 38 cases showed the presence of variable degrees of placental adhesive disorders (Table 2).

So correlating the early ultrasound and Doppler signs with the intraoperative findings, it was found that loss of retroperitoneal space by gray scale ultrasound and the presence of focal lacunae are the most sensitive early sign for prediction of placenta adhesive disorder (sensitivity 55.26%), while thinning of myometrium is the least sensitive sign (13.16%), on the other hand thinning myometrium, presence of diffuse lacunae and tornado sign are the most specific with specificity reaches 100%, while loss of retroperitoneal space was the least specific

(41.18%) , so the most accurate early sign for prediction of placental adhesive disorder is the presence of focal lacunae with accuracy 63.64% , while thinning of the myometrium is the least accurate with accuracy 40%.(Table 4).

In the term of the need of blood transfusion 26 cases did not need blood transfusion (47%) while 5 cases needed 3 unit of blood transfusion (9%), and the early appearance of loss of retroperitoneal space, thinning of myometrium, presence of diffuse lacuna and tornado signs, all has significant relationship with the need of blood transfusion. (Table 2, Table 5).

Also thinning of myometrium, presence of diffuse lacuna and tornado signs had a significant relationship with

the prolonged timing of operation and the gestational age at time of delivery. (Table 5)

In the term of operative complications , 13 cases had bladder injury (24%) and only 9 cases (16%) needed hysterectomy , while 13 (24%) cases complicated by sepsis, 11 cases (20%) needed ICU admission , and 5 cases (9 %) complicated by uterine atony (Table 2).

Diffuse lacunae is the only early sign which had significant relationship with the occurrence of bladder injury with *P value* 0.0032 , while thinning of myometrium, presence of diffuse lacuna and tornado signs all had significant relationship with the need of hysterectomy, and no early sign had significant relationship with the postoperative complications.

**Table 3:** Showed the true and false positive and negative results of ultrasound and Doppler signs

	True positive	False positive	True negative	False negative
Loss	21	10	7	17
thinning	5	0	17	33
Focal	21	3	14	17
Diffuse	16	0	17	22
tornado	8	0	17	30

**Table 4:** Showed sensitivity , specificity , PPV , NPV and accuracy of early ultrasound and Doppler signs

	Sensitivity	Spesificity	PPV	NPV	accuracy
Loss	55.26%	41.18%	67.74%	29.17%	50.91%
Thinning	13.16%	100%	100%	34%	40%
focal	55.26%	82.35%	87.5%	45.16%	63.64%
Diffuse	42.11%	100%	100%	43.95%	60%
Tornado	21.05%	100%	100%	36.17%	45.45%

**Table 5:** correlation between early ultrasound and Doppler signs with different surgical data

	Timing of operation	Gestational age	Blood trans	bladder	hysterectomy	Postoperative complication
Loss	t.value 1.759 P test 0.0422	t.value -0.265 P test 0.396	t.value 1.952 P test 0.028*	Chi sq. 1.146 P test 0.284	Chi sq. 0.464 P test 0.496	Chi sq. 0.939 P test 0.333
Thinning	t.value 2.843 P test 0.003*	t.value 2.237 P test 0.015*	t.value -3.508 P test 0.0005*	Chi sq. 4.0293 P test 0.447	Chi sq. 22.535 P test 0.0001*	Chi sq. 2.103 P test 0.147
Focal	t.value -0.63 P test 0.266	t.value -0.369 P test 0.357	t.value 1.076 P test 0.143	Chi sq. 0.185 P test 0.667	Chi sq. 4.629 P test 0.314	Chi sq. 0.181 P test 0.671
Diffuse	t.value 5.23 P test 0.0001*	t.value -3.042 P test 0.002*	t.value -5.844 P test 0.00001*	Chi sq. 8.689 P test 0.0032*	Chi sq. 18.653 P test 0.0002*	Chi sq. 3.489 P test 0.618
Tornado	t.value 2.685 P test 0.004*	t.value 2.907 P test 0.003*	t.value -2.963 P test 0.002*	Chi sq. 7.834 P test 0.005	Chi sq. 7.739 P test 0.005*	Chi sq. 0.403 P test 0.0402

## DISCUSSION

Adhesive placenta spectrum is considered a surgical challenge facing every obstetrician, and the key for proper management of these cases is early diagnosis and proper preoperative preparation.

There are many gray scale ultrasound signs and Doppler study signs which could rise the suspicious for the presence of adhesive placental spectrum, and the appearance of these signs vary according to the cases and the number of scars. But the appearance of these signs carry variable diagnostic accuracy for the presence of morbidly adherent placenta.

The need of evaluation of the significance of the appearance of these early signs is emerging in the literature, and our study tried to evaluate the significance of early appearance of these signs by examining 55 women in the duration of the study (14 months) all suffering from the presence of low lying placenta with previous uterine scar between 12-20 weeks gestation.

The most common appeared sign was loss of retroperitoneal space (31 cases – 56%) by gray scale ultrasound and focal lacuna (24 cases – 44%), by Doppler study. (Table 2).

Loss of retroperitoneal space by gray scale ultrasound and the presence of focal lacunae are the most sensitive early sign for prediction of placenta adhesive disorder (sensitivity 55.26%), so absence of these signs could exclude the occurrence of placental adhesive disorders by about 55.26%. while thinning of myometrium, presence of diffuse lacunae and tornado sign are the most specific with specificity reaches 100%, so the early appearance of these signs could diagnose the prove the presence of placental adhesive disorder by 100%, and the most accurate early sign for prediction of placental adhesive disorder is the presence of focal lacunae with accuracy 63.64%. (Table 4).

Also the early appearance of loss of retroperitoneal space, thinning of myometrium, presence of diffuse lacuna and tornado signs, all had a significant relationship with the need of blood transfusion. Also thinning of myometrium, presence of diffuse lacuna and tornado signs had a significant relationship with the prolonged timing of operation, the gestational age at time of delivery and the need for hysterectomy. While diffuse lacunae is the only early sign which had significant relationship with the occurrence of bladder injury.

Jerasim B (2012) tried in a retrospective study to identify the value of first trimester sonographic markers for placenta accrete. Only 10 case. But they depended on simple Sonographic findings included anechoic placental areas, low implantation gestational sac, and an irregular placental-myometrial interface. And they concluded that

these simple ultrasonographic signs are important for first trimester prediction of placenta accrete<sup>[8]</sup>.

W. sragent *et al* (2023) tried to made a model of prediction of normal, abnormally adherent (AAP) or abnormally invasive placentation (AIP) by including the women with anterior low-lying placenta or placenta previa associated with previous caesarean delivery . 106 women were included, of whom 42 (40%) were normal, 24 (23%) had AAP and 40 (38%) had AIP. They depended on four ultrasonographic signs (loss of clear zone, abnormal placental lacunae, placental bulge and bladder wall interruption) it was found that all four signs were reliably predict presence and severity of PAS, with an optimism-corrected C-index of 0.901. So the four US markers can predict likelihood and severity of PAS with high accuracy. And they recommended Further prospective works on a large patient cohort<sup>[9]</sup>.

In our study, only the presence of placental lacunae was the most specific and the most accurate, and the other three signs had low sensitivity and accuracy, they did not include thinning of myometrium which was found with high specificity in our study, also they did not specify certain gestational age in their study, they examine the patients form 16-36weeks gestation which may put many differences to our study.

A. Arakaza *et al* (2023) retrospectively reviewed PubMed, Google Scholar, Web of Science, Medline, and other website databases for the different methods of diagnosis of placenta accrete. And they found that despite that the ultrasound is a reliable for the diagnosis of PAS, but it cannot exclude the diagnosis of PAS. And the clinical assessment of risk factors, MRI tests, serological markers, and placental histopathological tests are also very important for the prediction of PAS. So prediction and conclusive diagnosis of placenta accrete need a multidisciplinary squad with well-experienced obstetricians, radiologists, and histopathologists<sup>[10]</sup>.

Ahmed M. H. *et al* (2022) evaluate the preoperative ultrasound imaging for prediction of the surgical outcomes in placenta accrete spectrum (PAS). It was a retrospective cohort study done at Cairo University Maternity, Egypt. They reviewed the records of 90 patients and they found that the presence of subplacental vascularity by Doppler ultrasound increase the risk for hysterectomy while increase number of lacunae increase the risk of need for blood transfusion. Their study was retrospective and lack the determination of certain gestational age for ultrasound scanning<sup>[11]</sup>.

Albaro J. N. *et al* (2022) had a retrospective study including patients with high risk for PAS. And the Data from the prenatal imaging were compared with the final diagnoses after delivery. 162 patients were included and they found that the false positive results was 68.5%

although all the data was recorded at 34 weeks gestations as they had their study at limited resource sitting<sup>[12]</sup>.

Fatemeh R. Sh. et al (2014) agreed with our study as they tried a longitudinal study to determine the accuracy of ultrasound for placenta accrete in the first trimester comparing the results with second and third trimester ultrasound. They studied 323 high risk women for placenta accrete. Unlike to our study they measured the overall ultrasound sensitivity and specificity for detecting placenta accrete in the first trimester which was 41% and 88% respectively. And it was lower than the high sensitivity and specificity in second and third trimester of pregnancy<sup>[13]</sup>.

Martha W. F. et al (2015) they had a retrospective study to evaluate the association between first-trimester sonographic findings and morbidly adherent placenta. And they found that the thickness of anterior myometrium is the most reliable ultrasonographic sign. ( $P < .02$ ). Our study showed that the most accurate sign was the presence of focal placental lacunae, but they did not use the Doppler examination in their study. In our study we found that thinning of myometrium is 100% specific but only 13% sensitive, and this may go in line with their study<sup>[14]</sup>.

Christine H. C. et al (2004) agreed with our study as they studied prospectively the role of ultrasonography in placenta accrete in at-risk patients. And they found that the Placenta accrete can be detected as early as 15 to 20 weeks of gestation in most at-risk patients by the presence of the placental lacunae. While the Obliteration of the retro placental 'clear space' is not a reliable diagnostic sign for placenta accrete. Our study showed a similar result as we found the placental lacunae was the most accurate sign with 63.64% accuracy while the loss of retro placental space only 50.91% accuracy<sup>[15]</sup>.

Eric J. et al (2017) evaluated the accuracy of ultrasound in the diagnosis of placenta accrete by a meta-analysis of the previous cohort studies (5 retrospective and 9 prospective) including 3889 pregnancies presenting with placenta previa and presence of prior cesarean deliveries. There were 328 cases of placenta previa accrete (8.4%), of which 298 (90.9%) were diagnosed prenatally by ultrasound. The ultrasound could detect placenta accrete in prospective higher than retrospective studies, with a diagnostic odds ratios of 228.5 (95% confidence interval, 67.2–776.9) and 80.8 (95% confidence interval, 13.0–501.4), respectively. But they found no data on the ultrasound screening of at the midtrimester examination<sup>[16]</sup>.

Junling Z. et al (2023) et al tried to develop scoring system for placenta accrete spectrum, they studied 532 pregnant at high risk women in Hospital of Zhengzhou University, the ultrasound scoring system proposed by them include placental location, and thickness, absence of the retro placental space, thickness of the retro placental myometrium, presence of placental lacunae, retro placental

myometrial blood flow and history of cesarean section. With giving each feature a score of 0–2, according to severity. Including. And they found that no PAS is diagnosed at a total score  $< 5$ , placenta accrete or placenta increta is diagnosed at a total score 5–10, and placenta percreta is diagnosed at a total score  $\geq 10$ . This study could be incorporated later on for early prediction by giving scoring system for each trimester, especially that the ultrasound findings of this study go with our study<sup>[17]</sup>.

## CONCLUSION

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In conclusion the use of ultrasound in evaluation of placenta accrete between 12-20 weeks is very beneficial and could be used with variable degrees of accuracy. As the appearance of thinning myometrium by gray scale ultrasound and diffuse lacunae and tornado flow by Doppler ultrasound is 100% specific while the appearance of focal lacuna is accurate by 63.64%.

## CONFLICT OF INTERESTS

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There are no conflicts of interest.

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