

Antenatal Diagnosis of Placenta Previa Accreta Syndrome by Transabdominal Color Doppler Ultrasound in Comparison with Intra Operative Finding

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Abstract

Background: Massive obstetric hemorrhage is still one of the leading cause of pregnancy related death and placenta previa accreta remain one of the major predisposing factors. With the increasing rate of cesarean delivery the incidence of both placenta previa and accreta is steadily increase so we anticipate more cases of placenta previa accreta in our obstetric practice. Diagnosis can be achieved by ultrasound in the majority of cases.

Aim of the study: To determine the accuracy of trans-abdominal Doppler U/S in diagnosing of placenta previa accreta in patients with previous cesarean sections and comparing with intraoperative finding

Patient and Methods: The study included 80 pregnant women who had under gone previous cesarean section at Obstetrics and Gynecology department of Al-Yarmouk teaching hospital and were diagnosed to have partial or total placenta previa in the current pregnancy were subjected to trans-abdominal Doppler ultrasound examination after 28th week of gestation to determine the possibility of placenta accreta in comparison with intra operative finding.

Results: The result of the 80 placenta previa cases, twenty-six women exhibited characteristic color Doppler imaging patterns highly specific for placenta accreta. One of them had false positive color Doppler imaging, and twenty-five confirmed at cesarean section to have placenta accreta. Of the 54 women with negative color Doppler imaging results, two of them had placenta accreta both of them were posterior placenta previa. The sensitivity of color Doppler imaging in the diagnosis of placenta previa accreta was 92.6%, specificity was 98.1%, the positive predictive value was 96.2% and negative predictive value was 96.3%

Conclusion: Color Doppler U/S provides an opportunity for early and accurate diagnosis of placenta accreta

INTRODUCTION

Placenta accreta is considered as a severe pregnancy complication that may be associated with massive and potentially life-threatening intrapartum and postpartum hemorrhage.⁽¹⁾ The problem occur when there is abnormal separation of placenta in the third stage of labor and attempts to deliver the placenta may provoke massive blood loss that may necessitate hysterectomy.⁽²⁾ Placenta accreta is becoming an increasingly common complication of pregnancy,

mainly due to the increasing rate of cesarean delivery over the past 50 years.⁽³⁾ In view of the fact that the indications for cesarean delivery seem to be steadily expanding, including cesarean delivery on maternal request, the incidence of placenta accreta is likely to continue to increase.⁽⁴⁾ Maternal morbidity had been reported to occur in up to 60% and mortality in up to 7% of women with placenta accreta. In addition, the incidence of perinatal complications is also increased mainly due to preterm birth and small for gestational age fetuses.⁽⁵⁾

Placenta accrete is classified into; *Placenta previa*—the internal os is covered partially or completely by placenta. In the past, these were further classified as either total or partial previa⁽⁶⁾ and *Low-lying placenta*—implantation in the lower uterine segment is such that the placental edge does not reach the internal os and remains outside a 2-cm wide perimeter around the os. A previously used term, *marginal previa*, described a placenta that was at the edge of the internal os but did not overlie it.⁽⁷⁾ The Latin *previa* means *going before*—and in this sense, the placenta goes before the fetus into the birth canal, in obstetrics, placenta previa describes a placenta that is implanted somewhere in the lower uterine segment, either over or very near the internal cervical os.⁽⁸⁾

The incidences for placenta previa average 0.3 percent or 1 case per 300 to 400 deliveries. It was reported to be almost 1 in 300 deliveries in the United States. The frequency at Parkland Hospital from 1988 through 2012 was approximately 1 in 360 for nearly 366,000 births.⁽⁹⁾

Similar frequencies have been reported from Canada, England, but it was only 1 in 700 deliveries from a Japanese study.⁽¹⁰⁾ One theory behind the process of resolution of low lying placenta and placenta previa is that the lower uterine segment develops, and elongates, changing from 0.5 cm at 20 weeks to 5 cm at term, and this will cause the lower edge of the placenta to move away from the internal cervical os.⁽¹¹⁾

It is critically important that obstetricians and radiologists are familiar with the risk factors and diagnostic modalities for placenta accreta because of its potential emergent nature and the associated risk of life-threatening hemorrhage, if there is a strong suggestion for the presence of abnormal placental invasion, health care providers practicing at small hospitals or institutions with insufficient blood bank supply or inadequate availability of subspecialty and support personnel should consider patient transfer to a tertiary perinatal care center, improved outcomes have been demonstrated when these patients give birth in specialized tertiary centers.⁽¹²⁾ To enhance patient safety, it is important that the delivery be performed by an experienced obstetric team that includes an obstetric surgeon, with other surgical specialists, such as urologists, general surgeons, and gynecologic oncologists, available if necessary. Because of the risk of massive blood loss, attention should be paid to maternal hemoglobin levels in advance of surgery, if possible.⁽¹³⁾ Because of this antenatal diagnosis of placenta accreta is very important in reducing morbidity and mortality by choosing the time and place

of delivery and allow the necessary preparation (blood and skilled surgeon) to be present.

PATIENTS AND METHODS

A prospective clinical study was carried out in the Department of Obstetrics and Gynecology at AL-YARMOUK Teaching Hospital/Baghdad, for the period from February 2015 to January 2016. The study protocol was approved by the Obstetrics and Gynecological council of Iraqi Board for Medical Specialization and Department of Obstetrics and Gynecology of AL-YARMUK Teaching Hospital.

In this study a total of 80 pregnant women included were beyond 28 weeks of gestation and their gestational age were assessed by history, last menstrual period, clinical and physical examination and by U/S if it was performed for her in the 1st half of pregnancy or before attended to us and those with history of previous one or more caesarean sections were confirmed to have placenta previa in the current pregnancy. Those women admitted to our hospital directly from outpatient clinic or referral from other hospital.

A verbal consent was obtained from each patient prior to the inclusion into the study and the study was approved by the local ethic committee.

Those patients were admitted to labour after her acceptance and approval. A detailed history obtained from each patient regarding age, gravidity, parity, numbers of previous caesarean sections, previous dilatation and curettage and uterine surgery, history regarding her recent pregnancy included history of APH and past obstetrical history was recorded.

General physical, obstetric examination had been performed. Routine Investigation was done such as full blood count, blood group, RH typing and cross match had been performed. Ultrasound was performed by experience ultrasonographer using medical system (GE healthcare, Austaria GMBH & CoOG, Voluson E6) equipped with convex probe 3.5 MHz transducer.

Gray-scale B-mode sonography was first used to screen the placental tissue in a systematic fashion. Careful attention was paid to homogeneity and echogenicity patterns of the placenta and those with suspicion of having abnormal placenta were referred to color Doppler U/S for further evaluation of the uteroplacental vascular morphological manifestation for possibility of placenta accreta.

Ultrasound criteria for diagnosis of placenta accreta by Grey scale;^(14,15)

- loss of the retroplacental sonolucent zone.
- Irregular retroplacental sonolucent zone.
- Thinning or disruption of the hyperechoic serosa–bladder interface.
- Presence of focal exophytic masses invading the urinary bladder
- Abnormal placental lacunae.

Color Doppler signs suggestive of placenta accreta are;⁽¹⁵⁾

- Diffuse or focal lacunar flow.
- Vascular lakes with turbulent flow (peak systolic velocity over 15 cm/s)
- hypervascularity of serosa–bladder interface.
- markedly dilated vessels over peripheral subplacental zone.

The color Doppler observation in patient not suspected of having placenta accreta included the following characteristic feature: Discrete branching of surface chorionic arteries and intraplacental villous arteries clearly visualized within the homogeneous placental substance with typical flow velocity waveforms.⁽¹⁵⁾

Statistical analysis; The data were analyzed using the Statistical Package for Social Sciences (SPSS) version 20. The categorical data presented as frequency and percentage tables. Pearson’s chi-square test was used to assess the association between categorical data. Relative risks with 95% confidence intervals were calculated (when possible) to assess the risk factors for placenta accreta. The continuous variables were presented as mean, standard deviations, median and range. Reliability and validity tests were used to calculate (Sensitivity, specificity and accuracy) of colored Doppler U/S in the diagnosis of placenta accreta. P-value less than 0.05 was used as the level of significance.

RESULTS

The present study included 80 pregnant females with placenta previa, about one third 27/80 (33.4%) were diagnosed to have placenta accreta.

The median age of the participants was 35 years and ranged from 23 to 42 years. The median gravida numbers were four with a range from one to nine and median parity of three with a range of one to eight.

Table 1: Incidence of placenta Accreta among 80 cases diagnosed with placenta previa

Placental condition	No	%	95% Confidence interval
Cases with placenta accrete delivery	27	33.8	23.4-44.1
Total cases with placenta previa	80	100	

Regarding the risk factors for placenta accreta in the studied group all age, gravida and parity did not show significant associations with the accreta presence, despite the results showed high percentages of young ages, high number of gravida and parity among patients with placenta accreta as compared to only previa group (Table 2).

Table 2: Incidence and relative risks of placenta accrete, according to age, gravida and parity of the study group.

gravida and parity of the study group. Variables	Placental condition No. (%)		Total N=80 No. (%)	Relative Risk	95% Confidence Interval	p-value
	Placenta accrete N=27	Placenta previa N=53				
Age <35	14 (51.9)	25 (47.2)	39 (48.8)	1.1	0.69 to 1.74	0.688
=>35 years	13 (48.1)	28 (52.8)	41 (51.2)	Ref.		
Gravida <3	3 (11.1)	15 (28.3)	18 (22.5)	Ref.		
=>3	24 (88.9)	38 (71.7)	62 (77.5)	1.24	0.99 to 1.54	0.051
Parity <2	2 (7.4)	12 (22.6)	14 (17.5)	Ref.		
=>2	25 (92.6)	41 (77.4)	66 (82.5)	1.2	0.99 to 1.43	0.051

*Significant difference in proportions using Pearson Chi-square test at 0.05 level.

The incidence of placenta accreta was found to be increased significantly (p= 0.013) with the increase in the number of previous cesarean sections. The median number of cesarean sections in the accreta group was three and ranged from one to six, and that for previa was 1 as it ranged from 1` to 4; so a significant difference between the study groups was found even in median numbers (Table 3)

Table 3: Incidence and relative risks of placenta accreta, according to number of previous Caesarean among the study group.

Previous Caesarean among the study group. Variables	Placental condition No. (%)		Total N=80 No. (%)	p-value
	Placenta accrete N=27	Placenta previa N=53		
Number of caesarean sections				
1-2	10 (37)	35 (66)	45 (56.2)	0.013*
3+	17 (63)	18 (34)	35 (43.8)	
Range	(1 – 6)	(1 – 4)	(1 – 6)	
Median	3	1	2	

*Significant difference in proportions using Pearson Chi-square test at 0.05 level.

In comparison of perinatal events between the study groups, the type of delivery, sex of the newborn and their outcomes, did not have any association with placental conditions (Table 4).

Table 4: Differences in rate of major perinatal events between the study groups.

Rate of major perinatal events between the study groups. Variables	Placental condition No. (%)		Total N=80 No. (%)	p-value
	Placenta accrete N=27	Placenta previa N=53		
Type of delivery				
Elective C/S	14 (51.9)	36 (67.9)	50 (62.5)	0.16
Emergency C/S	13 (48.1)	17 (32.1)	30 (37.5)	
Sex of newborn				
Female	22 (81.5)	42 (79.2)	64 (80)	0.813
Male	5 (18.5)	11 (20.8)	16 (20)	
Outcome of the fetus				
Alive	22 (81.5)	50 (94.3)	72 (90)	0.146
Neonatal Death	3 (11.1)	1 (1.9)	4 (5)	
IUGR	2 (7.4)	2 (3.8)	4 (5)	
Total	27 (100)	53 (100)	80 (100)	

*Significant difference in proportions using Pearson Chi-square test at 0.05 level.

The median gestational age at delivery for previa group was 37 weeks and ranged from 35 to 39 weeks, while the median for placenta accreta was 35 and ranged from 32 to 38 weeks with significant difference between the study groups (p<0.001).

In the way for screening the patients with placenta previa for being accreta, the validity parameters of cases examined by B-mode in comparison with gold standard (intra-operative &/or histopathology), B-mode U/S was found to be 88.9% sensitive in detection of accreta cases with a positive prediction of positive cases by 82.8% and 90.6% specific in role out only accreta cases and negative prediction by 94.1%, while the accuracy of this device in true detection was 90% (Table 5).

Table 5: Validity parameters of B-mode U/S diagnosis of placenta Previa Accreta among 80 cases with placenta Previa.

Placenta Accreta diagnosis By M-mode U/S	Placental condition		Total
	Previa & accreta	Previa	
Positive	24	5	29
Negative	3	48	51
Total	27	53	80

Sensitivity= 88.9%; Specificity= 90.6%
 Positive predictive value (PPV)=82.8%; Negative predictive value (NPV)= 94.1%
 Accuracy rate= 90%

Regarding the validity parameters of Colored Doppler U/S in comparison with gold standard (intra-operative &/or histopathology), it was found to be 92.6% sensitive in detection of accreta cases with a positive prediction of positive cases by 96.2% and 98.1% specific in role out only previa cases and negative prediction by 96.3%, while the accuracy of this device in true detection was 96.3% (Table 6)

Table 6: Validity parameters of color Doppler U/S diagnosis of placenta Previa Accreta among 80 cases with placenta Previa.

Placenta Accreta diagnosis By color Doppler U/S	Placental condition		Total
	Previa & accreta	Previa	
Positive	25	1	26
Negative	2	52	54
Total	27	53	80

Sensitivity= 92.6%; Specificity= 98.1%
 Positive predictive value (PPV)=96.2%; Negative predictive value (NPV)= 96.3%
 Accuracy rate= 96.3%

Figure 1, illustrates the comparison of validity parameters between B-mode and colored Doppler U/S and revealed better validity of colored Doppler as compared to that of B-mode.

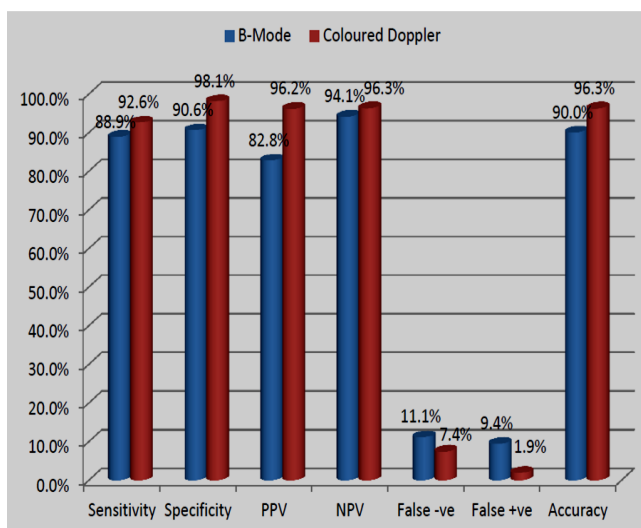


Figure 1: Bar chart comparing the validity parameters of color Doppler U/S and B-Mode diagnosis of placenta previa accreta among pregnant women with placenta Previa.

Concerning the placental location among the patients diagnosed as placenta accrete as well as the one case falsely diagnosed by colored Doppler U/S, the highest percentage 75% were lying anterior, and other locations were presented in table 7.

Table 7: Number and percentage of established diagnosed placenta Accreta, according to the location of the placenta.

Placental localization	No	%
Anterior previa	21	75.0
Posterior previa	4	14.3
Antero-Lateral previa	2	7.1
Central previa	1	3.6
Total	28	100

Regarding accreta placenta description as it was visualized by coloured Doppler U/S, more than half ,15/26 (57.7) of the viewed placenta were focal LF and the least were Focal LF+U-B, Interface hyper-vascularity and SPC as it represented by 1 for each (Table 8).

Table 8: Number and percentage of established diagnosed cases with placenta Accreta according to Doppler description of visualised placenta, n=26.

Doppler description of visualized placenta	No	%
Focal LF	15	57.7
Diffuse LF	8	30.8
Focal LF + U-B hyper-vascularity	1	3.8
Interface hyper-vascularity	1	3.8
SPC	1	3.8
Total	26	100

DISCUSSION

Placenta accreta is a potentially life-threatening obstetric condition that requires rapid decision and a multidisciplinary approach for management.

Life-threatening condition, is defined as any placental implantation with abnormally firm adherence to myometrium because of partial or total absence of the decidua basalis and imperfect development of the fibrinoid or *Nitabuch layer* Benirschke.⁽¹⁶⁾ Unfortunately, the clinical consequences of this abnormal implanted placenta can be quite serious resulting in incomplete separation of the placenta at the time of delivery and postpartum hemorrhage Resnik.⁽¹⁷⁾ Early recognition of placenta accreta may improve the outcome by providing the obstetrician an opportunity to plan the surgery and potentially reducing maternal morbidity and mortality. Incidence of placenta accreta has increased 10-fold over the past 50 years.⁽¹⁸⁾ The increased frequency of accreta syndromes due to liberalized use of cesarean delivery. Total number of delivery in Al-Yarmouk Teaching Hospital in 1999 was about 7454, total vaginal delivery was 5661, and

caesarean was 1793, so percentage of caesarean to total number was 24% and in 2010 total number was about 13013, total vaginal delivery was 7811 and total cesarean was 5202 so percentage of cesarean was 40% and in 2015 was about 14247 vaginal deliveries was 7471 and cesarean section was 6776 so percentage of cesarean was 48%, as an increasing trend of cesareans. In this study the median maternal age between the two ages groups of placenta previa and placenta previa accrete was 35 years and this agree with Biro et al.⁽¹⁹⁾ and Haratz-Rubinstein et al.⁽¹⁴⁾

Our study agrees with Hung et al.⁽²⁰⁾ That gravidity was higher in patient with placenta accreta. However, it failed to reach statistical significance. This may reflect the increasing uterine insult with repeated pregnancies and other study of Abu Heija et al,⁽²¹⁾ show that the gravidity became important after 5 or more previous pregnancies.

Regarding parity this study failed to show statistically significant relationship between placenta accreta and parity, despite that the result showed high percentages of high parity this agree with Zaki et al,⁽²²⁾ who showed that increase parity not associated directly with increase placenta accreta.

Our study shows that previous cesarean is the major risk factor for placenta accreta and this risk had a significant relationship with the number of cesarean. In this study the incidence of placenta accreta started from 37% for those with one or two cesarean up to 63% in those who having three or more cesarean. That result agree with Clark et al,⁽²³⁾ who found that the incidence of placenta accreta when previa present is 5% in unscarred uterus and increase proportionately with the number of previous one cesarean deliveries reaching 24% in previous one cesarean to 67% in those with four or more cesarean and Silver and colleagues⁽²⁴⁾ and Juntunen et al⁽²⁵⁾ and Makoha et al.⁽²⁶⁾

Decidual tissue is scant in the lower uterine segment and decidualization may be impaired further in the presence of one or more lower segment scar. This may lead to an increase in the likelihood of trophoblastic invasion into the myometrium. Accreta syndrome tissue specimens have shown evidence for hyper-invasiveness. compared with otherwise uncomplicated previa specimens Pri-Paz et al.⁽²⁷⁾ The distribution of large vessels is different than that seen with non accreta placentae Chantraine et al⁽²⁸⁾ and the increased risk conveyed by previous uterine trauma-for example, cesarean delivery-may be partially explained by an increased vulnerability of the decidua to trophoblast invasion following incision into the decidua Garmi et al.⁽²⁹⁾

This result agrees with the study done by Hershkwit et al.⁽³⁰⁾ and others. Getahun et al⁽³¹⁾ found the risk of placenta previa not enhanced with number of previous cesarean section his explanation depends on theory related to placental migration in early pregnancy and one cesarean section would be enough to prevent placental migration. However, this result regarding high risk associated with even one scar not agrees with the finding of the study done by Silver et al⁽²⁴⁾ who revealed that each additional cesarean delivery is associated with an increased subsequent risk of incurring a placenta previa.

In this study fetal female gender was noticed as a possible risk factor for the development of placenta accreta. This agree with Khong et al⁽³²⁾ and Some studies suggest that the rate of incidence is higher when the fetus is female. American Pregnancy Association⁽³³⁾ and disagree with Hung et al⁽²⁰⁾ although it is statistically not significant.

Regard gestational age at delivery, The median gestational age at delivery for previa group was 37 weeks, while the median for previa accreta was 35 weeks.

The American College of Obstetricians and Gynecologists,⁽³⁴⁾ recommends individualization of delivery timing. In their work. The results of two recent surveys indicate that most practitioners do not deliver these women until 36 weeks or later Esakoff et al,⁽³⁵⁾ and Wright et al.⁽³⁶⁾

At Parkland Hospital, they generally schedule these procedures after 36 completed weeks but are prepared also to manage them in non-elective situations. Women with placenta previa are managed depending on their individual clinical circumstances. At Parkland Hospital, they prefer to wait until 37 to 38 weeks before delivery. In our study placenta previa may show a protective effect due to those patients may have many opportunities for receiving antenatal steroids earlier in gestation and in addition knowing of presence of low lying placenta during antenatal care, makes mothers more oriented about their pregnancy and attends hospital early for follow up.⁽⁹⁾

Regarding maternal complications, fortunately there were no maternal death happened in our study may be due to multiple reasons. First, the small number of sample, second, the study was performed in a tertiary center with well-trained multidisciplinary team present and facilities of blood and blood product access.

This agrees with the study of Eller et al⁽¹²⁾ who found that maternal morbidity is reduced in women with

placenta accreta who deliver in a tertiary care hospital with multidisciplinary care team. But other study report of 4693 maternal deaths in the United States, placenta previa and accrete syndromes accounted for 17 percent of deaths from hemorrhage Berg et al.⁽³⁷⁾

Ultrasonography remains the most sensitive and commonly used imaging modality for the diagnosis of placenta accreta, because it is accurate, inexpensive, non-invasive and time-saving. The B-mode U/S had sensitivity of 88.9% and specificity of 90.6%. The positive and negative predictive values were 82.8% and 94.1% respectively. Grayscale sonography is an excellent tool for the prenatal diagnosis of placenta accreta in women at risk for this abnormality. Its sensitivity has been reported in the range of 77% to 87% with specificity of 96% to 98%, a positive predictive value (PPV) of 65% to 93%, and a negative predictive value (NPV) of 98%. [34]. And the color Doppler had sensitivity 92.6% and specificity of 98.1%. In this study the parameter of color Doppler agreed with across four studies, sonographic diagnosis of placenta accreta has been associated with a sensitivity of 77.0-93.0% and specificity of 71.0-96.8%, with a PPV of 65.0-87.5% and NPV of 92.0-98.0% [38,39]. Levine et al⁽⁴⁰⁾ showed color Doppler imaging had a sensitivity of 86% and a specificity of 92%.

As shown in this study the rate of false positive diagnosis of placenta accreta by B-mode was 9.4% compare to color Doppler 1.9%. In this study only one case was false positively diagnosed as having placenta accreta by both B-mode and color Doppler U/S. This woman admitted at 30 week gestation because she had attack of vaginal bleeding. This patient had a previous three cesarean sections, Color Doppler Ultrasound showed evidence of abnormal bladder –uterine serosa interphase hyper vascularity which was assumed to be placenta accreta this mistaken interphase hypervascularity caused by bladder varices. Two cases were false negative diagnosed by both modality (B-mod and Doppler). Both had pure posterior placenta previa.

In our study placenta accreta more common when placenta anterior this agree with study done by Dong Gyu Jang, et al⁽⁴¹⁾ who found that placenta accrete more common in anterior placenta.

In conclusion; women at greatest risk of placenta accreta syndrome (abnormal placenta) are those who have uterine damage caused by previous cesarean delivery with placenta previa overlying the uterine scar with risk increases with more repeated cesarean

sections. Color Doppler U/S provides an opportunity for early and accurate diagnosis of placenta accrete

It is recommended to; encourage women for vaginal delivery, impressing the idea that repeated cesarean sections behind abnormal placenta so we recommend reducing unnecessary cesarean sections, encourage women who deliver by cesarean section to limit the number of cesarean section. Those with repeated cesarean section should have proper antenatal care and encouraged to be extensively examined by color Doppler and properly counseling.

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