

UTERINE ARTERY DOPPLER AND PLACENTAL MORPHOLOGICAL FEATURES AS PREDICTORS OF PERIPARTUM COMPLICATIONS IN PLACENTA PREVIA AND PLACENTA PREVIAACCRETA

By

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ABSTRACT

Background: Placenta previa and placenta previaaccreta are severe pregnancy complications with 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.

Objectives: The aim of this study was to investigate whether different placental morphological features and uterine artery Doppler can predict maternal and fetal outcome in pregnancies complicated with placenta previa and placenta accreta.

Patients and Methods: This study was done at Al-Hussien Obstetrics-Gynaecology department during the period from June 2019 till December 2019, patients were selected from outpatient clinic, ultrasound unit, and patients admitted in Al-Hussien Obstetrics-Gynaecology department. It is a prospective observational study on 30 patients with placenta previa including placenta previaaccreta compared to 30 patients with normal pregnancies. This was done to assess if uterine artery Doppler and Placental morphological Features could be predictors of peripartum complications in cases with Placenta Previa and Placenta Previaaccreta.

Results: There were significant relations between location of the placenta, presence of lacunae, absent echolucent space and placental vascularity and the three groups, with no relation with bladder uterine interface. There were significant relations between CS hysterectomy, blood transfusion, NICU, bladder injury, ICU, preterm labour and the 3 groups. This shows significant correlations between different types of placentae and neonatal birth weight. There was significant relation between uterine artery PI and the 3 groups, with no significance with RI. There were significant relations between presence of lacunae and CS hysterectomy, blood transfusion, NICU, bladder injury, ICU admission preterm labour, - as p value was less than 0.001-, with no significance with maternal mortality and neonatal death. There were significant relations between PI of uterine artery doppler and apgar score in 1 & 5 min with p value 0.007 and less than 0.001 respectively, with no relation with IUGR.

Conclusion: From results of our study we can conclude that ultrasound has a high diagnostic value in diagnosing placenta previa and placenta previaaccreta by certain placental morphological features. High grade of placental lacunae and moderate placental vascularity were highly associated with maternal and fetal complications.

Keywords: Uterine Artery Doppler, Placental Morphological Features, Peripartum Complications, Placenta Previa, Placenta PreviaAccreta

INTRODUCTION

Placenta previa and placenta previa accreta are severe pregnancy complications with 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 (*Eller et al., 2009*).

Such abnormal placentation may be associated with massive and potentially life-threatening antepartum, intrapartum and postpartum hemorrhage (*Faranesh et al., 2010*). The severe uterine hemorrhage may lead to the need of extensive life-saving surgical interventions such as hysterectomy and ligation of major pelvic vessels, placenta accreta has become the leading cause of emergency hysterectomy (*Daskalakis et al., 2011*).

Several risk factors for placenta accreta have been reported including a previous cesarean delivery particularly when accompanied with a coexisting placenta previa, increasing numbers of prior cesarean deliveries exponentially increase the risk of placenta accrete (*Wu et al., 2005*). Other predisposing factors have been identified including: scarred uterus, multiparity, previous uterine surgery, advanced maternal age, previous uterine curettage (*Miller et al., 2012*).

As a consequence of placental invasion to adjacent organs, reconstruction of the urinary bladder or bowel may be necessary. Massive blood and blood products transfusions are the rule in these dramatic cases. Other complications include neonatal death, infection, fistula formation & ureteral damage.

It is likely that antenatal diagnosis of placenta accreta has contributed to the overall drop in maternal morbidity and deaths that has been associated with this condition (*Stafford & Belfort, 2008* and *Eller et al., 2009*). So, it is important to make the diagnosis of placenta accreta prenatally because this allows effective management planning to minimize morbidity, this diagnosis is usually made by ultrasonography or magnetic resonance imaging (MRI).

PATIENTS AND METHODS

This study was done at Al-Hussien Obstetrics-Gynaecology department during the period from June 2019 till December 2019, patients were selected from outpatient clinic, ultrasound unit, and patients admitted in Al-Hussien Obstetrics-Gynaecology department.

It is a prospective observational study on 30 patients with placenta previa including placenta previa accreta compared to 30 patients with normal pregnancies. This was done to assess if uterine artery Doppler and Placental morphological Features could be predictors of peripartum complications in cases with Placenta Previa and Placenta Previa accreta.

Cases were assigned into 3 groups:

- Group I: 30 pregnant women with normal pregnancy.
- Group II: 15 pregnant women with placenta previa.
- Group III: 15 pregnant women with placenta previa with placental morphological features of placenta accreta.

The study was approved by the ethics committee and after proper counseling; all women solicited for enrollment and provided written informed consent.

Inclusion criteria:

- Singleton pregnancies.
- Women bearing a living fetus.
- Gestational age ranging between 34 and 37 weeks calculated from first day of LMP or by a first trimester abdominal U/S.
- Patients with no co existing medical disorders.
- Patient acceptance to join the study after signing an informed consent.

Exclusion criteria:

- Multifetal pregnancies or pregnancies with IUFD.
- Associated other medical conditions as pregnancy induced hypertension, heart diseases and rheumatological diseases apart from iron deficiency anemia.
- Prelabor ROM.
- Presence of diagnosed fetal anomalies.
- Patients who refuse to take part in the study.

All the women in this study were subjected to:

- History
 - Personal history (name, age, file number).
 - Obstetric history (number of C.S, abortion, placenta previa in previous pregnancy, history of ectopic, medical disorder with pregnancy & number of living children).

- Present history (complaint, gestational age, medical disorder in present pregnancy & history of ante partum hemorrhage).

- Past history (postpartum sepsis, postpartum hemorrhage & chronic diseases).

● Examination

- General
- Abdominal

Investigations

● Laboratory

Preoperative and postoperative (CBC, INR, PT, PTT, liver functions, kidney functions, 2h PP & FBG).

● Ultrasonography evaluation

- Abdominal Ultrasound and color Doppler examinations were done by (Voluson 58-GE ultrasound Korea.ltd.9.Sunhwan-ro-214beon-gil, Gyneonggi-do, Korea) in Al-Hussien Obstetrics-Gynaecology department (fetal medicine unit, department 21).

- Routine fetal viability checking was done.

- Patients were placed in supine position and abdominal ultrasound examination was performed with the bladder partially filled, which allowed optimal visualization of the uterine serosa and the bladder wall.

- Diagnosis of total and marginal placenta previa was made when either the internal cervical os was completely covered by placenta or the leading edge of the placenta was less than 2 cm from the internal os, but not fully covered by

the placenta, respectively (Heller, 2013).

- Prediction of placenta accreta was made based on the following features:
 - Lacunae
 - Echolucency
 - Bladder uterine interface
 - Pattern of vascularity
- Doppler studies of both uterine arteries were done.
- All participants in the study including control subjects as well as patients with placenta previa were evaluated for the following features: placental lacunae, placental vascularity, echolucent area,

bladder wall uterine interface and uterine artery PI&RI values .

Monitoring the outcome: The outcome of this study was measured by the occurrence of peripartum complications in both mother and fetus.

Statistical methods:

Data were statistically described in terms of mean + standard deviation, frequencies (number of cases) and percentages when appropriate. All statistical calculations were done using computer program SPSS (statistical package for the social science, SPSS Inc., Chicago, IL USA) release 15 for Mictosoft windows 2006.

RESULTS

There were significant relations between location of the placenta, presence of lacunae, absent echo lucent space and

placental vascularity and the three groups, with no relation with bladder uterine interface (Table 1).

Table (1): Different placental morphological features of the groups in relation to each other

Groups	Parameters	group 1		group 2		group 3		P Value
		Count	%	Count	%	Count	%	
Placenta	Fundal posterior	30	100.0%	0	.0%	0	.0%	<0.001
	Marginal anterior	0	.0%	11	73.3%	6	40.0%	
	Complete centralis	0	.0%	4	26.7%	9	60.0%	
Lacunae	0	29	96.7%	4	26.7%	0	.0%	<0.001
	1	1	3.3%	8	53.3%	0	.0%	
	2	0	.0%	2	13.3%	10	66.7%	
	3	0	.0%	1	6.7%	2	13.3%	
	4	0	.0%	0	.0%	3	20.0%	
Echo lucent space presence	Yes	0	.0%	0	.0%	15	100.0%	<0.001
	No	30	100.0%	15	100.0%	0	.0%	
Bladder & uterine interface distinction	yes	0	.0%	0	.0%	1	6.7%	0.500
	No	30	100.0%	15	100.0%	14	93.3%	
Vascularity	Normal	30	100.0%	11	73.3%	0	.0%	<0.001
	Mild	0	.0%	3	20.0%	0	.0%	
	Moderate	0	.0%	1	6.7%	15	100.0%	

There were significant relations between CS hysterectomy, blood transfusion, NICU, bladder injury, ICU, preterm labour and the 3 groups (Table 2).

Table (1): Peripartum complications in the different 3 groups

Parameters	Groups	Group 1		Group 2		Group 3		P value
		Count	%	Count	%	Count	%	
CS hysterectomy	Yes	0	.0%	1	6.7%	6	40.0%	< 0.001
	No	30	100.0%	14	93.3%	9	60.0%	
blood transfusion	Yes	0	.0%	7	46.7%	12	80.0%	< 0.001
	No	30	100.0%	8	53.3%	3	20.0%	
NICU	Yes	0	.0%	7	46.7%	2	13.3%	< 0.001
	No	30	100.0%	8	53.3%	13	86.7%	
bladder injury	Yes	0	.0%	1	6.7%	3	20.0%	0.034
	No	30	100.0%	14	93.3%	12	80.0%	
ICU	Yes	0	.0%	2	13.3%	3	21.4%	0.021
	No	30	100.0%	13	86.7%	11	78.6%	
Preterm labor	Yes	0	.0%	8	53.3%	6	42.9%	< 0.001
	No	30	100.0%	7	46.7%	8	57.1%	

There were significant correlations between different types of placentae and neonatal birth weight (Table 3).

Table (2): Relation between peripartum complications neonatal birth weight and different 3 groups

Parameters	Groups	Group 1		Group2		Group 3		P value
		Mean	SD	Mean	SD	Mean	SD	
Neonatal birth weight (grams)		3336.6	249.8	2460.0	564.1	2606.6	638.6	< 0.001
		7	0	0	7	7	0	

There were significant relation groups, with no significance with RI between uterine artery PI and the 3 (Table 4).

Table (3): Uterine artery PI& RI in relation to the 3 groups

Parameters	Groups	Group 1		group 2		group 3		P value
		Mean	SD	Mean	SD	Mean	SD	
Rt. ut art PI		0.76	0.11	0.94	0.19	1.05	0.16	< 0.001
Rt. Ut art RI		0.61	0.08	0.64	0.14	0.63	0.19	0.636
Lt. ut art PI		0.78	0.11	0.90	0.25	1.14	0.30	< 0.001
Lt. ut art RI		0.60	0.09	0.62	0.12	0.64	0.18	0.669

There were significant relations between presence of lacunae and CS hysterectomy, blood transfusion, NICU, bladder injury, ICU admission preterm labor, - as p value was less than 0.001-, with no significance with maternal mortality and neonatal death (Table 5).

Table (4): Relation between lacunae and maternal mortality, CS hysterectomy, blood transfusion, NICU, neonatal death, bladder injury, ICU and preterm labor

Parameters		0		1		2		3		4		P value	
		Count	%	Count	%	Count	%	Count	%	Count	%		
Lacunae	Maternal mortality	No	33	100.0%	9	100.0%	12	100.0%	3	100.0%	3	100.0%	-----
	Yes	0	.0%	0	.0%	1	8.3%	3	100.0%	3	100.0%	< 0.001	
CS Hysterectomy	No	33	100.0%	9	100.0%	11	91.7%	0	.0%	0	.0%	< 0.001	
	Yes	0	.0%	4	44.4%	12	100.0%	3	100.0%	3	100.0%	< 0.001	
Blood transfusion	No	33	100.0%	5	55.6%	0	.0%	0	.0%	0	.0%	< 0.001	
	Yes	0	.0%	7	77.8%	2	16.7%	3	100%	3	100.0%	< 0.001	
NICU	No	33	100.0%	2	22.2%	10	83.3%	0	.0%	0	.0%	< 0.001	
	Yes	0	.0%	9	100.0%	12	100.0%	3	100.0%	3	100.0%	-----	
Neonatal death	No	33	100.0%	9	100.0%	12	100.0%	3	100.0%	3	100.0%	< 0.001	
	Yes	0	.0%	0	.0%	1	8.3%	3	100.0%	2	66.7%	< 0.001	
Bladder injury	No	33	100.0%	9	100.0%	11	91.7%	0	.0%	1	33.3%	< 0.001	
	Yes	0	.0%	0	.0%	3	25.0%	2	66.7%	2	66.7%	0.001	
ICU	No	33	100.0%	9	100.0%	9	75.0%	1	33.3%	1	33.3%	< 0.001	
	Yes	0	.0%	6	66.7%	8	66.7%	3	100.0%	3	100%	< 0.001	
Preterm labor	No	33	100.0%	3	33.3%	4	33.3%	0	.0%	0	0%	< 0.001	

There were significant relations between PI of uterine artery doppler and apgar score in 1& 5 min with p value

0.007 and less than 0.001 respectively, with no relation with IUGR (Tadle 6).

Table (5): Relation between PI of uterine artery and neonatal birth weight and apgar score in 1& 5 min

Parameter	Uterine arteryPI	
	Neonatal birth weight	R
	P value	0.093
	N	60
Apgar 1 min	R	-0.343-
	P value	0.007
	N	60
Apgar 5 min	R	-0.450-
	P value	<0.001
	N	60

DISCUSSION

Placenta accreta is a pathological condition in which the placental trophoblast invades the endometrium beyond the Nitabuch's layer due to a defect in the decidua basalis (ACOG, 2010). In more severe cases, the trophoblast invades the myometrium (placenta increta) or the serosa and beyond (placenta percreta).

Placenta accreta is considered as major pregnancy complication that may be associated with massive and potentially

life-threatening intrapartum and postpartum hemorrhage (Faranesh *et al.*, 2007). It has become the leading cause of emergency hysterectomy accounting for nearly 40–60% of such cases (Daskalakis *et al.*, 2011).

In addition, pregnancies complicated by placenta accreta are thought to be associated with increased incidences of cystotomy, ureteral injury, pulmonary embolism, need for ventilator use, reoperation, and intensive care unit (ICU)

admission which causes increased maternal hospital stay (*Silver, 2016*).

The incidence of placenta accreta is likely to continue to increase most probably due to increase in caesarean section rates (*Warshak et al., 2010*). Until 2002 the incidence was 1 in 533 deliveries, but in 2006, the incidence increased up to 1 in 210 deliveries (*Stafford and Belfort, 2008*). It has been noted that one prior Cesarean delivery doubles the risk of placenta previa in a subsequent pregnancy such that the incidence increases from 0.38 to 0.63% (*Getahun et al., 2015*); this effect is further compounded such that women with a placenta previa in the setting of prior uterine surgery are particularly at risk for accreta. Other risk factors for placenta accreta include uterine instrumentation and intrauterine scarring, all of which may be associated with damage to or absence of the decidua basalis, as well as placenta previa, smoking, maternal age over 35, grand multiparity and recurrent miscarriage (*Gielchinsky, 2012*).

Because an antenatal diagnosis of placenta accreta could contribute to remarkable drop in maternal morbidity and deaths that has been associated with this condition (*Stafford & Belfort, 2008, and Eller et al., 2009*), it is important to make the diagnosis of placenta accreta prenatally. This allows effective management planning to minimize morbidity and mortality (*Comstock, 2015*).

In our series, the study planning included proper preoperative counseling mainly for the possible morbidities and lines of management and proper

preoperative preparation. This included control of preoperative morbidities especially anemia, summoning necessary resources mainly blood and blood products and summoning necessary experienced teams from anesthetists through urologists to senior obstetricians with the experience to manage such a dreadful complication. Thus an emergency cesarean hysterectomy in its hasty meaning was avoided and replaced by a more planned and more or less elective procedure. All of this was achieved through proper anticipation due to antenatal diagnosis.

Wu et al. (2009) reported that Placenta accreta is much more common than placenta increta and percreta with the following incidences: placenta accreta – 79%; placenta increta – 14%; and placenta percreta 7% of the total number of abnormally adherent placentae.

Maternal morbidity had been reported to occur in up to 60% of women with placenta accrete (*Eller et al., 2009*). However, due to proper planning, we have much lower rates.

Maternal mortality has been reported in up to 7% of cases (*ACOG, 2010*). In the current study there were no maternal deaths. This may be due to the sample size that was insufficient to detect the actual maternal mortality count. It might also be due to proper patient diagnosis preoperatively, adequacy and availability of blood and blood products for transfusion, very experienced surgical team and availability of resources which improved maternal and fetal outcome and decreased maternal and fetal mortality. If such measures were not adopted, mortality might have agreed with that described by

the ACOG which probably describes the total mortality in emergency and properly planned procedure.

In the present work, placental lacunae was greatly associated with maternal and fetal complications. This agreed with *Yang and Colleagues (2016)* who report that found that presence of placental lacunae increased the risk of hemorrhage at delivery, the need for massive transfusion, admission to the intensive care unit and cesarean hysterectomy.

Others have not only described the mere presence of such placental lacunae but also their grading. In 2014 investigators found that increasing grade of lacunae was significantly associated with the need for massive blood transfusion and increased the cesarean hysterectomy rate (*Yoon et al., 2014*). This agreed with the current study as blood transfusion increased in patients who had lacunae types 2, 3&4. CS hysterectomy also increased in patients who had lacunae especially types 3& 4 and a high rate of ICU admission was with presence of lacunae types 3&4.

According to *Yoon and Colleagues (2014)*, uteroplacentalhypervascularity was significantly associated with a higher risk of cesarean hysterectomy, blood transfusion and peripartum complications and that was in agreement with the current study as it was found that mild and moderate placental vascularity were associated with CS hysterectomy, blood transfusion, bladder injury, ICU admission and iatrogenic preterm labour. We strongly believe that categorizing and quantitating such sonographic observations will help in planning such morbid deliveries.

The real value of screening of uterine artery Doppler is that a mean uterine artery PI predicts most women who will experience severe preterm consequences of impaired placentation. Uterine artery PI was higher -above 1.45- in complicated pregnancies than those with normal outcome. Additionally its sensitivity for predicting severe adverse outcome was increased and that correlates with the present study as an increase uterine artery PI had significant association with CS hysterectomy, blood transfusion and NICU.

Cho and Colleagues (2015) reported that the mean uterine artery PI was significantly lower in the placenta accreta group compared to placenta previa group and this disagreed with the present study as we found no significant association. Perhaps such difference could be due to difference in sample size.

Some authors showed that uterine artery blood velocity RI was the best predictor of adverse outcome of pregnancies suspected for IUGR (*Ghosh et al., 2016*), but this disagreed with the current study as there was no significance between uterine artery RI and fetal outcome.

Our study had some other limitations as uterine artery Doppler velocimetry and placental morphology were performed by different operators during the study period. However, all operators were well-trained experts who fully understood the protocol before starting the examination, but a bias between operators may still have existed. A well-organized prospective study will be necessary to address this issue. Yet what we conclude and address firmly is that planning which

could be aided by such simple tools could easily decline morbidity and mortality both on maternal and fetal sides.

CONCLUSION

Ultrasound has a high diagnostic value in diagnosing placenta previa and placenta previa accreta by certain placental morphological features. It is helpful and non-invasive tool in prediction of maternal and fetal outcome. Uterine artery Doppler PI is also useful in prediction of complications both maternal and fetal. High grade of placental lacunae and moderate placental vascularity were highly associated with maternal and fetal complications.

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استخدام دوبلر الشريان الرحمي والخصائص الشكلية للمشيمة للتنبؤ بمضاعفات الفترة المحيطة بالولادة في الحمل ذو المشيمة المتقدمة والمشيمة المتقدمة الملتصقة

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خلفية البحث: تعد المشيمة والمشيمة الملتصقة من مضاعفات الحمل الشديدة مع
مراضة الأمهات وقد بلغت عن حدوثها بنسبة تصل إلى 60% والوفيات فى ما
يصل إلى 7% من النساء المصابات بالمشيمة الملتصقة بالإضافة إلى ذلك تزداد
نسبة حدوث مضاعفات الفترة المحيطة بالولادة بشكل رئيسى بسبب الولادة
المبكرة وللأجنة صغيرة الحجم مقارنة بعمر الحمل .

الهدف من البحث: إستكشاف ما إذا كانت السمات المورفولوجية المختلفة للمشيمية
ودوبلر الشريان الرحمى يمكنهما التنبؤ بنتيجة مضاعفات الأم والجنين فى حالات
الحمل بالمشيمة المتقدمة والمشيمة الملتصقة .

المريضات وطرق العلاج: أجريت هذه الدراسة فى قسم أمراض النساء والتوليد
فى مستشفى الحسين الجامعى خلال الفترة من ابريل 2019 حتى ديسمبر 2019
وتم اختيار المرضى من العيادة الخارجية ، وحدة الموجات فوق الصوتية
والمريضات اللائى تم قبولهن فى قسم امراض النساء والتوليد فى مستشفى
الحسين الجامعى . أنها دراسة رصدية مستقبلية على 30 مريضة يعانين من
المشيمة المتقدمة بما فى ذلك المشيمة الملتصقة مقارنة مع 30 مريضة يعانين من
حالات الحمل الطبيعية . وقد تم ذلك لتقييم ما إذا كان دوبلر الشريان الرحمى
والميزات المورفولوجية المشيمية يمكن أن يكون تنبؤا بمضاعفات كل جزء فى
الحالات المصاحبة للمشيمة المتقدمة والمشيمة الملتصقة .

نتائج البحث: كانت هناك علاقات كبيرة بين موقع المشيمة ووجود الثغرات ،
وغائبة الفضاء الصدى والأوعية الدموية للمشيمة والمجموعات الثلاث ، مع عدم
وجود علاقة مع واجهة الرحم والمثانة كانت هناك علاقات كبيرة بين استئصال

الرحم أثناء القيصرية ، ونقل الدم ، ودخول الأطفال المحضن وجرح المثانة ودخول وحدة العناية المركزة ، والولادة المبكرة فى المجموعات الثلاث مما يدل على علاقات مشتركة كبيرة بين أنواع مختلفة من المشيمة ووزن المواليد الجدد وكان هناك علاقة كبيرة بين معدل نبض الشريان الرحمى فى المجموعات الثلاث مع عدم وجود أهمية مع معدل المقاومة.

الاستنتاج: الموجات فوق الصوتية لها قيمة تشخيصية عالية فى تشخيص المشيمة المتقدمة ، والمشيمة الملتصقة لتوافق مع بعض الخصائص المورفولوجية للمشيمة وقد كان هناك درجة عالية بين الثغرات المشيمية والأوعية الدموية المعتدلة بشكل كبير مع مضاعفات الأم والجنين.