ORIGINAL ARTICLE

The role of Uterine Artery Doppler Velocimetry in The Diagnosis of Morbidly Adherent Placenta

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Abstract

Background: ***Placental attachment disorders (PAD) encompasses a spectrum of conditions distinguished by abnormal adherence of placenta to the implantation site.***

Aim: ***To determine the role of uterine artery Doppler velocimetry in the identification of morbidly adherent placenta together with other diagnostic criteria of placenta accreta and thus help in early diagnosis and management of placenta accreta and decrease the maternal mortality.***

Patients and methods: ***This investigation was prospective cohort investigation, and has been carried out on 60 cases of pregnant females with one or more previous caesarian deliveries and with placenta previa previously diagnosed by Ultrasound all of them having singleton fetuses between 28 and 34 weeks of pregnancy, and has been carried out at the department of obstetrics and gynecology faculty of medicine Al-Azhar University.***

Results: ***At cut off point .51, Resistive index (RI) has 87% sensitivity and 82% specificity for prediction of placenta accreta. At the cut-off point, .83, the resistive index (RI) has 97% sensitivity and 78% specificity for the prediction of placenta accreta.***

Conclusion: ***Uterine artery Doppler velocimetry is a good instrument in the diagnosis of placenta previa accreta in cases of placenta previa. We found that uterine artery Doppler is additionally beneficial in the prediction of complications, both fetal and maternal.***

Keywords: Morbidly Adherent Placenta; Uterine Artery Doppler velocimetry; placenta previa

1. Introduction

Placental attachment disorders, morbidly adherent placenta (MAP), or the most current synonym, abnormally invasive placenta (AIP), are a category of conditions that are defined by the abnormal adherence of the placenta to the site of implantation. The three variants are classified based on the extent of trophoblastic invasion through the myometrium and the uterine serosa: placenta, accreta, percreta, and increta. The most prevalent variant, placenta accreta, is characterized by an abnormally adherent placenta to the uterus, in which the chorionic villi have directly embedded into the myometrium in the absence of decidua.[1]

The rate of placenta accreta spectrum is increasing. The most recent investigation conducted in 2016 revealed that the total rate of placenta accreta in the US was 1 in 272 for females who had a birth-related hospital discharge diagnosis. It's likely due to increased rates of cesarean deliveries.[2]

Placenta accreta frequency elevated with the number of previous cesarean section: 1.9 percent, 15.6 percent, 23.5 percent, 29.4 percent, 33.3 percent, and 50.0 percent following 0, 1, 2, 3, 4, and 5 earlier cesarean section, correspondingly.[3]

Morbidly adherent placenta is generally correlated with elevated maternal mortality and morbidity rates due to caesarean hysterectomy, elevated blood loss rates and transfusion, injury to nearby organs, and elevated intensive care admission rates.[4]

Accepted 15 March 2025.
Available online 31 May 2025

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https://doi.org/10.21608/aimj.2025.446555

Despite the new modalities in imaging techniques, the diagnosis of placenta accreta is still difficult and requires multiple modalities. Both 2D grey scale ultrasound, either transabdominally or transvaginally, accompanied with color Doppler ultrasound, have a significant role in the identification of MAP through some of the sonographic criteria of MAP such as retroplacental clear zone loss, existence of abnormal placental lacunae, placental bulge, interruption of bladder wall, thickness of the myometrium less than one millimeter, uterovesical hypervascularity & bridging vessels.[5,6]

The goal of the work was to determine uterine artery Doppler velocimetry role in the identification of morbidly adherent placenta together with other diagnostic criteria of placenta accreta and thus aid in early diagnosis and management of placenta accreta and decrease the maternal mortality.

2. Patients and methods

This investigation was a prospective cohort investigation, and was carried out on 60 cases of pregnant females with one or more previous caesarian deliveries and with placenta previa previously diagnosed by Ultrasound, all of them having singleton fetuses between 28 and 34 weeks of pregnancy, and was carried out at the department of obstetrics and gynecology faculty of medicine, Al-Azhar University.

Inclusion criteria: Maternal age between twenty and forty-five years, gestational age between 28 and 34 weeks of gestation diagnosed by the 1st last menstrual period day or 1st trimesteric ultra sound, Single living fetus, one or more caesarian sections and placenta previa all grades with great risk of MAP.

Exclusion criteria: Multiple pregnancies, maternal chronic medical disorders (DM or HTN or chronic renal affection), pregnancy-related disorders (gestational diabetes or preeclampsia), and gestational trophoblastic diseases

Ethical Consideration

The information that has been collected from participants is considered confidential. The investigation participants weren't identified by name in any report or publication related to this investigation. The nature and purpose of the investigation, as well as the risk-benefit assessment, have been explained to the participants prior to their admission to this investigation. Informed consent has been acquired.

Methods:

All patients have been subjected to: Full history taking, physical examinations, and investigational studies.

The degree of placental invasion has been defined as follows:

Placenta accreta has been suspected when placental "cones" disrupted the decidual zone with slightly elevated vascularization surrounding these cones. Placental increta has been identified when the occurrence of diffuse and irregular demarcation of the placental–uterine wall, thinning, and interface of the myometrium that overlies the placental–myometrial tissue led to sonographic suspicion of placental invasion into the myometrium. The intraplacental vascular lacunae were irregularly shaped, and the placenta increta has additionally been distinguished by elevated vascularization, which resembled the characteristic "moth damage" appearance. The sonographic diagnosis of placenta percreta has been characterized by the complete absence of the myometrium, with placenta extending to serosa or beyond, involving vascular breakthrough. Furthermore, placenta percreta has been distinguished by extensive subplacental hypervascularization, which has been characterized by multiple large intraplacental lacunae and irregularly extending vessels into the placental–myometrial tissue.

Uterine artery Doppler velocimetry

Uterine artery Doppler velocimetry is a medical technique used to assess blood flow in the uterine arteries during pregnancy. The two commonly measured parameters are the Resistive Index and the Pulsatility Index. These measurements are obtained through Doppler ultrasound, which evaluates the velocity and direction of blood flow.

Females have been instructed to evacuate their bladders prior to the transvaginal scan and have been positioned in the dorsal lithotomy position. The ultrasound instrument has been subsequently inserted into the vagina and positioned in the lateral fornix. The uterine artery has been recognized at the internal cervical os utilizing color Doppler. The point closest to the internal os and the paracervical portion of the ascending branch of the uterine artery have been both identified. Pulsed wave Doppler has been used with a sampling gate of two millimeters and an angle of insonation of less than thirty degrees. The scanner software automatically calculated the Pulsatility index, resistivity index, and systolic/diastolic ratio (S/D) following four consecutive similar waveforms being gathered. The Pulsatility index, Resistive index, and systolic/diastolic ratio have been defined by the following formulas:

PI= A-B/Mean

SD= A/B

RI= A-B/A

Where:

Mean= mean velocity

A peak systolic velocity

B end diastolic velocity

Postoperative histopathological

Placenta accreta has been identified by the partial incorporation of placental villi into the decidua basalis. A partially missing decidua basalis and united trophoblastic cell structures in the myometrium have been the defining characteristics of placenta increta. The diagnosis of placenta percreta has been made when the placental villi extend beyond the serosa.

3. Results

According to demographic data, the mean± SD of age was 31.1 ± 5.56, the mean± SD of BMI was 28.3±4.46 and the mean± SD of GA (weeks) was 34.7 ± 2.19 (Table 1).

Table 1. Shows demographic data in the examined group

	EXAMINED GROUP NO (60)
AGE MEAN± SD	31.1 ± 5.56
BMI MEAN± SD	28.3±4.46
GA (WEEKS) MEAN± SD	34.7 ± 2.19

According to ultrasonographic characteristics, there was 38(63.3%) cases had not more than one millimeter thickness of uterus and 22(36.7%) cases had more than one millimeter thickness of uterus, 55(91.7%) cases lost retroplacental space and 5(8.3%) cases preserved retroplacental space, 10(16.7%) had ≤2 lacunae and 50(83.3%) had >2 lacunae, 44(73.3%) did cesarean section only and 16(26.7%) did cesarean hysterectomy (Table 2)

Table 2. Shows ultrasonographic characteristics in the examined group

	EXAMINED GROUP NO (60)
THICKNESS OF UTERUS (MM)	
≤1	38(63.3%)
>1	22(36.7%)
RETROPLACENTAL SPACE	
LOST	55(91.7%)
PRESERVED	5(8.3%)
NUMBER OF LACUNAE	
≤2	10(16.7%)
>2	50(83.3%)
PROCEDURE	
CESAREAN	44(73.3%)
HYSTERECTOMY	16(26.7%)

According to histopathological findings, there was 18(30%) cases had one sign of adhesion of placenta previa and 20(33.3%) cases had more than one sign of adhesion of placenta previa (Table 3).

Table 3. Shows histopathological findings in the examined group

	EXAMINED GROUP NO (60)
PLACENTA PREVIA DON'T SHOW SIGNS OF ACCRETA	22(36.7%)
PLACENTA PREVIA SHOWING ONE SIGN OF ADHESION	18(30%)
PLACENTA PREVIA SHOWING MORE THAN ONE SIGN	20(33.3%)

According to Uterine artery Doppler velocimetry, the mean± SD of Resistive index was 0.49± 0.09 and the mean± SD of Pulsatility index was 0.74± 0.18 (Table 4).

Table 4. Shows Uterine artery Doppler velocimetry in the examined group

	EXAMINED GROUP NO (60)
RESISTIVE INDEX (RI) MEAN± SD	0.49± 0.09
PULSATILITY INDEX (PI) MEAN± SD	0.74± 0.18

According to maternal outcome, there was 15(25%) cases had bladder injury, 2(3.3%) cases had bowel injury, 40 (66.7%) cases need post-operative blood transfusion and 26(43.3%) cases admitted to ICU (Table 5).

Table 5. Shows maternal outcome in the examined group

	EXAMINED GROUP NO (60)
BLADDER INJURY	
YES	15(25%)
NO	45(75%)
BOWEL INJURY	
YES	2(3.3%)
NO	58(96.7%)
BLOOD TRANSFUSION	
YES	40 (66.7%)
NO	20 (33.3%)
ICU ADMISSION	
YES	26(43.3%)
NO	34(56.7%)

According to neonatal outcome, there were 10(16.7%) cases admitted to NICU (Table 6).

Table 6. Shows neonatal outcome in the examined group

	EXAMINED GROUP NO (60)
NICU ADMISSION	
YES	10(16.7%)
NO	50(83.3%)

At cut off point .51, Resistive index (RI) has 87% sensitivity and 82% specificity for prediction of placenta accreta. And at cut off point .83, Resistive index (RI) has 97% sensitivity and 78% specificity for prediction of placenta accrete (Table 7).

Table 7. sensitivity and specificity of Resistive index and Pulsatility index of Uterine artery Doppler velocimetry for prediction of placenta accreta.

	AREA UNDER THE CURVE	CUT OFF VALUE	SENSITIVITY%	SPECIFICITY%	95% CI INTERVAL	
					Lower bound	Upper bound
RESISTIVE INDEX (RI)	.849	.51	87%	82%	.732	1.966
PULSATILITY INDEX (PI)	.988	.83	97%	78%	.968	1.000

4. Discussion

The present study showed that according to demographic data, the mean±SD of age was 30.9±5.8, the mean±SD of BMI was 28.3±4.46, and the mean±SD of GA (weeks) was 34.4±2.3.

In agreement with our results, Fahmy et al.,[7] who aimed to demonstrate the significance of the Pulsatility index of uterine artery Doppler in the identification of placenta accreta in cases with placenta previa. Their study carried out on 54 pregnant famales diagnosed with placenta previa by Ultrasound. They reported that according to demographic data, the mean±SD of age was 32.8 ± 3.6 and the mean±SD of GA (weeks) was 30+0 (28+0−33+2).

In our study we found that according to ultrasonographic characteristics, there was 38(63.3%) cases had not more than one millimeter thickness of uterus and 22(36.7%) cases had more than one millimeter thickness of uterus, 55(91.7%) cases lost retroplacental space and 5(8.3%) cases preserved retroplacental space, 10(16.7%) had ≤2 lacunae and 50(83.3%) had >2 lacunae, 44(73.3%) did cesarean section only and 16(26.7%) did cesarean hysterectomy.

Our results were consistent with, Fahmy et al.,[7] who found that according to ultrasonographic characteristics, there was 21 (65.6%) caes had not more than one millimeter thickness of uterus and 11 (34.4%) cases had more than one millimeter thickness of uterus, 30 (93.8%) cases lost retroplacental space and 2 (6.3%) cases preserved retroplacental space, 4 (12.5%) had ≤2 lacunae and 28 (87.5%) had >2 lacunae, 24 (75.0%) did cesarean section only and 8 (25.0%) did cesarean hysterectomy.

In our study we found that according to uterine artery Doppler velocimetry, the mean± SD of Resistive index was 0.49± 0.09 and the mean± SD of Pulsatility index was 0.74± 0.18.

Also, our results were consistent with Cho et al.,[8] who found that according to uterine artery Doppler velocimetry, the mean± SD of Resistive index was 0.43 ± 0.07 and the mean± SD of Pulsatility index was 0.57 ± 0.13.

Our results were consistent with Kandil et al.,[9] who found that according to uterine artery Doppler velocimetry, the mean± SD of Resistive index was 0.54 ± 0.12and the mean± SD of Pulsatility index was 0.81± 0.21.

In our study we found that according to maternal outcome, there was 15(25%) cases had bladder injury, 2(3.3%) cases had bowel injury, and 40 (66.7%) cases need postoperative blood transfusion and 26 (43.3%) cases admitted to ICU.

Our results were consistent with, Maged et al.,[10] who reported that according to maternal outcome, there was 31 (49.2%) cases had bladder injury, 2 (3.2%) cases had bowel injury, 61 (96.8%) cases need postoperative blood transfusion and 40 (63.5%) cases admitted to ICU.

Additionally, Jadala et al.,[11] who attempted to examine the significance of uterine artery Doppler in the identification of placenta accreta in cases who have placenta previa. They discovered that bladder injury was the most common intraoperative complication, with a prevalence rate of 13.8 percent. This was the result of the presence of difficult bladder dissection and excessive pelvic adhesions.

In our study we found that according to neonatal outcome, the mean± SD of Apgar 1 min was 5.18± 0.94, the mean± SD of Apgar 5 min was 6.95± 0.79 and there were 10(16.7%) cases admitted to NICU.

Our results were consistent with, Maged et al.,[10] who reported that according to neonatal outcome, the mean± SD of Apgar 1 min was 5.12 ± 1.13, the mean± SD of Apgar 5 min was 7.05 ± 0.97and there were 9 (14.3%) cases admitted to NICU.

In our study we found that at cut off point 0.51, Resistive index has sensitivity of 87% and specificity of 82% for prediction of placenta accreta. And at cut off point 0.83, Pulsatility index has sensitivity of 97% and specificity of 78% for prediction of placenta accreta.

Our results were consistent with ABDELMONAEM et al.,[12] who found that Resistive index (RI) has 60 % sensitivity, 71.4% specificity, 66.6% accuracy, 60% PPV and 71.4% NPV for prediction of placenta accreta. Pulsatility index (PI) has 64% sensitivity, 74.3% specificity, 70% accuracy, 64% PPV and 74.3% NPV for prediction of placenta accreta.

4. Conclusion

In the current investigation, we discovered that the uterine artery Doppler velocimetry is a good instrument in placenta previa accreta diagnosis in cases of placenta previa. We found that uterine artery Doppler is additionally beneficial in prediction of complications both fetal and maternal.

Disclosure

The authors have no financial interest to declare in relation to the content of this article.

Authorship

All authors have a substantial contribution to the article

Funding

No Funds : Yes

Conflicts of interest

There are no conflicts of interest.

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