

DIAGNOSTIC ACCURACY OF DOPPLER ULTRASONOGRAPHY IN DIAGNOSIS OF PLACENTA ACCRETA TAKING OPERATIVE FINDING AS GOLD STANDARD

Abu Huraira*, Arfa Anwar, Umar Aftab, Naila Iftikhar, Noor Fatima

ABSTRACT

To assess the diagnostic accuracy of Doppler ultrasonography and 2D and 3D sonographic criteria to identify the differentiation of placenta accreta from percreta. For preliminary observation of morbidity adherent placenta transvaginal and transabdominal ultrasound examinations enrolled 190 patients with a history of previa and uterine surgery. Interruption of hyperechoic space between the bladder wall and uterine fossa, absence/abnormal presence of echo lucent area, and the existence of the high-velocity flow of unsettled placental lacuna was investigated by using 2D sonographic criteria. Uneven placental vascularization and the presence of many blood vessels in the uterine serosa-bladder wall interface were evaluated using 3D sonographic features. During cesarean section, against the final diagnosis, the ultrasound findings were inspected. Patients detected with MAP on cesarean most of them had anterior placenta previa. Good Diagnostic evaluation showed on ultrasonographic criteria. The falsest positive results were because of the loss of clear space and the low positive predictive value demonstrated. The sensitivity, specificity, and accuracy of color Doppler were found to be 84%, 95%, and 89%. Color-flow Doppler together with ultrasound highlights the antenatal evaluation of accreta in patients with persistent previa.

Authors Affiliation

Maqsooda Zia Hospital
Faisalabad.

*Corresponding Author:

abuhuraira2788@gmail.com

KEYWORDS: Doppler Ultrasonography, Placenta accreta, 2D and 3D sonographic criteria, Diagnostic accuracy, Antenatal evaluation

INTRODUCTION

Uterine blood supply mainly is the ovarian artery and uterine artery. The division of arterial vessels first into arcuate arteries, next into radial arteries then into spiral arteries when they reach the myometrium. A process that is fundamental for a normal placenta is when the trophoblast invades spiral arteries in the first and second trimesters of pregnancy. In uterine arteries, resistance to blood flow decreases when during the first half of pregnancy the trophoblastic invasion progressively continues. In normal pregnancies, between 6 and 24 weeks trophoblastic invasion of spiral arteries takes place. Placenta accreta is abnormal placental implantation to the myometrium because of the defect in decidua basalis (1). The placenta usually

receives attention when there is abnormal detection otherwise in the normal evaluation of gestation it is often overlooked. Placenta is divided into three grades when there is myometrium abnormality (Accreta) when myometrium and chorionic villi are in contact, (Increta) when the invasion of chorionic villi in myometrium and (Percreta) when penetration of the chorionic villi in the uterine serosa.

Although there is no known pathogenesis of this abnormality according to a proposed hypothesis there is more trophoblastic invasion and maldevelopment of decidua or a combination of both. Excessive intrapartum hemorrhage is built up when uteroplacental vasculature is hypertrophied and disorganized. The maternal mortality rate is as high as 8% with notable maternal

hemorrhage because of incomplete separation of the placenta at delivery (2, 3). As the maternal age and cesarean section increase in number, the prevalence of placenta accreta also increases rapidly. After one C-section the frequency of morbid placenta increases by 25% and after four or more C-sections, it increases by 68%. The deliveries at home without the backup of surgical facilities are also considered an important aspect so variation in the positive predictive value of color Doppler is created (4). The risk of accreta has become 41% in women with central placenta previa and who have had two or more cesarean deliveries (5). Over the last 50 years, with more deliveries through the cesarean section, the incidence of placental invasion has increased 10-fold. Although pregnancy-related deaths are due to massive obstetrics hemorrhage still the main cause is placenta previa accreta.

Due to emergency hysterectomy and life-threatening peri/postpartum bleeding, the major cause of maternal mortality and morbidity is invasive placentation contributing maternal death rate of 7-8% (6). The grave complications of invasive placenta include acute respiratory distress syndrome, multi-system organ failure, consumptive coagulopathy, vesicovaginal fistula formation, damage to adjacent organs, amniotic fluid embolism, and postoperative thromboembolism (7). All these complications are not only associated with placenta location but also the variable degree of uterine wall invasion of placental tissue also attributable. Antenatal diagnosis is required when echoing lucent areas are absent between the uterus and placenta, focal exophytic mass present, and a placenta lacuna is visualized in the placenta (8).

To diagnose placenta previa and its various forms many modalities are being used like Doppler USG, trans abdominal USG, and

MRI but the most accessible, less expensive, and non-invasive is Doppler USG [9]. Properties of blood flow in the targeted vessel are analyzed by the Doppler principle which describes the speed relative to the wave frequency of the mobile object. When the ultrasound beam reaches the moving blood, the ultrasound frequency changes. The principle is the same for various modalities of ultrasound like CW Doppler, PW Doppler, power Doppler, and color Doppler (1993,1990,2001). However, direction and visualization of blood flow are provided by color Doppler. Doppler color flow enhances the accuracy of placenta accreta diagnosis. So, the positive accuracy value is 55% to 91% due to the presence of signs at 15 to 20 weeks (10). As color Doppler highlights dilated blood vessels in uterine and placental tissues with hypervascularity in abnormal areas, therefore in the diagnosis of placenta previa, it is highly suggested. According to a study, 68% of women were reported with abnormal placental invasion (11). When the distance between the uterine serosa bladder wall and the retroplacental vessel is >1mm then a high predictor of myometrial invasion is Doppler color flow mapping (12). In patients with accreta color Doppler is shown as turbulent blood flow extending from the placenta into surrounding tissue (13).

With the use of transabdominal color Doppler, placenta previa with vascular morphological manifestations of uteroplacental can be evaluated. To detect other abnormalities of accreta and loss of sub-endometrial echo lucent area, a gray-scale transabdominal ultrasound. While at the serosa-bladder border to scan vessels that are newly formed, color flow mapping is performed. The characteristics of grey-scale ultrasound for 2nd and 3rd trimesters include irregular vascular space in the placenta, with the implantation site giving the appearance of "Swiss cheese", uterine wall discontinuity,

lack of myometrial zone, and distended myometrial and placental site and doppler sonography visualization of increased vascularity. Diagnosis of placenta previa accrete in Doppler USG, the sensitivity is between 82.4% to 100% and specificity is between 92% to 96.8% (14, 15).

The objective of this study was to evaluate and assess the accuracy and prevalence of Doppler ultrasonography in the diagnosis of placenta accreta taking operative findings as a gold standard. After fetal lung maturity is documented, through C-section patient is delivered at 34 to 35 weeks. In this case, a consultation with an experienced surgeon and specialized radiologist is planned.

LITERATURE REVIEW

Ahmad M.Maged et al.(2017) studied at least one preceding cesarean section with anterior placenta previa in 100 patients. All were gone through Doppler ultrasonography and matched up with operative findings. A notable difference was noticed between accreta and non-accreta patients with age (32.6 vs 29.1) and postoperative hemoglobin with a noteworthy difference (6.71 vs 8.41) and preceding cesareans ($p<.001$). Hypervascularity in uterine bladder interface (47.6% vs 5.4%), loss of uteroplacental clear zone (87/3% vs 10.8%), blood vessel invading myometrium (82.5% vs 18.9%) and intraplacental lacuna (93.7% vs 37.8%) are highly differentiated on doppler findings. The highest specificity to hypervascularity in uterine bladder interface, highest sensitivity to lacunae, and the highest accuracy to loss of uteroplacental zone are shown as (47.62,94.59, 93.75, 51.47, 65.00) V, (93.65, 62.16, 80.82,85.19, 82.00) and (87.30 89.19 93.22 80.49 88.00).

So concerning surgical treatment of the occurrence of injury to the bladder, post, and intraoperative blood transfusion, and hysterectomy, there is a notifying difference between the two groups. However, they concluded that for better maternal and fetal

outcomes and to improve the prediction of myometrial placental invasion, ultrasound, as well as color Doppler, are allowed to be used (16).

M.M.CHOU et al. (2015) evaluated the diagnosis of placenta previa accreta by transabdominal color Doppler ultrasound. Eight patients who are at high risk of access underwent the evaluation of persistent previa by color Doppler ultrasound with transabdominal B-mode in 2nd and 3rd trimesters. According to previous criteria,14 have histopathological proof and 16 out of 80 patients showed the highly specific characteristics of placenta accreta on color Doppler imaging. For interphase hypervascularity, two patients have false positive evidence. In the suspected group accreta hysterectomy is done with thirteen patients. Two out of sixty-four needed cesarean hysterectomy however three had placenta accreta while for bleeding from the lower uterine segment the leftover patients underwent uterine artery ligation with negative color Doppler imaging results. The specificity for placenta previa in color Doppler was 96.8% (61/63) and sensitivity was 82.4% (14/17). Respectively the predictive values for negative and positive results were 95.3% (61/64), and 87.5% (14/16).

For the exhibition of differential diagnosis for placenta previa accreta, the color Doppler is so important to explain it. From histopathological reports and at delivery time clinical data of follow-up were received from obstetricians. For the clinical peripartum management of targeted patients, the identification of particular vascular patterns like transabdominal color Doppler sonography had positive effects (17).

C.H.COMSTOCK (2005) explained that as the advanced age and the frequency of cesareans are increasing the risk of placenta accreta is speedily rising. So the characteristics findings and identification

should be done before ultrasound examination for those patients who are at risk. Low lying sac adhered to the anterior wall uterus appeared in the first trimester. The turbulent flow of irregular vascular sinus was demonstrated in 16 weeks. In the bladder, the space placenta appears as small bulges and so the bladder wall may be disturbed. In a normal patient with an anterior placenta echo lucent space is absent. When placental sinuses cross the uterine wall, the color Doppler will show this (4).

J.P. Lerner et al. (1995) confirmed that for patients of placenta previa transvaginal sonography is the safest for use. The main purpose of this study was to identify the effectiveness of color-coded blood flow and transvaginal sonography for placenta accreta. The tenacious previa was scanned in 21 patients by transvaginal sonography and color flow. So the suspected placenta accreta was shown in five of the patients while one patient showed lacunar described as cervical and placental blood flow. For placenta accreta five cesarean hysterectomies were performed. For suspected patients of accreta pathology was confirmed and was done. Placenta previa with the irregular color flow in a cervical area is not confirmed to be an accreta. The leftover fifteen patients underwent clear cesarean section and were not suspected of placenta previa on ultrasound. In patients of placenta accreta with tenacious previa, doppler imaging, and transabdominal sonography improve the perfection of diagnosis. When turbulent flow extends to nearby tissue from the placenta then according to a physician there is a chance of placenta accreta.

Paras Surahyo (2021) conducted a study in the radiology department in which 20 to 40 years of 213 pregnant women at 28 gestational weeks underwent an antenatal scan and were presented with a minimum of

one preceding cesarean section. Upon surgery, the diagnosis was confirmed later but to diagnose invasive placenta color doppler was performed. The mean gestational age of the patient was 32.2 ± 2.1 weeks and the mean age of the patient was 31.7 ± 4.7 years. Of the women who had a previous cesarean section, 6.1% had one, 28.6% had two and 9.9% had 3. When color Doppler imaging was done 24.9% of patients had invasive placenta however when it was confirmed through operation seen in 22.1%. It is noticed that the number increases with c-section cases increased. In invasive placenta diagnosis, sensitivity was 87.2%, accuracy was 91.55% and specificity was 92.77% with negative and positive predictive values of 96.25% and 77.36%.

It is estimated that in the diagnosis of morbidity and adherent placenta, as the frequency is increasing in number, the sensitive and specific tool color Doppler sonography will also be applicable in future practice (12).

Riza MADAZLI (2018) evaluated that in the diagnosis of placenta accreta which ability of either magnetic resonance imaging or ultrasonography is useful for the assessment of the anteriorly localized placenta. The patients at high risk of placenta accreta were 29 who had undergone MRI and US. Thirteen (44.8%) out of twenty-nine pregnancies were labeled with accreta upon surgery. Seven (53.8%) cases underwent a cesarean hysterectomy. In ultrasound sensitivity was 84.6%, specificity calculated was 81.2% and diagnostic accuracy was 82.7% while in Magnetic resonance imaging sensitivity was 100%, specificity calculated was 76.9% and accuracy was 86.2%. Ultrasound diagnosed accreta in 2 of 29 cases while MRI detected accreta in 3 of 29 cases.

It seemed that cases of earlier cesarean sections and maternal blood transfusion were considerably higher and at birth and

delivery weight average gestational age was considerably lower in previa group patients with accreta despite those without accreta (18).

Syed Mubarak Ali (2018) included 591 women with placenta previa for antenatal determination of non-normal placental invasion secondary to previa. The diagnosis was performed by Doppler ultrasonography compared to the operative findings as the gold standard. Identify abnormal uteroplacental flow patterns from antenatal Doppler USG imaging and this identification will help in challenging complications of obstetric. Doppler sonography predicted abnormal placental invasion in 244/591 patients however on operative findings it is diagnosed in 264/591 pregnant women. 224 cases were positive and 307 were negative of which 531 had the same findings on Doppler USG as well as surgery. Doppler sonography was false -ve in 40 proven surgical cases. Surgical findings were false +ve however positive doppler findings were in 20 cases (19).

According to Warshak et al., 30 out of 39 women were accurately diagnosed with placenta accreta by Ultrasonography and 398 out of 414 exactly ruled out placenta accreta with a specificity of 96% and sensitivity of 77%.(20).

T. WOODRING et al. (2011) tried to detect placenta accreta by the correctness of color flow Doppler and ultrasound. The signs that were demonstrated on ultrasound images differentiated with detections upon pathological examination and surgery. By ultrasound, suspicious 12 cases were studied over sixty-four months. According to the First diagnosis, gestational age was 25 weeks and previa was 92% However, the minimum one foregoing C-Section was the history of all. The patients who required hysterectomy due to adherent placenta were 83% (10/12) at surgery and those who required blood transfusion because of

average hematocrit of $22.7 \pm 4.6\%$ were 9/12(75%). So it is evaluated that both ultrasounds with Doppler color flow are useful for antenatal diagnosis of placenta accreta (21).

Philip S. Lim et al. (2011) performed a study to rule out the final diagnosis on the findings of USG and MRI. Small placental infarction without accreta is indicated through pathological detections. Many theories have been presented because pathologies gave unclear accreta. These include the focal absence of normal physiologic conversion of maternal vessels, another is abnormal trophoblast invasion. They may also be due to a lack of decidualization and placental septa which are covered with uterine muscle than normal decidua and fibroids.

The reports from color Doppler and obstetric sonography doubted for placenta accreta were reviewed in this study. With previous uterine surgery (myomectomy, cesarean sections, or curettage) and placenta previa, were enrolled the 190 patients from 1992 to 2021. On evaluation, it came to know that in their duration between 16 and 36 weeks (2nd and 3rd trimester), all patients were detected with systemic ultrasound using 2D, 3D, and color Doppler. A 3D ultrasound system with transvaginal and transabdominal transducer was preferred (22). For evaluation of uterine serosa-bladder interface, bladder filling of 300mL was considered. Investigation of interruption of the hyperechoic interface between wall and serosa, irregular presence of placenta lacuna and between placenta and uterus, loss of echo lucent area using 2D color doppler transabdominal and transvaginal ultrasonography.

Using a 3D Doppler, mapped the vascularization of serosa and intraplacental. The sagittal and coronal sections are visualized by 180-degree rotation. This helped in the investigation of hypervascularity of the uterine serosa

bladder wall and twisting vessels around the width of the placenta with the characterization of intraplacental vascularization. To assess the depth of neovascularization of placental tissue the sagittal sections were used either it affected the whole placental parenchyma or it was limited to the basal layer. To find out the expanse of the serosa-bladder wall, Coronal sections were used for the detection of either the entire area or only a portion involved (23).

Clinical diagnosis was assessed based on cesarean sections. In this study, all patients were taken who underwent C-Section. Two diagnostic criteria for MAP shown on ultrasound examination before surgery cystoscopy for ureteral stent placement were performed. Moreover, the placement of two balloon catheters in hypogastric arteries and after the umbilical cord clamped were inflated. To prevent much bleeding keep away from the lower segment and a uterine incision was put on. The attempt of a balloon catheter was performed to discharge the placenta by insertion of carbetocin and managed cord adhesion.

The placenta became unable to expel dynamically when it interfered with the uterine serosa. When placental detachment failed, a hysterectomy was performed while keeping the adnexa and placenta in place. All patients refused to try the conservative treatment. After the uterus was removed and subjected to a histological test, a final diagnosis of MAP was made. The examination for each of the sonographic criteria for MAP was completed by calculating the sensitivity, specificity, accuracy, positive predictive value (PPV), and negative predictive value (NPV). Patients with probable ultrasonographic pictures had their clinical features, such as age, gravidity, parity, and history of avoiding uterine surgery, evaluated by looking over their records. This covered aspects of the

pregnancy including gestational age at delivery and diagnosis in addition to concurrent previa, third-trimester hemorrhage, and blood loss during cesarean sections, the requirement for blood transfusions, and hysterectomy were also looked into (24).

Prenatal detection of MAP and its variants can lower the risk of maternal illness and mortality since it enables us to choose the most advantageous moment and location for delivery. Since prenatal identification of MAP and its variants enables us to select the most beneficial time and place for birth, it can reduce the risk of maternal sickness and mortality. Many authors have looked at the diagnostic accuracy of sonographic criteria for placenta accrete. Risks like subsequent hemorrhage following placenta removal or needless hysterectomy should be taken into account. It is not adequate to evaluate just based on sensitivity and specificity to plan suitable management and advise patients about PPV and NPV (25). High PPV could help treat preterm CS, hysterectomy, and corporal hysterotomy appropriately. High NPV could be used to manage placenta removal without bleeding hazards. Through a review of recent literature, it is possible to determine that placenta accreta is becoming more common, mostly as a result of more frequent CSs. In nearly all cases, aberrant placental invasion is found at the site of the previous uterine scar. Myometrial damage from a myomectomy with endometrial entry, advanced maternal age, heavy curettage with secondary Asherman syndrome, submucosal myoma hysteroscopic removal, thermic endometrial ablation, and uterine artery embolization are other risk factors, but they are not strongly linked to MAP (26). Women who previously underwent cesarean section (CS) with placenta previa covering the prior uterine scar are most at risk for developing MAP. 187 patients who had myomectomy or curettage were registered,

For the estimation of the precision of greyscale, color Doppler, and 3D power Doppler ultrasonography in the diagnosis of MAP, placenta Previa (major and minor), and CS history. 41 individuals had undergone previous myomectomy; although the specific location and size of excised myomas cannot be determined, all such cases were carefully considered to be at risk for MAP.

There were 8 minor and 35 major anterior placentas in the women. Previa, only one woman had CS before; none of them had undergone curettage or a myomectomy. The placenta Previa, earlier CS, and MAP are directly related to one another. The most accurate ultrasound criteria for the diagnosis of MPA are abnormal clear space and uterine serosa-bladder wall interface hypervascularity, both with NPVs of 96.7% and 97%, respectively. Due to the high rate of false positives that might result from the irregularity of the echo lucent area between the placenta and the uterus, this test cannot be utilized to make a diagnosis by itself. This was highlighted by Feinberg and Williams (27). With the aid of the absence of apparent spatial irregularity, MAP can be diagnosed. MAP cannot arise due to the preservation of the echo lucent region between the placenta and the uterus. It is confirmed that clear space should be employed in conjunction with a higher PPV rather than as a sole diagnostic criterion. We used gray-scale and color Doppler imaging on intraplacental lacunae to examine the connection between intraocular turbulent flow and the grade of MAP. All of the patients with placenta percreta had more than six lacunae with turbulent flow inside. While our series has a high NPV and a low PPV in placenta lacunae, other investigators have hypothesized a robust association between multiple placental lacunae with irregular shapes and MAP (28). A 3D power we employed Doppler to examine the

vascularity of the serosa-bladder interface and intraplacental veins. On a 3D Doppler scan, the uterine serosa and bladder wall interface seemed to be widely hypervascularized, with densely confluent anarchic arteries protruding into the bladder lumen. The serosa-bladder interface demonstrated hypervascularity in 16 of 17 cases of placenta percreta, where vascularization over the entire placental breadth resembled a sizable aneurysm.

The timing and management of childbirth could be effectively handled by looking for placenta accretes that are growing into placenta percreta. If a diagnosis is made earlier in the second trimester, there aren't enough conversations to decide on the best course of action. If MAP is suspected, the birth should be scheduled for the 36th to 38th week. Although giving birth at the 34th week could be done safely (29). If a diagnosis is made after the 24th week, there is a chance that the fetus will survive. Early detection of placenta percreta may assist in explaining preterm labor and potentially significant bleeding problems brought on by uterine rupture in the 36th to 39th week. In MAP situations, ultrasound has higher diagnostic accuracy than MRI. A combination of more effective sonographic criteria, some of which are also examined in this study, is more effective for diagnosing MAP and its variants. Diagnostic success is evaluated mostly on PPV and NPV and aids in optimal management and precise timing of administration.

The operative's abilities have a major impact on the data gathered. The information we collected is encouraging because it detects placenta percreta, diagnoses MAP, and also verifies previous researchers' findings. It can be acquired by a solitary operator. Sagittal and coronal sections, which were the most helpful from a diagnostic standpoint, were acquired using 3D power Doppler (30).

Some new confirmatory multicellular

investigations are needed, which may establish the typical and objective 3D ultrasound criteria, to reduce interoperator variability and assess the likelihood of differential diagnosis between placenta accrete and percreta.

CONCLUSION

I concluded that Doppler ultrasonography is crucial for identifying the placenta accreta,

especially in those patients who are presented with a background history of cesarean sections and placenta previa although transabdominal ultrasonography and transvaginal ultrasonography also play their role. Within the placental and uterine tissues, Doppler USG provides an important aid in the diagnosis of unusual areas of hypervascularity with dilated blood vessels.

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