# DIAGNOSTIC ACCURACY OF ULTRASOUND (U/S) AND MAGNETIC RESONANCE IMAGING (MRI) IN PRENATAL DIAGNOSIS OF PLACENTA ACCRETA TAKING OPERATIVE FINDINGS AS GOLD STANDARD

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## ABSTRACT

**BACKGROUND:** Placenta Accreta (PA) is the extension of chorionic villi into myometrium due to abnormality in decidua basalis which may lead to massive peripartum haemmorhage, hence putting the life of patient at risk. Therefore, antenatal diagnosis of PA is essential for which ultrasonography (USG) and magnetic resonance imaging (MRI) play a pivotal role. However, USG is an easily accessible and low cost imaging modality as compared to MRI and that is why it is more widely used for screening purposes. **OBJECTIVE:** To determine diagnostic accuracy of USG and MRI in prenatal diagnosis of placenta accreta taking operative findings as gold standard as limited local research has been done on this. **METHODS:** A prospective study was conducted in radiology department of Khyber Teaching Hospital, Peshawar from June, 2014 to June, 2016. Twenty five antenatal patients who were at high clinical risk of placenta accreta were identified and undergone USG and MRI for confirmation of diagnosis. Sensitivity, specificity, positive predictive value, negative predictive value and accuracy were calculated both for USG and MRI. **RESULTS:** Twenty five patients at risk of placenta accreta underwent both USG and MRI. Seven cases were diagnosed with placenta accreta per operatively (gold standard). The sensitivity, specificity, positive predictive value, negative predictive value and accuracy of the USG were 85.7%, 83.3%, 66.7%, 93.8% and 84% respectively. While the sensitivity, specificity, positive predictive value, negative predictive value and accuracy of the MRI were 71.4%, 72.2%, 50%, 86.7% and 72% respectively. **CONCLUSION:** The study concluded that diagnostic accuracy of USG is higher than MRI for the antenatal diagnosis of placenta accreta.

**Key words:** Magnetic Resonance Imaging; Placenta Accreta; Prenatal Diagnosis; Ultrasonography.

## Introduction

Placenta accreta is a form of abnormal placentation which occurs due to defect in decidua basalis leading to extension of chorionic villi upto myometrium.[1] On the basis of depth of myometrial invasion, it can be categorized into three types depending upon whether it is limited to myometrium without invading it (Placenta accreta vera), invading the myometrium (placenta increta) or penetrating through the myometrium and reaching up to serosa ( placenta acreta).[2] Since placenta accreta is so morbidly adherent to myometrium, during placental separation at the time of delivery, it can lead to massive haemorrhage; hence, making it a leading cause of maternal morbidity and mortality.[3] Due to extensive haemorrhage, mother can go into renal failure, respiratory distress and can even die which makes the need for emergency hysterectomy inevitable.[4] In Pakistan, Placenta accreta is the third most common indication for hysterectomy after uterine

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rupture and atony.[5] Again, hysterectomy has its own implications in the form of urinary bladder or ureteral injury, pulmonary embolism and of course those related to anaesthesia.[4]

Risk factors for placenta accreta include previous cesarean section, myomectomy or any other uterine surgery and presence of placenta previa.[6] The incidence of placenta accreta has soared significantly in the past three decades.[7] Increased numbers of cesarean deliveries is mainly responsible for this rise which increases the likelihood of placenta accreta eight folds.[8]

Owing to the catastrophic maternal complications that can occur due to placenta accreta, its timely recognition in prenatal period is very important so that proper obstetric management can be planned ahead of time including the mode of delivery, arrangement of blood products for transfusion and enlistment of experienced anesthesia and surgical team.[9,10]

The investigation modalities available for prenatal diagnosis of placenta accreta include Ultrasound (USG), Magnetic Resonance Imaging (MRI) or a combination of both. USG has the benefits of being easily accessible, cost effective and doesn't have any ionizing radiations hence being safe in pregnancy.[11] Although MRI has drawbacks of not being easily available, uneconomical and claustrophobia, yet the outstanding soft tissue resolution that it offers cannot be denied and it is also free of radiations.[12]

Sonographic features of placenta accreta include marked thinning or loss of retroplacental clear space, prominent lacunae in placenta with turbulent flow on Doppler study, interruption of the hyperechoic border between the uterine serosa and bladder and presence of placenta previa.[13] Placenta accreta on MRI is identified by presence of dark intraplacental bands, heterogeneous placenta and lower uterine bulging.[14]

Taking into consideration the lethal nature of placenta accreta, the aim of my study was to determine the diagnostic accuracy of ultrasound (USG) and magnetic resonance imaging (MRI) in prenatal diagnosis of placenta accreta so that it can be diagnosed well before time and hence, appropriately managed.

## Material and Methods

It was a prospective study that was conducted over a period of two years i.e. from June, 2014 to June, 2016 at Radiology Department, Khyber Teaching Hospital, Peshawar. Our study included twenty five antenatal patients at high clinical risk for placenta accreta who underwent both USG and MRI examinations. Multigravida patients with past history of cesarean sections and third trimester bleeding were included in the study while primigravida, women having comorbid medical conditions and coexistent uterine & placental pathologies were excluded from the study. All cases were subjected to USG & MRI examinations after taking informed consent.

Ultrasound examination was performed by consultant radiologist on TOSHIBA XARIO-100 having high resolution B-mode & Doppler flow imager apparatus using 3.5MHz convex and 7.5MHz linear probe. Patients were advised to partially fill their urinary bladder for proper evaluation of uterine serosa & bladder wall interface. First, placenta was assessed for homogeneity using gray scale mode and myometrial thickness was obtained at site of placental implantation. Then, color Doppler was performed to assess the variable uteroplacental vascularity.

MRI examination was performed using Philips 1.5 Tesla machine model 2006. Patients were positioned supine and advised to hold their breath as much as they could during the image acquisition. T2WI were acquired in axial, saggital and coronal planes. Axial cuts were also obtained in STIR and T1W sequences. The images were evaluated by consultant radiologist. Peroperatively, placenta is considered normal if it is easily removed without any bleeding complications. But if there is difficulty in removing placenta coupled with excessive bleeding, it is considered placenta accreta.

Statistical analysis was performed using statistical software (SPSS version 16, Inc., Chicago, IL). The sensitivity, specificity, positive predictive value, Negative predictive value and Diagnostic accuracy were calculated for both USG and MRI examinations.

## Results

Twenty five patients that fulfilled the inclusion criteria underwent both USG and MRI examinations. Patients were between 22 - 36 years of age with mean age of 29.92 ± 4.05 years. Patients having parity between 1-3 were 12 (48%) whereas 13 (52%) patients were

> 3 paras. Comparison was made between the number of previous C-Sections and the frequency of placenta accreta peroperatively (Tab. 1). It showed that increased frequency of placenta accreta was seen with increased number of caesarean sections.

| No. of previous C-Sections | Placenta accreta on peroperative findings | Percentage |
|---|---|---|
| 1 | 0 | 0% |
| 2 | 1 | 14.3% |
| 3 | 4 | 57.1% |
| 4 | 2 | 28.6% |
| **Total** | **7** | **100%** |

**Table 1:** Comparison of number of previous C-sections with frequency of placenta accreta

Of the 25 patients, placenta accreta was confirmed peroperatively in 7 patients. USG detected placenta accreta in 6 (True Positive) patients while MRI detected in 5 (True positive) patients. USG and MRI falsely detected Placenta accreta in 3 and 5 (False positives) patients respectively. Among the 16 USG negative patients, 1 (false negative) patient while out of the 15 MRI negative cases, 2 patients had placenta accreta on peroperative findings. USG and MRI truly negated 15 and 13 cases (True negatives) respectively as is shown in (Tab. 2 & 3). The sensitivity, specificity,

|  |  | Per Operative finding | | Total |
|---|---|---|---|---|
|  |  | Yes | No |  |
| Ultrasound | YES | 6<br>True Positive (a) | 3<br>False Positive(b) | 9 |
|  | NO | 1<br>False Negative (c) | 15<br>True Negative (d) | 16 |
| Total |  | 7 | 18 | 25 |

Senitivity = a/a+c X 100= 85.7%
Specificity = d/d+b X 100= 83.3%
Positive Predictive Value = a/a+b X 100= 66.7%
Negative Predictive Value = d/c+d X 100= 93.8%
Accuracy rate = a + d / (a + d + b + c) x 100= 84 %

**Table 2:** Comparison of Peroperative findings vs Ultrasound

|  |  | Per Operative finding | | Total |
|---|---|---|---|---|
|  |  | Yes | No |  |
| MRI | YES | 5<br>True Positive (a) | 5<br>False Positive(b) | 10 |
|  | NO | 2<br>False Negative (c) | 13<br>True Negative (d) | 15 |
| Total |  | 7 | 18 | 25 |

Sensitivity = a/a+c X 100= 71.4%
Specificity = d/d+b X 100= 72.2%
Positive Predictive Value = a/a+b X 100= 50%
Negative Predictive Value = d/c+d X 100= 86.7%
Accuracy rate = a + d / (a + d + b + c) x 100= 72 %

**Table 3:** Comparison of Peroperative findings vs MRI

positive predictive value, negative predictive value and accuracy of the USG were 85.7%, 83.3%, 66.7%, 93.8% and 84% respectively. While the sensitivity, specificity, positive predictive value, negative predictive value and accuracy of the MRI were 71.4%, 72.2%, 50%, 86.7% and 72% respectively (Fig. 1).
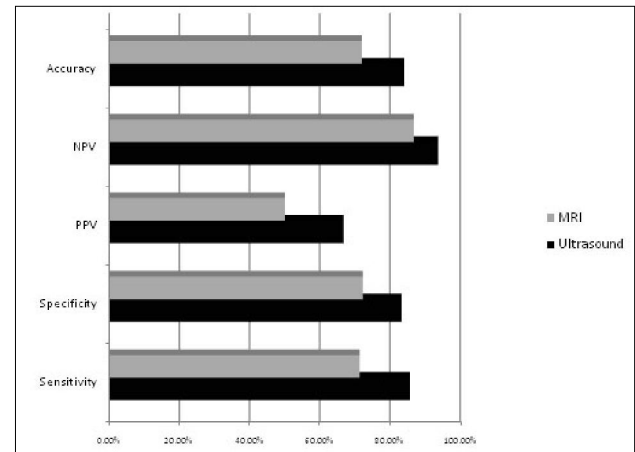


**Figure 1:** Graphical representation of results

Results of USG and MRI features of placenta accrete were also assessed. Of the 9 USG positive cases, loss/thinning of retroplacental space (Fig. 2) was seen in 7 (77.77%) cases and prominent lacunae with turbulent flow (Fig. 3) were evident in 8 (88.88%) cases. Placenta Previa was found in 6 (66.67%) cases of whom all had interruption of hyperechoic border between the uterine serosa and bladder. Of the 10 MRI positive cases, heterogenous placenta was seen in all (100%), 8 (80%) cases showed myometrial thinning, dark intraplacental bands (Fig. 4) were seen in 7 (70%) cases and lower uterine bulge (Fig. 5) was exhibited in 6 (60%) cases.



**Figure 2:** Transabdominal USG showing loss of retroplacental clear space
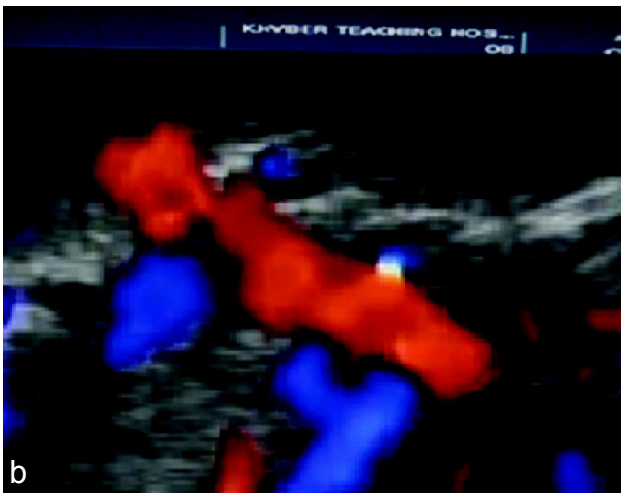
**Figure 3(a & b):** Transabdominal USG showing multiple tortuous hypoechoic areas within the placenta, which on color Doppler demonstrated vascularity within them thus proving to be placental lacunae.
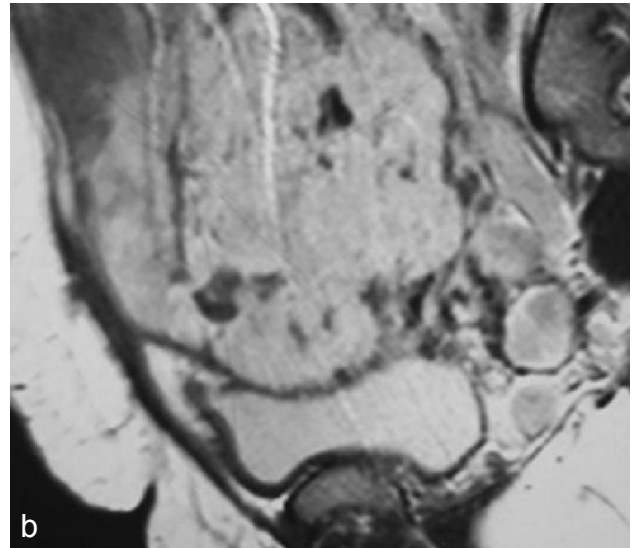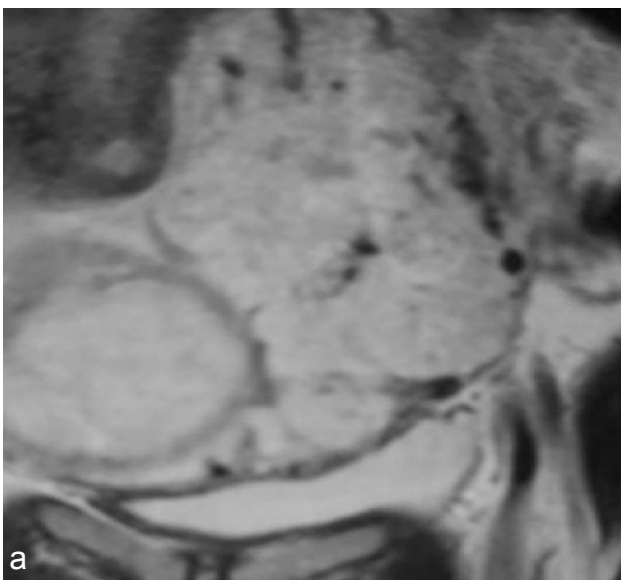




**Figure 4(a & b):** T2 weighted saggital images of pelvis showing dark intraplacental bands- a feature of placenta accreta.
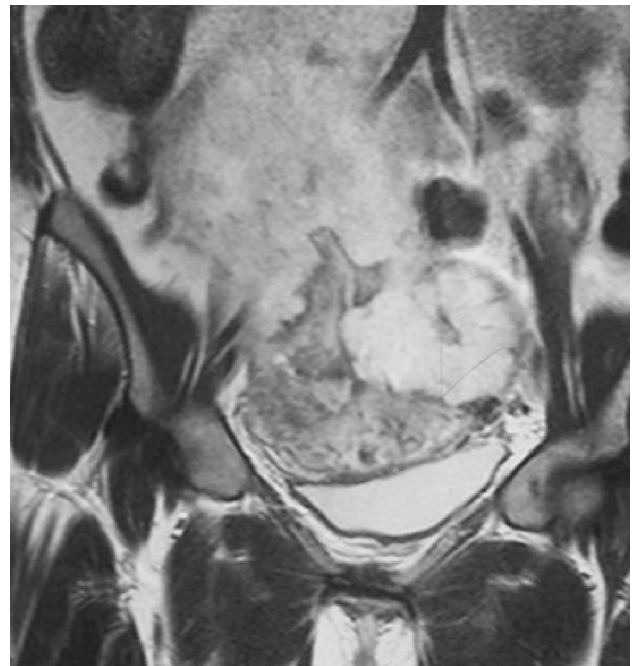


**Figure 5:** T2 weighted sagittal image of pelvis showing lower uterine bulging.

## Discussion

Until recently, placenta accreta was considered rare but now its incidence is relatively increasing, owing to the great number of cesarean sections that are taking place. Incidence of placenta accreta increases from 24% after one cesarean section to about 67% after four or more cesarean sections.[15] This correlation

between the increasing incidence of placenta accreta with increased frequency of cesarean sections was evident in our study (Tab. 1). Due to the serious implications of this condition leading to life threatening obstetric haemmorhage, the significance of its timely identification and management cannot be denied. Usually, ultrasound and color doppler is the mainstay in the imaging of placenta accreta since it is cost effective and is readily available. MRI is used adjunctively when sonographic results are equivocal or clinical suspicion is high.

In our study, we compared the diagnostic accuracies of USG and MRI in the diagnosis of placenta accreta and took peroperative findings as gold standard. USG accurately detected 6 out of the total of 7 cases of placenta accreta compared to 5 in case of MRI which resulted in sensitivity of 85.7% for USG and 71.4% for MRI. The specificity of USG was also relatively higher being 83.3% as compared to 72.2% for MRI. Hence according to our study, USG proved to be more accurate than MRI with diagnostic accuracy rates of 84% for USG and 72% for MRI.

Our findings are supported by other studies as well that showed increased diagnostic value of USG when compared to MRI. According to Daney at al[16] sensitivity and specificity for ultrasonography were, respectively, 92% and 67%, for MRI 84% and 78%. The study done by Maher et al[17] also corresponded with our results showing sensitivity of 95.1% and specificity of 95.5% for USG and sensitivity of 85.7% and specificity of 76.9% for MRI. Meng et al[18] showed increased sensitivity (83%) and specificity (95%) of USG as compared to MRI with 82% sensitivity and 88% specificity.

Few studies were contradictory to our findings. According to Lerner et al[19] MRI has better diagnostic accuracy for detection of placenta accreta than ultrasound with sensitivity of 88% and specificity of 100%. A retrospective study done by Lam et al[13] also showed increased sensitivity of MRI with value of 38% as compared to that of USG with sensitivity of 33%. D' Antonio et al[20,21] reported increased sensitivity of 94.4% for MRI while the sensitivity of USG according to their studies was 90.7%.

USG and MRI when used conjunctively, increase the rate of detection of placenta accreta. Since, USG is much more readily available; it should be included in the initial screening of high risk patients for early detection and timely management of Placenta accreta.

## Conclusion

The study concluded higher diagnostic accuracy of USG than MRI in the detection of Placenta accreta which is a plus point. Since, ours is a developing country, most patients cannot afford the expenses of MRI. USG is a cost effective imaging modality and hence its use and significance must be encouraged for timely diagnosis of placenta accreta so that its catastrophic complications can be prevented hence decreasing maternal mortality and morbidity.

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