

## Utility of Magnetic Resonance Imaging in the Diagnosis of Placenta Accreta

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### Abstract

**Background:** Placenta accrete is one of the causes of postpartum hysterectomy. Accurate prenatal diagnosis can aid in its management. **Objectives:** To evaluate the diagnostic accuracy of magnetic resonance imaging (MRI) in the diagnosis of placenta accreta. **Methods:** This prospective observational study was conducted in the department of radiodiagnosis at Sri Ramachandra Institute of Higher education and research from April 2014 to September 2017. The study included 27 patients with suspected placenta accreta based on prenatal sonography or inconclusive sonogram or at high risk for placenta accrete. Placenta accreta findings as per MRI were compared with clinical findings at delivery. Data were analyzed by using coGuide software, V.1.03. **Results:** Out of 27 participants, 70.4% were in the age group of 21 to 30 years, 9(33.33%) participants were second and third gravida, respectively, and 21(77.78%) were in >36 weeks of gestational age. Among the study participants, 70.4% (19/27) had positive findings in MRI for placenta accrete, and 40.74% (11/27) had positive clinical findings. In MRI findings, 9(81.8%) had Indistinct myometrium, and 6 (54.55%) had T2 bands. The total diagnostic accuracy of MRI findings for placenta accreta was 70.37%. **Conclusion:** MRI has a sensitivity of 100% and specificity of 50% in diagnosing placenta accreta. The overall diagnostic accuracy was 70.37%. Hence, MRI in the antenatal period can be used in diagnosing placenta accreta in a high-risk population.

**Keywords:** MRI, Placenta Accreta, Prenatal Diagnosis, Sensitivity and Specificity.

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### Introduction

An abnormal attachment of the placenta to the myometrium is called placenta accrete. It is currently the commonest reason for an emergency postpartum hysterectomy. It can occur due to a defect of the decidua basalis which allows the chorionic villi to invade the myometrium. It is classified based on the depth of myometrial invasion. Villi are attached to the myometrium but do not invade the muscle in placenta accreta vera; Villi partially invade the myometrium in placenta accreta. In the placenta percreta, villi penetrate through the entire myometrial thickness or beyond the serosa- this is the most serious type of all. Identified risk factors include surgery, previous cesarean section, and placenta previa[1,2]. Worldwide, the prevalence has risen by ten times in the past 50 years, attributed to the increasing number of cesarean deliveries. The previous cesarean section increases the risk of having placenta accreta about 8.7-fold[3]. Accurate prenatal identification is vital. Optimal obstetric management can be carried out based on the timing and site of delivery, availability of blood products; also, skilled anesthesia and surgical team can be organized in advance[4,5]. Ultrasonography and magnetic resonance imaging (MRI) is used for the diagnosis of placenta accrete; however, the accuracy of these imaging techniques remains uncertain and is dependent on the skill of the sonographer or radiologist. The sonographic characteristics of the adherent placenta are intraplacental lacunae, thinning or disruption of the hyperechogenic uterine serosa-bladder wall interface, and loss of the normal retroplacental clear space. Specific findings in placenta accrete under MRI are uterine bulging, heterogeneous signal intensity within the placenta, and dark intraplacental bands on T2-weighted images. A previous study by Satija B et al[6] showed that the sensitivity of ultrasound in detecting placenta accrete was 87.5%, and

that of MRI was 75%. However, there is a lack of literature comparing the clinical diagnosis with MRI findings. Hence, this study was done to evaluate the role of magnetic resonance (MR) imaging in the diagnosis of placenta accrete and to compare the MRI imaging findings of placenta accreta with clinical results at delivery and to delineate the accuracy of each finding in MRI.

### Methods

A prospective observational study was conducted in the department of radiodiagnosis at Sri Ramachandra Institute of Higher education and research from April 2014 to September 2017. The study included 27 patients recruited by convenient sampling. The inclusion criteria were subjects with suspected placenta accreta based on prenatal sonography or inconclusive sonogram or at high risk for placenta accrete. Institutional ethical clearance was obtained, and all participants signed informed consent forms. Assuming the proportion of Placenta accreta as 22.22% with Sensitivity of MRI in detecting the same as 75% (as per a study by Bhawna Satija)[6]. The sample size was calculated by considering a 95% confidence interval and 17% Precision for sensitivity[7]. Based on the above values, the required sample size was 25 subjects after including two more patients as lost to follow-up total of 27 subjects were considered into the study. Clinical diagnosis of persistently adherent placenta was used as the reference standard. Women in second and 3rd-trimester pregnancy, patients referred for suspected placenta accreta after the ultrasound, and High-risk patients referred with suspected placenta accrete were included in the study. Women in the First trimester, Uncooperative / Claustrophobic patients, and Patients with known contraindications like pacemakers, cochlear implants were excluded. Multiplanar MRI was performed with a 1.5-tesla scanner unit – with 16 elements phased-array torso body coil. Images were obtained with 4mm slice thickness in axial, sagittal, and coronal planes. T2W single-shot fast spin-echo (SSFSE / HASTE), Steady-state free precession pulse sequence (FIESTA / Tru Fi), Dual-phase T1 W sequence, Gradient, and diffusion-weighted sequences in axial plane were also done. No gadolinium contrast was used. Loss of retroplacental clear space, cavities in the placenta, or a mass

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extending into the urinary bladder are considered as prenatal diagnostic findings of PA in ultrasound. Pelvic MRI was done without using contrast material (since all the patients were scanned prenatally), and the five most common prenatal diagnostic findings of PA such as dark T2 intraplacental bands, heterogeneous signal intensity in the placenta, uterine bulging, focal interruption in the myometrial wall and abnormal increased intraplacental vascularity were considered for this study. Other MR findings of PA include placenta previa, myometrial thinning less than 1mm thickness, tenting in the urinary bladder, and invasion by placental tissue outside the uterus. A true-positive finding was recorded if a case had positive MRI findings for PA and persistently adherent placenta found clinically during delivery. Criteria for a true-negative result included patients with negative MRI findings for PA and placental separation with ease without much bleeding. Percentages of presence or absence of abnormal placentation of all cases identified with MRI and clinical findings were evaluated. Regarding the management of the placenta accrete, patients with MRI positive diagnoses for 88concrete were prepared for elective/emergency LSCS in our institution's interventional suite with femoral artery being catheterized beforehand. If there is the spontaneous separation of the placenta during delivery, then the placenta and membranes are delivered in toto. And if the placenta is adherent to the myometrium or any signs of intense bleeding, the patient's bilateral uterine arteries are embolized with gel foam (usually), and the placenta is left in situ.

**Statistical Methods:** Placenta 88accrete findings as per MRI, and clinical examination was considered the primary outcome variable. Descriptive statistics were used to 88 accrete data by the study's objectives. Data were expressed as the percentage, where appropriate. Data was 88 calculated 88 by using coGuide software, V.1.03[8].

**Results**

A total of 27 subjects were included in the final analysis. Out of 27 participants, 70.4% were in the age group of 21 to 30 years, 9(33.33%) participants were gravida 2 and 3 respectively, and 21(77.78%) people were in >36 weeks of gestational age. Among the study participants, 70.4% (19/27) had positive findings in MRI for placenta accrete, and 40.74% (11/27) had positive clinical findings. (Table 1)

Out of 11 participants as true positive cases, majority 8(72.7%) were aged between 21 to 30 years of age group, 5(45.4%) were the third gravida, 7(63.6%) were in gestational age >36weeks, 9(81.8%) had previous LSCS, 8(72.7%) had multiple (> 1) risk factors. In MRI findings, 9(81.8%) had Indistinct myometrium, and 6 (54.55%) had T2 bands (Table 2)

Among positive placenta accrete in MRI findings, 57.8% (11/19) were positive as per clinical findings also, and all negative cases in MRI reported as negative clinically too. (Table 3)The sensitivity of MRI in predicting placenta accrete was 100% (11/11) and specificity 50% (8/16). The false positive rate was 50%, and the false-negative rate was 0%. The total diagnostic accuracy of MRI findings for placenta accrete was 70.37%. (Table 4)

**Table 1: Summary of baseline parameter(N=27)**

Parameter	Summary
<b>Age group (in years)</b>	
21 to 30 years	19 (70.4%)
31 to 40 years	7 (25.9%)
41 to 50 years	1 (3.7%)
<b>Gravida</b>	
Primi	4 (14.81%)
• 2	9 (33.33%)
• 3	9 (33.33%)
• 4	5 (18.52%)
<b>Gestational age (in weeks)</b>	
<28 weeks	2 (7.41%)
28 to 36 weeks	4 (14.81%)
> 36 weeks	21 (77.78%)
MRI positive	19 (70.4%) [ 95% CI 53.1 to 87.6]
Clinical finding positive placenta accreta	11 (40.74%) [95% CI 22.2 to 59.3]

**Table 2: Baseline parameter in true positive cases (N=11)**

Parameter	Summary
<b>Age group (in years)</b>	
21 to 30 years	8 (72.7%)
31 to 40 years	3 (27.3%)
<b>Gravida</b>	
<b>Multi</b>	
• 2	3 (27.3%)
• 3	5 (45.4%)
• 4	3 (27.3%)
<b>Gestational age (in weeks)</b>	
<28 weeks	3 (27.3%)
28 to 36 weeks	1 (9.1%)
> 36 weeks	7 (63.6%)
<b>Risk factors</b>	
Previous LSCS	9 (81.8%)
Placenta previa	8 (72.7%)
Dilatation and curettage	3 (27.2%)
Other uterine surgeries	1 (9.1%)
<b>Number of risk factors</b>	
Multiple (> 1)	8 (72.7%)
Single	2 (18.2%)

Nil	1 (9.1%)
<b>Positive MRI findings for Accreta in true positive cases</b>	
T2 bands	6 (54.55%)
Heterogenous placenta	5 (45.4%)
Increased vascularity	3 (27.2%)
Uterine bulge	3 (27.2%)
Indistinct myometrium	9 (81.8%)
<b>Positive MRI findings for Accreta in false positive cases</b>	
T2 bands	5 (45.4%)
Heterogenous placenta	4 (36.4%)
Increased vascularity	-
Uterine bulge	-
Indistinct myometrium	5 (45.4%)

**Table 3: Comparison of MRI findings between clinical findings at delivery (N=27)**

MRI findings	Clinical findings	
	Placenta accrete (N=11)	No Placenta accrete (N=16)
Positive	11 (100%)	8 (50%)
Negative	0 (0%)	8 (50%)

**Table 4: Predictive validity of MRI findings in predicting placenta accreta (N=27)**

Parameter	Value	95% CI	
		Lower	Upper
Sensitivity	100.00%	71.51%	100.00%
Specificity	50.00%	24.65%	75.35%
False positive rate	50.00%	24.65%	75.35%
False negative rate	0.00%	-	28.49%
Positive predictive value	57.89%	33.50%	79.75%
Negative predictive value	100.00%	63.06%	100.00%
Diagnostic accuracy	70.37%	49.82%	86.25%

**Discussion**

Ultrasound is the routinely used imaging technique in cases of placenta accrete. Yet, when the ultrasound results are equivocal with high clinical suspicion, MRI is also used as an adjunct in diagnosis. In our study, the MRI diagnosis of placenta accrete was correct in 100% of the patients with clinical findings of placenta Accrete. Routine evaluation of normal gestation is incomplete without assessment of the placenta. Imaging in the antepartum period is performed using non-invasive techniques which do not use ionizing radiation. USG and MRI form the mainstay for placental imaging. In this current study, the majority (70.4%) were of the age group of 21 to 30 years, 9(33.33%) participants were second and third gravida, respectively, and 21(77.78%) were in more than 36 weeks of gestational age. The patient profile of this study was similar to other studies in the literature[9-11]. In our study, with MRI, the diagnosis of abnormal attachment of the placenta to the myometrium was correct in 100% of the cases: The sensitivity of MRI in the current study was 100%, and specificity 50%. However, a mixed performance is observed in the literature: The sensitivity of MRI ranges between 38% and 100%, and its specificity between 55% and 100%[10,12,21,13-20] Various recent meta-analyses have considered the accuracy of ultrasound for diagnosing invasive placentation, the use of MRI, and a comparison of ultrasound and MRI.16-19-22 D’Antonio et al.16-22 reported 90.7% sensitivity for ultrasound and 94.4% for MRI, 96.9% specificity for ultrasound, and 84% for MRI. Meng et al.19 showed that ultrasound sensitivity was 83%, and its specificity was 95%, compared with 82% and 88%, respectively, for MRI. These meta-analyses results proved that both ultrasound and MRI have good accuracy in diagnosing placental invasion. This Metanalysis included various studies with a large number of patients. However, methodologically and clinically varied studies were included where ultrasound and MRI were not used in the same population. This might be considered a potential bias, and hence the study results can only be generalized to women who have undergone cesarean delivery in the past. In comparison with the previously available literature, in the current study, there was better sensitivity but a lower specificity of MRI for the diagnosis of placenta accrete, perhaps because, as in Comstock et al[23] placenta accrete was considered with just one

feature present. This increases the number of false positives and reduces the specificity of the test[16,24]

**Conclusion**

Placenta accrete has become more frequent, largely because of the increasing rates of cesarean sections. Even though ultrasound is considered as the main imaging modality in investigating placenta accreta, but MRI has a significant role in antenatal diagnosis of placenta accreta and aids in planning a multidisciplinary treatment course to reduce maternal morbidity and mortality caused due to placenta accreta. Vigilant adherence to the protocol for MRI image acquisition and appropriate interpretation with awareness regarding the potential diagnostic difficulties can increase MRI accuracy and aid in the management of patients with invasive placentation.

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