

## Comparative Effectiveness of Ultrasound and MRI in Diagnosing and Managing Placenta Accreta Spectrum Disorders

Sneha Sethy Jawalkar<sup>1</sup>, Prasad P Jawalkar<sup>2</sup><sup>1</sup>Assistant Professor, Department of Obstetrics and Gynecology, Dr Rajendra Gode Medical College Amravati<sup>2</sup>Assistant Professor, Department of Radiodiagnosis, Dr Rajendra Gode Medical College, Amravati

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Corresponding Author: Dr. Prasad P Jawalkar

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### Abstract

**Background:** PAS disorders which include placenta accreta/Placenta accreta spectrum involves the abnormal anchoring of the placenta in the uterine wall. It is very important in order to prevent hazardous effects on both the mother and fetus since it is directly correlated with path of the pregnancy and further delivery. Ultrasound has usually been the main imaging technique used in PAS, but MRI has been recognized as an adjunct technique, which provides better anatomic information. The purpose of this work will be to provide a comparison of the diagnostic efficacy and role of ultrasound and MRI as a means of managing PAS.

**Objective:** This work therefore aims and assesses the diagnostic accuracy, and clinical management implication of ultrasound in PAS disorders relative to MRI.

**Methods:** This is a case study presented on patients with PAS who underwent both, ultrasound and MRI 3 years in a tertiary care hospital. Cohen's kappa coefficients of agreement between the two modalities of diagnostic metrics were also computed. The study also evaluated the effect of each imaging modality for preoperative planning and outcome of the surgeries.

**Results:** Harrington et al (2004) noted that MRI has better diagnostic sensitivity of 93% than ultrasound at 85% while its specificity stands at 95 % as compared to the 92% of ultrasound. MRI also showed the higher importance in making changes in preoperative planning (90% vs. 75%) and surgical results (95% vs. 80%). MRI was found to be superior to other imaging in the diagnosis of different forms of PAS especially placenta accreta.

**Conclusion:** MRI is found to give better diagnostic sensitivity and better influence on management and surgical intervention of PAS than ultrasound. MRI is thus a complementary diagnostic tool to complete the evaluation of the fetus in addition to the traditional screening through ultrasound and real-time imaging. Therefore, it could be used as a guide that combining both the approaches may be the best strategy in handling PAS.

**Keywords:** PAS conditions, Placenta accreta spectrum, diagnostic imaging, placenta imaging, MRI, US accuracy, clinical management, preoperative planning, preoperativesurgical results.

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### Introduction

The placenta accreta spectrum (PAS) disorders include placenta accreta, increta and percreta, these conditions involve the implantation of placental tissue into the uterine wall. These conditions can further predispose maternal morbidity and mortality hence it is important that these disorders are diagnosed early and managed appropriately. The development of PAS in conjunction with the rising rates of cesarean sections and other surgeries that affect the uterus mean that there is need for accurate diagnostic tools to help in the management of such cases so as to improve outcomes for both the mother and the baby.

Imaging is very instrumental in the diagnosis and management of the disease, that is Prader-Willi

syndrome. Heretofore, ultrasound has been the most commonly employed imaging modality because of its universal accessibility, low cost and real-time perspective. Non-stationary Ultrasound, trans abdominal and trans vaginal forms is used in evaluating the localization of placenta, the thickness and degree of penetration in the body of uterus. Still, its ability depends upon the maternal body structure and position and placental position and the skill of the operator.

Magnetic Resonance Imaging (MRI) has become an adjunct imaging modality because of its better contrast and better coverage of placental invasion. MRI is most profitable in those cases when ultrasound investigation is ambiguous or when the detailed structural picture of the developing

pathology is necessary for further surgical planning. MRI results can be integrated with ultrasound scan results with the aim of improving the diagnosis of conditions that may threaten the patient's life and help plan for surgery.

Inch and MRI are relatively new in the diagnosis and management of PAS, and the effectiveness of the two modalities is still under study. Some works pointed out that both modalities present advantages and disadvantages and have addressed the comparison of their performance depending on a specific condition, which might be important to decide the best approach in the clinic in order to enhance patient prognosis. The purpose of this research is to present the comparison of the ultrasound and MRI as the diagnostic tools of PAS and their roles in the context of the diagnosis and management of the disease.

### Aim and objectives

#### Aim

The aim of this study is to evaluate and compare the effectiveness of ultrasound and MRI in About PAS disorders, strengths and weaknesses of the diagnosis and management methods are discussed.

#### Objectives

- To establish diagnostic effectiveness of ultrasound and MRI for the detection of placenta accreta spectrum disorders with regards to sensitivity, specificity and overall diagnostic yield.
- To assess the effect of each imaging modalities on diagnosis and therapeutic approaches of placenta accreta spectrum, therefore, on preoperative outlining and surgical process.

#### Materials and Methods

This study enrolled patients with PAS disorders who undergone ultrasounds and MRI as a part of their examinations. The study population was recruited from a tertiary, referral center that delivers high-risk obstetric cases. Inclusion criteria encompassed: The inclusion criteria for this study were: [1] pregnant women with clinical diagnosis of placenta accreta, increta or percreta through clinical examination, MRI and/or ultrasound imaging and histopathological examination post-surgery, [2] women who had both ultrasound and MRI imaging prior to surgery and [3] those patients who had consented to use of their clinical data for research. Exclusion criteria included: Firstly, it includes [1] patients with cog incomplete imaging or clinical data, [2] subjects who underwent imaging within the latter part of pregnancy and at the time of admission, and [3] cases where imaging results have not been witnessed by members from both departments – radiology and obstetrics. Information on the location and degree of placental involvement in the endometrium as well as clinical consequences associated with surgical interventions and maternal and fetal morbidity were gathered. The efficacy of ultrasound and MRI was then evaluated by the Sensitivity, Specificity and Overall accuracy in diagnosing PAS. Furthermore, the amount of contribution on surgical planning and patient management by each imaging modality was quantitatively assessed to understand their usage. The performances of the different imaging techniques used in the diagnosis and management of the PAS were statistically compared using such methods.

#### Results

The results of the study comparing ultrasound and MRI for diagnosing placenta accreta spectrum (PAS) disorders are presented in the following tables:

**Table 1: Diagnostic Accuracy of Ultrasound and MRI for PAS**

Imaging Modality	Sensitivity (%)	Specificity (%)	Positive Predictive Value (%)	Negative Predictive Value (%)	Accuracy (%)
Ultrasound	85	92	88	89	88
MRI	93	95	94	94	94

MRI is found to be more sensitive than ultrasound with sensitivity of 93% and specificity of 95% while the sensitivity of ultrasound is 85% and specificity of 92%. The sensitivity and specificity of chest X-ray and MRI was high for positive and negative predicting values but MRI was more accurate for diagnosis of PAS.

**Table 2: Impact of Imaging Modality on Surgical Planning and Management**

Imaging Modality	Preoperative Planning Impact (%)	Surgical Outcome Impact (%)
Ultrasound	75	80
MRI	90	95

MRI preoperative planning was more affected by MRI than ultrasound with 90% and 75% respectively while surgery was more affected by MRI but with 95% compared to 80% for ultrasound.

MRI provided more detailed and accurate images as compared to conventional CT scans and thus surgical planning and results were enhanced.

**Table 3: Frequency of PAS Types Diagnosed by Each Modality**

PAS Type	Ultrasound (%)	MRI (%)
Placenta Accreta	70	85
Placenta Increta	20	10
Placenta Percreta	10	5

MRI was superior to ultrasound in the diagnosis of all types of PAS including P.A. In fact, sensitivity and specificity for placenta accreta was higher in MRI than in ultrasound (85 versus 70 percent).

These tables show that MRI offers better diagnostic ability than ultrasound while its contribution to clinical decision making is greater than that of ultrasound in PAS.

### Discussion

Observations made out of this study comparing ultrasound and MRI for diagnosing and managing pas disorders reveal some differences in their diagnostic and clinical activities. The findings of this study revealed that MRI yielded better results regarding sensitivity, specificity as well as accuracy as compared to the ultrasound imaging. Our results are in concordance with literature where MRI is known to better demonstrate the placental invasion because of its higher soft tissue contrast resolution [8, 10].

MRI has a greater sensitivity of 93% and specificity of 95% as compared to ultrasound with sensitivity of 85% and specificity of 92% which indicates MRI's ability to discern small differences in the placental tissue and its extent of tissue infiltration into the uterine wall [12,13]. This is especially important since PAS disorders are often challenging to diagnose, and proper identification of invasiveness of the placenta plays a major part in the management of the disorder and prevention of any dangerous complications in the mother [1, 5]. These enhancements in MRI diagnosis corroborate with other established works about its usefulness in acquiring precise anatomical details as a factor that aids in clinical management and in making surgical plans [3, 8].

Concerning benefit to clinical practice, MRI provided a greater value to preoperative planning and surgery. MRI gives a detailed picture of the anatomic structure of the placenta as well as its location in the region of the uterus and the relation to other structures that are important in the surgery; thus, it can increase surgical accuracy with better clinical results and decreased side effects of surgery [14, 15]. This is as supported by result of other studies done recently that underlines MRI utility in directing the approach to management of PAS because of crucial topographical features that may be obscure on ultrasound [7,9]. The frequency of different kinds of PAS types diagnosed also supported the MRI, especially placenta accreta, for purpose of diagnosis and therapeutic approaches. As for the detection performance, MRI's improvement guarantees the correct

identification of all sorts of PAS, including the severe ones, which is vital for the development of suitable management measures [2, 4].

However, MRI is more expensive and is not available in as many centres as ultrasound, which has a role because it is cheap, and provides imaging in real time [6]. Therefore, even though MRI gives a detailed information, the ultrasound remains relevant in first level examinations and regular checkup examinations.

Lastly, MRI is more accurate diagnostic tool and has a greater influence on the clinical decision making than ultrasound in relation to PAS. These results provide evidential evidence to supplement ultrasound through MRI, especially for better and important cases when anatomy is important to the patient.

### Conclusion

Therefore, this study stresses on the better specificity of MRI in identifying PAS disorders rather than ultrasound. MRI was also shown to be more sensitive and specific as well as yielding a higher accuracy in mapping the degree of placental invasion, which impacted on the patient's further management plan. Although ultrasound still acts as the first-line imaging modality that is non-invasive, time efficient and relatively cheap, MRI's histological detail helps in preoperative planning and results in better operation outcomes. There are advantages in the integration of both modalities, as it would take the best of both techniques for the patient's benefit. Further longitudinal studies investigating more extensive integrated imaging strategies, and relating them to outcomes in patient care, should be conducted and attempts to overcome the difficulties associated with accessibility and cost of MRI should be pursued. In general, it is found that the integration of MRI in evaluation of patients with PAS results in efficient approach towards the disorder, hence the improvement in the quality of treatment.

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