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ORIGINAL ARTICLE

THE VALUE OF ULTRASOUND AND MAGNETIC RESONANCE IMAGING IN DIAGNOSIS OF PLACENTA PREVIA AND ABNORMAL PLACENTATION

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ABSTRACT

Background: Maternal morbidity and mortality are significantly increased in cases with placenta accreta spectrum (PAS), a severe obstetric disease. Accurate antenatal diagnosis is essential for optimal peripartum planning and management. Using intraoperative and histological findings as the gold standard, this study aimed to evaluate and compare the diagnostic accuracy of magnetic resonance imaging (MRI) and ultrasound in detecting PAS.

Materials & Methods: From the 1st of March, 2023 to the 1st of August, 2025, Radiology, Obstetrics & Gynaecology, a validational cross-sectional study was conducted at Rehman Medical Institute and Hayatabad Medical Complex. We conducted a study on 146 pregnant women with 28 weeks soaring pregnancy age and history of abnormal placentation using non-probability consecutive sampling technique. MRI and USG values were standardised in all the subjects. The calculated sensitivity, specificity, positive predictive value, negative predictive value and accuracy were used for the assessment. The SPSS ver 26.0 analyzed the information statistically, and p0.05 is significant.

Results: On average, participants were 32.47 ± 6.66 years old and 32.79 ± 3.28 weeks pregnant. A clinical diagnosis of PAS was confirmed in 99 (67.8%) cases. The diagnostic accuracy of ultrasound for probable infective pyelonephritis and UTI was found to be 82.19%. The results of the MRI analysis improved.

Conclusion: When it came to recognizing the placenta accreta spectrum, MRI proved to be more accurate than ultrasound. In high-risk pregnancies, magnetic resonance imaging (MRI) is a useful adjunct to ultrasound for enhancing diagnostic certainty and facilitating right surgical planning, while ultrasound is still the gold standard.

KEY WORDS: Hysterectomy; Magnetic resonance imaging; Maternal morbidity; Placenta accreta spectrum; Ultrasound.

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INTRODUCTION

There is a strong correlation between placenta accreta, increta, and percreta, all of which are disorders that make up the placenta accreta spectrum (PAS), and an increased risk of maternal morbidity, peripartum hysterectomy, and major bleeding[1]. An increase in uterus procedures, such as cesarean sections, is directly responsible for the worldwide increase in PAS incidence.[2] Appropriate referral, surgical planning, and multidisciplinary management can only be achieved with early and accurate antenatal detection of PAS.[3]

Due to its accessibility, non-invasiveness, and real-time capacity, ultrasound is still the imaging method of choice for prenatal screening of PAS.[4] Diagnostic criteria include the following: turbulent blood flow on color Doppler, myometrial thinning, placental lacunae, and obliteration of the retroplacental clear zone.[5,6] Having trouble with placentas that are situated posteriorly and the reliance on the operator both reduce its diagnostic accuracy. The specificity of ultrasound for detecting PAS ranges from 80% to 95%, whereas the stated sensitivity falls somewhere between 77% and 87%. When it comes to ambiguous or posteriorly placed cases, magnetic

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resonance imaging (MRI) provides better resolution of soft tissues and makes it easier to evaluate the depth of placental invasion.[7,8] The key benefit of taking a magnetic resonance imaging is lack of radiations. The quality of the image is better than that of an ultrasound. As a result, tiny details and abnormalities are visible which in other cases could have been missed. Moreover, while the technology can produce cross-sectional images, no x-rays are still required. As a result, it is easy and does not require the insertion of special instruments.

Because of the significant risk of severe hemorrhage, hysterectomy, and maternal morbidity associated with delayed diagnosis, accurate antenatal identification is now crucial for optimal delivery planning and multidisciplinary management of placenta previa and placenta accreta spectrum (PAS) disorders. This rise in incidence is mainly caused by the increasing rates of cesarean sections. In complex or posterior placental locations, however, there is a need for institution-based validation due to the difference in diagnostic performance between ultrasound and magnetic resonance imaging (MRI). To that end, we set out to compare and contrast the sensitivity, specificity, positive predictive value, negative predictive value, and overall diagnostic accuracy of ultrasonography and magnetic resonance imaging (MRI) for the antenatal diagnosis of placenta previa and PAS disorders in our clinical setting, with intraoperative and/or histopathological findings serving as the gold standard.

MATERIALS AND METHODS

After receiving approval from the Institutional Ethical Review Board, this cross-sectional validation study was carried out at the Radiology and Obstetrics & Gynaecology Departments of Rehman Medical Institute and Hayatabad Medical Complex from 1st March 2023 to 1st August 2025. All participants were asked to sign an informed consent form before they could be included in the study. The World Health Organization's sample size calculator for investigations of diagnostic accuracy was used to determine the sample size. The minimum required sample size was estimated to be 146 patients, taking into account a previously reported sensitivity of 87% for ultrasound in diagnosing placenta accreta spectrum (PAS),[9] with an absolute precision of 5% and a confidence level of 95%. It was also anticipated that 30% of high-risk pregnancies would have PAS. A non-probability consecutive sampling method was used to recruit participants who met the qualifying requirements.

All women who were above 28 weeks along in their pregnancies were considered, provided that there was either clinical suspicion (such as a history of a prior cesarean section with placenta previa) or sonographic suspicion of an aberrant placentation. All patients were screened to ensure they satisfied the inclusion criteria, which included no history of uterine abnormalities, no metallic implants, pacemakers, or severe claustrophobia, and no repeated pregnancies.

Standardized imaging examination was performed on all patients who were enrolled. Proficient radiologists used a Mindray ultrasound equipment to do transvaginal and transabdominal ultrasound exams. The sonographic signs of PAS included a narrowed or blocked retroplacental clear zone, many placental lacunae, a thinned myometrium (<1 mm), and a rise in subplacental or uterovesical vascularity as seen on color Doppler imaging. After that, a 1.5 Tesla GE MRI machine was used for the procedure. To evaluate the shape of the placenta and the extent of invasion, axial, sagittal, and coronal T2-weighted fast spin-echo sequences were acquired. Uterine bulging, variable placental signal intensity, disruption of the uterine-bladder interface, focal myometrial interruption, and dark intraplacental bands on T2-weighted images were MRI characteristics that suggested PAS. Intraoperative results and/or histological analysis of the placenta after delivery served as the gold standard for definitive diagnosis. Ultrasound and magnetic resonance imaging (MRI) results were evaluated separately from the gold standard diagnosis.

An analysis was conducted using SPSS version 26.0, which was developed by IBM Corp. and located in Armonk, NY, USA. Categorical variables were shown as frequencies and percentages, whilst continuous variables were shown as mean ± standard deviation (SD). Using 2×2 contingency tables, the diagnostic performance metrics such as sensitivity, specificity, PPV, NPV, and total diagnostic accuracy were determined. Imaging results were statistically correlated with the gold standard diagnosis using the Chi-square test. It was deemed statistically significant if the p-value was less than 0.05.

RESULTS

The study included 146 patients overall. The average age of the patient was 32.47±6.66 years and 32.79±3.28 weeks pregnant. Of the patients, 116 (79.5%) had previous C-section. The ultrasound indication of placenta accreta spectrum was present in 85 cases (55.5%). Out of 146 patients, 95 were 65 years or older. Intraoperatively or on histopathology PAS was confirmed in 99 patients (67.8%). (Table 1).

P-AS has become a major concern for obstetrics nowadays. The P-AS condition refers to an abnormal adhesion of the placenta to the muscular wall of the uterus. The uterine wall's inner most layer is fibro muscular. (Table 2).

The diagnostic accuracy of magnetic resonance imaging (MRI) was 97.26%, with a positive predictive value (PPV) of 100.00%, a specificity of 100.00%, a sensitivity of 95.06%, and a negative predictive value (NPV) of 92.16%. $P < 0.001$ also indicates a statistically significant correlation between MRI findings and ultimate diagnosis. (Table 3).

Table 1: Descriptive Statistics of Study Participants (n = 146)

Variable	Value
Age (years)	32.47 (6.66)
Gestational Age (weeks)	32.79 (3.28)
History of Cesarean Section	
• Yes	116 (79.5%)
• No	30 (20.5%)
Ultrasound Suggestive of PAS	
• Yes	81 (55.5%)
• No	65 (44.5%)
MRI Suggestive of PAS	
• Yes	95 (65.1%)
• No	51 (34.9%)
Final Diagnosis (Gold Standard)	
• PAS Present	99 (67.8%)
• PAS Absent	47 (32.2%)

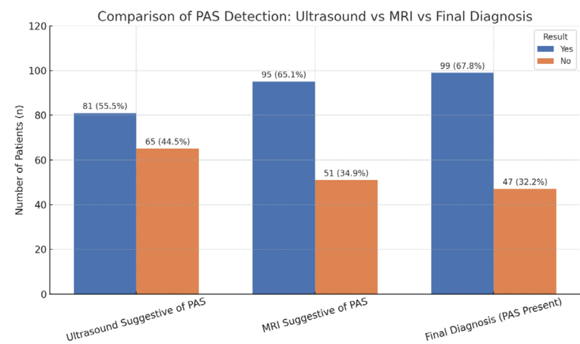

Figure 1: Graphical Presentation of Comparison of PAS Detection

DISCUSSION

According to the data, MRI was more accurate than ultrasound in diagnosing the placental implantation which is PAS. The overall accuracy, specificity, and sensitivity of ultrasound can reach 82.19%, 91.49 and 77.78%, respectively. According to the diagnostic performance, MRI can produce results with a sensitivity of 94.96%, specificity of 100%, and accuracy of 97.26%. A recently-published paper has similar results regarding the diagnosis of PAS.[10-12]

Table 2: Diagnostic Performance of Ultrasound in Detecting Placenta Accreta Spectrum Compared to Gold Standard (n=146)

		Final Diagnosis (Gold Standard)		Total	Statistics
		PAS Present	PAS Absent		
PAS (US)	Yes	77	4	81	P Value = < 0.001 Sn = 77.78% Sp = 91.49% PPV = 95.06% NPV = 66.15% Accuracy = 82.19%
		77.8%	8.5%	55.5%	
	No	22	43	65	
		22.2%	91.5%	44.5%	
Total 100.0%		99	47	146	
		100.0%	100.0%		

Table 3: Diagnostic Performance of MRI in Detecting Placenta Accreta Spectrum Compared to Gold Standard (n=146)

		Final Diagnosis (Gold Standard)		Total	Statistics
		PAS Present	PAS Absent		
MRI (PAS)	Yes	95	0	95	P Value = < 0.001 Sn = 95.96% Sp = 100.00% PPV = 100.00% NPV = 92.16% Accuracy = 97.26%
		96.0%	0.0%	65.1%	
	No	4	47	51	
		4.0%	100.0%	34.9%	
Total 100.0%		99	47	146	
		100.0%	100.0%		

An additional tool for the diagnosis of placenta accreta spectrum, magnetic resonance imaging (MRI) was discussed in the article. In the context of medical diagnosis, the use of magnetic resonance imaging (MRI) as a supplementary test is known as adjuvant imaging. The significance of was especially emphasized. For suspected PAS, especially in cases where ultrasound results are inconclusive, Dudiak et al. initially suggested MRI as an adjunct imaging modality.[13] Newer research backs this up; one study found that MRI had a specificity of 85–95% and a sensitivity of 80–90% in high-risk obstetric groups.[14] We confirm the usefulness of magnetic resonance imaging (MRI) in defining the extent and distribution of placental invasion, and our results are within this range.

This study's ultrasound results were consistent with those of others in which trained professionals used established PAS sonographic criteria to assess patients.[15] as However, issues like a posterior placenta, poor acoustic windows, and obesity in the mother can compromise its diagnostic accuracy.[16] To ensure optimal diagnostic yield, it is crucial to train operators and follow approved protocols. In our group, MRI had a 100% specificity rate, which means it effectively eliminated all instances of false-positive ultrasonography. This finding agrees with those of recent studies that shown the efficacy of magnetic resonance imaging (MRI) in reducing the number of needless surgical procedures by improving the ability to differentiate between actual invasion and placental adhesion.Utilizing contrast-enhanced procedures and high-resolution T2-weighted sequences significantly improves the efficacy of MRI for PAS mapping.[17-19]

Tertiary care centers see a disproportionate number of high-risk pregnancies, particularly those with a history of cesarean sections, which may explain why PAS is so common in our group (67.8%). As the number of caesarean sections performed and PAS is recognized as a common obstetric issue, this pattern is repeated across the world. [20,21] It is important to note that there are several limitations to this study, even though it has certain positives. One limitation that could restrict its generalizability is that it was only done at one center. Second, we did not look at how different experts interpreted the results of the ultrasound and MRI scans. Thirdly, histopathologic and surgical confirmation formed the basis of the gold standard diagnosis; nevertheless, there was a lack of uniformity in intraoperative grading, which could have introduced interpretive bias.

Definitive diagnostic methods could be established by future multicenter prospective trials that include blinded radiologic assessment and uniform PAS staging. However, we confirm that combining ultrasonography and MRI greatly increases surgical readiness and diagnostic certainty in instances suspected of PAS.

CONCLUSION

When comparing MRI with ultrasound for the detection of placenta accreta spectrum (PAS), this study shows that MRI had better diagnostic accuracy, sensitivity, and specificity. In high-risk pregnancies, MRI should be considered a supplementary technique, as it consistently and considerably outperforms ultrasound as a first-line modality, thanks to its accessibility and real-time utility. To strengthen the comparative analysis, all patients were scanned using both imaging modalities in the same context. This updated local evidence will help with clinical decision-making for prenatal PAS identification.

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CONFLICT OF INTEREST
Authors declare no conflict of interest.
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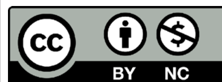
None declared.

AUTHORS' CONTRIBUTION

The following authors have made substantial contributions to the manuscript as under:

Conception or Design:	SK, US
Acquisition, Analysis or Interpretation of Data:	SK, US, ZK, WK, GG, HUR, HS
Manuscript Writing & Approval:	SK, US, ZK, WK, GG, HUR, MH

All the authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.



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