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Original Article

Diagnostic Accuracy of Magnetic Resonance Imaging in Detecting Placenta Accrete Keeping Post-Operative Histopathology Findings as a Gold Standard

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ABSTRACT

Objective: To determine the diagnostic accuracy of MRI in diagnosing placenta accrete with post-operative histopathological findings considered a gold standard.

Study Design: Cross-sectional study.

Place and Duration of study: Combined Military Hospital, Kharian Pakistan, from Jan to Dec 2020.

Methodology: In total, 119 individuals suspected of placenta accreta were evaluated with the help of magnetic resonance imaging (MRI). However, confirmation for 71 patients was obtained based on clinical criteria at the time of delivery.

Results: The mean age of women was 28.67±5.64 years, and the mean gestational age for the foetus was 33.14±1.74 weeks. The present study showed that MRI has 90(141%) sensitivity, 91(66%) specificity, 94(11%) positive predictive value (PPV), and 86(27%) negative predictive value (NPV) and diagnostic accuracy of 90(75%) for diagnosing placental accreta.

Conclusion: It is concluded that the use of MRI should be encouraged as an efficient and primary diagnostic tool for placenta accreta.

Keywords: Magnetic resonance imaging (MRI), Placental accreta, Placental adhesion.

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INTRODUCTION

The abnormal placental implantation results in a medical disorder called placenta accreta. Placenta accreta is an outcome of the enfolding of placental villi in uterine myometrium. Other reasons may include direct interaction of uterine myometrium and placenta or disappearance of decidua between the placenta and uterine wall.[1] Abortion, old age, multiple births, caesarean section, uterine operation and placenta previa are risk factors for placenta accreta.

Despite its prevalence, placental accreta lacks any unified standard for diagnosis. Pathological examination is considered a gold standard for the detection of placenta accreta.[2] It has the benefits of definite diagnosis with identification of the type of placental implantation. However, many patients suff-ering from placental accreta undergo a hysterectomy. Thus, most cases remain ignored due to the conservative nature of treatment.[3] The applicability of molecular biology techniques is also limited in the clinical context due to decreased specificity. On the other hand, the requirement for more applicable clinical diagnostic criteria for early diagnosis of placental accreta has emerged. Imaging techniques are the most applicable method for diagnosing placenta accreta.[4]

Magnetic resonance imaging (MRI) is one of the most common methods utilized due to high soft-tissue resolution, better contrast resolution, the capability of multi-planner imaging, provision of stable images of the foetus and good imaging range.[5] Furthermore, it enables the detection of the location of placental attachment, scope and degree of placental invasion and extent of involvement of nearby tissues.[6] Furthermore, various research works have pointed out at relationship of MRI with the prognosis of the operation. Thus, MRI can be used as a guide for selecting the appropriate surgical method.[7] The present research work is an effort towards understanding the diagnostic potential of MRI for placental accreta.

METHODOLOGY

This cross-sectional study was performed from January to December 2020 at Combined Military Hospital (CMH), Kharian Pakistan. The Ethical permission (Letter No. 644) was obtained from the Ethical Committee. Taking previous prevalence of 1 in 1000, according to Showman *et al*.[8] with a 5% margin of error and 95% confidence level, the calculated sample size was 119. The sampling technique utilized for data collection was convenience sampling. The medical

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information of pregnant females was retrieved from the database.

Inclusion Criteria: Pregnant women of 2nd or 3rd-trimester with the risk factors of abnormal placentation like placenta previa on ultrasonography, C-section and advanced age were included in the study.

Exclusion Criteria: Pregnant women with artificial metallic devices in the body, like prostheses, pacemakers, and claustrophobic patients, were excluded from the study.

In total, 119 individuals suspected of placenta accreta were evaluated with the help of magnetic resonance imaging (MRI). However, confirmation for 71 patients was obtained based on clinical criteria at the time of delivery. The normal placenta was marked for easily removable and devoid of the excessive bleeding placenta. Histopathological diagnosis was performed for the abnormally stuck placenta.

The demographic of patients included the age of the mother and gestational age at the time of the study. MRI was performed by using a 0.35 Tesla Siemens machine. The examination was performed in a supine position with a partially filled bladder. T2 images were taken in axial, sagittal and coronal planes to assess the placental position. The features of bladder invasion, bladder tenting, abnormal placental vascularity, focal interruptions in the myometrial wall, placental heterogeneity, visualization of invasion of adjacent organs, dark intra-placental bands on T-2 weighted sequences, and focal uterine bulging were considered indicative of abnormal placentation, which is marked as placental accreta. A consultant radiologist reported the MRI.

The Statistical Package for Social Sciences (SPSS) software version 23.00 was utilized to analyse the data. The positive and negative outcome was presented as frequencies and percentages. The mothers' age and gestational age were depicted as mean±standard deviation. Diagnostic parameters were calculated using a 2x2 table. Sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy were determined by using the standard formulae taking histopathological findings considered the gold standard.

RESULTS

The total number of patients included was 119. The mean age for pregnant women was 28.67±5.64 years, and the mean gestational age for the foetus was 33.14±1.74 weeks (Table-I).

Table-I: Demographic Characteristics of Patients (n=119)

Demographics	Mean±SD
Age (Years)	28.67±5.64
Gestational age (weeks)	33.14±1.74

Based on histopathological findings, 71(59.66%) patients were positive, and 48(40.33%) patients were negative. However, MRI found that 68(57.14%) patients were positive, and 51(42.85%) patients were negative. Therefore, the matched results between MRI and histopathological findings marked 64(53.78%) as true positives and 44(36.97%) as true negatives. On the other hand, the non-matching results between MRI and histopathological findings indicated that 4(3.36%) outcomes were false-positive and 7(5.88%) results were false-negative (Table-II).

Table-II: Comparison of Magnetic Resonance Imaging (MRI) and Post-Operative Histopathological Results (n=119)

MRI Results	Post-Operative Histopathological Results	
	Positive	Negative
Positive	64 (True positive; TP)	4 (False positive; FP)
Negative	7 (False negative; FN)	44(True negative; TN)

The present study showed that MRI has 90.141% sensitivity, 91.66% specificity, 94.11% PPV, and 86.27% NPV values. The diagnostic accuracy of MRI in diagnosing placental accreta was found to be 90.75% (Table-III).

Table-III: Calculation for Diagnostic Attributes of Magnetic Resonance Imaging (MRI) (n=119)

Factors	Formulas	Calculations	Results (%)
Sensitivity	TP/ TP+FN x 100	64/64+7 x 100	90.14
Specificity	TN/ FP+TN x 100	44/4+44 x 100	91.66
Positive predictive value (PPV)	TP/TP+ FP x 100	64/64+ 4 x 100	94.11
Negative predictive value (NPV)	TN/ FN+ TN x 100	44/7+ 44 x 100	86.27
Diagnostic accuracy	TP+TN/ TP+FP+ FN+TN x 100	64+44/64+4+7 +44 x 100	90.75

DISCUSSION

The placenta accreta appears in 1 out of every 1000 deliveries making a prevalence of 0.01 to 1%.[9] Mazhar *et al.* [10] found that about 0.1% of Pakistani females suffered from placenta accreta. Among these, 4.5% of cases occur in women with serious maternal outcomes. Placenta accreta has been found to cause problems in delivery, and unbearable uterine bleeding, which is harmful to the well-being of mother and child.[11,12] The perinatal death rate of 44.8%and maternal death rate of 0.05% has been associated with placenta accreta.[13-15]

In the present study, the mean age for patients was 28.67±5.64 years with a range of 20-40 years. On the other hand, the mean gestational age for the foetus was 33.14±1.74 weeks with a range of 30-36 weeks. The comparative results of MRI and histopathological findings suggest 90.141% sensitivity, 91.66% specificity, 94.11% PPV, 86.27% NPV and 90.75% diagnostic accuracy of MRI in diagnosing placental accreta.

Hassan *et al*. [16] found placenta accreta in 38.3% of the study population through MRI with a sensitivity of 84.0%, specificity of 94.3%, PPV of 91.2% and NPV of 89.2%. Thus, the results favour using MRI as an early diagnosis tool for placental accreta. Ayati *et al*.[17] found a sensitivity of 76% and specificity of 83% for MRI diagnosing placental accreta. Lopes *et al*.[18] associated sensitivity of 92.9%, PPV of 76.5%, and an NPV of 75.0% with MRI in the diagnosis of placenta accreta. Masood *et al*.[19] noted a sensitivity of 100% and specificity of 83.3% for MRI diagnosing placental accreta. Xia *et al*.[20] found a sensitivity of 89.13%, specificity of 87.67%, PPV of 82%, and NPV of 93% for diagnosing placental accreta in the second trimester by MRI. This changed by 92.50% for sensitivity, 87.21% for specificity, 77% for PPV and 96% for the third trimester. The study further pointed out that the features of the disappearance of the myometrium, loss of normal retroplacental clear space, vascularization perpendicular to the uterine wall, uterine bulging, enhanced vascularization at the uterine serosa-bladder wall interface and dark intraplacental bands on MRI are distinctive for patients suffering with placental accreta as compared to normal individuals.

The present study further points out through statistical comparison between findings of MRI with histopathological results that there is no significant difference between the two types of diagnostic tools. This indicates the efficiency of MRI in accurately diagnosing placental accreta. Thus, MRI must be used as a primary diagnostic tool accompanied by ultrasonography for diagnosing placental accreta.

The literature regarding using MRI for diagnosing placental accreta is controversial. According to Budorick *et al*.[3] MRI is a better imaging method in the diagnosis of placental accreta in comparison to ultrasonography. Similarly, Kumar *et al*.[21] found MRI to be more sensitive and specific than ultrasonography. However, Einerson *et al*.[22] claimed that ultrasound is better at diagnosing placental accreta than MRI. Furthermore, the study claimed that MRI resulted in either underdiagnosis or overdiag-nosis of the disorder, which can be very costly and time wasting for practitioners. This could alter the clinical management of placental accreta for more than one-third of cases. Thus, the use of MRI needs to be limited due to its high cost and clinical value. Thus, further research exploration is required to investigate the diagnostic potential of MRI in diagnosing placental accreta.

CONCLUSION

Placenta accreta is becoming highly prevalent in recent times. The resulting increase in morbidity and mortality of mothers and neonates is attention-seeking. The findings of the present study highly suggest the use of MRI for the early diagnosis of placental accreta in suspected patients. The clinical management of such patients can be effective through the such approach.

Conflict of Interest: None.

Author's Contribution

Following authors have made substantial contributions to the manuscript as under:

SB & SJ: Study design, drafting the manuscript, data interpretation, critical review, approval of the final version to be published.

NSN & KZ: Conception, drafting the manuscript, approval of the final version to be published.

AHH & MOA: Data acquisition, data analysis, critical review, approval of the final version to be published.

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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