Original Article

Diagnostic Value of Magnetic Resonance Imaging (MRI) in Morbidly Adherent Placenta, Taking Surgical Findings as Gold Standard

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ABSTRACT

Objective: To evaluate the diagnostic accuracy of Magnetic Resonance Imaging in diagnosis of morbidly adherent placenta, comparing with surgical findings.

Study Design: Comparative study.

Place and Duration of Study: This study was conducted at the Radiology Department of Nishtar Medical Teaching Hospital from Jan, 2019 to Jan. 2020.

Materials and Methods: Total 77 patients with clinical suspicion of morbidly adherent placenta having age between 18-38 years were included. Patients with history of more than one cesarean section, antepartum hemorrhage and contra-indications to magnetic resonance imaging were excluded. All the patients were under went MRI pelvis with 1.5 Tesla MRI Achiva scanning system using multiplanner multi-echo imaging. MRI findings were recorded as positive and negative for placenta accreta. MRI findings were correlated with operative findings. Using SPSS-18, data was analyzed and diagnostic accuracy, positive predictive value, negative predictive value, sensitivity and specificity were calculated.

Results: 77 patients were included in study according to inclusion criteria. Patients mean age was 26.95±4.05 years. MRI was true positive for 25 and false positive for 3 patients. True negatives were 19 and false negative were only 3 patients. Diagnostic accuracy, positive predictive value (PPV), negative predictive value (NPV), sensitivity and specificity of MRI were 87.01%, 88.37%, 85.29 %, 88.37%, and 85.29% respectively.

Conclusion: MRI is a new non-invasive diagnostic modality with significantly high accuracy in diagnosis of morbid adherence of placenta.

Key Words: MRI, Morbidly adherent placenta, imaging modality, sensitivity.

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INTRODUCTION

Morbid adherence of placenta occurs due to a defect in decidua basalis resulting in abnormal invasion of placental tissue into uterus. Morbid adherence is classified as placenta accrete (reaching myometrium), placenta increta (into myometrium) and placenta percreta (through myometrium).[1] Risk factors of morbid adherence of placenta includes Placenta Previa, increasing number of deliveries by previous C-sections and higher maternal age at deliveries. [2]

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Prevalence of morbid adherence of placenta has increased to 69% in developed countries due to delay in child bearing and increased in trends of C-Sections. [3]

The frequency of morbid adherence of placenta in the presence of Placenta Previa increases from 24% after one C-Section to 67% after four or more C-sections. [4]

Very important complication of morbid adherence of placenta is massive hemorrhage at the time of delivery, so accurate antenatal diagnosis of morbid adherence has significant impact on morbidity and mortality that needs early preparation of surgical team for a complicated delivery. Accurate antenatal diagnosis is also essential for appropriate counseling and surgical planning. [5]

Definite diagnosis depends on the visualization of chorionic villi embedded in the myometrium with absent decidua. Radiologically ultrasonography and MRI are the diagnostic tests for evaluation of morbid adherence of placenta. Traditionally ultrasound is used as a screening tool for patients with risk factors, but definite diagnosis is made with histopathology. [6]

MR imaging is indicated when placenta is implanted posteriorly or when sonographic findings are equivocal.

MR imaging can better define areas of abnormal implantation, degree of invasion and ultimately can change surgical management planning and should be used routinely. [7]

Rationale of our study was to determine the diagnostic accuracy of MRI in morbid adherence of placenta but also these particular patients can be provided with an accurate diagnostic modality for screening of placenta accreta which will help the surgeons to make accurate management steps to decrease the maternal morbidity and mortality.

MATERIALS AND METHODS

Study was conducted at Radiology Department of Nishtar Medical Teaching Hospital, Punjab, Pakistan including 77 patients from Jan, 2019 to Jan, 2020. Patients mean age, gestational age & parity were collected. Patients with history of more than one cesarean section, antepartum hemorrhage and contra-indications to magnetic resonance imaging were excluded. MRI pelvis of all patients was done with 1.5 Tesla MRI Achiva scanning system using multiplanner multi-echo imaging. MRI findings were recorded as positive and negative for placenta accreta. MRI findings were correlated with surgical findings. Using SPSS-20, data was analyzed and diagnostic accuracy, positive predictive value, negative predictive value, sensitivity and specificity were calculated.

Effect modifier like age, gestational age, BMI and parity were controlled by stratification. Chi-square test was applied post stratification and p-value ≤0.05 was considered as significant.

RESULTS

Total 77 patients fulfilling inclusion criteria were included. Patients mean age was 26.95± 4.05 years with range of 18-38 years. Mean gestational age was 37.57 ± 1.85 weeks. Mean parity was 3.75±0.87. Mean BMI was 29.55 ± 2.15.

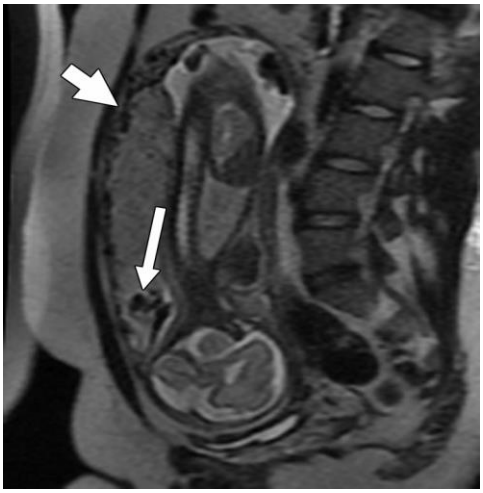

Figure No. 1: I MRI showing Hypo-intense Intraplacental bands suggestive of Placenta Accreta.

MRI was true positive for 25 and false positive for 3 patients. True negatives were 19 and false negative were only 3 patients.

Diagnostic accuracy, positive predictive value (PPV), negative predictive value (NPV), sensitivity and specificity of MRI were 87.01%, 88.37%, 85.29 %, 88.37%, and 85.29% respectively.

Post stratification association of outcome with age, gestational age, BMI and parity were calculated using chi square test considered p≤0.05 as significant. The results showed significant association with gender, age and duration of gestation.

Table No. 1: Diagnostic Accuracy of MRI in Evaluation of Morbidely Adherent Placenta Taking Surgical Findings as Gold Standard (n=77)

MRI Findings	Operative Findings		Total
	Positive	Negative	
Positive	True positive (a) 38 (49.35%)	False positive (b) 5 (6.49%)	a + b 43(55.84%)
Negative	False negative (c) 5 (6.49%)	True negative (d) 29 (37.66%)	c + d 34 (44.15%)
Total	**a + c 43 (55.84%)**	**b + d 34 (44.16%)**	**77 (100%)**

Accuracy = True +ve +True -ve / (True +ve+ True –ve/ False +ve+False -ve) x 100 = 87.01%

PPV = True +ve / (True +ve + False +ve) x 100 =88.37%

NPV = True -ve / (True –ve +False -ve) x 100 = 85.29%

Sensitivity = True +ve / (True +ve + False -ve) x 100 = 88.37%

Specificity =True -ve / (True -ve + False +ve) x 100 =85.29%.

DISCUSSION

Placenta is responsible for the nutritive, respiratory and excretory functions of the fetus in pregnancy. Morbid adherence of placenta (MAP) increases the morbidity and mortality of both mother and fetus due to severe postpartum hemorrhage with possible multi-organ failure. [8]

One third to one half of all emergency hysterectomies are performed due to morbid adherence of placenta. Previous C-section deliveries increases the risk to 3% for first delivery to 40% and 65% for the third and fifth deliveries respectively. Placenta Previa is another major risk factor of morbid adherence. [9]

Antenatal sonography is the first line investigation for diagnosis of morbid adherence of placenta (MAP) with high sensitivity and specificity reaching upto85.9% and 88.4% respectively. However posterior placement of placenta is difficult to evaluate by ultrasound, where magnetic Resonance Imaging (MRI) is consider the preferred diagnostic modality. Specific signs of abnormal placental implantation are reported in literature. [10]

We have conducted this study to determine the diagnostic accuracy of MRI in cases of morbid

adherence of placenta considering operative findings as gold standard.

In our study, age range was 18-38 years with mean age of 26.95±4.05 years. Majority of patients were between 29-38 years of age. In MRI positive patients,25 were true positive while three were false positive. Among 22 MRI negative patients, 19 were true negative and three were false negative. Overall sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of MRI in diagnosing morbidly adhering placenta, taking intra-operative findings as gold standard was 88.37%,85.29%,88.37%,85.29% and 87.01% respectively.

According to Berkley EM et al has found the sensitivity and specificity of MRI in diagnosing morbid adherence of placenta is 84.14% and 80.34% respectively, however Warshak CR et al has shown the sensitivity and specificity of 88.45% and 100% respectively. [11]

Many signs have been demonstrated in literature regarding morbid adherence of placenta, using the clinical evidence at the time of C-Section as reference standard. A recent study of 28 patients using the clinical findings as the reference standard that an association of characteristic signs strongly indicates placental invasion by MRI. [12]

Three meta-analysis have considered the accuracy of ultrasound in diagnosing invasive placental implantation, the use of MRI and the comparison of ultrasound and MRI. According to D 'Antonio et al the sensitivity and specificity of ultrasound and MRI were 90.72%, 96.90% and 94.40%, 84.40% respectively. These meta-analyses showed good accuracy of ultrasound and MRI in the diagnosis of placental invasion.[6]

According to Lim et al abnormal implantation was correctly identified by MRI in seven out of nine patients with two false positive and placenta accreta in three out of four patients (one false negative).[7] Toe et al found that the most useful MRI findings for the diagnosis of placenta accreta were heterogeneous signals with in the placental tissue and dark intraplacental bands on T2W imaging.

Accurate diagnosis of morbid adherence in antenatal period is very important to reduced maternal morbidity and mortality. Sonography has an important role in the diagnosis of placenta accreta in which placental lacunae is the highly sensitive sonographic sign with 93% sensitivity that is conformed with Color Doppler Ultrasound. [13,14,15]

MRI is important to differentiate placenta accreta, increta and percreta. According to Teo THet MRI has reported sensitivity and specificity of 90% and 99% respectively. [16,17] In a study by Elhawary TM et al 30.7% patient were for positive and 69.3% were negative for placenta accreta on MRI. He concluded the sensitivity, specificity, positive predictive value, negative predictive value of MRI as 88.8%, 86.8%, 66.6% and 96.2% respectively.

One of the limitations of this study is that it was conducted with small sample size and in urban environment therefore, the results might not be generalized to larger populations. Further, it could have been better if other related risk variables could be included in the study.

CONCLUSION

Our results have demonstrated that MRI is a highly sensitive and accurate modality in diagnosing morbid adherence of placenta that has not only dramatically improved our ability of diagnosing morbid adherence, but also improves patient care taking proper pre-operative measures. So being non-invasive and a highly sensitive tool of investigation, we should consider as a primary tool for accurate identification of morbid adherence of placenta to reduce maternal morbidity and mortality.

Author's Contribution:

Concept & Design of Study:	Abdul Sattar
Drafting:	Humaira Bashir, Saeeda Rana
Data Analysis:	Sadia Anjum
Revisiting Critically:	Abdul Sattar, Humaira Bashir
Final Approval of version:	Abdul Sattar

Conflict of Interest: The study has no conflict of interest to declare by any author.

REFERENCES

1. Noda Y, Kanematsu M, Goshima S, et al. Prenatal MR imaging diagnosis of placental Invasion. Abdom Imaging 2015; 40:1273–1278.
2. Ueno Y, Maeda T, Tanaka U, et al. Evaluation of inter observer variability and diagnostic performance of developed MRI-based radiological scoring system for invasive placenta Previa. J Magn Reson Imaging 2016;44:573–583.
3. Coviello EM, Grantz KL, Huang CC, Kelly TE, Landy HJ. Risk factors for retained placenta. Am J Obstet Gynecol 2015; 213:864. e1–e11.
4. Lurie S, Raz N, Boaz M, et al. Comparison of maternal outcomes from primary cesarean section during the second compared with first stage of labor by indication for the operation. Eur J Obstet Gynecol Reprod Biol 2014; 182:43– 47.
5. Ueno Y, Kitajima K, Kawakami F, et al. Novel MRI finding for diagnosis of invasive placenta Previa: evaluation of findings for 65 patients using clinical and histopathological correlations. Eur Radiol 2014; 24:881–888.
6. Algebally AM, Yousef RR, Badr SS, Al Obeidly A, Szmigielski W, Al Ibrahim AA. The value of

ultrasound and magnetic resonance imaging in diagnostics and prediction of morbidity in cases of placenta Previa with abnormal placentation. Pol J Radiol 2014; 79:409–716.

7. Solheim KN, Esakoff TF, Little SE, Cheng YW, Sparks TN, Caughey AB. The effect of cesarean delivery rates on the future incidence of placenta Previa, placenta accreta, and maternal mortality. J Matern Fetal Neonatal Med 2011;24:1341–1346.
8. Chen T, Xu XQ, Shi HB, Yang ZQ, Zhou X, Pan Y. Conventional MRI features for predicting the clinical outcome of patients with invasive placenta. Diagn Interv Radiol 2017;23:173–179.
9. Alamo L, Anaye A Rey J, et al. Detection of suspected placental invasion by MRI:do the results depend on observer experience. Eur J Radiol 2013;82;51-57.
10. Meng X, Xie l, Song. Comparing the diagnostic value of ultrasound and magnetic resonance imaging for placenta accreta: a systematic review and meta-analysis. Ultrasound Med Biol 2013; 39:1958-1965.
11. Berkley EM, Abuhamdan AZ, Prenetal diagnosis of placenta. Is sonography all we need? J Ultrasound Med .2013;32: 1345-50.
12. Rac MW, Dashe JS, Wells CE, Moschos E, McIntire DD, Twickler DM. Ultrasound predictors of placental invasion: The Placenta Accreta Index. Am J Obstet Gynecol 2015; 212:343. e1–343.e7
13. D'Antonio F, Iacovella C, Palacios-Jaraquemada J, Bruno CH, Manzoli L, Bhide A. Prenatal identification of invasive placentation using magnetic resonance imaging: systematic review and meta-analysis. Ultrasound Obstet Gynecol 2014; 44:8–16.
14. Lim BH, Palacios-Jaraquemada JM. The morbidly adherent placenta, a continuing diagnostic and management challenge. BJOG 2015; 122:1673.
15. Bour L, Placé V, Bendavid S, et al. Suspected invasive placenta: evaluation with magnetic resonance imaging. Eur Radiol 2014; 24:3150–3160.
16. Riteau AS, Tassin M, Chambon G, et al. Accuracy of ultrasonography and magnetic resonance imaging in the diagnosis of placenta accreta. PLoS One 2014; 9: e94866.
17. Masselli G, Gualdi G. MR imaging of the placenta: what a radiologist should know. Abdom Imaging 2013;38:573–587.
18. Horowitz JM, Berggruen S, McCarthy RJ, et al. When timing is everything: are placental MRI examinations performed before 24 weeks' gestational age reliable? AJR 2015; 205:685–692.