

Role of MRI in Detecting Abnormal Placentation in Patients with Strong Ultrasound Concern for Myometrial Invasion

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ABSTRACT

Abnormal placentation has raised the ratio of cesarean cases. In such obstetric complication the placenta lie at the lower segment of the uterus. These abnormal attachments of placenta to uterus and invasion to adjacent organs are the main cause of placenta previa. These are not only raising delivery challenges but also raising the mortality cases.

Objective: For evaluation of the diagnostic efficacy of MRI to locate placentation abnormalities with high accuracy and sensitivity. This not only helps in preoperative delivery planning but also decreases the ratio of mortality.

Study Setting: It was an observational study, conducted at radiology department of Mardan Medical Complex Mardan for the duration of six months from September 2021 to February 2022.

Methods: The women suspicion of placentation abnormalities were recommended with MRI. The consecutive 185 pregnant women were included in the study. The results obtained from MRI were compared with the results obtained by C-section. Cesarean section results were considered as standard. The treatment strategy was decided in accordance with the MRI findings. The treatment strategies which opt during the CS were compared with the strategy created on the basis of MRI.

Results: 115 women were diagnosed with abnormal placentation. The 70 women out of 185 were diagnosed with placenta previa. The percentage false results were seen in 18 patients. The false negative results of MRI were seen in three patients. After comparison between the findings of MRI and CS the sensitivity, positive predictive values and other parameters were calculated. The sensitivity was 97%, while the positive predictive value was 84%. The other parameters such as specificity were 79% and negative predictive value was 95%. The sensitivity, accuracy, and positive predictive values of the planning strategy created for treatment on the basis of MRI findings were calculated. There was significant correlation between the findings of MRI and CS.

Conclusion: For the future planning of treatment strategy for the women suspected of abnormal placentation, MRI is highly suggested diagnostic tool with better efficacy and sensitivity. This imaging modality helps in proper and accurate diagnosis of abnormal placentation.

Keywords: Abnormal placentation, obstetric complications, treatment strategy, placenta previa.

INTRODUCTION

The increasing ratio of obstetric complication such as abnormal placentation has raised the percentage of cesarean section deliveries. The placenta abnormally lies at the lower segment of uterine in a condition named as placenta previa¹. The abnormal attachment of the uterus to the placenta is the main cause of development of abnormal placentation. These complications create the challenging condition for the medics during delivery. At the time of delivery these placentation prevent the normal separation of placenta. These ultimately lead to uterine hemorrhage that is life-threatening in most of the cases. The risk of placenta previa in the women who has undertaken the prior cesarean section is double as compared to the others²⁻³. The 7% cases of mortality are reported resulted from abnormal placentation. In the other words, the risk of developing placenta accrete are higher in the women having prior placenta previa leading to operative bleeding conditions. Therefore preoperative planning are highly suggested for such patients. But the timely diagnosis of placental abnormalities is prominently required for such planning⁴.

The timely and accurately diagnosis of abnormal placentation is necessary to reduce the risk ratio of blood loss and other associated obstetric complications. The abnormal placentation are invasive, these invade to myometrium. The second commonly used name for abnormal placentation is Placenta accreta. The trophoblastic cells of placenta invade into endometrium. The main cause of invasion is defective decidua basalis. The risk of developing placenta accrete are higher in the women have placenta accrete⁵⁻⁶. The risk factor of prime importance that has significantly contributed to increase the cases of invasive abnormal placentation is cesarean section. Maternal age is also among the prominent risk factors. The undiagnosed

Placenta accrete leads to poor management during delivery that resulted in higher reported cases of mortality⁷.

The blood loss due to abnormal placentation can be life threatening in most of the cases. To avoid the further complication associated with placenta accrete, the early diagnosis of abnormal placentation is highly recommended. For evaluation of obstetric complications the ultrasonography is highly used. The multiplanar imaging modality MRI provide with the better organs evaluation images⁸. It's working principle based on generation of more stable images adventing from contrast resolution technique used. It is most accurate tool for diagnosis of abnormal placentation. For assessment of abnormal invasive placentation the MRI can more preferably used over ultrasonography⁹⁻¹⁰.

METHODS

The human ethic and investigation committee of the hospital approved the study. The consent was taken from the patients full filled the inclusion criteria of the study. This 06 months observational study was conducted from September 2021 to February 2022. The women suspicions of placental abnormalities were recommended with MRI. Then they undergo the hysterectomy or CS. The inclusion criteria were set. All the patients clinically diagnosed with abnormal placentation were included. The placental previa diagnosed women who undergo abortions were excluded from the study. The pregnant women having gestation period greater than 28 weeks were included in the present study. Those who were not diagnosed with antepartum bleeding were also excluded. The pregnant women who are sensitive to contrast agents were also excluded from the study. Those having abnormal blood coagulation also fail to pass the inclusion criteria of the study.

The pathological findings are the reference standard for placental abnormalities diagnosis. In this regard hysterectomy also plays the crucial role. The hysterectomy is not a routinely used procedure. Therefore the data obtained by performing cesarean section at the time of delivery was used for further analysis. The placenta that is easily removed during delivery without any obstetric complications is considered normal. In case the placenta had invasion in uterine serosa or the organs adjacent to it, the delivery become highly complicated and even impossible. In order to classify the degree of placental abnormalities, their location and accurate diagnosis the included patient undergo the MRI of the pelvis in accordance with the Siemens Medical System. The repetition time was set at 400-600 ms while the echo time was set at 5-30 ms. The 330x194 was the axial and sagittal plane matrix. The fast spin echo was set as 70-160ms. The matrix of 290x256 was used in sagittal, coronal and axial plane. The angle of flip was set at 90. The 380-410 mm was the field of view for all the sequences. The four observers were assigned with the task of dataset analysis. The 5 point scale was created for the data confidence. The 5 was given to those in which no placental abnormality was detected.

The 4 was assigned to the patients within range of probably absent AP. The three was assigned to the patients whose dataset was uncertain. The patient with probability of AP presence was

labelled as 2. Those having definite AP were marked as 1. All the patients in which AP was not diagnosed were labeled as negative. The data obtained from MRI was compared with the data obtained from CS. The treatment plan was created on the basis of data obtained from MRI. The patients in which there is no reported evidence of placental abnormalities invasion to adjacent organs, the placenta removal and uterus preservation was suggested as complete delivery plan. The occlusion of iliac artery helps to stop bleeding during C-section. In those pregnant women where placenta has invaded to uterine serosa, hysterectomy was suggested as treatment. The placenta left in-situ, a conventional treatment was suggested in cases of placenta accreta. For statistical analysis of data the chi-squared test was performed by using SPSS. The data obtained from MRI and CTA was compared with the data obtained during CS.

RESULTS

185 pregnant women with the gestation period greater than 28 weeks were included in the present study. The 26 years was the calculated mean age. 115 women were diagnosed with abnormal placentation by MRI, while 97 were diagnosed with abnormal placentation during delivery time. Out of 115 women, 70 was diagnosed with placenta previa.

Table 1: The comparison of data obtained from MRI and C-section

Abnormal placentation	Frequency	percentage	Diagnosed by CS	percentage	False positive results
Women diagnosed with abnormal placentation by MRI	115	62.2%	97	52.4%	18
Women without abnormal placentation on MRI	70	37.8%	67	36.2%	3
Total	185	100%	164	88.6%	21

Out of 70 women labelled with missing abnormal placentation complication the 3 were diagnosed with abnormal placentation during cesarean delivery (shown in table 1). The percentage accuracy of MRI is comparable with CS results. MRI was marked as 89% accurate, 97% sensitive, and 78% specific with negative predictive values of 95% and positive predictive values of 85%. (Shown in table 2)

Table 2: Showing the different statistically calculated parameters that determine the diagnostic efficacy of MRI

Serial No	The imaging modality MRI calculated parameters for diagnosis of AP and placenta previa in correlation with CS	percentage
1	Relative Accuracy	89%
2	Relative sensitivity	97%
3	Relative specificity	79%
4	Relative positive predictive value	85%
5	Relative negative predictive value	95%

The 182 patients undergo complete C-section deliveries, while other 2 undergo incomplete delivery. The incomplete deliveries were planned for six patients, four out of which undergo complete delivery by occlusion of iliac artery and embolization of uterine artery. Hysterectomy was planned for four patients, out of which 3 undergo complete CS delivery by using above methods. The accuracy of planned treatment strategy created by evaluating the data obtained from MRI was 97%. The treatment strategy for remaining 3 percent changed at the time of delivery according to the required conditions.

DISCUSSION

The increasing rate of cesarean deliveries has increased the percentage ratio of obstetric complications. The placental abnormalities incidence has raised to one in every 550 deliveries. When the placenta invaded into the myometrium lining of the placenta it is called as placenta increta. It has major share in increased mortality rates. In this type of placental invasion, the placenta don't invade into adjacent organs. The postpartum hemorrhages cases have raised because of undiagnosed placental abnormalities¹¹⁻¹². These ultimately lead to coagulopathy in the

survived patients. The need of the hour is to improve the diagnostic techniques involve in screening of placental abnormalities. This not only decreases the percentage mortality cases, but also provide with the better treatment strategies¹³.

The first-line imagining modality that is highly used for screening of placental invasion is ultrasonography. The accuracy of this modality has been further increased by using color doppler reconstructed images. The trans-vaginal approach facilitates the ultrasonography by increasing accuracy of results. During abnormal invasive placentation there is an increased in vascularity with the extension of bridging vessels to bladder¹⁴. The myometrium echogenicity raises and placenta lacunae develop. The ultrasonography is readily available technique and inexpensive. As compare to MRI, the ultrasonography is easier to perform. The ultrasound normally give false negative results, as it failed to diagnose placental abnormalities in many cases. Therefore for more accurate and precise location of placental abnormalities the MRI is preferably used. It is the safest alternative of ultrasonography. The surgical planning created based on MRI reduces the death ratio¹⁵⁻¹⁶. Sometimes non-ambiguous results are obtained after ultrasonography, therefore the such patient recommended to undergo the MRI for better evaluation and results. The diagnostic efficacy of MRI was evaluated in present study. It is a comparative study in which findings of MRI are compared with CS findings and the parameter that are measure of diagnostic efficacy are calculated. The sensitivity of MRI was observed to be 97% , while specificity was observed to be 79% in the present study¹⁷. In a study conducted by Iqtadar et al., the sensitivity was observed to be 84%. The results of present study are comparable to their results. The specificity of the MRI, in a study conducted by El-Assaly was observed to be 100%. Hazem et al., calculated the sensitivity of MRI in diagnosis of placental abnormalities to be 100%. The Wang et al., in his study reported sensitivity of MRI to be 88% with specificity percentage of 96%. A similar study was conducted by Sattar et al., and he concluded with the 88% sensitivity and 85% specificity of MRI in diagnosis of placental abnormalities¹⁸.

MRI is highly recommended in many studies to predict the stages of placental abnormalities. The study conducted by Aitken

et al., also depicted that the MRI is more accurate for diagnosis of placental abnormalities. The findings of ultrasound are less accurate and sensitive. For better assessment of location and degree of placental abnormalities the MRI used¹⁹. The diagnostic accuracy of MRI depends on certain factors, it changes with varying factors. The skill of radiologist reading the images of MRI has the major impact on the diagnostic accuracy and results. The more skilled radiologist read the images more clearly. So it is concluded that the human error affects the accuracy of ultrasound and MRI²⁰⁻²¹.

Hence it was founded that for early diagnosis and better evaluation of placental abnormalities, the MRI is the superior and highly recommended imaging modality. The diagnostic criteria for MRI are set in the cases of invasive abnormal placentation. The diagnostic accuracy of MRI is more in determination of posterior placentation²².

CONCLUSION

MRI is highly suggested diagnostic tool for the planning of treatment strategy of the women suspected of abnormal placentation. It has better efficacy and enhanced sensitivity. This imaging modality is preferable over ultrasonography for accurate diagnosis of abnormal placentation especially placenta previa and increta.

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