Original Article

Detection of Suspected Placental Invasion by MRI - A Prospective Study in a Tertiary Care Hospital

Sadaf Nasir, Saleha Anwar and Bushra Rehan

ABSTRACT

Objective: To evaluate the diagnostic value of MRI features used for detecting suspected placental invasion.
Study Design: Prospective / Observational study
Place and Duration of Study: This study was conducted at the Radiology Department Liaquat National Hospital and Medical College, Karachi June 2015 to December 2017.
Materials and Methods: All the patients referred to MRI department for the evaluation of placental invasion over 18 months and then went for surgery were included in the study. MRI images of all the patients who met the inclusion criteria were evaluated for placental invasion according to the established MR criteria and the findings were correlated with surgical findings.
Results: Total 9 patients met the inclusion criteria with a mean gestational age of 32 weeks. All of these patients had placenta previa and history of multiple previous C-sections. Placental invasion was proven (both surgically and pathologically) in 5 cases (55%). Out of which 3 had pathologically proven increta (60%), one had pathologically proven accreta (20%) and one had pathologically proven percreta (20%). MR evaluation of these patients showed focal interruption of myometrial band, thick intra-placental bands, heterogenous signal intensity of placenta and focal uterine bulging. The MR features of 4 non-invasive placentas include prominent flow voids on fetal and maternal surface of placenta and focal interruption of retro-placental myometrial border. One of the patient had thin intra-placental band.
Conclusion: We found that focally interrupted myometrial border was found to be the least sensitive MR feature. Thick intra-placental bands, heterogenous placental signal intensity and disorganized intra-placental vessels were the sensitive MR features for invasion.

Key Words: MRI pelvis, placenta previa, placenta accrete, placenta percreta, placenta increta.

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INTRODUCTION

Placenta accreta is abnormal placentation in which placenta is either abnormally adherent or invaded into the uterine myometrium. It is further classified into three entities namely placenta accreta vera, placenta increta and placenta percreta, based on depth of placental invasion into the myometrium. 'Placenta accreta vera' refers to abnormally attached placenta to myometrium without definite evidence of invasion.'Placenta increta' refers to invasion of placenta into the myometrium, without crossing the serosal surface of placenta.' Placenta percreta' refers to invasion of placenta through whole thickness of myometrium with disruption of the serosal layer with or without invasion of adjacent pelvic viseras.[1,2]

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The two most common risk factors are placenta previa and previous cesarean section and its prevalence is rising because of the rising percentage of cesarean section and advanced maternal age.[3,4]
Accurate prenatal diagnosis allow optimal obstetric management. Ultrasound remains the first line modality for the diagnosis of placenta accreta. MRI is used in equivocal cases for the evaluation of posterior placentas.[1,2,3]
The aim of our study is to evaluate the diagnostic value of MR features for detecting suspected placental invasion in our population.

MATERIALS AND METHODS

The design of our study is prospective observational. All patients who came to our institution with suspicion of invasive placenta from June 2015 to December 2017 were included in the study. Pelvic MRI of all of these patients was performed using 1.5T MR unit (Toshiba).
MR protocol used includes: fast spin echo T2 weighted images in axial, sagittal and coronal planes, T1 weighted images in axial and sagittal planes, STIR in axial, sagittal and coronal planes. For all the above-mentioned sequences the slice thickness was 4mm –

5mm with a 1mm gap and FOV was 350- 400mm. To reduce the respiratory artifacts we use the breath holding technique. We did not use any intravenous MR contrast. All MR images were reviewed according to the established MR criteria for placental invasion previously described in literature. It includes following features: (1) focal uterine bulging (a focal outward bulge or disruption of normal pear shaped myometrium of uterus), (2) heterogenous signal intensity of placenta (due to intra-placental hemorrhages), (3) dark thick intra-placental bands (nodular or linear areas of low SI on T2 weighted images, usually extend from the uterine–myometrial surface and have varying thickness and random distribution), (4) focally interrupted myometrial border (lack of myometrium at the site of placental invasion), (5) tenting of urinary bladder wall (represents bladder wall invasion) and (6) direct invasion of pelvic organs.

MRI findings were correlated with surgical findings and/or surgical pathology. Those patients whose surgical record were not available for correlation were excluded from the study.

Statistical analysis was performed using SPSS for windows version 2

RESULTS

11 pregnant patients underwent MRI for suspicion of placental invasion with a mean gestational age of 32.7 weeks and mean age of the women was 31.7(+-2.4) years. 2 (18%) out of 11 patients were excluded from the study due to unavailability of surgical records, as these patients were lost to follow up. The rest of 9 patients were followed till their time of delivery. All these patients had placenta previa and history of multiple C-sections (table 1). 5 (55%) out of 9 patients had proven placenta accreta either surgically or pathologically and all these patients underwent hysterectomy. In 4 (44%) out of 9 patients no placental invasion was found at surgery and the placenta was removed manually without any bleeding complication so there was no need of hysterectomy in these patients. Out of 5 positive cases 3 patients had pathologically proven placenta increta, one patient had pathologically proven percreta and one had pathologically proven accrete vera.

MR evaluation of cases is summarized in table 2. MRI of all invasive placentas shows thick dark intra-placental bands, heterogenous placental signal intensity and focal interruption of retro-placental myometrial band. Focal uterine bulging was seen in 3 out of 5 patients. There is invasion of placenta into adjacent pelvic organs in one patient. MRI evaluation of non-invasive placentas show focal interruption of retro-placental myometrial band in 3 patients and thin dark deep intra-placental band in 1 patient.

Table No.1: Details of patients with placenta previa and history of multiple C-sections

Patients age in yrs (n=9)	Gestational age in weeks	Placental previa	Previous C-section
35	30	Complete, central	2
28	31	Anterior, marginal	3
33	35	Complete, posterior	3
32	34	Complete, posterior	3
30	32	Complete, posterior	1
32	33	Complete, central	2
29	33	Posterior, marginal	2
35	30	Complete, posterior	3
32	37	Complete, anterior	4

Table No.2: Details of patients underwent hysterectomy

Patient's age in years	Surgical/ H/P diagnosis of placenta	MRI findings					
		Focal uterine bulging	Heterogenous SI of placenta	T2 dark bands	Focal inter-ruption of myometrium	Tenting of UB	Infiltration of pelvic organs
35	Percreta	Yes	Yes	Large	Yes	Yes	Yes
28	Normal	No	No	Small	Yes	No	No
33	Increta	Yes	Yes	Large	Yes	No	No
32	Increta	Yes	Yes	Large	Yes	No	No
30	Normal	No	No	No	Yes	No	No
32	Increta	No	Yes	Large	Yes	No	No
29	Normal	No	No	No	No	No	No
35	Accreta vera	No	Yes	Small	Yes	No	No
32	Normal	No	No	No	Yes	No	No

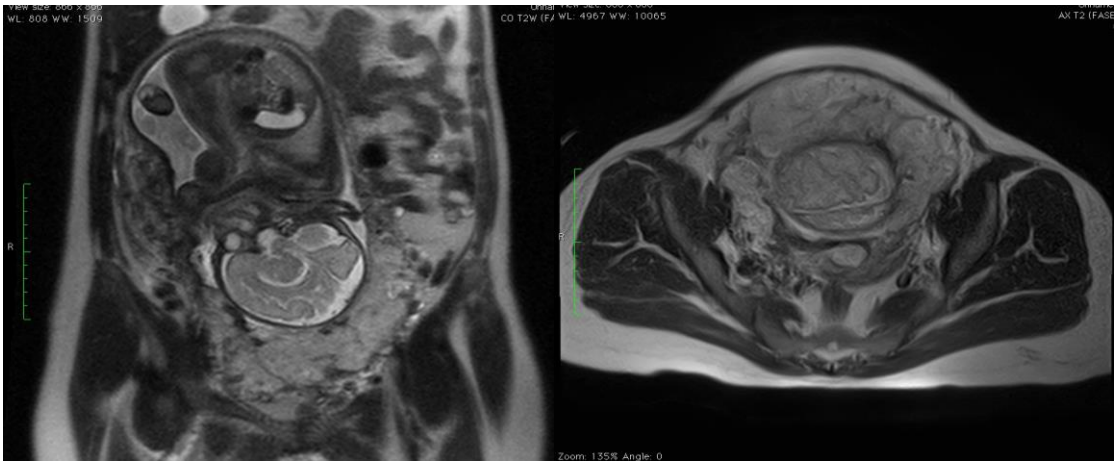

Figure No.1: T2 weighted coronal and axial MRI images of one the patient with invasive placenta, showing heterogeneous placenta with focal uterine bulging and multiple thick intra-placental bands

Diagnostic value of 5 observed MRI-features in invasive and non-invasive placentas is demonstrated in table 2. Dark deep intra-placental bands and heterogenous signal intensity of placenta are the 2 most significant MR features for detecting placental invasion (p-value = 0.008 for each feature) and the focal interruption of retro-placental myometrial band was found to be the least sensitive MRI feature (p-value=0.444).

DISCUSSION

Placenta accreta this risk increases to 67% in women with placenta previa along with previous three or more cesarean sections[7]. A pregnancy following a previous placenta accreta is at increased risk for severe placental attachment. It occurs when the chorionic villi (CV) of placenta invades the myometrium abnormally due to defect in the decidua basalis[5]. Placenta accreta is used as a broad term for invasive placentation and is classified on the basis of the degree of myometrial invasion into 3 entities namely: Placenta accrete vera, Placenta increta and Placenta percreta. In placenta accrete vera, the mildest form, chorionic villi are attached to the myometrium but do not invade the muscles. In placenta increta chorionic villi invades the myometrium partially while in placenta percreta, the most severe form, there is complete invasion of myometrium through uterine serosa into adjacent pelvic organs[4, 5].

Previous cesarean delivery and placenta previa are the two most common risk factors for placenta accreta[6]. In women with placenta previa there is 24% risk of placenta accreta and maternal outcomes such as recurrent accreta, uterine rupture, and peri-partum hysterectomy [(8)] . In our study all patients with invasive placentas had history of at least 2 previous C-sections which itself is a grave risk factor.

The accurate prenatal diagnosis of invasive placenta reduces the morbidity, complication rate and length of hospital stay as it allows optimal obstetric management (deciding the time of delivery and site of surgical incision), proper patient's counselling and planning for the type of resources needed at the time of delivery (including arrangement of blood products, recruitment of skilled surgical and anesthesia team, possible intervention guided procedures like uterine artery embolization and post operative intensive care unit[1,3].

Grey scale and color Doppler ultrasound of placenta remains the most commonly used and first line imaging modalities for the diagnosis of placental invasion as it is inexpensive, widely available and cost effective[2,4]. As ultrasound is operator dependent there is a wide variation in accuracy of grey scale and color Doppler ultrasonography in prenatal diagnosis of placenta accreta with sensitivity varying 33% to 100%[9-14]. There are limitations of ultrasound in diagnosis of placental invasion in cases of large body habitus and posterior placenta resulting in equivocal ultrasound findings [(3,4)].

Magnetic resonance imaging (MRI) is another diagnostic tool and has been widely used for further improving the prenatal diagnosis of placenta and acts as a problem-solving tool in cases of equivocal ultrasound findings[15]. Several MR features have been described in literature for the diagnosis of placenta accreta and among these features some are consistently associated with placental invasion[1-4].

In 2013 Alamo et al[3] stated that the combination of four imaging features increases the specificity of MRI. These four features are the T2-hypointense intra-placental bands, a focally interrupted myometrial border, infiltration of the pelvic organs and tenting of the bladder wall, the so-called "gold combination" in their study. In our study the tenting of urinary bladder wall and infiltration of pelvic organs were found only in one patient with surgically proven placenta percreta where as the focal uterine bulging and focal interruption of myometrium are found to be sensitive MR features in diagnosing placental invasion. The results of Alamo, et al.[3] suggests that reorganisation of myometrium/

placental interface to comment on focal interruption of myometrium requires experience in evaluation of placental MR studies and they recommend to perform MRI for placental invasion before 35 weeks of gestational age for better diagnosis.

In concordance with the MR imaging findings of Derman et al. in 2011[2] and Lax et al[16], we also found the thick dark intra-placental bands and heterogenous signal intensity in all invasive placentas.

Mansur, et al in 2011[4] conclude that MRI hand in hand with ultrasound is important for accurate diagnosis of placenta previa and seriously coexisting placenta accrete.

CONCLUSION

In conclusion we found thick dark intra-placental bands, heterogenous signal intensity of placenta and focal uterine bulging as the most reliable MR features. Focal interruption of retro placental myometrium was also identified at the sites of placental invasion but it was also seen in non-invasive placentas probably due to marked thinning of myometrium at the site of previous scar.

Author's Contribution:

Concept & Design of Study:	Sadaf Nasir
Drafting:	Saleha Anwar
Data Analysis:	Bushra Rehan
Revisiting Critically:	Sadaf Nasir, Saleha Anwar
Final Approval of version:	Sadaf Nasir

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

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