The value of MRI features in the evaluation of suspected placenta accreta postpartum

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Aims and objectives

Placenta accreta (PA) occurs when a defect of the decidua basalis allows the invasion of chorionic villi into the myometrium. Placenta accreta, increta and placenta percreta, three grades of abnormal placental attachment, are defined according to the depth of myometrial invasion by the chorionic villi. In placenta accreta vera, the mildest form of PA, chorionic villi are attached to the myometrium but do not invade the muscle. In placenta increta, chorionic villi partially invade the myometrium. The most severe form is placenta percreta, in which chorionic villi penetrate through the entire myometrial thickness or beyond the serosa (1).

These three conditions are potentially life-threatening disorders and are an important cause of peripartum morbidity and mortality (2). There is an increased risk of damage to adjacent visceral structures and of severe postpartum haemorrhage, requiring multiple blood transfusion and hysterectomy. The exact incidence of maternal mortality related to placenta accreta and its complications is unknown, but has been reported to be as high as 6-7% in case series and surveys (3-5). Therefore, early and accurate preoperative diagnosis of placenta accreta and the correct identification of the topography of placenta accreta are crucial in minimizing risks and planning a safer surgery.

Ultrasonography (US) has been the primary diagnostic tool for PA and has been shown to help detect this disorder in 50%-80% of cases (6-8) but the results of which might be unreliable for posterior placenta or when estimating the degree of placenta.

It has also been reported that MRI is better than US in posterior location of placenta or in patients with prior myomectomy, or with placenta praevia(9-11).

Although there have been several studies that evaluated the efficacy of MRI in the prenatal placenta accrete (1,12,13), few studies to describe the features of placenta accrete postpartum MRI.

The aim of the present study is to review our initial experience using magnetic resonance imaging (MRI) for assessment of placental increta postpartum and present a review of specific MRI features that may reliably predict placental increta.
Methods and materials

Between August 2010 and September 2013, we retrospectively reviewed the MRI examinations of 16 patients with clinical and histopathologically confirmed to have placental increta in our radiology department. The institutional review board did not require approval or the patients’ informed consent for the review of medical records and MRI examinations.

MRI Technique

The MRI imaging examinations were performed using a 1.5 Tesla (T) unit scanner (Signa HDxt; General Electric Medical Systems, GE Healthcare, USA) with a phased-array body coil. All patients were supine position and feetfirst for the examination. Axial, coronal, and sagittal spin-echo T1-weighted imaging (TR: 530-700 ms, TE: 11 ms; slice thickness, 5-8 mm; gap, 0.5 mm; field of view, 400 x 370 mm; and matrix, 288 x 192 mm) were performed. And axial, coronal, and sagittal fat-suppressed fast spin-echo T2-weighted images (TR: 3700-5000 ms, TE: 86-134 ms; slice thickness, 5-8 mm; gap, 0.5 mm; field of view, 400 x 370 mm; and matrix, 288 x 192 mm) were also obtained. Contrast-enhanced MR imaging was performed in all 16 patients after manual IV administration of 0.1 mmol/kg of gadopentetate dimeglumine (Magnevist, Bayer Schering Pharma) into an antecubital vein and fat-suppressed spin-echo T1-weighted images in the axial, coronal, and sagittal planes using the same parameters as the unenhanced images were obtained.

MR Image Interpretation

MR image interpretation was evaluated by two experienced radiologists. These radiologists did not have knowledge of the clinical and histopathologic findings and surgery findings. All images were analyzed on a workstation (GE Healthcare, USA). MR image interpretation of placenta included the size, shape, location, and the extent of attachment to the uterus myometrium. Placenta shape was categorized as round, ovoid, lobulated, or irregular. MRI features of the internal characteristics of placenta increta were analyzed in terms of signal intensity on the T1- and T2-weighted MR images. On T1-weighted and T2-weighted images, compared with the signal of the outer layer of the myometrium on the same scanning sequence, placenta increta were assessed as having high, low, or mixed signal intensities relative to myometrium. The homogeneity or heterogeneity of placenta increta was estimated. Finally, patterns of contrast enhancement were recorded. The enhancement pattern were categorized as homogeneous and heterogeneous enhancement. The degree of enhancement compared with the myometrium was analyzed as follows: marked, moderate, and poor.
The myometrial thickness of the attachment and opposite site were measured and analyzed. The size of uterus were also recorded.

We then retrospectively reviewed their clinical records for pertinent information including the mean age of the patient, the cause, the average gestational age, parity, relevant history of previous uterine surgery or caesarean delivery, and treatment.
Results

Clinical Features

The patients were 24-40 years old, at the time of diagnosis with average age 31.1 years old. Postpartum placenta could not be discharged or incomplete discharged in 9 cases (7 patients were at the first delivery and 2 patients were at the second delivery; 3 patients had cesarean deliveries and 6 patients had spontaneous vaginal delivery); spontaneous abortion or medium-term abortion were in 7 cases. The mean term was 28.4 weeks (range: 12-39 weeks). 7 patients had history of previous uterine interventional procedures (cesarean sections in 2 patient, dilatation & curettage in 4 patients and myomectomy in one patient). 3 (18.8%) out of the 16 women had placenta previa.

MR Imaging Features

Uterus enlarged in various degrees (range from 6.4cm*4.7cm*7.0cm to 15.1cm*7.8cm*16.0cm on MRI) and the junctional zone became thinner locally or discontinued. The thickness of the myometrium of the attachment side was 4±7mm; The thickness of the myometrium of the opposite side was 15±19mm; and in all cases, the myometrium of the attachment side was thinner than that of the opposite side. Lesions invaded close to perimetrium in 5 cases and were located within muscular layer basically in 11 cases. Placenta increta (Fig1-2) showed that the placental tissue invaded the myometrium in the shape of "round" and "irregular lobulated". The location of placenta were in bottom of the uterus (13 cases) or anterior or posterior uterine body (3 cases), the size of placenta increta range from 3.5cm*2.9cm*3.3cm to 8.5cm*6.8cm*7.0cm on MRI. Compared with the signal of the outer on the same scanning sequence, on T1WI, the placental signals showed isointense or iso-hyperintense and the dividing line between the placenta and layer of the uterine myometrium all was indistinct; while on T2WI, 13 patients showed mixed hyperintense with a few dark intraplacental spotted or linear bands, and 3 patients showed uniform hyperintense#All 16 cases received enhanced MR scan. On Gadolinium-enhanced T1WI#placentas were heterogeneous enhancement significantly#appeared to be "rosette or petal-like" or "nodular" enhancement. The necrotic area was not enhanced#sometimes depicted as "aperture shape". The degree of enhancement compared with the myometrium was classified as marked in 5 of 16 patients, moderate in 9 of 16 patients, and poor in 2 of 16 patients.

Treatment
Treatment consists of hysterectomy (in 1 patients), uterine artery embolization (in 6 patients), curettage (in 4 patients) and drug conservative treatment (in 5 patients).
Fig. 1: 1 A, B,C: Placenta accrete. The 20th day after abortion. A: Sagittal SE T1WI: The placental signals were isointense or slightly hyperintense. B: Sagittal fat-suppressed FSE T2WI: placenta had hyperintense signal and surrounding by vessel. C: enhanced Sagittal T1WI. The intensity of placental enhancement was similar to enhancement degree of myometrium and the placental tissue was confluent with the uterine myometrium (arrow).

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Fig. 2: A, B, C: Placenta accrete. The 20th day after abortion. A: Sagittal SE T1WI: The placental signals were isointense or slightly hyperintense. B: Sagittal fat-suppressed FSE T2WI: placenta had hyperintense signal and surrounding by vessel. C: enhanced Sagittal T1WI. The intensity of placental enhancement was similar to enhancement degree of myometrium and the placental tissue was confluent with the uterine myometrium (arrow).
Fig. 4: 1 A, B,C: Placenta accrete. The 20th day after abortion. 1 A, B,C: Placenta accrete. The 20th day after abortion. A: Sagittal SE T1WI: The placental signals were isointense or slightly hyperintense. B: Sagittal fat-suppressed FSE T2WI: placenta had hyperintense signal and surrounding by vessel. C: enhanced Sagittal T1WI. The intensity of placental enhancement was similar to enhancement degree of myometrium and the placental tissue was confluent with the uterine myometrium (arrow).

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Fig. 3: 2. Placenta accrete. The 12th day after spontaneous vaginal delivery. A: Axial SE T1WI: The placental signals were isointense. B: Axial fat-suppressed FSE T2WI: placenta had heterogeneity hyperintense signal. The myometrium of the attachment side was thinner than that of the opposite side. C: enhanced Axial SE T1WI. The intensity of placental enhancement was similar to enhancement degree of myometrium, appeared to be "nodular" enhancement, with a few dark intraplacental linear bands.

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**Fig. 5:** 2. Placenta accreta. The 12th day after spontaneous vaginal delivery. A: Axial SE T1WI: The placental signals were isointense. B: Axial fat-suppressed FSE T2WI: placenta had heterogeneity hyperintense signal. The myometrium of the attachment side was thinner than that of the opposite side. C: enhanced Axial SE T1WI. The intensity of placental enhancement was similar to enhancement degree of myometrium, appeared to be "nodular" enhancement, with a few dark intraplacental linear bands.

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Fig. 6: 2. Placenta accrete. The 12th day after spontaneous vaginal delivery. A: Axial SE T1WI: The placental signals were isointense. B: Axial fat-suppressed FSE T2WI: placenta had heterogeneity hyperintense signal. The myometrium of the attachment side was thinner than that of the opposite side. C: enhanced Axial SE T1WI. The intensity of placental enhancement was similar to enhancement degree of myometrium, appeared to be "nodular" enhancement, with a few dark intraplacental linear bands.

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Conclusion

In the present study, the location of placenta were in bottom of the uterus (13 cases) or anterior or posterior uterine body (3 cases). 3 (18.8%) out of the 16 women had placenta previa. Only two patients had history of previous cesarean sections, and the location of placenta was not at the site of the scar. This could be related to the small number of patients (16 patients) recruited into the study.

MRI can be a useful adjunct to ultrasound in diagnosing placenta accreta postnatally and can accurately evaluate placental configuration, the extent of placental accreta and the location and deepness of placental invasion. It is a kind of auxiliary diagnostic tool ideally.

Limitations

There are several limitations to this study. First, it is a retrospective study and contains a small sample size. As a consequence, our results should stimulate further prospective and controlled trials including more patients. The second limitation relates to the retrospective design of our study. In the future, further studies should be performed by using dynamic gadolinium contrast enhanced MRI. Features of dynamic contrast enhancement should be evaluated. MRI can be a useful adjunct to ultrasound in diagnosing placenta accreta postnatally and can accurately evaluate placental configuration, the extent of placental accreta and the location and deepness of placental invasion. It is a kind of auxiliary diagnostic tool ideally.
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