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Case Report

Diagnosis of abnormally invasive posterior placentation: the role of MR imaging

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ABSTRACT

Abnormally invasive placentation is becoming more common with a recent increase in cesarean sections and maternal age, among other risk factors. Ultrasonography is the first line-imaging, but it can be difficult to diagnose when limiting factors are present. Failure to recognize this serious placental abnormality precludes us from making the appropriate plan for the delivery and consequently can lead to fatal results. In this report, we present a case in which magnetic resonance imaging was used to diagnose posterior placenta increta missed by multiple sonographic examinations in a patient with previous myomectomies, and we also include a review of the literature on this topic. It is our conclusion that magnetic resonance imaging is superior to sonography to diagnose abnormally invasive placentation in cases of posterior placenta previa and high pretesting probability.

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Introduction

Abnormally invasive placentation (AIP) has had a recent rise because of the increased rate of multiple risk factors including advanced maternal age, previous cesarean section, multiparity, myometrial scarring from prior uterine surgery, and placenta previa. AIP occurs when the placenta has an abnormal attachment to the uterus, invades into the myometrium, or invades through the uterus to attach to nearby organs. Any disruption in the decidua of the uterus increases the risk of AIP. With a maternal mortality as high as

7% reported in cases with AIP [1], it is critical to make an accurate and early diagnosis that allows us to take the appropriate measures approaching the delivery. For many years, ultrasound has been the first imaging modality used in the assessment of AIP. However, it is limited by several factors including the patient's body habitus, a posteriorly located placenta, and the skills of the ultrasound operator. These limitations are practically eliminated by magnetic resonance imaging (MRI), which is emerging as an accurate diagnostic test of AIP. The following case and review of the literature discuss the role that MRI plays in the diagnosis of AIP,

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specifically in pregnancies with posterior placenta and risk factors for AIP.

Case report

The patient was a 37-year-old G2P0A1 obese woman (body mass index 41.4 kg/m²) presenting for an initial prenatal visit with a singleton intrauterine pregnancy at 9^{0/7} weeks gestation conceived by in-vitro fertilization. Her past obstetric history was significant for a twin pregnancy loss at 14 weeks managed by a dilation and curettage procedure. Her surgical history was remarkable for 2 prior myomectomies in the posterior uterine wall.

Her pregnancy course was complicated by multiple episodes of vaginal bleeding. The first episode occurred at 12^{4/7} weeks of gestation that resolved spontaneously. She was admitted to the hospital at 19^{1/7} weeks because of a new episode of vaginal bleeding. During this period, she had 2 abdominal and transvaginal ultrasound examinations at 16 and 19 weeks of gestation that showed a posterior placenta previa without evidence of accreta.

She experienced another episode of heavy vaginal bleeding at 20^{5/7} weeks requiring transfusion of 2 units of blood. An abdominal-pelvic MRI was then obtained to further assess the possibility of AIP. The MRI revealed a complete placenta previa with the placenta located posteriorly and inferiorly within the uterus (Fig. 1). The placenta was heterogeneous inferiorly and posteriorly in the lower uterine segment. Abnormal low signal intensity bands were identified on T2-weighted images within the posterior uterus near the site of the patient's myomectomy (Fig. 2). In addition, prominent periuterine vasculature was identified about the lower uterine segment, appearing as

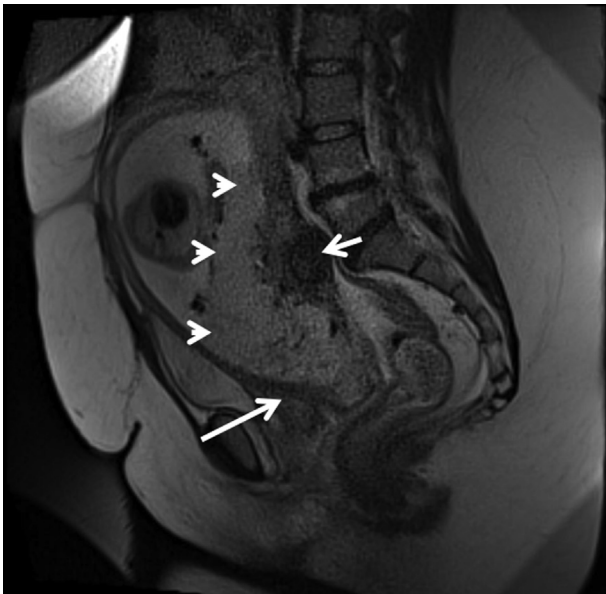


Fig. 1 – Half-Fourier acquisition single-shot turbo spin-echo (HASTE) magnetic resonance imaging (MRI). Sagittal section depicting the posteriorly located placenta (arrow heads) covering the internal os of the cervical canal (long arrow) as well as the posterior myomectomy site (short arrow).

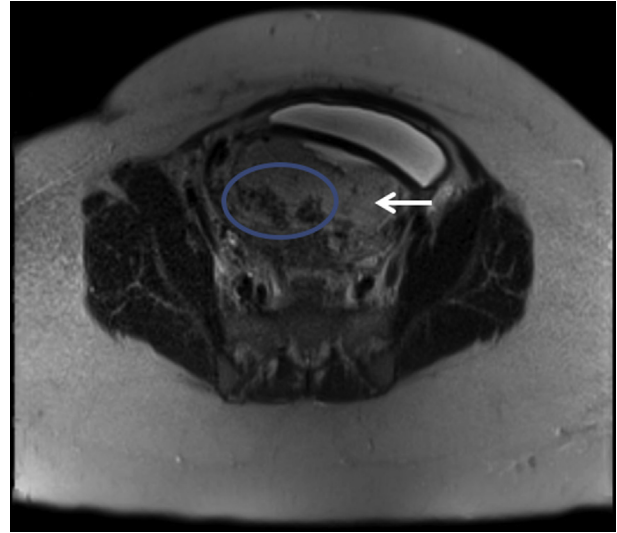


Fig. 2 – T2-weighted axial MRI. This image depicts dark T2 bands (circled) posteriorly in the placenta (arrow).

tubular high signal intensity structures on TrueFISP sequences (Fig. 3). No frank transmural extension of placenta or placental vascularity was identified. The constellation of findings was highly suggestive of placenta accreta or increta. The placenta located cephalad to the myomectomy site demonstrated normal signal intensity with a normal underlying myometrial interface. The site of prior myomectomy was well delineated at MRI, appearing as a 3.5 cm well-defined area of low T2 signal intensity within the posterior lower uterine segment (Fig. 4). A T1-weighted image also demonstrated small retroplacental hematomas superior to the myomectomy site. Interestingly, another transvaginal ultrasound performed at 24 weeks still could not identify any signs of AIP (Fig. 5).

Her next episode of significant active vaginal bleeding occurred at 25 weeks that continuously progressed and delivery by cesarean section was then indicated. Her surgery was performed by a multidisciplinary team including a gynecologist oncologist, a maternal-fetal medicine specialist, and a general gynecologist. The preparation included 2 large peripheral IV lines, one central IV line, and blood products were in the room for immediate transfusion. Intraoperatively, a gravid uterus was identified with significant levorotation because of posterior adhesive disease involving the sigmoid colon. The sigmoid colon was noted to be densely adherent to the posterior aspect of the uterus and the posterior cul-de-sac was obliterated. The adnexa were densely adherent to the surrounding tissue bilaterally. In addition, the bladder was adherent to the anterior surface of the uterus to the level of the round ligaments bilaterally. The infant was delivered through a high transverse hysterotomy. The placenta was not removed given the high index of suspicion for AIP, and she underwent a total abdominal hysterectomy and extensive lysis of adhesions. She received multiple units of blood products intraoperatively. Her postoperative course was complicated by ileus and one febrile episode. She was discharged home on postoperative day 5 in a satisfactory clinical condition.

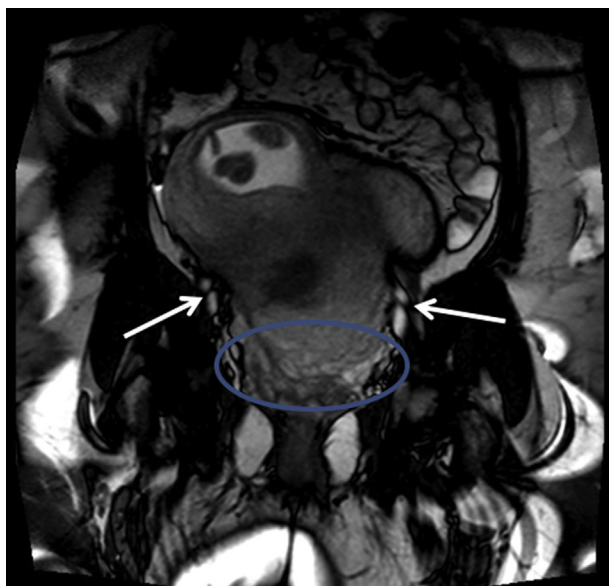


Fig. 3 – TrueFISP. Coronal image demonstrating flow within iliac vessels (arrows) and prominent periuterine vessels surrounding the lower uterine segment (circled).

Histopathologic analysis demonstrated extension of chorionic villi into myometrial smooth muscle fibers, consistent with placenta increta (Figs 6A and B).

After delivery, the infant was intubated at 2 minutes of life. Apgar scores were 2, 5, and 7 at 1, 5, and 10 minutes of life, respectively. The infant was admitted to the level 3 neonatal intensive care unit. Birth weight was 815 g (42nd percentile). The infant was extubated on day of life (DOL) 38 to continuous positive airway pressure and weaned to room air on DOL 49. Infant was discharged home on DOL 84.

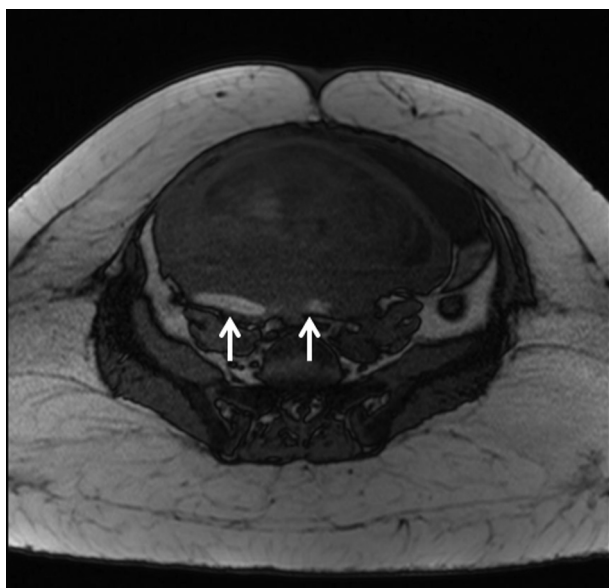


Fig. 4 – T1-weighted gradient echo MRI image. This image demonstrates 2 small areas of high signal periplacental hemorrhage (arrows).

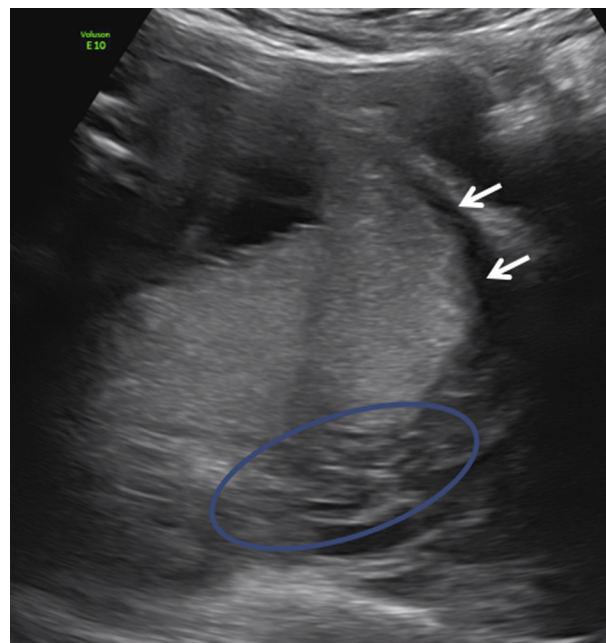


Fig. 5 – Transabdominal ultrasound image of the placenta. This image demonstrates a normal subplacental clear space laterally (arrows) with subtle potential loss of the clear space overlying the myomectomy site (circle).

Discussion and review of the literature

The increased incidence of placental invasion is largely attributed to the increased rate of cesarean deliveries in the last 2 decades, and the estimated rate is as high as 1 in 550 pregnancies [2–4]. Placenta increta, where the chorionic villi invade the myometrium, but do not involve the serosa or the adjacent organs, can be a major contributor to increased maternal morbidity and mortality [5]. If undiagnosed or unrecognized at birth, this can cause significant postpartum hemorrhage resulting in coagulopathy and in the worst-case scenario maternal death [5,6]. Therefore, every effort needs to be made to screen and diagnose this complication if sufficient risk factors are present.

Sonography is the first line diagnostic measure in assessing for placental invasion, and color Doppler images along with transvaginal imaging have been able to increase its diagnostic accuracy. The most important sonographic features of AIP include increased vascularity with bridging vessels extending to the bladder, an increase in echogenicity of the myometrium, the presence of placental lacunae, and a loss of the placental and/or myometrial hypoechoic delineation [7]. However, in our case, none of these features were appreciated prospectively, although subtle loss of retroplacental clear space may have been present, only seen in retrospect (Fig. 5). Despite the negative ultrasound findings of AIP, there was a strong consideration to perform an MRI given the presence of multiple risk factors for placental invasion. Diagnostic features at MRI were invaluable, potentially averting a catastrophic outcome.

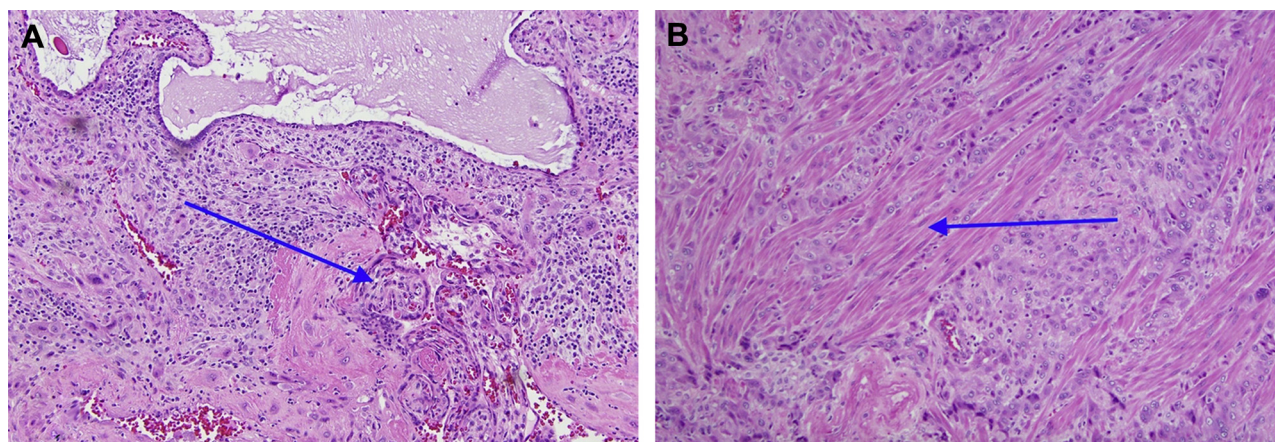


Fig. 6 – Hematoxylin and eosin stained pathology slides. These demonstrate (A) chorionic villi infiltrating into the uterine wall (arrow) at 40× magnification and (B) chorionic villi infiltrating between myometrial smooth muscle fibers (arrow) at 200× magnification.

Many authors believe that MRI is indicated in the setting of an equivocal ultrasound if the patient continues to experience symptoms (ie, bleeding) or if there are multiple risk factors in the patient's history [2,8]. Although ultrasound is a useful first-line imaging modality, its dependence on operator skill, limitations in the setting of obesity, and poor performance in detection of posterior placental invasion limit its accuracy and effectiveness. MRI is considered to be a safe alternative and has the capability to accurately reveal possible sites of abnormal placentation, especially in cases of large body habitus or posteriorly located placenta [5,8]. A recent study performed by Aitken et al [2] concluded that MRI was significantly better than ultrasound in predicting stage of invasive placentation. They also concluded that any patient who has suspected invasive placentation on ultrasound imaging should undergo further imaging with MRI to best assess and guide surgical management. Although not all centers perform MRI in all cases of suspected AIP, our case effectively illustrates the utility and indications of this imaging modality.

Just as the skill of the ultrasound operator dictates the accuracy of a diagnosis, the skill of the radiologist reading the MRI also impacts the accuracy of the diagnosis. A high level of expertise of the reading radiologist is needed to appreciate subtle imaging abnormalities. Normal MRI appearance of the myometrium demonstrates a trilaminar delineation where a thicker and slightly more hyperechoic middle layer is flanked by thinner inner and outer layers [5]. Any interruption in these layers can signify placental invasion. However, in practice, thinning of the myometrium during later stages of pregnancy makes assessment of myometrial layers difficult at best. Therefore, other imaging findings have been shown to be more useful, including dark intraplacental T2 bands, uterine bulging in localized areas, loss of a clear interface between uterus and surrounding organs, as well as a heterogeneous signal intensity in the placenta [7–9]. Although there are no set diagnostic MRI criteria for absolute diagnosis, certain findings can help to indicate the presence of AIP [8]. The more findings present, the more predictive of increased depth of invasion. Dark, intraplacental bands on T2-weighted images are considered the most useful of the signs and are thicker than normal placental

septae, which may be due to increased vascularity or deposited fibrin after placental infarction and/or hemorrhage.

Several studies have concluded that there was no significant difference in the sensitivity and specificity in diagnosing abnormal placentation between ultrasound and MRI [10,11]. However, one of the studies stipulated that the experience and skill of the ultrasound operator, as well as the radiologist, can significantly affect the diagnostic outcomes of both modalities [10]. Although there may not be an overall difference in the sensitivity and specificity of the overall diagnosis, MRI may be superior in characterizing the degree of placental invasion [2].

In a recently published study by Budorick et al [12], they sought to directly compare the use of MRI and ultrasound in the diagnosis of placenta accreta. In a subset of 10 cases with posterior placenta, the authors found 3 false positive cases in patients who underwent sonographic examination compared with none in cases who had MRI. They reported that the most effective MRI features for placental invasion detection are loss of the myometrial mantle, heterogeneous placental appearance, and intraplacental hemorrhage. Their conclusion was that MRI should be considered when there is a posterior placenta previa with suspicion of accreta along with equivocal ultrasound findings [12]. We agree with their conclusions, but add the recommendation of performing MRI to assess for placental invasion in the setting of posterior placentation and risk factors for AIP as a first imaging choice, even after ultrasound has shown no evidence of placental invasion.

In conclusion, ultrasound should remain the first diagnostic imaging modality in the assessment of abnormal placentation, but there should be a low clinical threshold for MRI to further investigate if there are continued concerns of placental invasion. As demonstrated in our case, multiple ultrasound examinations performed by different operators did not prospectively demonstrate any features of abnormal placentation. In agreement with the literature, MRI in this case of posterior placentation was a better diagnostic test for AIP than ultrasound and provided information that was relevant to determine antenatal management, appropriate preparation for delivery, and multidisciplinary surgical approach. Further

research is warranted to standardize the MRI diagnostic criteria for abnormal placentation and to establish clinical guidelines that outline the appropriate diagnostic algorithms necessary to avert potentially fatal pregnancy complications.

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