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## Interstitial pregnancy: role of MRI

Received: 21 February 2003  
Revised: 19 January 2004  
Accepted: 2 March 2004  
Published online: 7 May 2004  
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**Abstract** We report the MRI features of two cases of interstitial pregnancy. In both cases, MRI was able to localize the ectopic pregnancy by showing a gestational structure surrounded by a thick wall in the upper part of the uterine wall separated from the endometrium by an uninterrupted junctional zone. Because US may confuse angular and interstitial pregnancies and because interstitial pregnancy has a particular evolutive course, MR imaging may play a key role in the diagnosis and management of women with interstitial pregnancy.

**Keywords** Ectopic pregnancy · MRI

### Introduction

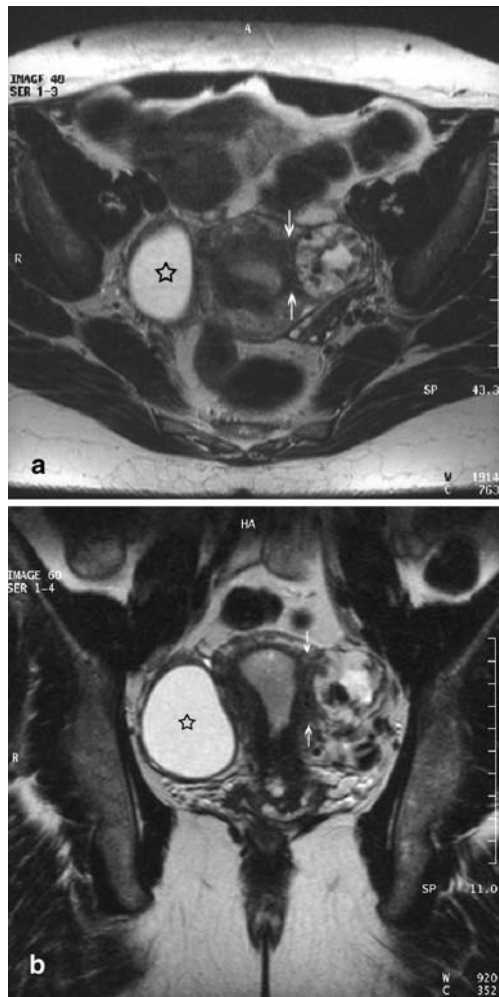
An interstitial pregnancy is a condition in which a fertilized ovum implants in the proximal part of the fallopian tube, which is embodied within the muscular wall of the uterus. Interstitial pregnancy occurs in 2–4% of all tubal pregnancies [1]. The diagnosis of ectopic pregnancy is usually performed by the combination of beta hCG level and transvaginal ultrasonography (TVUS). The diagnosis of interstitial pregnancy, however, remains challenging, with some interstitial pregnancies misdiagnosed as intrauterine pregnancy by TVUS [2]. Failure in the diagnosis of interstitial pregnancy may be disastrous, because the rupture is generally late and very hemorrhagic.

The role of MR imaging in the diagnosis of ectopic pregnancy has not been defined. MR imaging is not usually essential for diagnosis. However, it may be useful for specific diagnosis of rare or complicated forms of ectopic pregnancy [3–5]. We report two cases that illustrate the features and the contribution of MRI in the diagnosis of interstitial pregnancy.

### Case reports

#### Case 1

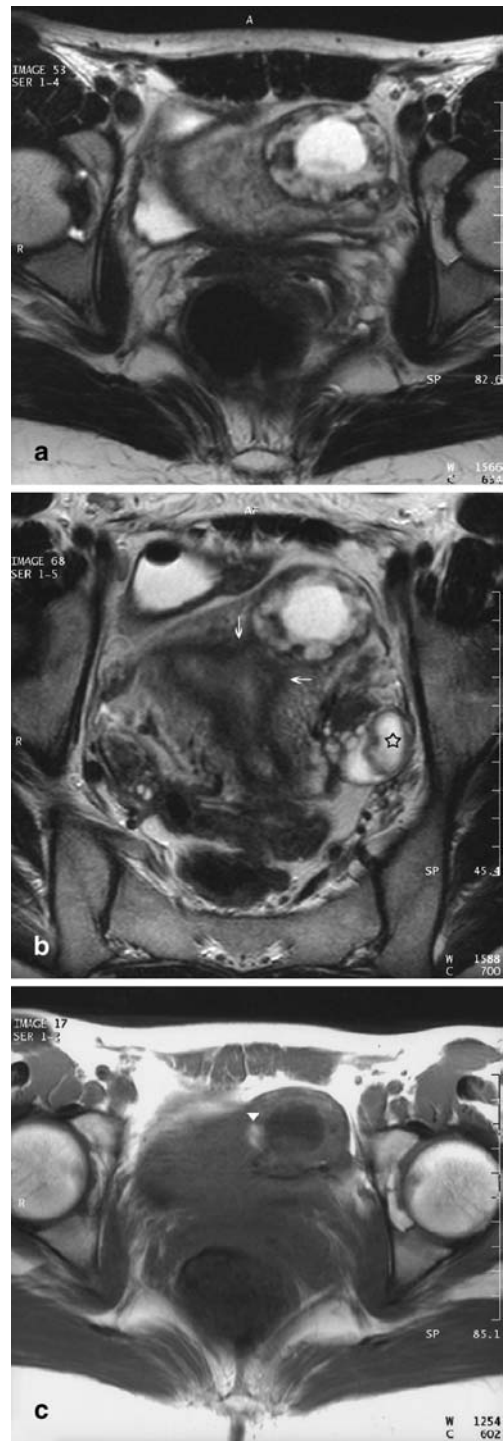
An asymptomatic 33-year-old woman (gravida 2, para 1) was referred to our hospital for an US examination in the management of a treatment for infertility. She had a history of bilateral salpingectomy for chronic salpingitis. Six weeks before the US, she had a frozen thawed embryo transfer. At the time of US, the beta hCG level was 24,113 UI/l. TVUS showed an empty uterine cavity and revealed an eccentrically located gestational sac separated from the uterine cavity by a myometrial layer. An embryo with cardiac activity was individualized in the sac. Although US diagnosed the interstitial pregnancy, an MRI was performed 1 day later in order to document the interstitial pregnancy because a medical treatment was considered. It showed a gestational structure surrounded by a thick wall located in the upper part of the left uterine wall with an uninterrupted junctional zone confirming the diagnosis (Fig. 1). Six hours later, the patient presented an acute abdominal pain and symptoms of shock evoking a rupture of the ectopic pregnancy. A laparotomy was performed, which confirmed the rupture of the interstitial portion of the tube. The surgical treatment was a left cornual resection. Histological evaluation confirmed the ruptured ectopic pregnancy. The patient was discharged with a good post-operative course.



**Fig. 1** **a** Axial and **b** coronal fast-spin echo T2-weighted images show a left gestational-like structure measuring 9 mm in diameter, which is surrounded by a thick wall. The entire lesion is located lateral to the left cornus and the junctional zone is uninterrupted (*arrows*). Endometrium is thickened, but has no sign of intrauterine pregnancy. Note also a cyst of the right ovary (*star*)

## Case 2

A 32-year-old woman (gravida 2, para 0) with a past of surgery for a right ovarian cyst presented in our hospital with slight pelvic pain, minimal vaginal bleeding and 5 weeks of amenorrhea. The beta hCG level was 13,142 UI/l. TVUS showed a gestational sac, considered to be in the uterine cavity and containing an embryo without cardiac activity or embryo movement. A diagnosis of miscarriage was performed, but the curettage did not identify any trophoblast. Because of this discrepancy, MRI was performed, which showed the gestational sac located in the left upper part of the uterus, outside the cavity from which it was separated by an uninterrupted junctional zone. The content of the gestational sac showed non-specific fluid signal, and the cystic part was surrounded by a thick wall that presented a localized area with signal suggestive of blood (Fig. 2). A diagnosis of interstitial pregnancy was thus performed, and a treatment by methotrexate was chosen by the patient after counselling. Methotrexate was applied by a combination of local injection under ultrasono-



**Fig. 2** **a** Axial and **b** coronal fast-spin echo T2-weighted images show a left gestational-like structure measuring 20 mm in diameter, which is surrounded by a thick wall. The entire lesion is located lateral to the left cornus and the junctional zone clearly shown on the coronal view is uninterrupted (*arrows*). Note also on the coronal view a left corpus luteum cyst inferiorly located (*star*). **c** On axial T1-weighted image, the medial wall of the cystic structure shows an area of hypersignal suggestive of blood (*arrowhead*)

graphic guidance and systemic injections. The patient was discharged with a good course and a normalization of the beta hCG level within 20 days.

## Discussion

An ectopic pregnancy is a clinical condition in which implantation and growth of the fertilized ovum occur outside the uterine cavity. The most common sites are the ampullary and isthmic portions of the tube. However, in some cases, ectopic pregnancy may develop in the interstitial part of the tube, which is covered by the external myometrium. MRI features have been studied in the classical site of tubal pregnancy. Although sagittal T2-weighted sequence is the basic sequence in MRI performed in gynaecologic emergencies [5], axial and coronal views are helpful in suspicion of ectopic pregnancy to show the relationship between the gestational sac and the myometrium; additionally, T1-weighted sequence performed in one of these three planes is helpful to identify blood. It has been established that tubal wall enhancement and fresh tubal hematoma were specific for ectopic pregnancy, whereas a gestational sac-like structure without tubal structure was equivocal because of the differential diagnosis of cystic masses of the ovary [6]. By contrast, little has been reported about MRI findings in interstitial pregnancy [3, 4]. These two cases confirm that the presence of a junctional zone between the gestational sac surrounded by myometrium and the uterine cavity is very suggestive of interstitial pregnancy. Differential diagnoses of cystic masses in the myometrium include adenomyoma with central hemorrhagic zone, cystic fibroma and gestational trophoblastic disease. However, adenomyoma with central hemorrhagic zone and cystic fibroma have a different biological presentation and MR findings in gestational trophoblastic disease, which may mimic ectopic pregnancy because it is usual-

ly accompanied by tumour necrosis and hemorrhage, also associate endometrial and junctional disruption [7]. In a context of ectopic pregnancy, MRI allows to differentiate pregnancy in a rudimentary horn from interstitial pregnancy, because in the former case the gestational sac is clearly located outside the myometrium, whereas in the latter case the gestational sac is surrounded by myometrium [8]. In practice, angular pregnancy constitutes the more common and difficult differential diagnosis. In angular pregnancy, the embryo is implanted within the lateral angle of the cavity, medial to the uterotubal junction. The difference between an interstitial pregnancy and an angular pregnancy may be subtle on US, and laparoscopy may be helpful to differentiate these two entities by showing a gestational swelling medial to the round ligament in angular pregnancy, whereas it is lateral to the round ligament in interstitial pregnancy [1]. By identifying on all slices an intact junctional zone between the cavity and the gestational sac, MRI may eliminate an angular pregnancy in doubtful cases.

In the setting of gynecologic emergencies, the main strength of MR imaging is its ability to determine the exact organ of origin when this is not clearly determined by transvaginal US [5]. This situation requires access to MRI in emergencies in such clinical settings. The role of MRI in the diagnosis and management of ectopic pregnancy remains debatable, and the indications for MRI in suspected ectopic pregnancies must be explicit. Obviously, ultrasonography is the standard imaging study for the diagnosis of tubal pregnancy. However, MRI study may provide additional information for a limited number of patients, including patients with pre-existing damage in the contralateral tube and patients with suspected rare forms of ectopic pregnancy, such as interstitial pregnancy for whom US diagnosis may be difficult. Furthermore, a right topographic localization may influence the follow-up and clinical and sonographic survey, making MRI useful when a conservative treatment is considered.

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