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Review

Incarceration of the gravid uterus: diagnosis and preoperative evaluation by magnetic resonance imaging

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ABSTRACT

Incarceration of the gravid uterus is a rare obstetric disorder that is often not recognized despite the ready availability of ultrasound. However, detailed imaging of the disturbed uterine and pelvic anatomy – from an obstetric point of view- is the key in reducing the potentially severe complications of this condition and planning its treatment. In this paper, we will describe the specific magnetic resonance imaging (MRI) features of an incarceration of the gravid uterus and we will discuss the role of magnetic resonance imaging in defining anatomy and in the medical decision whether to operate or not.

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Introduction

Incarceration of the gravid uterus – defined as the intrapelvic locking of the uterine fundus while pregnancy advances – is rare (1/3000 pregnancies). Most providers -obstetricians and

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Table 1
Signs, symptoms and complications of an incarceration of a gravid uterus according to gestational age. Q4

First trimester	
Obstetric	(Late) Miscarriage, false-positive diagnosis of extra-uterine gravidity, vaginal bleeding
Urologic	Mictalgia, dysuria, pollakysuria, urinary infection, urinary retention
Second and third trimester	
Obstetric	Vaginal bleeding, intra-uterine growth retardation, oligohydramnios, false-positive diagnosis of placenta praevia, premature labor, preterm premature rupture of membranes, premature delivery, sacculation, dystocia, fetal malpresentation, abnormal placentation, rupture of the uterus/bladder/cervix, incision of bladder/cervix/vagina/posterior & anterior uterine wall during caesarean section, postpartum hemorrhage, pulmonary embolism
Urologic	Urinary retention, dysuria, frequency, urinary incontinence, urinary infection, renal failure, sepsis, hydronephrosis, postobstructive diuresis
Gastroenterologic	Abdominal pain, constipation, rectal gangrene
Vascular	Venous congestion in lower limbs, venous thrombosis

radiologists- are unaware of this potentially perilous disorder. An early diagnosis and a detailed imaging are the cornerstone of an optimal (conservative or surgical) approach.

Symptoms often are non-specific or even absent. Most symptoms of an incarceration of the gravid uterus are related to pressure on the anatomical structures adjacent to the entrapped uterus (Table 1). Especially, urinary symptoms during the early mid-trimester should alert the clinician. During the vaginal examination, a large mass can be felt in the cul-de-sac and the cervix is usually out of reach of the examining fingers. In advanced gestational ages severe complications have been reported (Table 1). Although several authors described ultrasound features of an incarceration of the gravid uterus [1–9], a large number of reported sacculations are not recognized before term [1,10–23], confirming the importance of the experience of the single sonographer. Difficulty in identifying the cervix with transvaginal ultrasound during the second and third trimester should raise suspicion for uterine incarceration [2,4]. Accidental transection of the bladder, the cervix, the vagina or the uterine wall during a caesarean section has been reported, especially when diagnosis of the incarceration is only made peroperatively [1,10,11,24–28].

Magnetic resonance imaging (MRI) is superior to ultrasound in the assessment of the disturbed uterine and pelvic anatomy due to the multiplanar imaging capabilities, the large fields of view and an excellent contrast between the bowel, the blood vessels, the bladder and the uterus [2,4,5,13,15,17,29–35].

It is important that the interpretation of the MR Images and the treatment of the incarceration are geared to one another. As we will describe in this paper, one should consider to perform MRI in every pregnant woman with an incarceration of the uterus, since a conscientious description of the MR Images from an obstetric point of view is the key to anticipating possible complications and morbidity of this disorder (Table 1) and the medical decision whether to operate or not.

Specific magnetic resonance imaging findings of the incarceration of the gravid uterus

The role of MRI in diagnosing an incarceration of the gravid uterus already has been described in a few case reports [2,4,5,13,15,17,32–35]. Starting from these papers and our own experiences, we will summarize some specific MRI features that can play a significant role in guiding the obstetrician to the optimal approach of this potentially perilous condition.

A posterior versus an anterior incarceration

In the presence of a posterior incarceration, the cervix is elongated and wedged behind the symphysis and the fundus is rotated backward and located deep in the pouch of the Douglas (Fig. 1(a)). The presence of a "multi-layer" aspect just posterior of the bladder on midsagittal images is pathognomonic for a posterior incarceration (Fig. 1(a)). The multi-layered myometrium can have a "T-shaped" aspect as was described by Sutter et al. [32]. Another MRI feature suggesting the presence of a posterior incarceration is Q3 a Y-shaped connection between the lumen of the endocervical canal and the amniotic fluid, as is shown in Fig. 1(b).

The specific MRI features of an anterior incarceration – described only twice in the English medical literature – are shown in Fig. 1(c) [13,36].

From the obstetric point of view differential diagnosis between an anterior and a posterior incarceration is crucial because: (1) an anterior incarceration is considered to be a contra-indication for a (colonoscopic-assisted) manual reduction [17], and (2) a conscientious description of the displaced structures just posterior of the abdominal wall should guide the surgeon while performing any subumbilical incision (Fig. 1(a) and (c)).

The fetal presentation

Due to the reversed uterine polarity, the cervix and the accompanying presenting fetal part are located more cranially than the uterine fundus. This is illustrated in Fig. 1(a): the fundus containing the fetal head is located in the pouch of the Douglas but the cervix and the presenting fetal part -the breech- are located more cranially.

The detailed scanning of the uterine wall at the locus of the sacculation

Because the uterine fundus does not participate in growth, the lower uterine segment is progressively stretched -while pregnancy advances- until the upper limit of this type of uterine growth. This stretched sacculated part of the anterior uterine wall becomes a locus of minor resistance [37] and may predispose to the development of a diverticulum and/or uterine rupture. This is why (consecutive) evaluation of the wall thickness and regularity should be considered to be part of the imaging of an incarceration of the gravid uterus [38], as is illustrated in Figs. 2 and 3.

Other concomitant factors for uterine wall dehiscence are: (1) a previous caesarean scar [39], (2) a uterine instrumentation or trauma [40,41] and (3) a placenta located in the sacculation [41].

Some important observations about the placenta

The location of the placenta

If the placenta is located in the fundus of an incarcerated uterus, the sonographer often takes the uterine fundus in the cul-de-sac by

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