CASE REPORT

Role of serial MRI assessment in the management of an abdominal pregnancy

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SUMMARY

A 33-year-old woman was admitted to the hospital with an abdominal pregnancy at a gestational age of 20 weeks. An initial MRI mapping of fetal location and placental vascular invasion was obtained. The patient refused surgical intervention until fetal survival would be possible. Serial MRIs were essential in timing delivery and avoiding an emergency surgical situation. The baby was delivered at 24 weeks with the assistance of a multidisciplinary surgical team. The mother as well as the baby survived. This case report highlights the role of serial MRI evaluations in the diagnosis and expectant management of an abdominal pregnancy. It also highlights the importance of interdisciplinary communication for a successful outcome.

BACKGROUND

Abdominal pregnancies are rare, with an incidence of only 1 in 10 000 births.¹ A mother is 89.8 times more likely to die due to an extrauterine pregnancy versus a normal intrauterine pregnancy with a mortality risk of 0.1/1000.² Maternal mortality is high, estimated at about 5/1000 cases, which is significantly higher than the maternal mortality associated with tubal ectopic pregnancies at 0.7/1000 cases.² While early in pregnancy sonography is very useful in the identification of an abdominal pregnancy, it is very difficult to make the diagnosis at a later gestational age due to the inability to image the fetus in relation to the whole placenta and the uterine wall.³ Some investigators have suggested using an extended-field-of-view (EFOV) ultrasound. This is a method of obtaining a panoramic view as a real time US transducer is moved over the lesion of interest and multiple images are processed into one large single image in relation to surrounding structures. EFOV has been reported to be more useful than MRI for the diagnosis of an abdominal pregnancy; however, its use in obstetrics has been limited.⁴ An MRI, however, has the sensitivity of outlining the placenta attachment site to abdominal organs and in this case was a tool that detected worsening abruption and leakage of amniotic fluid into the abdominal cavity which precipitated a well-controlled delivery.

CASE PRESENTATION

The 33-year-old G2P1 patient had initially presented to the emergency room with a chief symptom of abdominal pain at 20 weeks gestation. An ultrasound there raised suspicion of an abdominal pregnancy and this was confirmed by repeat ultrasound in our prenatal diagnosis clinic

Figure 1 Twenty weeks gestation longitudinal image showing a mass posterior to the gestational sac which may be mistaken for a fibroid but is actually the uterine fundus.

(figures 1 and 2). She was then directed to the hospital for admission and further workup. Earlier during the first trimester, an ultrasound at 6 weeks gestation age was performed for vaginal bleeding and neither an intrauterine or extrauterine pregnancy was identified. The possibility of a pregnancy in an unknown location was considered and serial human chorionic gonadotropin (HCG) levels were obtained and rose appropriately suggesting a normal intrauterine pregnancy. A follow-up ultrasound for determination of pregnancy location was not obtained due to the patient not returning to her primary care physician until the second trimester.

An MRI obtained after admission to our hospital revealed a normally developed single extrauterine

Figure 2 Twenty weeks gestation a vaginal ultrasound confirmed the discontinuity of the cervix with the pregnancy sac, cervix (white arrow), fundus (green arrow), cul de sac with fluid (red arrow).

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Figure 3 Coronal (A) and Sagittal (B) T2-weighted half Fourier single shot turbo spin echo (HASTE) images of the abdomen showing an abdominal pregnancy at 20 weeks of gestation. Note the implantation of the placenta (P) on the uterine fundus and urinary bladder (B). A loop of the sigmoid colon (arrows) is superiorly draped over the enlarging gestational sac.

fetus in an amniotic sac with normal amniotic fluid volume (figures 3 and 4). The placenta had a broad attachment to the uterine fundus. There appeared to be multifocal placental blood supply including the adnexa bilaterally, more on the left including, the left ovarian artery and possibly the mesenteric vasculature. Small haematomas were noted in the recto uterine pouch and vesicouterine region appearing as T1-hyperintensities (figure 4A). The placenta edge bordered the bladder, left lateral pelvic wall, left ureter and iliac vessels. The sigmoid colon

coursed just superior to the placenta and along the right lateral portion of the gestational sac.

TREATMENT

Immediate surgical intervention was recommended to avoid an emergency situation with the potential for massive haemorrhage leading to maternal morbidity and or mortality. Despite prolonged conversations with the patient and her husband, the patient stated her desire to continue the pregnancy until fetal

Figure 4 An MRI was helpful in detection of complications like peritoneal haemorrhage (arrows) that appeared hyperintense on a T1-weighted fat suppressed non-contrast scan (A) and to study the placental relations on the axial T2-weighted half Fourier single shot turbo spin echo (HASTE) sequence (B). Note the adherence of the placenta to the retroperitoneal structures on the left side, including the left ureter (long arrow).

Figure 5 Coronal T2-weighted half Fourier single shot turbo spin echo (HASTE) (A) and sagittal T1-weighted T1W high resolution isotropic volume examination (THRIVE) (B) images from a second follow-up MRI scan at 23 weeks of gestation demonstrated interval increase in the size of the fetus and decrease in the size of the previously noted peritoneal haemorrhage (arrows).

viability. The plan was then to manage expectantly with best judgment without any guidelines to follow in doing so. The subspecialties of general surgery, vascular surgery, interventional radiology and neonatology were made aware of this situation in case intervention was needed. Central venous access was placed and blood products were available at all times.

Follow-up ultrasound 3 weeks later (23 weeks gestation) revealed normal growth and fluid. An MRI was repeated to evaluate progression of the vascular invasion (figure 5). No changes in the previously noted placental blood supply were apparent, but interim development of areas along the inferior and posterior aspects of the uterus suspicious for haemorrhage and/or infarction were noted. There appeared to have been worsening of the patient's bilateral hydronephrosis along with decreased volume of the haematoma previously observed in the cul-de-sac. These

findings were compatible with a low-grade resolving placental abruption and accelerated aging of the placenta. There was no evidence of an acute abruption. The obstetric team administered prenatal steroids at this time in anticipation of the need for an early delivery at viability or 24 weeks gestation.

At 24 weeks an additional ultrasound was performed failing to show further fluid accumulation in the cul-de-sac or a retroplacental blood collection (figures 6 and 7). Because of a high index of suspicion of potential emergence of new abruption due to the patient's new symptoms of abdominal discomfort, a repeat MRI was performed since the ultrasound was not informative. The non-contrast MRI revealed interim development of loculated pockets of amniotic fluid collections along the right posterior lateral margin of the amniotic sac with an irregular appearance of the amniotic sac's right lateral margin suggesting a contained

Figure 6 Twenty four weeks gestation, ultrasound of the cul de sac and uterus failing to show blood or amniotic fluid collection in the cul de sac.

Figure 7 Twenty four weeks gestation; placental image failing to show retroplacental blood collection.

perforation of the amniotic sac (figure 8). In addition, there was development of a thin T1-hyperintense rim surrounding the amniotic sac that was likely a perigestational haemorrhage. An interval increase in T2-hypointensities within the placenta suggested further infarcts and ageing of the placenta.

Owing to this progression of findings on the MRI and new symptoms, the patient was taken to the operating room for delivery. Through a midline abdominal incision and under general anaesthesia the infant was delivered atraumatically from a frank breech position by the obstetric team with the neonatal team in attendance. The newborn weighed 660 g with Apgar score of 2, 4, 5 at 1, 5 and 10 min, respectively. After delivery of the infant, continued bleeding was noted along with placental detachment. The surgeons then decided that they would be unable to control the bleeding by leaving the placenta in situ. In a combined effort, the vascular and gynaecological oncology

surgical teams cooperated on placental removal. The placenta was adherent primarily to the left side of the conual region of the uterus, the left tube and the left ovary as well as the side-wall. The posterior portions were adherent to the mesentery of the sigmoid colon. There were communicating branches coming from the aorta and mesentery; these were controlled with suture and ligatures. A hysterectomy was not required. The patient was transfused 12 units of packed red blood cells, 10 units of fresh frozen plasma, 4 units of platelets and 1 unit of cryoprecipitate with an estimated blood loss of 5500 mL.

OUTCOME AND FOLLOW-UP

The patient was extubated on the first postoperative day with no complications due to the operative procedure. Later the patient experienced minor postoperative complications of atelectasis, fever and tachycardia which were managed

Figure 8 Axial T2-weighted (T2W) half Fourier single shot turbo spin echo (HASTE) (A) and sagittal T2W HASTE (B) images obtained at 24 weeks gestation show development of fluid collection around the gestational sac (arrows) indicative of rupture or perforation of membranes. Note well defined fluid collection posterior to the sac C. Also notice interval development of heterogeneous areas in the placenta P indicative of accelerated aging. The sagittal T1-weighted T1W high resolution isotropic volume examination (THRIVE) image (C) shows interval development of thin layer of hyperintense perigestational haemorrhage (dashed arrows).

conservatively. The patient was discharged on post operative day 7. At the time of the writing of this case report, 14 weeks post-delivery, the infant weighed 2.6 kg and had bronchopulmonary dysplasia controlled by oxygen supplementation via nasal cannula home treatments.

DISCUSSION

An abdominal pregnancy is defined as a pregnancy that occurs outside the uterine cavity and fallopian tubes.¹ Some predisposing factors associated with abdominal pregnancy include endometriosis, multiparity, pelvic inflammatory disease, tubal damage, progesterone, intrauterine devices and assisted reproductive techniques. Mothers often do not have an abnormal trend in serial HCG as seen in other ectopic pregnancies.^{1 5} This is what was observed in the first trimester of this patient's pregnancy when her HCG levels increased as expected although an intrauterine pregnancy was not documented by ultrasound. This highlights the need to correlate appropriately rising HCG levels with ultrasound confirmation of the pregnancy locations in pregnancies complicated by first trimester bleeding.

The signs and symptoms of an abdominal pregnancy include a history of vaginal bleeding or excessive abdominal pain in the first trimester which worsens as the pregnancy advances, bleeding or non-labour abdominal pain during the third trimester, maternal declaration of cessation of fetal movement, displaced cervix or abdominal mass palpated apart from the fetus, an unusual echographic appearance of the pregnancy and a failed labour attempt.^{5 6} The abdominal examination may even be normal with the abdominal girth increasing as would be seen with a normally implanted pregnancy.^{5 7} In one retrospective study only 45% of abdominal pregnancies were diagnosed pre-operatively.⁶ The location of this abdominal pregnancy, uterine fundus and uterine fundus/adnexa is in the most common location for abdominal pregnancies based on a comprehensive review of abdominal pregnancies before 20 weeks of pregnancy.⁸ Ultrasonography (US) is the gold standard used in diagnosing problems with pregnancies. However, US is very user dependent and may be limited by bowel gas, the gravid uterus and maternal obesity.⁹ It is often very difficult to diagnose abdominal pregnancies at a later gestational age with a routine US. Extended view ultrasound has been shown to be more useful than routine US or MRI in some studies in the initial diagnosis.⁴ An MRI, however, has the additional advantage of detailing vascular and placental organ invasion.

The major issue in delivering an abdominal pregnancy is managing the placenta postdelivery.¹ Removal can incite massive bleeding and efforts to control the bleeding may lead to organ damage.^{1 10} Occasionally organ removal may be required on placental removal to maintain homeostasis. In case of intractable haemorrhage medical antishock garment (MAST suit) or pre-emptive arterial embolisation has been used successfully.¹⁰ Ligating the vascular supply to the placenta and removing it at delivery is another option. This was unavoidable in our case in spite of the great risk of uncontrolled haemorrhage due to the vascular supply of the placenta and lack of a uterus to clamp down and slow the bleeding.¹ The partial and complete removal of the placenta have been reported with successful outcome.^{3 11} If the placenta is found to be firmly attached with bleeding well controlled, the cord and membranes can be trimmed and the placenta left in situ.¹⁰ If removal of the placenta is not possible due massive vascular invasion, it is recommended to leave the placenta in situ and maintain follow-up for involution.⁵ Systemic methotrexate can be used postoperatively to encourage involution of the remaining placenta; however, it must be done

at lower doses and with less frequency to prevent the destruction too quickly and the build up of excess necrotic tissue.^{5 10} Imaging modalities and serial β -HCG levels should be done as follow-up for placental involution.¹⁰ Long-term effects of leaving the placenta in situ including sepsis, abscess formation, fistulas formation, paralytic ileus, peritonitis, delayed haemorrhage and intestinal or ureteral obstruction.^{1 5}

The serial use of MRI coupled with maternal change in symptoms coupled with a high clinical index of suspicion were very useful in timing of delivery and averting an emergency situation that may have resulted in loss of the fetus or harm to the mother in this pregnancy. The use of MRI should be considered in the diagnosis and expectant management of abdominal pregnancies and has the potential of providing additional useful information that will help achieve the best pregnancy outcome.⁶ An MRI has the advantage of better detailing vascular invasion and sparing the fetus exposure to non-ionising radiation exposure with other diagnostic modalities. Disadvantages of the MRI include expense, time required for a scan and lack of guidelines for extrauterine pregnancies. Ultrasound on the other hand has the advantage of less expense and better availability, but the information it provides is limited by maternal habitus, location of the placenta and is very user dependent.

Learning points

- ▶ Normal rising human chorionic gonadotropin levels are not sufficient to rule in an intrauterine pregnancy.
- ▶ An MRI is frequently used in confirming the diagnosis of abdominal pregnancies.
- ▶ Serial MRI may be considered in the expectant management of an extrauterine pregnancy.

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