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CASE REPORT

Serial Uterine Artery Embolization for the Treatment of Placenta Percreta in the First Trimester: A Case Report

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Abstract Two patients with placenta percreta underwent uterine artery embolization (UAE) for abnormally invasive placenta (AIP) in the first trimester. Patient 1 had a 9-week cervical ectopic, while Patient 2 had a 9-week cesarean scar pregnancy. Elective termination of pregnancy was performed in both patients. UAE was performed with tris-acryl gelatin microspheres as well as gelfoam until stasis and was repeated in cases of revascularization. Both patients were followed with US/MRI/MRA scans and β-hCG levels. Revascularization occurred in both patients following UAE, requiring multiple embolizations to achieve complete placental involution. Serial bland UAE may be an effective technique in the treatment of first-trimester AIP, with the distinct advantage of maintaining a patient's fertility.
Level of Evidence Level IV

Introduction

Abnormally invasive placenta (AIP) is a formerly rare, but increasingly common complication of pregnancy [5]. AIP is associated with increased morbidity and mortality, particularly in the third trimester due to peripartum hemorrhage [2]. Current American College of Obstetricians and Gynecologists (ACOG) guidelines recommend preterm cesarean hysterectomy with the placenta left in situ in more severe cases of AIP; removal of the invasive placental tissue is not recommended due to the high risk of significant hemorrhage [1, 7]. The obvious disadvantage to this approach is the loss of fertility and the chance of future pregnancy.

Previous literature has primarily focused on the techniques of third-trimester embolization and reduction of blood loss in the perioperative/peripartum setting, during either hysterectomy or attempted delivery. Herein is presented a case report of two first-trimester patients with AIP who requested uterine-sparing therapy and underwent early treatment with serial bland uterine artery embolization (UAE) utilizing tris-acryl gelatin microspheres and gelfoam as the sole therapy. This was followed by monitoring for revascularization via β-hCG, US, MRI/MRA, and angiography. Repeat UAE was performed when revascularization was observed on follow-up; the patients were followed for bleeding.

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Patient 1

Patient 1 was an asymptomatic 33 y/o woman who was diagnosed at 10 weeks' gestational age as a cervical ectopic pregnancy by ultrasound. MRI revealed cervical ectopic pregnancy and placenta previa with invasive placental tissue extending through the posterior cervical serosa consistent with placenta percreta (see Fig. 1). Initial femoral access was obtained, and a five-French Cobra catheter was inserted followed by selective catheterization of the uterine artery with a high flow microcatheter. The uterine arteries were embolized with three vials of 500–700 micron Embospheres (Merit Medical Systems, South Jordan, Utah, USA), three vials of 700–900 micron Embospheres, and gelfoam until complete stasis was achieved, defined as a static contrast column for 5–10 heartbeats. All subsequently reported week numbers are in reference to

UAE #1 as time zero. MRA 1.5 weeks after the first UAE showed persistent early enhancing placental tissue, for which another UAE was performed, utilizing 1.5 vials of 500–700 micron Embospheres. The second UAE was performed at 2.5 weeks. Revascularization occurred following the second UAE, seen on MRA at 7.5 weeks, confirmed on subsequent angiography. After a third UAE utilizing one vial of 300–500 micron Embospheres at 11.5 weeks, an MRA at 18 weeks indicated complete resolution.
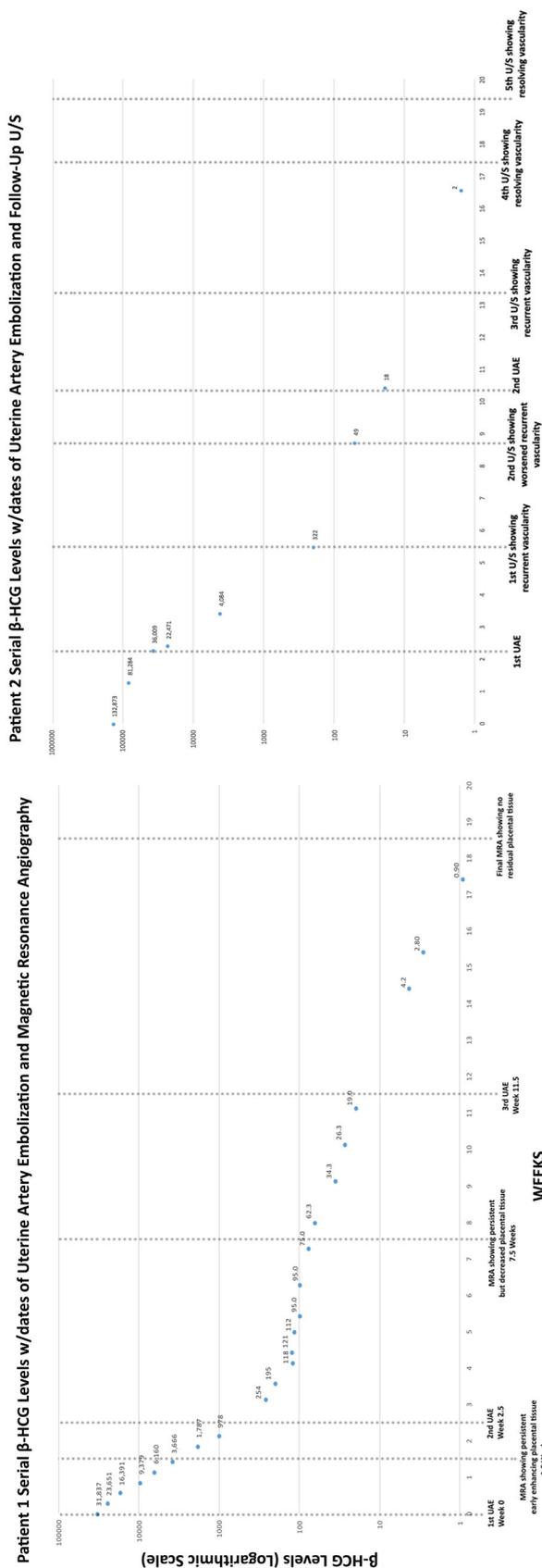
Patient 2

Patient 2 was an asymptomatic 27 y/o woman with a pregnancy dated at 9 weeks who was diagnosed as a cesarean scar pregnancy by ultrasound. MRI revealed a large intrauterine gestation as well as placenta percreta (see Fig. 1). The uterine arteries were embolized with the same technique described in patient 1, utilizing two vials of
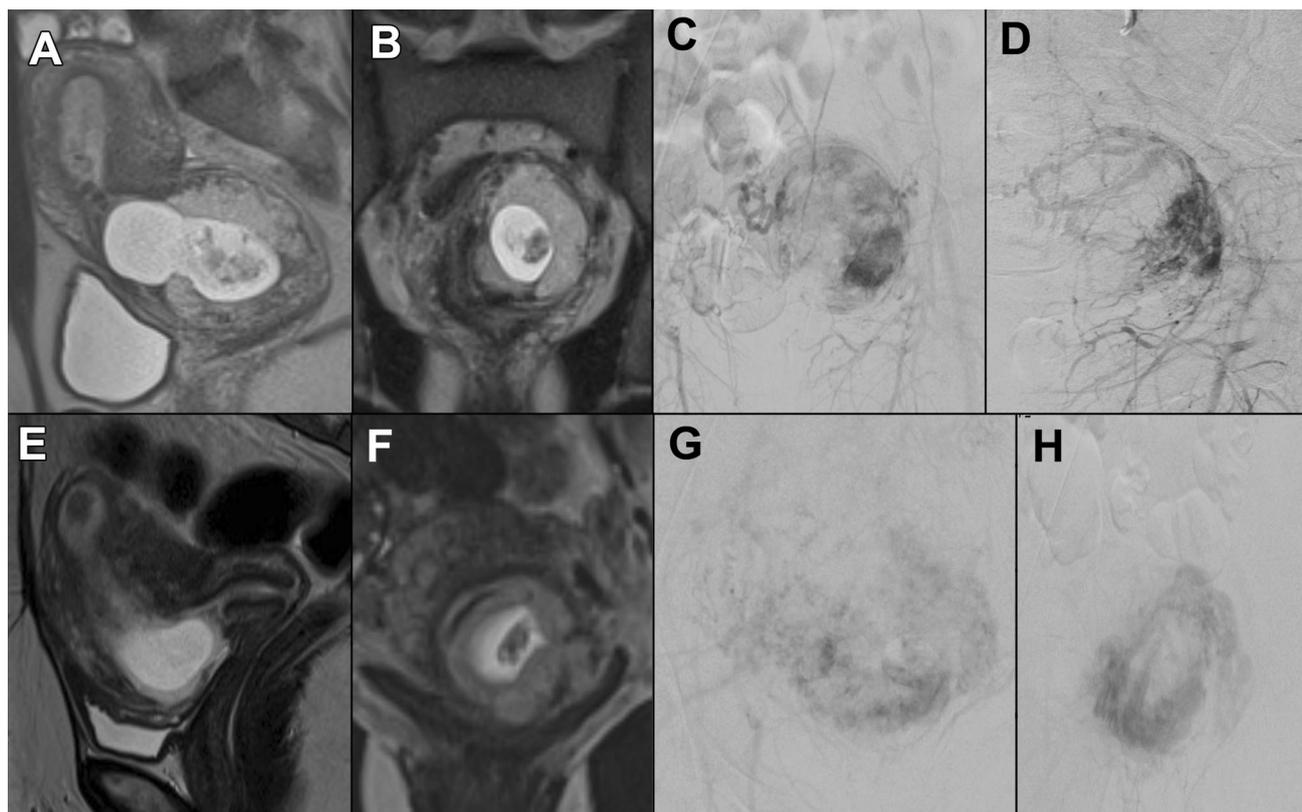
Fig. 1 A Sagittal image of patient 1 at baseline displaying an embryo and placental tissue within the endocervix, a placenta previa, and invasive placental tissue extending through the posterior cervical uterine serosa consistent with placenta percreta. **B** A coronal image of patient 1 at baseline. **C** Baseline uterine artery angiography (aortic injection) in patient 1 prior to UAE #1 demonstrating placental hypervascularity. **D** Pre-UAE #3 angiogram of patient 1 at 11.5 weeks demonstrating recurrent revascularization despite two previous embolizations. **E** Sagittal image of patient 2 at baseline displaying a large intrauterine cesarean scar pregnancy. **F** Coronal image of patient 2 at baseline with placental invasion through the serosa consistent with placenta percreta. **G** Baseline pelvic angiography in patient 2 (aortic injection) prior to the first UAE demonstrating placental hypervascularity of a 9-week cesarean scar pregnancy with placenta percreta. **H** Pre-UAE #2 pelvic angiogram (aortic injection) of patient 2 at 8 weeks post-UAE #1 showing revascularization after previous embolization

◀ **Fig. 2** Left: Patient 1 serial serum β-hCG levels w/dates of UAE and magnetic resonance angiography. Serum β-hCG scale is on a logarithmic scale, and time is measured in weeks. Right: Patient 2 serial β-hCG levels w/dates of UAE and follow-up U/S. Serum β-hCG is on a logarithmic scale, and time is measured in weeks

500–700 micron Embospheres and four vials of 700–900 micron Embospheres plus gelfoam. All subsequently reported week numbers are in reference to UAE #1 as time zero. In patient 2, recurrent vascularity was seen via US at 3 weeks. Initial angiography performed during the second UAE showed marked revascularization at 8 weeks. The second UAE utilized five vials of 500–700 micron Embospheres and one vial of 700–900 micron Embospheres plus gelfoam. Recurrent revascularization was visible via US at 11 weeks but patient declined repeat embolization. Repeat US at 15 weeks showed resolving vascularity. Complete resolution from UAE #1 was 4 months (16 weeks).

The progression of serum β-hCG measures relative to the date of UAE treatment and follow-up imaging for both patients is depicted in Fig. 2, and serial angiography can be seen in Fig. 3.

Discussion/Conclusions

To our knowledge, this is the first case report in which placenta percreta has been successfully treated with serial first-trimester bland UAE without initial or subsequent surgical intervention. The earliest report of the technique of attempted first-trimester AIP managed solely by UAE was published as a case report in 2006 by Tseng et al. Unfortunately, satisfactory vessel occlusion could not be achieved because of recurrent placental revascularization and hysterectomy was ultimately performed 2 weeks after the second UAE [10]. In 2009, Soleymani et al. [8] documented a case of using UAE to stop uterine bleeding associated with AIP in the first trimester. It should be noted that UAE followed incomplete surgical AIP removal and was intended to control bleeding rather than functioning as the primary treatment modality. In a different case report, first-trimester placenta increta was managed following incomplete surgical abortion by transcatheter arterial chemoembolization (TACE). In this case, dactinomycin along with gelatin sponge particles was utilized to achieve placental tissue involution, resulting in complete resolution of the placenta increta within 20 days, albeit starting at a reduced placental volume secondary to the incomplete abortion [9]. The rapid resolution of the first-trimester placenta increta seen in this single patient relative to the current case report (20 days in Takeda et al. and
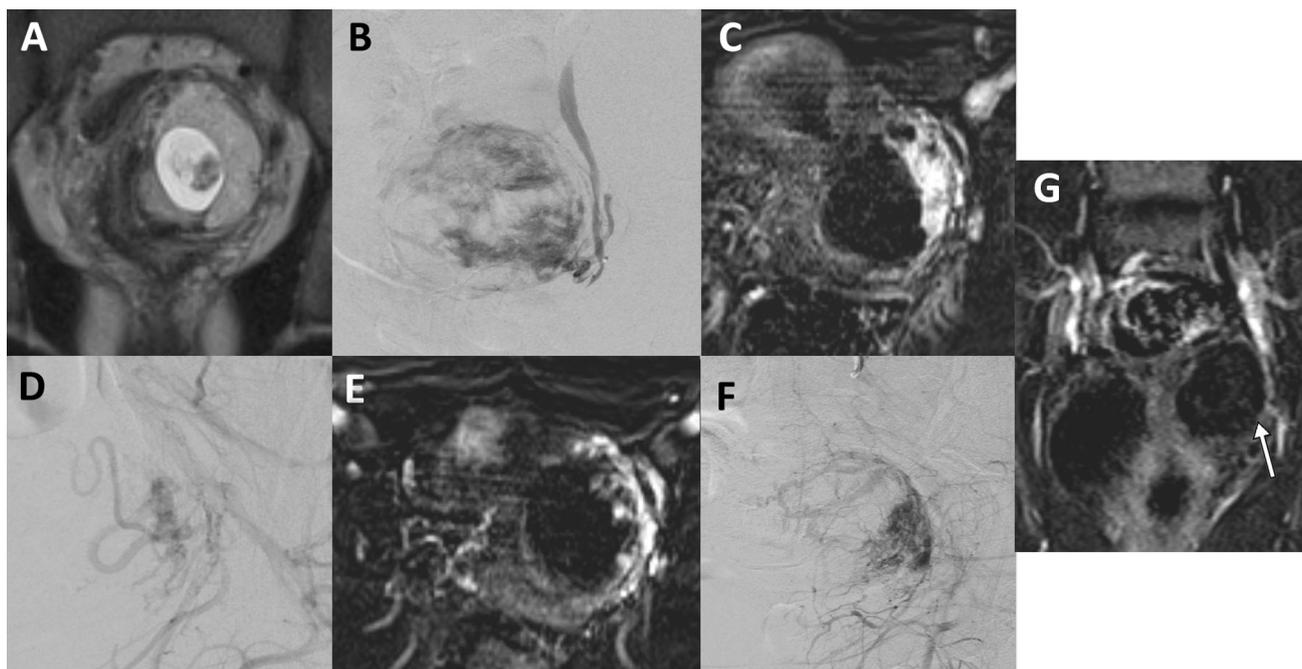
Fig. 3 Serial angiography and MRI of patient 1. **A** baseline MRI scan demonstrating 10-week cervical ectopic pregnancy with placenta percreta. **B** Baseline angiography prior to UAE #1 demonstrating placental hypervascularity. **C** MRA at 1.5 weeks post-UAE #1 showing persistent early enhancing placental tissue despite previous embolization. **D** Pre-UAE #2 angiogram at 2.5 weeks demonstrating revascularization after first UAE. **E** MRA at 7.5 weeks showing persistent albeit reduced early enhancing placental tissue despite two previous embolizations. **F** Pre-UAE #3 angiogram at 11.5 weeks demonstrating recurrent revascularization despite two previous embolizations; this image is also displayed in Fig. 1, Panel D. **G** MRA at 18.5 weeks showing complete resolution of percreta with no residual early enhancing placental tissue after three embolizations; note the absence of wall enhancement of the residual gestational sac (marked by white arrow)

3–4.5 months herein) may be attributable to the cytocidal effect of the dactinomycin.

Despite the observed falling serum β-hCG levels in the current case report, enhancing placental tissue persisted in both patients. In both patients 1 and 2, pre-UAE angiograms demonstrated significant enhancement of placental tissue at fairly low β-hCG levels (19 in patient 1 and 18 in patient 2). The observation of persistent placental tissue despite low β-hCG levels suggests that adjunctive imaging studies may be needed when monitoring for AIP resolution [4].

A recurrent theme complicating the endovascular treatment of AIP is the revascularization of embolized placental tissue, which likely reflects the known resistance of placental tissue to hypoxia [6]. The resistance of the placenta to hypoxia and the expression of angiogenic growth factors may account for persistent enhancing placental tissue on MRI/US and subsequent recanalization following UAE. Recurrent revascularization was documented in both of the patients in the present case report, sometimes occurring within 1 week after embolization. Tseng et al. [10], in the first 2006 case report of UAE to treat first-trimester placenta percreta, similarly noted that extensive recanalization occurred just 3 weeks after UAE, which contributed to

their treatment failure. Experimental evidence shows that the placenta is extremely resistant to hypoxia, which may account for its relative resistance to embolization in the setting of placenta accreta [11]. Williams and colleagues found that even with < 1% oxygen, placental protein synthesis was not inhibited while Schneider and colleagues found that the ex vivo perfused placenta could withstand total ischemia for > 30 min. At least one mechanism has been identified: Placental metabolic reprogramming under conditions of hypoxia leads to an induced and reversible state of reduced metabolic demand, similar to that seen in animals that undergo hibernation, sea-diving animals, and in metastatic cancer [6, 11]. Additionally, placental hypoxia stimulates local expression of angiogenic growth factors such as VEGF that stimulate revascularization of the tissue [3, 12].

Serial bland embolization may mitigate the risk of revascularization and holds promise as a treatment option for the management of placenta accreta when future fertility is desired. Although confined to the first trimester in this case report, the techniques described herein are potentially applicable to the more common scenario of a postpartum (placenta left in situ) third-trimester placenta accreta and should be investigated for this purpose.

Additionally, further studies should focus on the use of chemoembolic agents in the hopes of inducing more rapid placental involution.

Compliance with Ethical Standards

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

Ethical Standards All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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