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CLINICAL ARTICLE

Incorporating uterine artery embolization in the treatment of cesarean scar pregnancy following diagnostic ultrasonography

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ABSTRACT

Objective: To evaluate combining uterine artery embolization (UAE) with other treatments for cesarean scar pregnancy (CSP). *Methods:* A retrospective study included patients attending the First affiliated Hospital of Xi'an Jiaotong University, China, between March 1, 2009 and March 31, 2014, who were diagnosed with CSP. Patients were classified by ultrasonography as having endogenous CSP (CSP type I [CSP-I]) or exogenous CSP (CSP type II [CSP-II]). Patient outcomes were compared between patients who underwent treatment that included or excluded UAE. Patient records were reviewed and patients were interviewed by telephone to report on recovery following treatment. *Results:* In total, 52 patients met the inclusion criteria. In patients with CSP-I, the blood loss, length of hospital stay, and time before restoration of normal β human chorionic gonadotropin levels were significantly higher in patients who were treated with methotrexate combined with dilatation and curettage compared with those treated with UAE combined with dilatation and curettage ($P < 0.05$). In patients with CSP-II, blood loss was lower in patients treated with UAE combined with excision compared with excision alone ($P < 0.001$). *Conclusion:* Incorporating UAE in the treatment of CSP-I and CSP-II was safe; CSP should be properly classified to select the appropriate treatment.

1. Introduction

Cesarean scar pregnancy (CSP) is a term that describes the implantation of a gestational sac at the site of a previous cesarean delivery scar and was first described by Larsen and Solomon in 1978 [1]. The incidence of CSP has been reported to be one case per 1800–2216 normal pregnancies; this rate could rise in the future owing to increasing rates of cesarean deliveries [2–4]. Links have been suggested between uterine scar dehiscence or small-scar defects after cesarean deliveries and later CSPs [5], and routine transvaginal ultrasonography has been recommended in early pregnancy for patients who have previously undergone a cesarean delivery [6]. Vial et al. [7] classified CSP based on transvaginal ultrasonography. Endogenous CSP (CSP type I [CSP-I]) is caused by the implantation of the amniotic sac at the cesarean-scar site followed by progression towards either the cervical isthmic space or the uterine cavity. Exogenous CSP (CSP type II [CSP-II]) results from the deep implantation of the amniotic sac into a previous cesarean scar defect with growth that infiltrates the uterine myometrium, creating a bulge from the uterine serosal layer. The use of ultrasonography in clinical practice to assess the risks posed by CSP has been demonstrated [8,9] and this approach is widely applied in China.

Complications encountered in the treatment of CSP make it clinically challenging. Initially, mifepristone is administered or curettage is performed to terminate pregnancy; however, CSP is often accompanied by repeated vaginal bleeding, abnormal beta human chorionic gonadotropin (β-hCG) levels, and the growth of CSP masses. Moreover, deep implantation in CSP-II can lead to uncontrollable hemorrhaging if highly vascularized tissues are dissected from the uterus. Consequently, in recent years, considerable attention has focused on different methods for managing CSP to improve patient outcomes. Protocols for the treatment of CSP that have been investigated include methotrexate (MTX) injection (systemic or local), dilatation and curettage, uterine artery embolization (UAE), the excision of CSP lesions via laparotomy, and laparoscopic or hysteroscopic surgery; these approaches aim to prevent hemorrhage and preserve fecundity [10–16]. The benefits of including UAE in the treatment of CSP have been demonstrated previously [8,16,17]. Despite UAE having been proven to be a viable intervention to control hemorrhaging and preserve the uterus, there is no consensus on optimal combination therapies for each CSP type.

The aim of the present study was to analyze patient outcomes and complications following the use of UAE in the treatment of patients with CSP.

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2. Materials and methods

The present retrospective study analyzed data from patients who were diagnosed and treated for CSP at the First affiliated Hospital of Xi'an Jiaotong University, China, between March 1, 2009 and March 31, 2014. CSP was confirmed by a history of a prior cesarean delivery, clinical symptoms (postmenstrual spotting, mild lower abdominal pain), ultrasonography examination, and serum β-hCG levels. Patients were eligible for inclusion in the study if they met the following criteria under ultrasonography examination: (1) empty uterus and cervical canal; (2) development of the gestational sac or identification of a mixed-echo mass in the anterior part of the cesarean scar; (3) very thin myometrium or an absence of healthy myometrium between the bladder wall and the sac/mass or when running through the amniotic sac; and (4) the gestational sac or mixed-echo mass being located toward either the cervical isthmic space or the uterine cavity in CSP-I, or the infiltration of the gestational sac or mixed-echo mass into the myometrium and/or forming a bulge from the uterine serosal layer in CSP-II. Ultrasonography findings were used in guiding physician decisions on patient treatments. Patients with CSP-I meeting the above criteria were eligible for inclusion if they had been treated with either MTX followed by dilatation and curettage, or UAE followed by dilatation and curettage. Data from patients with CSP-II were included in the present study if they had been treated through direct excision of the CSP lesion using laparotomy or if they received UAE treatment followed by CSP lesion excision by laparotomy. The present study was approved by the Institutional Review Board of Xi'an Jiaotong University; obtaining informed consent from patients for the use of medical record data was waived owing to the retrospective nature of the study and all patients provided verbal consent to participate in telephone interviews.

Patients who underwent treatment for CSP-I with MTX received an intramuscular MTX injection (50 mg/m^2; Shanxi Powerdone Pharmaceutics Co Ltd., Datong, China). Patients were then evaluated after 1 week; if a patient's serum β-hCG level had decreased by at least 50%, or to below 2000 mIU/mL, follow-up ultrasonography examinations were performed to evaluate chorionic sac volume and vascularization. If initial MTX treatment was ineffective, patients received a further dose and follow-up period. If follow-up ultrasonography revealed no growth in CSP masses, dilatation and curettage was performed with abdominal ultrasonography monitoring.

When UAE was included in the treatment of patients who had CSP-I, the uterine artery was selectively catheterized using a Rosch hepatic catheter (Terumo Corporation, Tokyo, Japan) and was embolized using gel foam sponge particles (900–1200 μm). Embolization proceeded until the lower uterine segment was completely occluded. Digital subtraction angiography images were acquired during the procedure (Philips FD20; Philips, Best, The Netherlands). Dilatation and curettage with ultrasonography monitoring was performed 1–6 h to remove CSP lesions completely. Patients' right lower extremities were immobilized for 12 h after embolization, and patient pulses were measured at the dorsalis pedis artery every hour. Patients were monitored for the occurrence of vascular complications for 72 h.

Patients with CSP-II underwent the direct excision of CSP lesions via laparotomy with or without UAE. If the anatomical relationship was clear, the bladder peritoneum was incised and pressure was applied to the bladder to access the lower uterine segment and upper cervical segment. Following this, the gestational tissue, blood clots, and myometrial scar were removed. Wound repair was performed with interrupted sutures in the myometrium and a continuous suture in the serosal layer. When UAE was included in the treatment protocol for patients with CSP-II, it was performed as described in patients with CSP-I, with direct excision following after 1–6 h. All patients with CSP-II received general anesthesia during excision operations and lesion tissues excised from patients with CSP-II underwent pathological examination to confirm the preoperative ultrasonography diagnosis.

Data were collected from patients' medical records and operation notes. Treatment protocols and post-operation data up to the normalization of serum β-hCG levels were retrieved for each patient. Patients were contact by telephone and information was collected on the time taken after treatment to resume menstruation, on any anomalous symptoms experienced, and of any subsequent pregnancies.

Statistical analyses were performed using SPSS version 20.0 (IBM, Armonk, NY, USA). Clinical data, including age, gravidity and parity, the time interval between the previous cesarean delivery and the diagnosis of CSP, the duration of follow-up after treatment for CSP, intraoperative blood loss, and the length of hospital stay during treatment, were expressed as the mean ± SD or as the median and interquartile range. The Mann–Whitney *U* test was used to compare the differences between patients receiving different treatments and $P < 0.05$ was considered statistically significant.

3. Results

During the 6-year study period, the CSP to normal pregnancy ratio at the study institution was 57:16,391. Of these 57 patients, 25 (44%) were classified as CSP-I and 32 (56%) were classified as CSP-II (Fig. 1). The age

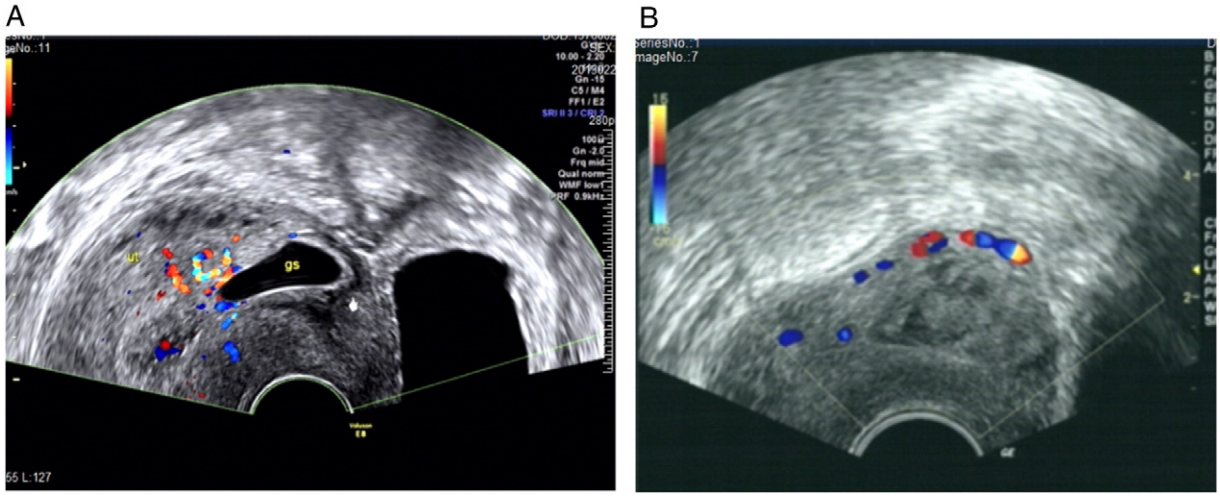

Fig. 1. Transvaginal ultrasonography images. (a) A 30-year-old woman with cesarean scar pregnancy type I; a gestational sac is embedded at the site of a previous cesarean scar. (b) A 29-year-old woman with cesarean scar pregnancy type II; the gestational sac had implanted into a previous cesarean scar defect with growth that has infiltrated into the uterine myometrium and bulges from the uterine serosal surface.