Misdiagnosis analysis of uterine scar pregnancy after cesarean section

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Abstract. Misdiagnosed uterine scar pregnancy after cesarean section can lead to serious consequences such as uterine rupture and hemorrhagic shock. The present study aimed to analyze the causes and treatment outcomes of misdiagnosed uterine scar pregnancy after cesarean section. A retrospective analysis was conducted on the clinical data of seven patients with cesarean scar pregnancy from the Department of Obstetrics and Gynecology at the 940th Hospital of the Joint Logistics Support Force of the Chinese People's Liberation Army (Gansu, China) in order to analyze the causes of misdiagnosis and explore effective treatment methods. All seven cases were misdiagnosed as intrauterine pregnancy, wherein three were threatened with miscarriage of early pregnancy and four with embryonic arrest. In total, three patients experienced bleeding reaching volumes of 800-1,400 ml (cases 1, 4 and 6). After active bilateral uterine artery embolization (cases 1, 2, 4, 5 and 6), a combination of mifepristone and methotrexate was administered, and the patients' bleeding stopped after embolization treatment. These observations suggest that the use of medications or interventional embolization (cases 1, 2, 4, 5 and 6) followed by ultrasound-guided curettage can yield positive benefits and allow for full patient recovery.

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Abbreviations: CSP, cesarean scar pregnancy; 3D, three-dimensional

Key words: post-cesarean section, scar pregnancy, misdiagnosis

Introduction

With the relaxation of birth policies in China it is possible to have a second or even a third child, and combined with the high rates of cesarean section surgeries, the proportion of scar pregnancies in China has significantly increased compared with rates before this policy change (1-3). Cesarean scar pregnancy (CSP) refers to a rare ectopic pregnancy, where a previous pregnancy is delivered by cesarean section but then an embryo implants in the scar site of the previous cesarean section (4). Owing to the thin muscle layer and poor elasticity of the scar tissue at the site of cesarean section, various serious complications, such as uterine perforation, blood loss and endangerment of life for the mother, can occur as gestational age increases (5). With the widespread application of transvaginal ultrasound examination and increasing awareness of CSP, its diagnosis and treatment with surgery and medication have greatly improved (6). However, in real-world clinical settings, pregnant and postpartum women remain frequently misdiagnosed with scarred uterine pregnancies that are mistakenly regarded as intrauterine pregnancy or cervical pregnancy, especially in underdeveloped areas of less developed countries, where the misdiagnosis rate may be even higher (7). If patients are initially misdiagnosed, they incur a particular risk of mistreatment, hysterectomy, or even fatality due to bleeding or uterine rupture. This risk is typically associated with both the diagnostic and treatment capabilities of obstetricians and gynecologists, in addition to the cognitive level of ultrasound clinicians. Therefore, this requires the attention of clinicians and monitoring physicians. In the present study, the clinical data of patients with CSP who experienced misdiagnosis and mistreatment during the initial diagnosis were retrospectively analyzed, whilst also exploring the contributing factors and potential treatment strategies.

Patients and methods

A retrospective review of medical record data from January 2018 to October 2024 identified 42 cases of CSP at the Department of Obstetrics and Gynecology, 940th Hospital of the Joint Logistics Support Force of the Chinese People's Liberation Army (Gansu, China).

Table I. Initial hematological examination indicators for the patients misdiagnosed with cesarean scar pregnancy.

Case	Medical file number	White blood cell count ($x10^9$/l)	Red blood cell count ($x10^{12}$/l)	Hemoglobin (g/l)	Platelet ($x10^9$/l)	Activated partial thromboplastin time (sec)	Prothrombin time (sec)	Human chorionic gonadotropin (IU/l)
Ref. range	-	3.5-9.5	3.68-5.13	113-151	101-320	23-32	9-14	0-10
1	ZX0388383	12.12	4.43	133	278	26.8	11.2	106.7
2	15069188	7.59	4.47	144	215	26.3	11.9	321.1
3	15097476	8.29	4.54	136	206	28.1	11.8	6,371.9
4	79042441	8.63	3.38	99	219	22.1	9.6	1,352.7
5	ZX0493131	8.5	4.46	137	232	21.7	11.1	2,414.3
6	ZX0360820	5.65	3.63	108	188	25.6	11	91.2
7	ZX0400103	4.59	3.91	125	172	23.5	11.1	3,5470.3

The inclusion criteria for CSP diagnosis and treatment (8,9) were based on a comprehensive evaluation of clinical, imaging and laboratory examinations: i) Clinical history, with a previous history of one or more cesarean section (transverse incision in the lower segment of the uterus), amenorrhea (for 5-12 weeks), presence or absence of early pregnancy symptoms (such as vaginal bleeding and lower abdominal pain) and the absence of serious complications (such as infection or coagulation dysfunction); ii) transvaginal/abdominal ultrasound features meeting at least two of the stated criteria [the absence of gestational sac in the uterine cavity and cervical canal; presence of the gestational sac at the scar site of the cesarean section in the lower anterior wall of the uterus; thinning (thickness ≤3 mm) or disruption of the muscle layer at the scar site; and absence of uterine muscle layer between the gestational sac and bladder is missing or presence of abundant blood flow (if Doppler shows low impedance blood-flow signals)]; and iii) laboratory examination showing positive blood β-human chorionic gonadotropin, with further ultrasound imaging needed to determine whether pregnancy had occurred.

The exclusion criteria were as follows: i) Cervical pregnancy, where the gestational sac is located inside the cervical canal, the cervix is enlarged and the uterine cavity is empty; ii) intrauterine pregnancy miscarriage, where the gestational sac detached into the cervical canal; and iii) evidence of other ectopic pregnancy, including tubal and cornual pregnancy.

All relevant patient data were collected from the electronic medical record system of the 940th Hospital of the Joint Logistics Support Force of the Chinese People's Liberation Army. The present study was approved by the Ethics Committee of the 940th Hospital of the Joint Logistics Support Force of the Chinese People's Liberation Army (approval no. 2024KYLL002). Written informed consent for participation and publication was obtained from all patients included in the present study.

Results

Of the 42 cases of CSP, 7 were identified as misdiagnosis and mistreatment, with a misdiagnosis and mistreatment rate of 16.67%. For the seven cases included in the present study, the age range was 28-35 years, with a mean age of 31.86±2.67 years. Hematological examination of the patients upon admission showed no abnormalities (Table I). The patients had amenorrhea for 40-94 days, whereas all had a history of 1-2 cesarean sections. The interval between cesarean section surgery and the current pregnancy ranged between 11-120 months. In total, three patients had a history of 1-2 induced abortions after cesarean section (cases 1, 5 and 7). All patients were diagnosed with intrauterine pregnancy by ultrasound. A total of three patients (cases 1, 4 and 6) had a small amount (<50 ml) of irregular vaginal bleeding after 50 days of amenorrhea and were diagnosed with threatened miscarriage (Table II).

Of the three cases (cases 2, 3 and 4) misdiagnosed with threatened miscarriage, two cases underwent abortion under anesthesia for a curettage procedure (cases 2 and 4) and one case required a medical drug-induced abortion (case 3). In total, 3 days after surgery, these three patients' ultrasound examinations revealed an incomplete abortion, resulting in uterine curettage being performed under ultrasound guidance in these three patients. During surgery, clear endometrial lines were observed and abnormal echoes were located at the scar site of the original cesarean section in the lower segment of the uterus (Fig. 1). CSP was therefore considered for the diagnosis. Two patients had minimal bleeding (<50 ml) and were administered a single intramuscular injection of methotrexate (50 mg/m^2) and an oral administration of 50 mg mifepristone once every 12 h for three doses (cases 2 and 3). In one case (case 4) the intraoperative bleeding volume reached 800 ml. After emergency bilateral uterine artery embolization, uterine bleeding ceased. For case 3 requiring a medical abortion, a mass with a diameter of ~4 cm was observed on the right side of the lower segment of the uterus, where the intraoperative bleeding volume reached 600 ml. A total of 2 days after blood transfusion, fluid replacement and anti-shock treatment, laparoscopic uterine CSP resection and uterine repair surgery were performed, where postoperative pathological specimens showed villous tissue and trophoblast cells in case 3 (Fig. 2).

In total, four of the seven patients were misdiagnosed as having embryonic arrest and underwent medical abortions that

Table II. Basic characteristics and treatment status of the seven patients misdiagnosed with cesarean scar pregnancies.

Case	Case no.	Age (years)	Days of amenorrhea	Time since last cesarean section (months)	Misdiagnosis	Pre-treatment	Bleeding volume (ml)	Surgery
1	ZX0388383	33	71	36	Embryo arrest	Medical abortion	1,200	Interventional embolization + laparoscopic scar resection and uterine repair
2	15069188	30	51	14	Threatened miscarriages	Ultrasound guided curettage surgery	300	Interventional surgery embolization + curettage
3	15097476	30	40	11	Threatened miscarriages	Medical abortion	150	Palace cleaning surgery + conservative treatment with medication
4	79042441	32	85	60	Threatened miscarriages	Ultrasound guided curettage surgery	600	Interventional embolization + curettage surgery
5	ZX0493131	35	45	120	Embryo arrest	Medical abortion	200	Interventional embolization + curettage surgery
6	ZX0360820	28	94	36	Embryo arrest	Medical abortion	1,400	Interventional embolization + laparoscopic scar resection and uterine repair
7	ZX0400103	35	45	36	Embryo arrest	Medical abortion	100	Palace cleaning surgery + conservative treatment with medication

included intramuscular injection of methotrexate (50 mg/m^2) and an oral administration of 50 mg mifepristone once every 12 h for three doses (cases 1, 5, 6 and 7). In these four cases, after methotrexate and mifepristone administration, vaginal bleeding occurred and the 'pregnancy product' was discharged, which were visually confirmed by the gynecologist. The uterus contracted well, but a moderate quantity (100-300 ml) of blood flowed out of the uterine cavity. Bleeding gradually stopped after local compression and intramuscular injection of oxytocin (10 U) in all four cases. A total of 10 days after surgery, one patient (case 6) returned to the hospital for a follow-up ultrasound examination, where abnormal echoes in the uterine cavity were noted. Therefore, curettage was performed under ultrasound guidance (Fig. 3). During the procedure, clear endometrial lines were observed and a small blood clot (15 ml) and decidual tissue were cleared. However, there was a considerable amount of uterine bleeding, with a cumulative blood loss of 1,400 ml during the operation. A mixed mass protruding outward from the lower part of the anterior wall of the uterus was noted, where the lower uterine muscle layer was thin. Therefore, CSP was considered. Immediate uterine artery intervention embolization was performed and bleeding ceased. Blood transfusions were then administered. Laparoscopic scar pregnancy resection was performed 3 days later, where

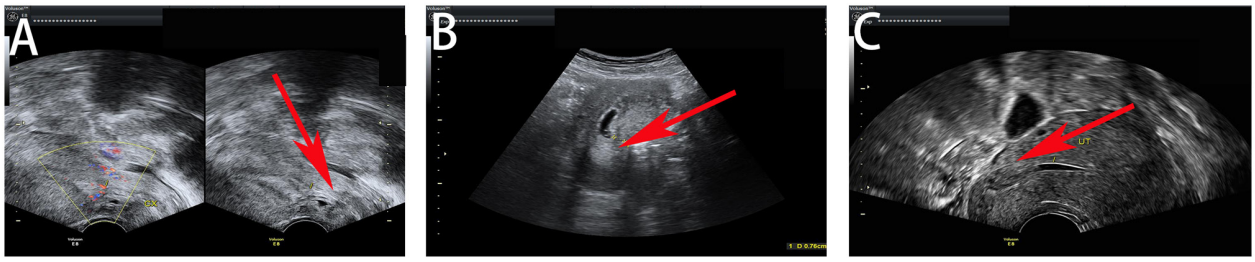

Figure 1. Ultrasound images of three patients' incomplete abortion (red arrow). (A) Case 2, (B) case 3 and (C) case 4.

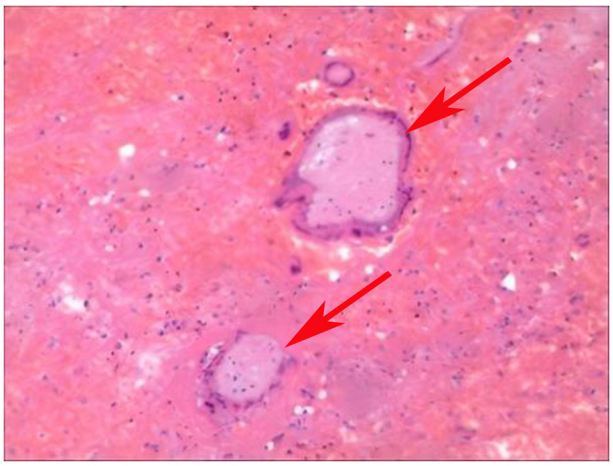

Figure 2. Postoperative pathological specimens (case 3 uterine cesarean scar pregnancy resection) showing villous tissue and trophoblast cells (red arrow).

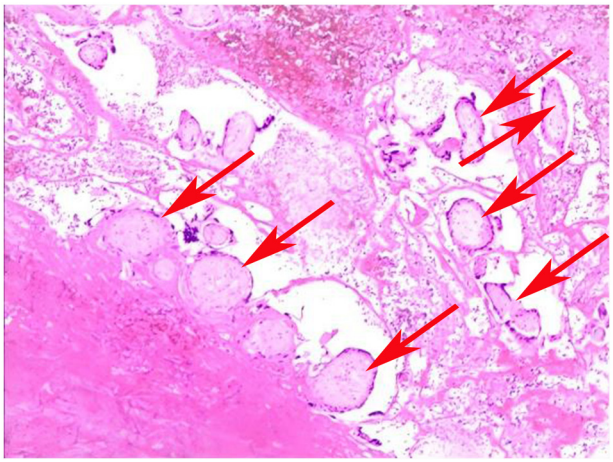

Figure 4. Postoperative pathological specimens (case 6 uterine cesarean scar pregnancy resection) revealing chorionic tissue and trophoblast cells (red arrows).

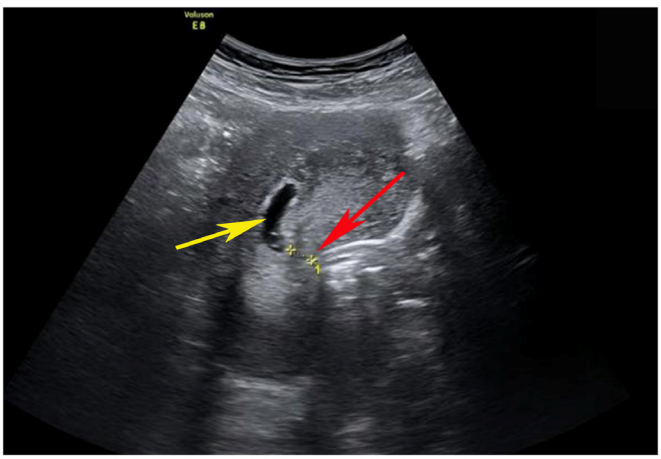

Figure 3. Scar incision (red arrow) in the uterine cavity and gestational sac without fetal heart (yellow arrow) are noted in the ultrasound image (case 6).

postoperative pathological specimens revealed chorionic tissue and trophoblast cells in case 6 (Fig. 4). The other three patients misdiagnosed with embryonic arrest had intermittent vaginal bleeding, and ultrasound examination 7-10 days after surgery revealed abnormal echoes in the lower part of the uterus, indicating CSP (Fig. 5). A single deep intramuscular injection of methotrexate (50 mg/m^2) was administered and bilateral uterine artery embolization was performed, followed by uterine curettage under ultrasound guidance. All the patients recovered and were discharged after surgery.

Discussion

Scar pregnancy after cesarean section is a unique type of ectopic pregnancy, but the cause remains unclear and has been proposed to be associated with a defect in the decidua at the scar site (10). Trophoblasts directly invade the uterine muscle layer, where the villi adhere to, implant into or even penetrate the uterine wall. The early clinical symptoms and manifestations of CSP are atypical and can be easily misdiagnosed as threatened miscarriage (11,12). In the present study, three patients with early pregnancy were diagnosed with miscarriage due to a short duration of amenorrhea. During the first pelvic ultrasound examination, only the presence of a gestational sac in the uterus was examined, but the position of the gestational sac was not examined. The relationship between the location of the gestational sac and previous cesarean section uterine scarring were not carefully examined. During the process of medical abortion and curettage, there was marked vaginal bleeding, which was considered an incomplete abortion. In total, four patients had amenorrhea for >70 days and experienced minor vaginal bleeding. Ultrasound examination revealed no original heartbeats in cases of intrauterine pregnancy, before only considering it as embryonic arrest and did not carefully observe the position of the gestational sac and its relationship with uterine scars and the bladder, leading to the incorrect original judgment.

CSP can be classified into types I, II and III based on the depth, growth direction and local muscle layer thickness of

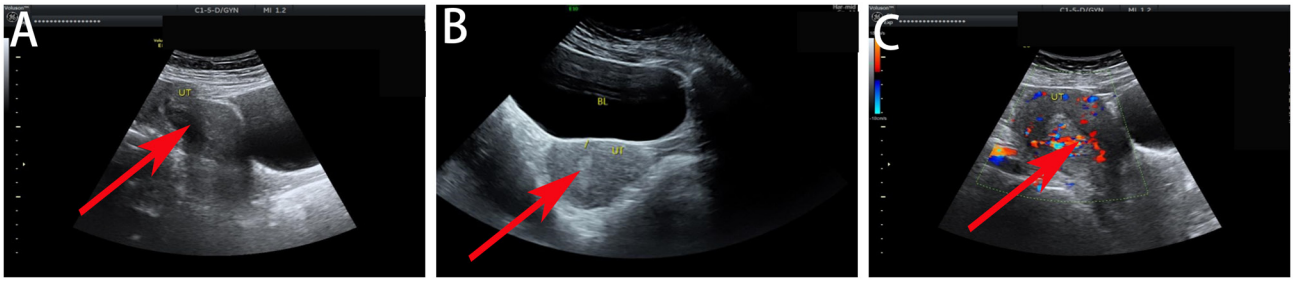

Figure 5. Misdiagnosis of embryonic arrest in three patients according to ultrasound (red arrow: Echo in the uterine cavity). (A) Case 1, (B) case 5 and (C) case 7.

the gestational sac implanted at the scar site of the cesarean section during ultrasound examination (13,14). The gestational sac in type I and type II CSP can grow into the uterine cavity. If the relationship between the gestational sac implantation site and the cesarean scar is not considered during the ultrasound examination, it can be easily misdiagnosed as an intrauterine pregnancy (15). As gestational age increases, the section of the gestational sac protruding into the uterine cavity gradually increases, such that its relationship with the cesarean scar becomes increasingly unclear, with indistinguishable boundaries observed by ultrasound. Therefore, misjudgments are prone to occur during ultrasound examinations.

Using the sonographic reporting system for CSP in early gestation, it is possible to reduce the misdiagnosis rate at ultrasound examination (16). In cases where CSP is difficult to diagnose using ultrasound, transvaginal three-dimensional (3D) color ultrasound or MRI should be combined to ensure timely diagnosis (17). Transvaginal ultrasonography is considered to be the optimal imaging technique for diagnosing CSPs due to its capabilities for soft tissue characterization, whilst MRI can also be used to inform the decision-making process (18). Therefore, MRI is considered a useful complementary tool alongside transvaginal ultrasonography for correctly diagnosing and categorizing CSPs to inform the subsequent therapeutic approach more accurately (19). As the gestational age increases, not only does the difficulty of diagnosing CSP increase, but the risk of poor treatment outcomes also increases drastically (5,10). Termination of a midterm pregnancy can cause severe bleeding, uterine rupture and even endanger the life of the mother (20,21). If the patient chooses to continue the pregnancy, the risk of serious complications, such as placental implantation, placenta previa, uterine rupture and postpartum hemorrhage, are increased during the middle and late stages of pregnancy, endangering the lives of both the mother and fetus (22,23). For patients with a history of cesarean section who have terminated their pregnancy, a detailed understanding of their previous pregnancy and childbirth history should be obtained. Irregular vaginal bleeding should not be generalized as a sign of miscarriage, whereby attention should be paid to the source of blood supply to the gestational sac. If there is heavy vaginal bleeding or a small amount of continuous hemorrhage, then the operation should be suspended to avoid serious consequences.

Performing transvaginal ultrasound examination during early pregnancy for mothers with high-risk factors, such as a history of pathological placenta, ectopic pregnancy and multiple cesarean sections, can significantly improve prognosis and reduce the occurrence of emergency surgeries (24). At present, pregnancy termination is recommended after a clear diagnosis of scar pregnancy after cesarean section, mainly to ensure the integrity and fertility of the uterus, reduce the risk of major bleeding and ensure the safety of the mother (6,10,15). Inappropriate treatment after a misdiagnosis of CSP can lead to hemorrhagic anemia, which can in turn render patients less tolerant to subsequent treatment and blood coagulation (25). Mistreatment can cause CSP to evolve into a more complex type III lump-type CSP, resulting in a more complex and fragile local tissue structure in the cesarean scar (25,26). When re-treated, these lump-type masses are more likely to rupture, causing severe hemorrhage (25,26). Therefore, remedial treatment after misdiagnosis is frequently passive and difficult. Comprehensive individualized considerations should be made based on the patient's general condition, classification and previous treatment status. Uterine artery embolization is typically the first choice of emergency rescue treatment for hemorrhage, but caution should be exercised regarding the possibility of disseminated intravascular coagulation (27,28). Hysterectomy is only used as a last resort to save the patient's life. For patients in good general condition, such as a history of little vaginal bleeding and low blood levels of human chorionic gonadotropin, oral mifepristone and intramuscular injection of methotrexate can be effective (29,30). If necessary, scar pregnancy lesion resection surgery can be performed. However, sufficient rescue measures, such as uterine artery embolization, surgical resection and compression hemostasis, should be performed for heavy intraoperative bleeding.

Notably, the misdiagnosis rate of CSP varies among different hospitals. Yu *et al* (31) previously reported 100 cases of CSP, with 7 being misdiagnosed (two cases of fetal arrest, one case of incomplete miscarriage, two cases of early pregnancy, one case of mid-pregnancy and one case of hydatidiform mole). In another study, Yin *et al* (32) reported 42 cases of CSP, amongst whom the initial symptoms varied and 14 cases were misdiagnosed at primary hospitals (33%) before being eventually diagnosed in Peking University First Hospital (Beijing, China). After treatment, all patients achieved favorable therapeutic outcomes. Therefore, in hospitals of different levels, due to the different experience levels of obstetricians, gynecologists and ultrasound physicians, with different symptom manifestations, misdiagnosis rates can vary. The 940th Hospital of the Joint Logistics

Support Force of the Chinese People's Liberation Army is located in the Gansu Province in western China, where patients frequently face economic challenges. Amongst the 42 patients, 7 cases (16.67%) were found to be misdiagnosed. Notably, Peking University First Hospital is a top hospital for obstetrics and gynecology, where patients were eventually sent to this hospital from less-specialized hospitals to confirm the diagnosis. This highlights a gap between less-specialized and top hospitals, implying the need for medical staff to exercise caution when making conclusions based on lesions identified using ultrasound in this patient population.

Misdiagnosis may be due to a number of factors. The operator may lack experience and be unfamiliar with the ultrasound characteristics of CSP, such as the positional relationship between the gestational sac and scar and muscle layer thinning. These symptoms can be confused with cervical or cornual pregnancy. This may also be compounded by a failure to comprehensively analyze the patient's medical history, including identifying a history of cesarean section. In addition, low-resolution ultrasound may not be able to clearly identify the subtle structures of gestational sacs and scars, such as muscle layer thickness and blood flow signals, especially during early pregnancy. Scar morphology is also typically complex, such as scar diverticulum (defined as depression at the incision site), which may be mistaken for a gestational sac or conceal the true location of pregnancy. Poor scar healing, hematoma or inflammation may further interfere with imaging. Furthermore, excessive forward or backward bending of the uterus may affect the probe angle and result in unclear imaging. In early pregnancy, the gestational sac is small and has not yet been clearly embedded in the scar tissue, which can also lead to misdiagnosis as intrauterine pregnancy. After multiple pregnancies or the use of assisted reproductive technology, the implantation site of the embryo is likely to exhibit complex characteristics, further complicating diagnosis. Additionally, it is difficult to distinguish between cervical pregnancy and cornual pregnancy. Obesity or intestinal gas interference, poor-quality transabdominal ultrasound images and a lack of combined transvaginal ultrasound examination can also contribute to missed diagnosis. The blood flow signal around the gestational sac may not have been evaluated, which is important given that CSP frequently presents with rich and low obstruction of blood flow (6,10,15). In particularly complex cases, 3D ultrasound or MRI should be applied to clarify the spatial relationships between the gestational sac and scar tissue.

In conclusion, in pregnant women with a history of cesarean section, a transvaginal ultrasound examination should be performed as soon as possible to exclude CSP. Difficulties in diagnosis can be resolved using transvaginal 3D ultrasonography or pelvic MRI. An accurate ultrasound investigation is necessary to correctly diagnose CSP and select appropriate treatment plans. If the diagnosis remains unclear, blind curettage should be avoided, particularly when unexpected heavy bleeding occurs with insufficient preparation, which may lead to irreversible outcomes. The difficulty and risk of CSP remedial treatment are greater than those of the initial treatment, where individualized comprehensive selection should be made according to the specific situation of each patient. The present study is limited by its retrospective nature and limited sample size, which should be addressed in future studies to enable suitable statistical analysis and promote the generalizability of the findings.

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Availability of data and materials

The data generated in the present study may be requested from the corresponding author.

Authors' contributions

XLX, WYC and YRH contributed to the drafting of the manuscript and the design of the study. KLW, XP, RRM, QS and JXY contributed substantially to the conceptualization and collected data for patient cases. XLX aided with completion of the surgery. QS and JXY approved the final version of the manuscript for publication. XLX and JXY confirm the authenticity of all raw data. All authors have read and approved the final manuscript.

Ethics approval and consent to participate

The present study was approved by the Ethics Committee of 940th Hospital of the Joint Logistics Support Force of the Chinese People's Liberation Army Hospital (approval no. 2024KYLL002; Lanzhou, China) and was performed in accordance with local legislative guidelines and the 2024 Revision of the Declaration of Helsinki. Written informed consent for participation and publication was obtained from all patients included in the present study.

Patient consent for publication

Written informed consent for participation and publication was obtained from all patients included in the present study.

Competing interests

The authors declare that they have no competing interests.

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