

# Surgical management for type II cesarean scar pregnancy

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Submitted: 12 November 2020 Revised: 27 January 2021 Accepted: 3 February 2021 Published: 15 June 2021

**Background:** Cesarean scar pregnancy (CSP), a rare type of ectopic pregnancy, can lead to adverse pregnancy outcomes. However, there is no uniform international treatment guideline for CSP. In this study, we retrospectively analyzed the advantages and disadvantages of three different surgical methods for type II CSP, trying to find the best treatment plan. **Methods:** From January 2013 to December 2018, a retrospective analysis was performed in 58 patients with type II CSP admitted to the Department of Gynecology, Second Affiliated Hospital of Anhui Medical University. 20 patients underwent hysteroscopic resection (Group A), 18 patients underwent laparoscopic resection and repair (Group B), and 20 patients underwent vaginal resection and repair (Group C). All patients were treated with preventive uterine artery embolization (UAE) preoperatively. The clinical data were collected, and the treatment effects of the different surgical methods were compared. **Results:** Age, gravidity, parity, number of previous cesarean sections, time period since the last cesarean section, menolipsis days, and preoperative level of the beta-subunit of human chorionic gonadotropin ( $\beta$ -hCG) were not significant different among the three groups ( $P > 0.05$ ). The differences in operation time ( $46.85 \pm 20.91$  min vs.  $105.78 \pm 32.95$  min vs.  $67.85 \pm 32.88$  min), intraoperative blood loss ( $45.00 \pm 17.32$  mL vs.  $262.22 \pm 235.74$  mL vs.  $166.50 \pm 150.66$  mL), postoperative hemoglobin level decreased ( $11.60 \pm 5.60$  g/L vs.  $20.11 \pm 7.72$  g/L vs.  $14.95 \pm 5.40$  g/L), and menstrual cycle recovery time ( $35.40 \pm 6.31$  day vs.  $30.11 \pm 5.04$  day vs.  $30.80 \pm 4.62$  day) were significant different. **Conclusions:** Hysteroscopic, laparoscopic, and transvaginal surgery can effectively treat type II CSP. Treatment should be individualized according to the diameter of the gestational sac, the patient's fertility requirements as well as the doctor's surgical experience and the surgical equipment of the local hospital.

## Keywords

Cesarean scar pregnancy (CSP); Hysteroscopic surgery; Laparoscopic surgery; Transvaginal surgery

## 1. Introduction

Cesarean scar pregnancy (CSP) is a rare type of ectopic pregnancy, defined as the implantation of a fertilized egg in the scar of a previous cesarean section, with an incidence rate of about 1 : 1688 to 1 : 2216 [1, 2]. The pathogenesis of CSP has not been fully clarified. Most researchers believe that it may be related to scar healing and myometrial defects in the uterine wall after a cesarean section, leading to the formation of a sinus between the myometrium and the uterine cavity,

where pregnancy implantation occurs. Another suggested mechanism is that when the endometrium has no planting ability and the uterine isthmus extends to the anterior wall of the uterus, a consequent change in the site of pregnancy implantation position occurs [3]. Because CSP can lead to adverse pregnancy outcomes, such as heavy bleeding, uterine rupture, placental implantation, and even the need for a hysterectomy, early pregnancy termination is recommended [4]. However, owing to the lack of clinical data, there is no uniform international treatment guideline for CSP. The current treatment plan is based on patient symptoms, level of the beta-subunit of human chorionic gonadotropin ( $\beta$ -hCG) in blood and ultrasound findings for an individualized treatment, including expectant, medical, and surgical treatment [4].

Clinically, CSP can be divided into two types according to ultrasound features. In type I (endogenic type), the embryo sac is planted in the scar of a previous cesarean section and grows toward the uterine cavity. Although it is possible to continue the pregnancy, complications such as placental implantation and severe bleeding often occur in the second and the third trimesters. In type II (exogenic type), the embryo sac is deeply implanted in the scar defect and grows toward the bladder and abdominal cavity, resulting in bleeding or even uterine rupture in early pregnancy [5]. Because of the greater risk of type II CSP, the literature recommends surgical treatment for this type [6].

In this study, we retrospectively analyzed the treatment of 58 patients with type II CSP. Our objective is to evaluate the feasibility of three different surgical procedures in order to provide constructive information in the clinical treatment of type II CSP.

## 2. Patients and methods

### 2.1 Patients and design

A total of 58 patients with CSP admitted to the Second Affiliated Hospital of Anhui Medical University from January 2013 to December 2018 were retrospectively analyzed (We have about 10,000 deliveries per year). All patients had type II CSP diagnosed with transvaginal ultrasound based on the following ultrasonographic criteria: (1) an empty uterus with a clearly visualized endometrium and an empty cervical canal;

(2) gestational sac implanted in the uterine scar and continuously invading the muscular layer, with the anterior wall of the uterus being continuously interrupted; (3) obvious blood supply around the gestational sac [4]. Furthermore, the ultrasound showed that the fetal cardiac activity is present (Fig. 1).



**Fig. 1.** Transvaginal ultrasound showed a gestational sac implanted in the uterine scar and invaded the muscular layer. U, uterine scar; G, gestational sac.

Among the 58 patients, 20 patients received hysteroscopic resection (Group A), 18 patients received laparoscopic resection and repair (Group B), and 20 patients received vaginal resection and repair (Group C). All the patients were treated with preoperative (UAE) because of the high level of preoperative  $\beta$ -hCG and the activity of the gestational sac.

The choice of the different surgical methods was based on the diameter of the gestational sac and the patient's fertility requirements. When the patient had no fertility requirement and the diameter of the gestational sac was less than 4 cm, the patient underwent hysteroscopic surgery, otherwise laparoscopic or transvaginal surgery was required, selected by the patient after informed consent. Informed consent was obtained from all patients, and the study was approved by the ethics committee.

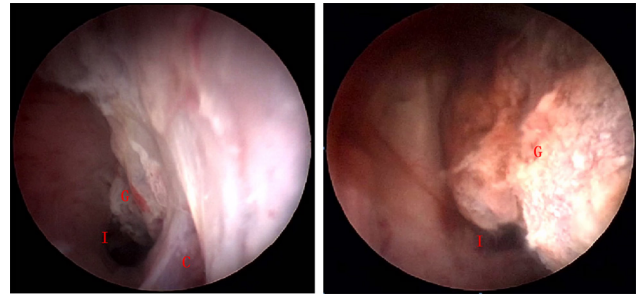
## 2.2 Treatment methods

### 2.2.1 UAE

The right femoral artery was catheterized according to the Seldinger method [7]. After confirming the position of the catheter, gelatin sponge particles and physiological saline were injected from the catheter to embolize the uterine arteries bilaterally. Surgical treatment was performed at 24–48 hours after embolization.

### 2.2.2 Hysteroscopic surgery

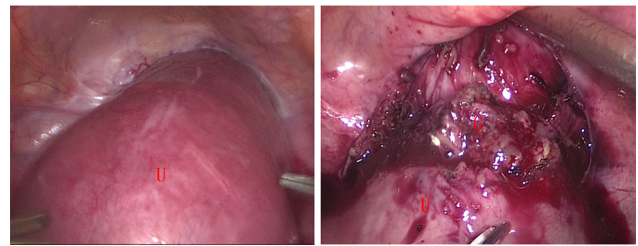
The cervix was injected with dilute solution of vasopressin after being dilated to 10 mm. Then we used the ring electrode to remove the CSP lesions and to stop bleeding by electrocoagulation (Fig. 2).



**Fig. 2.** Hysteroscopic view of CSP. The gestational tissue was implanted in the left anterior endocervical wall, compatible with prior caesarean section scar. C, caesarean scar diverticulum; G, gestational tissue; I, internal os.

### 2.2.3 Laparoscopic surgery

We first opened bladder uterus reflexive peritoneum and pushed the bladder down. After the bladder and adhesions were dissected, we injected vasopressin around the lesion. Unipolar electrocoagulation was used to cut the lesion deeply into the uterine cavity and the pregnancy tissues were clamped completely by using grasping forceps. Finally, the defect was trimmed and sutured with absorbable sutures. If an ovarian tumor or a uterine myoma was found during the operation, it was removed simultaneously (Fig. 3).



**Fig. 3.** Laparoscopic view of CSP showing a topical bulge in the lower segment over the caesarean scar from a patient with CSP. U, uterus; G, gestational tissue.

### 2.2.4 Transvaginal surgery

The bladder cervical space was separated after the vaginal wall was cut transversely below the bladder attachment point of the anterior fornix. The scar was exposed, and vasopressin (6 U) was injected around the lesion. After removing the pregnancy tissues, the cesarean section scar tissue was trimmed at the margin and the incision was also sutured.

A Foley balloon was placed in the uterine cavity postoperatively in all patients and was removed after 24–48 hours.

## 2.3 Statistical analysis

Statistical analysis was performed using SPSS 13.0 software (SPSS Inc., Chicago, IL, USA). Measurement data are presented by mean  $\pm$  SEM. The *t*-test was used for comparison between groups, whereas the  $\chi^2$  test was applied to enumeration data. A value of *P* < 0.05 was considered statistically significant.

**Table 1. Comparisons on the basic materials of the three groups before treatment.**

	Group A (20)	Group B (18)	Group C (20)	P value
Age (years)	33.70 ± 4.57	32.28 ± 4.27	31.90 ± 3.71	0.368
Gravidity	3.15 ± 1.39	3.11 ± 1.13	3.15 ± 1.57	0.995
Parity	1.35 ± 0.49	1.33 ± 0.49	1.35 ± 0.49	0.998
Number of previous cesarean sections	1.30 ± 0.47	1.28 ± 0.46	1.30 ± 0.47	0.986
Time period since the last cesarean section CS (year)	6.00 ± 3.99	5.22 ± 2.73	5.38 ± 3.07	0.744
Menolipsis days (d)	57.15 ± 9.20	60.11 ± 11.70	59.05 ± 12.32	0.348
Preoperative level of $\beta$ -hCG (mIU/L)	30916.95 ± 20124.39	31800.96 ± 20965.87	31610.27 ± 21201.19	0.092
Preoperative hemoglobin levels (g/L)	112.90 ± 15.13	112.56 ± 9.87	111.70 ± 17.60	0.965

#### 2.4 Follow-up

All patients were followed up for  $\beta$ -hCG measurement and vaginal ultrasound examination until the  $\beta$ -hCG level returned to normal and the menstrual cycle was recovered, and the corresponding times were recorded. The patients were instructed to choose the appropriate method of contraception.

### 3. Results

Age, gravidity, parity, number of previous cesarean sections, time period since the last cesarean section, menolipsis days and preoperative  $\beta$ -hCG level were not significantly different among the three groups ( $P > 0.05$ ) (Table 1).

There were no significant differences in the duration of hospital stay (9.00 ± 4.38 day vs. 10.11 ± 2.03 day vs. 8.90 ± 2.73 day) among the three groups ( $P > 0.05$ ), whereas the differences in operation time (46.85 ± 20.91 min vs. 105.78 ± 32.95 min vs. 67.85 ± 32.88 min) were significant ( $P < 0.05$ ). The intraoperative bleeding loss (45.00 ± 17.32 mL vs. 262.22 ± 235.74 mL vs. 166.50 ± 150.66 mL), and decrease in postoperative hemoglobin level (11.60 ± 5.60 g/L vs. 20.11 ± 7.72 g/L vs. 14.95 ± 5.40 g/L) were significantly different between Group A and Group B and between Group A and Group C, whereas there was no difference between Group B and Group C. The time interval before postoperative hCG returned to normal (27.00 ± 7.06 day vs. 20.44 ± 5.66 day vs. 18.15 ± 4.38 day) was not significantly different between Group B and Group C ( $P > 0.05$ ), but the time interval was significantly shorter in Group B than in Group A ( $P < 0.05$ ). The difference in menstrual recovery time (35.40 ± 6.31 day vs. 30.11 ± 5.04 day vs. 30.80 ± 4.62 day) among the three groups was the same as the difference in the time interval before hCG returned to normal. The treatment outcomes are presented in Table 2.

Two patients in Group A required secondary surgery. One patient was urgently treated with laparoscopic resection and repair because of heavy vaginal bleeding (approximately 500 mL) on the 12th day after surgery. Bilateral fallopian tube ligation was also performed because the patient had no fertility requirement. Another patient complained of irregular vaginal bleeding after the operation and ultrasound showed residual chorionic tissue. On the basis of these findings, the patient was indicated for laparoscopic surgery later. One pa-

tient had postoperative pain (5%) and another had gastrointestinal discomfort (5%), both symptoms were resolved with symptomatic treatment.

Patients in Group B were successfully treated without a secondary surgery. One of the patients had a lesion diameter of about 5 cm with abundant surrounding blood supply that was close to the serosal layer. At the same time, the pelvic adhesion caused by the previous cesarean section was severe, eventually leading to surgical difficulties. The intraoperative blood loss was about 2000 mL and the patient received blood transfusion. Of all patients in Group B, only one developed gastrointestinal discomfort. In two patients, a uterine myoma and an ovarian tumor were found during surgery, which were removed simultaneously.

One patient in Group C underwent emergency laparotomy for lesion resection followed by repair because of a high level of hCG and a large amount of vaginal bleeding postoperatively. Another patient had a wide lesion surrounded by abundant blood supply, and consequently, the surface of the wound was obviously bleeding when the lesion was removed. The intraoperative blood loss was 800 mL and the patient received blood transfusion. None of the patients in Group C had postoperative abdominal pain and gastrointestinal discomfort. Bladder injury occurred in one patient during the operation because of a severe adhesion around the scar tissue. In this patient, catheterization was retained after the operation. The catheter was removed after 2 weeks, and the patient had no discomfort thereafter. The complications and failed cases in each group are presented in Table 3.

We followed up the subsequent pregnancy outcomes of the patients with fertility requirements in Group B and C. In Group B, 5 patients received intrauterine pregnancy, of which 8 patients delivered at term and one had preterm delivery. Besides, one patient was diagnosed with ectopic pregnancy, no recurrent CSP reported. In Group C, there were also 5 patients who had intrauterine pregnancy. Except for one patient underwent termination of the pregnancy due to personal reason, the other four gave birth at term. In addition, one patient developed recurrent cesarean scar pregnancy. The subsequent pregnancy outcomes are presented in Table 4.



**Table 2. Comparisons on the treatment outcomes of the three groups.**

	Group A (20)	Group B (18)	Group C (20)	P value
Operation time (min)	46.85 ± 20.91	105.78 ± 32.95	67.85 ± 32.88	0.000
Intraoperative blood loss (mL)	45.00 ± 17.32	262.22 ± 235.74	166.50 ± 150.66	0.000
Length of stay (day)	9.00 ± 4.38	10.11 ± 2.03	8.90 ± 2.73	0.453
Time for serum-hCG returned to normal (day)	27.00 ± 7.06	20.44 ± 5.66	18.15 ± 4.38	0.000
Menstrual cycle recovery time (day)	35.40 ± 6.31	30.11 ± 5.04	30.80 ± 4.62	0.006
Postoperative hemoglobin decline (g/L)	11.60 ± 5.60	20.11 ± 7.72	14.95 ± 5.40	0.000

**Table 3. Complications and failed cases in each group.**

	Group A (20)	Group B (18)	Group C (20)
Hemorrhage	None	2	1
Blood transfusion	None	1	1
Adjacent organ injury	None	None	1
Postoperative pain	1	None	None
Gastrointestinal symptoms	1	1	None
Secondary treatment	2	None	1

**Table 4. Subsequent pregnancy outcomes in Group B and C.**

	Group B (18)	Group C (20)
Full term delivery	4	4
Pre term delivery	1	0
Abortion	None	1
Ectopic pregnancy	1	None
Repeat cesarean scar pregnancy	None	1
Rupture of scar	None	None

#### 4. Discussion

As CSP is a rare ectopic pregnancy, accurate diagnosis and effective treatment are essential to avoid serious complications [8]. Vaginal ultrasound, not only locates the gestational sac but also determines the relationship between the gestational sac and the anterior wall of the uterus, is important for early diagnosis of CSP [9]. The management options include expectant, medical, and surgical treatment. Owing to the high failure rate and high risk, it is not recommended to use expectant treatment in the clinic [10]. Medical treatment includes mifepristone, methotrexate, and UAE, which are considered more simple and less harmful to patients but not usually effective [11]. Therefore, surgery is often used for CSP [12] and the commonly used methods include hysteroscopic, laparoscopic, transvaginal, and transabdominal surgery [6]. However, none of these treatments are entirely efficient, especially for type II CSP with deep invasion of scar defect towards to the bladder and abdominal cavity. In our study, the patients were first accepted UAE. After that, three different surgical treatments were decided according to the diameter of the gestational sac and the patient's fertility requirements.

UAE is considered to be the preventive application for type II CSP [13], reducing intraoperative bleeding and avoid serious complications such as hysterectomy, especially in cases with a thin muscle layer and rich blood flow around the lesion [14]. Although some researchers believe that UAE af-

fects ovarian function and causes endometrial atrophy, leading to amenorrhea and other adverse events, more studies have shown that owing to the existence of communicating branches in the pelvic cavity, the blood supply to the uterus and ovaries can still maintain normal physiological needs [7]. In our study, because of the high level of preoperative  $\beta$ -hCG and the activity of the gestational sac, UAE was used to reduce intraoperative blood loss and to improve the success rate of surgery. All patients had normal menstruation after UAE, and we came to the conclusion that UAE had no significant effect on ovarian function.

Hysteroscopic surgery allows the surgeons to remove CSP lesions under direct vision to avoid endometrial damage [15] and to directly coagulate the bleeding site [16]. However, it is difficult to completely remove residual microscopic lesions [8], which leads to a slow decrease in serum  $\beta$ -hCG levels after surgery. In previous study, hysteroscopic surgery was considered to be a primary treatment especially for type I CSP [17]. But in this study, it is an innovative attempt to combine UAE and hysteroscopic surgery to treat type II CSP. Although Group A had a higher probability of secondary surgery (20%) and the time interval before the hCG level returned to normal as well as the time of menstrual cycle recovery were longer relative to the other two groups, resulting from the difficulty to remove the villus tissue implanted in the muscle layer completely, the advantages could not be ignored for Group A had the shortest procedure time and the lowest bleeding amount due to good visualization and electrocoagulation. Because large lesion increases the difficulty and risk of the surgery, we advised patient with the ultrasound showing the diameter of the gestational sac less than 4 cm to receive hysteroscopic surgery, which reduced intraoperative bleeding to some extent. But it is undeniable that hysteroscopic surgery can be an alternative choice for patients with type II CSP who do not have fertility requirements. It is essential for us to divide different groups in hysteroscopic surgery according to the size of the gestational sac in the further study.

Laparoscopic surgery for CSP is safe and effective [18], with a success rate of 97% [11]. This procedure has a high demand for the surgeon's laparoscopic skill because it is difficult to cut a large lesion especially in the presence of severe adhesions and to suture the normal thickness of the muscle layer in two layers after the intramuscular defect tissue being removed [19]. In transvaginal surgery, the scar can be repaired under direct vision, reducing the probability of CSP

recurrence [20]. However, there is a certain degree of blindness when the bladder is separated, which leads to the possibility of bladder injury. Thus, this treatment also requires a surgeon with extensive experience [21]. In our study, compared with Group A, the time interval before the hCG level returned to normal and the time of menstrual cycle recovery were shorter in Group B and Group C, for the latter two methods can remove the lesion completely. Because of difficult suturing and hemostasis, operative time in Group B and Group C increased. When the lesion was large or severe pelvic adhesion occurred, transfusion was needed due to more intraoperative blood loss (1/18 in Group B, 1/20 in Group C). Compared with laparoscopic surgery, transvaginal surgery, which requires no special instruments, is easy to promote. Besides, because transvaginal surgery does not open the retroperitoneal fold, it does not affect the intestinal function. So for patients with type II CSP, especially with large gestational sac and fertility requirements, it is better to have laparoscopic or transvaginal surgery. If patients also have a uterine myoma and an ovarian tumor, they are more inclined to laparoscopic surgery. The final choice of surgical method depends on the patient's willingness, the doctor's surgical experience and the surgical equipment of the local hospital.

After UAE with laparoscopic or transvaginal surgery, the patients with fertility requirements required strict contraception for 2 years, including intrauterine device, oral contraceptive and condom, in order to have enough time to repair the uterine scar and to reduce the risk of uterine rupture during pregnancy. The subsequent pregnancy outcomes showed that there were five intrauterine pregnancies in each group. However, Group B had one case of ectopic pregnancy and Group C developed one case of recurrent cesarean scar pregnancy. Because we started the follow-up from the third year after the operation, some patients with fertility requirements may have not yet tried to conceive again. In order to increase the accuracy of the data, the postoperative pregnancy outcomes require more time to follow up.

## 5. Conclusions

Although there is no universal agreement on the treatment for CSP, in this study, we find out that hysteroscopic, laparoscopic, and transvaginal surgery can effectively treat type II CSP, and the surgical method depends on the diameter of the gestational sac, the patient's fertility requirements as well as the doctor's surgical experience and the surgical equipment of the local hospital. However, further research should be designed based on some indicators such as the preoperative level of  $\beta$ -hCG, the diameter of the gestational sac, in order to provide patients with individualized treatment plans.

## Author contributions

BW and WYW designed the research study. LL and JJF performed the research. QS provided help during the research. LZ and JL analyzed the data. All authors contributed to editorial changes in the manuscript. All authors read and

approved the final manuscript.

## Ethics approval and consent to participate

All subjects gave their informed consent for inclusion before they participated in the study. The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Ethics Committee of the Second Affiliated Hospital of Anhui Medical University (approval number: YX2020-053).

## Acknowledgment

We would like to express my gratitude to all those who helped me during the writing of this manuscript.

## Funding

The article was supported by the school project of Anhui Medical University (2019xkt040).

## Conflict of interest

The authors declare no conflict of interest.

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