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Original Research

High-Risk Factors for Hemorrhage in Hysteroscopic Curettage for Cesarean Scar Pregnancy

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Abstract

Background: With the increase in cesarean sections, the occurrence of cesarean scar pregnancies has shown a significant upward trend. To investigate the high-risk factors for hemorrhage during hysteroscopy for cesarean scar pregnancy (CSP). **Methods**: This is a retrospective case-control study. A total of 338 cases of CSP were divided into-hemorrhage group and non-hemorrhaged group according to the volume of hemorrhage. The collected data included maternal age, duration of amenorrhea, frequency and interval time of cesarean sections, number of induced abortions, pre-treatment human chorionic gonadotropin (hCG) levels, gestational sac length, myometrial thickness at the uterine scar, blood flow signal around the gestational sac as detected by ultrasound, and CSP classification. Statistical analysis was performed to assess differences between the two groups. **Results**: Statistically significant differences between the two groups were observed in the duration of amenorrhea, gestational sac length, myometrial thickness at the uterine scar, and blood flow signal around the gestational sac. Hysteroscopic curettage for CSP was found to be safe and feasible when the duration of amenorrhea was $<$49 days, the gestational sac length was $<$30 mm, the resistance index (RI) of the blood flow signal around the gestational sac was $>$0.4, and the myometrial thickness at the uterine scar was $>$2 mm. **Conclusions**: Hysteroscopic curettage is a safe and effective procedure for CSP in carefully selected patients.

Keywords: cesarean scar pregnancy; hysteroscopy; hemorrhage; risk factors

1. Introduction

Cesarean scar pregnancy (CSP) refers to a rare type of ectopic pregnancy in which the fertilized egg is implanted in the scar from a previous cesarean section. The incidence of CSP is estimated to be between 1 in 2216 and 1 in 1800, representing 1.15% of women with a history of cesarean section [1]. At present, there are at least 31 reported treatments for CSP [2], including surgical, medical, minimally invasive approaches [uterine artery embolization (UAE), high intensity focused ultrasound (HIFU), balloon], expectant management, and multiple combinations thereof. No particular treatment is considered optimal [3,4]. Hysteroscopic curettage of pregnancy tissue is an effective treatment, but is limited by the risk of uncontrollable hemorrhage during the operation. However, it can still be considered safe and effective in certain cases. In the present study, we retrospectively analyzed 338 patients with CSP who underwent hysteroscopic curettage. Our aim was to identify risk factors for hemorrhage, thus providing a clinical basis for the early diagnosis and treatment of CSP.

2. Materials and Methods

2.1 Research Subjects

This is a retrospective case-control study. A total of 360 cases of CSP were identified in the Department of Gynecology, First Affiliated Hospital of Chongqing Medical University, between January 2016 and December 2021. All patients underwent hysteroscopic curettage as treatment.

The inclusion criteria were: complete clinical and follow-up data; elevated human chorionic gonadotropin (hCG) level; history of cesarean section; ultrasound demonstrating an empty uterine cavity and cervical canal; gestational sac implanted in the lower segment of the anterior wall of the uterus; stable vital signs; patients were fully informed of the various treatment methods and had voluntarily chosen hysteroscopic surgery. There were no contraindications for the operation based on preoperative physical examination and ancillary examinations (complete blood count, coagulation tests, liver and kidney function, electrolytes, blood glucose, electrocardiogram). The exclusion criteria were: evidence of a systemic infection or severe local infection; heart, lung, liver, or kidney complications; coagulation dysfunction; presence of trophoblastic disease; presence of malignant tumor; the patient chose a treatment method other than hysteroscopy.

Two cases with hydatidiform mole were excluded from the final analysis. Fourteen cases were treated with medications with expected outcomes, while 6 cases were excluded from uterine curettage, vaginal surgery, and laparoscopic surgery. The final cohort for analysis therefore consisted of 338 cases.

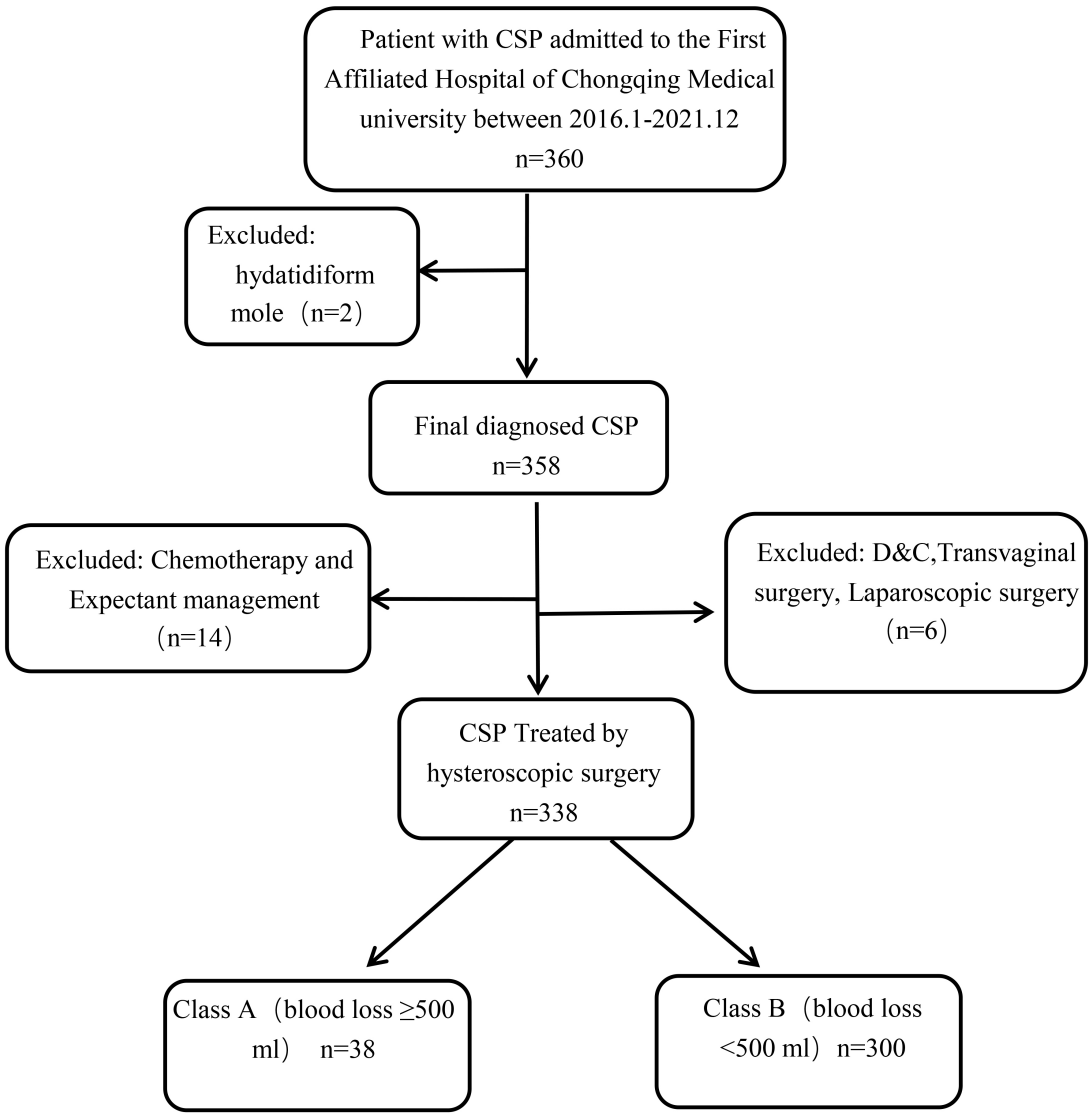

Fig. 1. Flow chart used for selection of the study population. CSP, cesarean scar pregnancy; D&C, dilatation and curettage.

2.2 Hysteroscopic Curettage Treatment

All patients provided informed consent prior to the operation. The information given to patients explained the risks associated with massive bleeding, including the possibility of requiring emergency surgery or potentially a hysterectomy. The cervix was dilated using oral or vaginal misoprostol 1 hour prior to surgery. Preparations were made for blood transfusion, fluid replacement, and emergency surgery. Antibiotics were given perioperatively to prevent infections.

The surgical instrument used was an intraluminal hysteroscope (StrykerHD1288, Kalamazoo, MI, USA), and the perfusion fluid consisted of 5% glucose. Local anesthesia with lidocaine block was used. All procedures were performed by the same team of doctors. After routine disinfection, hysteroscopy was performed to determine the position, shape, and size of the pregnancy, followed by curettage. A follow-up hysteroscopy was performed to determine if there was residual bleeding. If an active hemorrhage was detected during the operation, a water bag cervical tube was used to compress the bleeding site.

2.3 Patient Grouping and Data Collection

According to the literature, the standard criterion for postpartum hemorrhage is when the amount of bleeding during and within 24 h after the operation reached 500 mL. Patients with $\geq$500 mL of hemorrhage were allocated to Group A, while patients with $<$500 mL of hemorrhage were allocated to Group B (see Fig. 1).

The following data was collected for each patient: age, days of amenorrhea, frequency and interval time of cesarean section, number of induced abortions, hCG level before treatment, gestational sac length, CSP classification, blood flow signal around the gestational sac, and amount of hemorrhage.

Table 1. Characteristics of hemorrhage groups in CSP cases treated with hysteroscopy.

Clinical feature	Hemorrhage volume		*p*
	Group A ≥500 mL	Group B <500 mL	
Frequency of cesarean section			0.422[1]
1	61% (183/300)	68.4% (26/38)	
2	35.7% (107/300)	31.6% (12/38)	
3	3.3% (10/300)	0% (0/38)	
CSP classification			
I	45.7% (137/300)	55.3% (21/38)	0.232[1]
II	45.7% (137/300)	31.6% (12/38)	
III	8.6% (26/300)	13.2% (5/38)	
Blood flow signal			0.001[1]
H	8% (24/300)	28.9% (11/38)	
L	92% (276/300)	71.1% (27/38)	
Interval time of cesarean section	5 (3, 8)	5 (3, 9.25)	0.460[3]
Number of abortions	2 (1, 3)	2 (1, 3)	0.175[3]
Gestational sac length (mm)	30.50 (21.25, 42.00)	45.00 (35.00, 52.75)	0.001[3]
Days of amenorrhea	49 (43, 59)	57 (50, 74.25)	0.001[3]
hCG (mmol/mL)	47,732 (17,866, 14,582)	59,043 (11,415, 151,272)	0.639[3]
Age (years)	33.14 ± 4.30	32.24 ± 4.66	0.229[2]
Thickness of uterine scar (mm)	2.40 (1.30, 4.00)	0.95 (0.00, 1.93)	0.001[3]

[1] Chi-square test; [2] *t*-test; [3] Mann-Whitney U rank-sum test. hCG, human chorionic gonadotropin.

The Expert Consensus on the Diagnosis and Treatment of Scar Pregnancy after Cesarean Section issued by the Chinese Medical Association in 2016 defines several types of CSP. Type I refers to the part of the gestational sac located at the scar site, with a muscular layer thickness >3 mm. Type II refers to the part of the gestational sac located at the scar, with a muscular layer thickness ≤3 mm. In Type III, the gestational sac is located completely at the scar, protrudes outward toward the bladder, and the thickness of the muscular layer at the scar is ≤3 mm. Type III also includes a unique form of lumpy CSP, characterized by cystic or solid-like echoes. These cases typically involve a combination of pregnancy remnants and blood clots following a CSP abortion. No blood flow signal and a resistive index (RI) ≥0.4 were classified as group L, while those with a blood flow signal and RI <0.4 were classified as group H.

2.4 Statistical Analysis

Univariate and multiple logistic regression analysis were used to examine the relationship between variables and the risk of postoperative hemorrhage during hysteroscopy for CSP. SPSS 25.0 statistical software (IBM Corp., Chicago, IL, USA) was used for analysis. Measurement data were expressed as $\bar{x} \pm s$, and $p < 0.05$ indicating statistical significance. The 95% confidence interval (CI) was calculated using the total score function in GraphPad Prism 9.0 software (GraphPad Software, Inc., San Diego, CA, USA), where the standard deviation is calculated as the square root of [(incidence of hemorrhage within 1 week of amenorrhea days) × (incidence of hemorrhage within 1 week of amenorrhea days)/total number of cases within 1 week of amenorrhea days]. Measurement data that conformed to a normal distribution was expressed as the mean ± standard deviation, with groups compared using two independent sample *t*-tests. Measurement data that did not conform to a normal distribution was expressed as the median (Q25, Q75), and compared using the Mann Whitney U-rank sum test. Count data was analyzed using the Chi-square test.

3. Results

3.1 Clinical Characteristics of Hemorrhage Risk Groups in CSP Patients Treated by Hysteroscopy

The factors of age, number and years of previous cesarean sections, number of induced abortions, hCG level prior to treatment, and CSP classification were not significantly associated with the risk of hemorrhage during hysteroscopic treatment of CSP (Table 1). However, the number of amenorrhea days, gestational sac length, myometrial thickness of the uterine scar, and blood flow signal around the gestational sac were all significantly associated with the risk of hemorrhage ($p < 0.05$).

As shown in Table 1, the amenorrhea period with different bleeding volumes was 49.00 (43.00, 59.00) *vs.* 57.00 (50.00, 74.25), with statistical differences ($p = 0.001$). The diameter of gestational sac (mm) was 30.50 (21.25, 42.00) and 45.00 (35.00, 52.75), respectively, with a *p* value of 0.001, indicating statistical differences. The thickness of uterine scar (mm) was 2.40 (1.30, 4.00) and 0.95 (0.00, 1.93), respectively, with a *p* value of 0.001, indicating statistical differences (see Table 2).

Table 2. Results of multiple logistic regression analysis.

Factor	*p*	OR	95% CI
Amenorrhea days	0.001	1.036	1.015–1.058
Gestational sac length	0.016	1.027	1.005–1.049
Thickness of uterine scar	<0.001	0.392	0.268–0.573
Blood flow signal	0.001	4.103	1.737–9.691

OR, odds ratio; 95% CI, 95% confidence interval.

The amenorrhea days were odds ratio (OR) 1.036, with a 95% CI (1.015–1.058), and a *p*-value of 0.001. The gestational sac length was OR 1.027, with a 95% CI (1.005–1.049), and a *p*-value of 0.016. The myometrial thickness at the uterine scar was OR 0.392, with a 95% CI (0.268–0.573), and a *p*-value of <0.001. The blood flow signal around the gestational sac was OR 4.103, with a 95% CI (1.737–9.691), and a *p*-value of 0.001. The significant risk factors for greater hemorrhage after hysteroscopic treatment were fewer amenorrhea days, higher Type L blood flow signal around the gestational sac, and shorter gestational sac length. On the other hand, a thinner myometrial layer was a protective factor.

3.2 Analysis of High-Risk Factors during Hysteroscopic Treatment of CSP

Risk maps for hemorrhage during hysteroscopic treatment for CSP were constructed based on the period of amenorrhea and length of the gestational sac. The risk of hemorrhage from CSP increased after 49 days of amenorrhea, with the incidence of hemorrhage ≥500 mL being 17.46% after 70 days of amenorrhea. The incidence of hemorrhage ≥500 mL was 28.57%. Hysteroscopic treatment of CSP with a gestational sac length >30 mm increased the risk of hemorrhage ≥500 mL, with an incidence of 11.53% (Figs. 2,3).

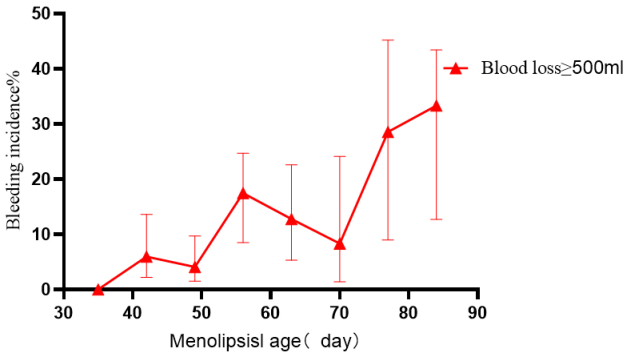

Fig. 2. Bleeding after hysteroscopic treatment of CSP according to days of amenorrhea.

The error line in Fig. 2 represents the 95% CI. The risk of bleeding was found to increase when the duration of amenorrhea was >49 days, and especially when it was >70 days.

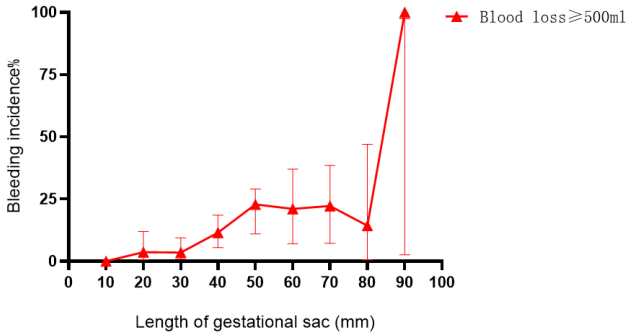

Fig. 3. Bleeding after hysteroscopic treatment of CSP according to the length of the gestational sac.

Bleeding after hysteroscopic treatment of CSP increased when the gestational sac length was >30 mm (Fig. 3), the blood flow signal RI around the gestational sac was <0.4, and the uterine scar showed a thicker myometrium.

4. Discussion

CSP is rare ectopic pregnancy that occurs at a specific location. Severe complications, such as massive hemorrhage and uterine rupture, may occur with continuing pregnancy or after surgical intervention [5]. The basic principles and methods for reducing morbidity should be followed as closely as possible in order to preserve patient fertility [6]. Due to the implementation of the two-child policy in China, CSP is becoming more common. As the number of gestational days increases, severe complications from CSP may occur, including uterine rupture, massive hemorrhage, and even life-threatening situations [7]. In this retrospective analysis, 338 patients with CSP were treated by hysteroscopy. None of the patients required additional treatments because of severe bleeding (e.g., hysterectomy). Hysteroscopic curettage has several advantages compared to other methods, including that it is direct, rapid, intuitive, low cost, and has no subsequent adverse complications. Moreover, it has been reported that pregnancy after a hysteroscopic operation has favorable outcomes [8]. According to the literature, not all patients are suitable for hysteroscopy, and the completion rate of hysteroscopic surgery for CSP is reported to be 50–80% [9]. The selection of suitable patients, as well as the timely execution of this procedure, are important for the successful outcome of CSP treatment by hysteroscopy in clinical practice.

The treatment principle is early diagnosis, prompt intervention, and timely resolution. We analyzed several factors that could potentially increase the risk of hemorrhage after hysteroscopic treatment of CSP, including patient age, days of amenorrhea, frequency and interval time of cesarean section, number of abortions, thickness of the myometrium at the uterine scar, hCG level prior to treatment, length and type of gestational sac, and blood flow signal around the gestational sac. Our study found that high-risk

factors for hysteroscopic curettage included the duration of amenorrhea, gestational sac length, myometrial thickness of the uterine scar, and blood flow signal around the gestational sac. These findings should allow clinicians to better select patients who are suitable for hysteroscopic surgery.

The most significant limitation of hysteroscopic treatment for CSP is the occurrence of massive hemorrhage [10,11]. Study that has systematically analyzed the effectiveness and safety of CSP treatment have defined massive hemorrhage as a volume >500 mL [12]. When intraoperative hemorrhage exceeds 500 mL and has not been stopped, the patient is at risk of multiple complications including shock, hysterectomy, and even disseminated intravascular coagulation (DIC). When hCG levels are low and the duration of amenorrhea has been prolonged, the patient may still be at risk of hemorrhage during hysteroscopy treatment for CSP [13]. In the 338 CSP patients who were followed up in this study, all underwent complete removal of the pregnancy, and none required an emergency hysterectomy due to massive hemorrhage. The risk of major bleeding increased significantly during hysteroscopic surgery if the duration of amenorrhea was >49 days, the length of the gestational sac was >30 mm, the RI of the blood flow signal around the gestational sac was <0.4, and the thickness of the myometrium at the uterine scar was >2 mm. We suggest that early diagnosis is the best way to avoid the risk of major bleeding during CSP termination caused by high hCG and a long period of amenorrhea.

5. Conclusions

We conducted a retrospective analysis of the factors associated with hemorrhage after hysteroscopic surgery for CSP. Curettage of CSP lesions by hysteroscopy was deemed safe and feasible when the duration of amenorrhea was <49 days, the length of the gestational sac was <30 mm, the RI of the blood flow signal around the gestational sac was >0.4, and the thickness of the myometrium at the uterine scar was >2 mm. This study found that hysteroscopic surgery for CSP has a significant impact on patient outcome and reduces the risk of hemorrhage.

Availability of Data and Materials

The data and materials that support the findings of this study are available from the first author.

Author Contributions

QY and CL designed the research study. CL and XX performed the research. CL provided help and advice on the article. QY analyzed the data. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript. All authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Ethics Committee of the First Affiliated Hospital of Chongqing Medical University (approval number: 2022 scientific research ethics (2020-531)). All patients provided informed consent prior to the operation.

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Conflict of Interest

The authors declare no conflict of interest. Cong Li is serving as one of the Editorial Board members of this journal. We declare that Cong Li had no involvement in the peer review of this article and has no access to information regarding its peer review. Full responsibility for the editorial process for this article was delegated to Michael H. Dahan.

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