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Predictors of Treatment Success in Cesarean Scar Pregnancy: A Retrospective Cohort Study of 172 Cases

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Abstract

Introduction: Cesarean scar pregnancy (CSP) is a rare form of ectopic pregnancy that carries a substantial risk of maternal morbidity. Because identifying which patients respond well to therapy is central to better clinical care, we set out to describe the demographic and clinical profile of women managed for CSP at our center and to look for factors tied to whether treatment succeeded.

Methods: We carried out a retrospective cohort study of 172 women with a confirmed diagnosis of cesarean scar pregnancy. Baseline demographic and obstetric details were recorded for each patient, who was then grouped according to whether her first-line treatment ultimately worked. Because first-line treatment was individualized rather than randomized, we also compared the baseline characteristics of the four primary treatment groups. Univariate and multivariate logistic regression were used to test which clinical variables were related to treatment success.

Results: Treatment was successful in 153 women (89.0%) and failed in 19 (11.0%). Women whose treatment failed were diagnosed at a later gestational age than those treated successfully (7.4 ± 1.3 vs. 6.8 ± 1.4 weeks, $p = 0.023$). Age, gravidity, parity, and the presence of fetal cardiac activity did not differ between the two groups. The first-line treatment used was closely related to gestational age and to fetal cardiac activity (both $p \leq 0.002$), which shows that treatment was chosen according to the clinical severity of the presentation. On multivariate analysis, none of gestational age at diagnosis, fetal cardiac activity, the number of prior cesarean sections, or the treatment approach was independently linked to treatment success.

Conclusion: When CSP is recognized early and managed appropriately, treatment usually succeeds. A later gestational age at diagnosis was associated with failure on univariate testing, but no factor remained an independent predictor of success after multivariate adjustment; the link between early diagnosis and success should therefore be read as a hypothesis-generating observation rather than a proven independent effect.

Key words: Cesarean scar pregnancy; ectopic pregnancy; treatment outcome; methotrexate.

Introduction

Cesarean scar pregnancy (CSP) is a rare but increasingly recognized form of ectopic pregnancy in which the gestational sac implants within the defect of a previous cesarean section scar (1,2). As cesarean delivery has become more common worldwide, CSP has likewise become more frequent (3). Although uncommon, it may lead to grave outcomes such as uterine rupture, life-threatening bleeding, placenta accreta spectrum (PAS) disorders, hysterectomy, and even maternal death when diagnosis or treatment is delayed (3,4).Timely recognition is critical and depends largely on transvaginal ultrasound (5). The characteristic picture is an empty endometrial cavity and cervical canal together with a gestational sac sitting in the anterior lower uterine segment, separated from the bladder by only a thin layer of myometrium (6,7). Even with improvements in imaging, how best to treat CSP is still disputed. Available options are varied and include systemic or locally injected methotrexate, surgical excision, suction curettage, hysteroscopic approaches, and combinations of these. Which factors govern the success of a given approach is still poorly understood (8,9). Given the lack of an agreed-upon management standard, treatment decisions benefit from real-world experience accumulated at tertiary centers. With this in mind, the present study reviews a decade of CSP cases at our institution, with particular attention to the treatments used and to subsequent reproductive outcomes.

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Materials and Methods

This retrospective cohort study was conducted at a tertiary obstetrics and gynecology referral center between January 2014 and December 2024. The study received ethical approval from the local Institutional Review Board (Approval No: 30.04.2026-38914) and was conducted in accordance with the principles of the Declaration of Helsinki. Due to the retrospective nature of the study, the requirement for informed consent was waived. We included 172 consecutive women in whom cesarean scar pregnancy was diagnosed at the referral center. The diagnosis rested on transvaginal ultrasound using established sonographic criteria: an empty uterine cavity and cervical canal, a gestational sac lying within the prior cesarean scar, a thinned or absent myometrial layer between the sac and the bladder, and increased peritrophoblastic flow on Doppler interrogation. First-line treatment consisted of dilatation and curettage (D&C), systemic methotrexate (MTX), combined D&C and MTX, or laparotomy. The choice of first-line treatment was not randomized but individualized by the managing team according to gestational age, the presence of fetal cardiac activity, the residual myometrial thickness, and the patient's hemodynamic status. In general, ultrasound-guided D&C was preferred for earlier gestations with a favorable myometrial margin; systemic MTX, alone or combined with D&C, was used for more advanced gestations or when fetal cardiac activity was present; and laparotomy was reserved for difficult cases such as suspected uterine rupture or uncontrolled bleeding. Because treatment was allocated by indication rather than at random, we compared the baseline characteristics of the four treatment groups to make the selection process explicit and to let the reader judge how comparable the groups were (Table 4). This approach is in line with reports that stratify the management of CSP by disease severity (18). Primary treatment was classified as having failed when the first intervention did not resolve the pregnancy, when hCG levels failed to fall, or when hemodynamic stability could not be achieved, so that further treatment became necessary. Demographic, obstetric, and clinical information was abstracted retrospectively from the medical records. The variables collected comprised maternal age, gravidity, parity, number of prior abortions, gestational age at diagnosis, history of dilatation and curettage, number of previous cesarean sections, fetal cardiac activity at diagnosis, and treatment outcome. Success was defined as full resolution of the CSP without any further major intervention, and failure as persistent pregnancy tissue, the need for a second treatment, significant hemorrhage, or escalation to surgery.

Statistical analysis: Continuous data are reported as mean ± standard deviation and categorical data as counts with percentages. The success and failure groups were compared with the Student t-test or the Mann-Whitney U test for continuous variables, and with the chi-square or Fisher exact test for categorical variables. Baseline characteristics across the four primary treatment groups were compared with the Kruskal-Wallis test for continuous variables and the chi-square or Fisher exact test for categorical variables. Clinically relevant variables were then entered into a multivariate logistic regression model. A p-value below 0.05 was taken as statistically significant.

Results

In total, 172 women were studied. Their mean age was 33.3 ± 6.1 years, with a mean gravidity of 4.4 ± 1.9 and a mean parity of 2.7 ± 1.2, and the mean gestational age at diagnosis was 6.9 ± 1.4 weeks. Seventy women (40.7%) had a prior history of dilatation and curettage. With respect to previous cesarean deliveries, 37 (21.5%) had had one, 69 (40.1%) had had two, and 66 (38.4%) had had three or more. Fetal cardiac activity was detected at diagnosis in 58 women (33.7%). During follow-up after CSP, 90 women (52.3%) went on to achieve a desired pregnancy, 13 (7.6%) miscarried, 36 (20.9%) had ongoing live pregnancies, 5 (2.9%) developed PAS in late pregnancy, and 28 (16.3%) were unable to conceive. Dilatation and curettage was the first-line treatment in most women (135, 78.5%); methotrexate was used alone in 11 cases (6.4%) and combined with D&C in another 14 (8.1%), and laparotomy was carried out in 12 women (7.0%), usually in the more complicated presentations. Table 1 sets out the baseline demographic and obstetric features of the cohort.

Overall, treatment succeeded in 153 women (89.0%) and failed in 19 (11.0%). When the two groups were compared, maternal age, gravidity, parity, and fetal cardiac activity were all similar (age, $p = 0.135$; gravidity, $p = 0.277$; parity, $p = 0.452$; fetal cardiac activity, $p = 0.075$). Gestational age at diagnosis, however, was higher among women whose treatment failed than among those treated successfully (7.4 ± 1.3 vs. 6.8 ± 1.4 weeks, $p = 0.023$). The comparison of clinical

Table 1: Baseline Characteristics of Patients with Cesarean Scar Pregnancy (CSP) (n = 172)

Variable	Mean ± SD
Age (years)	33.3 ± 6.1
Gravida	4.4 ± 1.9
Parity	2.7 ± 1.2
Number of previous abortions	0.9 ± 1.4
Gestational age at diagnosis, weeks	6.9 ± 1.4
Number of previous cesarean sections	**n (%)**
1	37 (21.5)
2	69 (40.1)
≥3	66 (38.4)
History of dilatation and curettage (D&C)	70 (40.7)
Fetal cardiac activity present	58 (33.7)
Primary treatment	**n (%)**
D&C (dilatation and curettage)	135 (78.5)
Methotrexate (MTX)	11 (6.4)
Laparotomy	12 (7.0)
D&C + MTX	14 (8.1)
Secondary treatment	**n (%)**
No secondary treatment (treatment success)	153 (89.0)
D&C	8 (4.7)
MTX	1 (0.6)
Laparotomy	8 (4.7)
D&C + MTX	2 (1.2)
Pregnancy outcome after treatment of CSP	**n (%)**
Fulfilled the desire for pregnancy	90 (52.3)
Miscarriage	13 (7.6)
Live birth / ongoing pregnancy	36 (20.9)
Placenta accreta spectrum	5 (2.9)
Pregnancy did not occur (infertility)	28 (16.3)

Data are presented as mean ± standard deviation or n (%).

features by outcome is shown in Table 2. Because first-line treatment was selected on clinical grounds, the four treatment groups differed in disease severity. Gestational age at diagnosis rose across the D&C, MTX, laparotomy, and combined D&C+MTX groups (6.5 ± 1.0, 8.1 ± 1.2, 8.2 ± 1.5, and 8.9 ± 2.3 weeks, respectively; $p < 0.001$), and fetal cardiac activity became more common in the same order (28.9%, 27.3%, 41.7%, and 78.6%; $p = 0.002$), while age, gravidity, and parity were comparable. Crude treatment success also varied across the modalities (D&C 90.4%, MTX 81.8%, laparotomy 66.7%, D&C+MTX 100%; $p = 0.034$), but these differences follow the underlying differences in gestational age and fetal cardiac activity rather than the intrinsic efficacy of each technique (Table 4).

Table 2: Comparison of Patients According to Treatment Success (n = 172)

Variable	Success (n = 153)	Failure (n = 19)	p-value
Age (years)	33.1 ± 6.2	35.1 ± 5.6	0.135
Gravida	4.4 ± 1.9	4.9 ± 2.1	0.277
Parity	2.6 ± 1.2	2.8 ± 1.3	0.452
Gestational age at diagnosis, weeks	6.8 ± 1.4	7.4 ± 1.3	0.023
Fetal cardiac activity present, n (%)	48 (31.4)	10 (52.6)	0.075

Data are presented as mean ± standard deviation or n (%). p-values were calculated using the Student t-test or Mann-Whitney U test for continuous variables and the chi-square or Fisher exact test for categorical variables.

Table 3: Multivariate logistic regression analysis of factors associated with treatment success

Variable	OR	95% CI	p-value
Gestational age at diagnosis (weeks)	0.76	0.52-1.13	0.173
Fetal cardiac activity (present vs absent)	0.49	0.18-1.39	0.180
Number of previous cesarean sections	0.88	0.53-1.46	0.623
Treatment modality*	1.31	0.69-2.49	0.404

*Treatment modality was analyzed as an ordinal variable based on primary treatment type. OR: odds ratio; CI: confidence interval

Table 4: Comparison of baseline characteristics and success across primary treatment groups (n = 172)

Variable	D&C (n = 135)	MTX (n = 11)	Laparotomy (n = 12)	D&C+MTX (n = 14)	p
Age (years)	33.5 ± 6.2	34.6 ± 5.5	34.3 ± 7.1	30.0 ± 4.7	0.134
Gravida	4.6 ± 2.0	3.6 ± 1.1	4.2 ± 2.1	4.4 ± 1.4	0.429
Parity	2.6 ± 1.2	2.3 ± 1.1	2.8 ± 1.7	3.0 ± 1.0	0.514
Gestational age, weeks	6.5 ± 1.0	8.1 ± 1.2	8.2 ± 1.5	8.9 ± 2.3	<0.001
Fetal cardiac activity, n (%)	39 (28.9)	3 (27.3)	5 (41.7)	11 (78.6)	0.002
Treatment success, n (%)	122 (90.4)	9 (81.8)	8 (66.7)	14 (100)	0.034

Data are presented as mean ± standard deviation or n (%). Continuous variables were compared with the Kruskal-Wallis test and categorical variables with the chi-square or Fisher exact test. Because first-line treatment was allocated on clinical grounds rather than at random, the groups differ systematically in gestational age and fetal cardiac activity; the crude success rates therefore reflect confounding by indication and should not be read as a head-to-head comparison of efficacy.

A multivariate logistic regression model was then fitted to look for independent predictors of treatment success. Gestational age at diagnosis was not an independent predictor (OR = 0.76, 95% CI 0.52 to 1.13, $p = 0.173$). None of the examined factors, namely gestational age at the time of CSP, fetal cardiac activity at diagnosis, the number of previous cesarean deliveries, and the treatment modality used, reached statistical significance ($p = 0.173$, 0.180, 0.623, and 0.404, respectively). These regression results are summarized in Table 3.

Discussion

By drawing on ten years of experience at a single tertiary referral center, this study offers a broad picture of how cesarean scar pregnancies are managed and what their outcomes look like in routine practice. Within our series of 172 women with CSP, treatment was successful in roughly 90% of cases. This high success rate is in keeping with reports from other tertiary centers where early diagnosis and individualized treatment are emphasized (7-10). The literature has noted that choosing D&C as the first-line option improves outcomes by substantially reducing maternal morbidity and mortality (11); its wide availability and low cost add to its practical appeal, and in our cohort it was the treatment used in the great majority of women. Crude success rates were lower in the laparotomy and methotrexate groups, but these modalities were used mainly for pregnancies diagnosed at a more advanced gestational age and with fetal cardiac activity, so the lower success reflects confounding by indication rather than an inferiority of the technique itself. This pattern is consistent with studies suggesting that medical therapy alone tends to be less effective, particularly when fetal cardiac activity is present or gestational age is more advanced, and with reports on the risk factors for failure of methotrexate-based treatment in later CSP (12-14). Consistent with earlier work (12,14), the main observation of our study was the link between late diagnosis and treatment failure on univariate analysis: women whose treatment failed had been diagnosed somewhat later than those treated successfully (15). This association did not persist in the multivariate model, in which no variable, gestational age included, emerged as an independent predictor of success, so the finding should be interpreted with caution. More advanced gestational age may be accompanied by deeper trophoblastic invasion, greater vascularity, and a larger gestational sac, any of which can make treatment more difficult (16). The mean gestational age in our cohort was 6.9 weeks, and, as others have reported, no complications resulting in maternal morbidity or mortality were seen after first-line treatment (17). Our data also showed that the success of surgical treatment for CSP held steady despite the growing number of cesarean births (19). On long-term follow-up after CSP treatment at our clinic, the proportion of women who later developed PAS during pregnancy was lower than the figures cited in the current literature (20,21). Our live birth rates after CSP were comparable to published series (8,20,21), and our post-CSP abortion rates were likewise in the range reported by others (3,15,19). Our infertility rates after CSP appeared lower than those in the literature, though this likely reflects the fact that about half of our patients went on to achieve a desired pregnancy following CSP (15,19,22). In keeping with the literature, our findings suggest that success in CSP improves when management is tailored to each patient's needs and to the operating capacity and resources of the treating center (8,20). Our practice of reserving laparotomy as the first intervention in life-threatening situations, at rates similar to those reported elsewhere, illustrates this point (23). A further caveat when comparing our results with the literature is that our management predated the more recent standardized CSP classification systems and did not incorporate them, so direct comparison with series that used these frameworks should be made with this difference in mind (7,18).

Limitations: Several limitations should be acknowledged. The study was retrospective, and it did not incorporate the more recent CSP classification systems or surgical techniques. More importantly, first-line treatment was allocated on clinical grounds rather than at random; because the treatment groups differed systematically in gestational age and fetal cardiac activity (Table 4), the crude success rates of the different modalities cannot be read as a head-to-head comparison of their efficacy, and residual confounding by indication cannot be excluded. Because some treatment groups contained relatively few patients, the statistical power of certain comparisons, including the multivariate model, was limited. At the same time, the single-center setting, the size of the cohort, and the ten-year span of records are strengths of the analysis.

Conclusion

In summary, cesarean scar pregnancy was managed successfully in about nine of every ten women at our center. A later gestational age at diagnosis was associated with treatment failure on univariate analysis, but no variable remained an independent predictor of success after multivariate adjustment, so this association should be viewed as hypothesis-generating. Prompt recognition, together with management tailored to the individual patient, nevertheless appears key to achieving the best clinical outcomes.

Ethical consent: The study was approved by the local Ethics Committee (Approval No: 30.04.2026-38914) and was conducted in accordance with the principles of the Declaration

of Helsinki. Due to the retrospective nature of the study, the requirement for informed consent was waived.

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