

# Long-term gynecologic, reproductive, and ultrasound outcomes after hysteroscopic resection vs dilation and evacuation for cesarean scar pregnancy: a secondary analysis of a randomized clinical trial



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**BACKGROUND:** Cesarean scar pregnancy is a rare form of ectopic pregnancy in which the gestational sac implants within the myometrial defect of a previous cesarean section. We previously conducted a randomized trial comparing hysteroscopic resection with ultrasound-guided dilation and evacuation, both preceded by systemic methotrexate, for the treatment of cesarean scar pregnancy with positive embryonic heart activity. That trial demonstrated a higher success rate in women undergoing hysteroscopic resection. Beyond immediate treatment success, women treated for cesarean scar pregnancy may experience chronic gynecologic symptoms and impaired fertility.

**OBJECTIVE:** This study evaluates long-term gynecologic symptoms and reproductive and ultrasound outcomes in women who were previously enrolled in the parent randomized trial.

**STUDY DESIGN:** This is a secondary analysis with long-term follow-up of a randomized trial comparing hysteroscopic resection vs ultrasound-guided dilation and evacuation for the treatment of cesarean scar pregnancy. Women with singleton cesarean scar pregnancy and positive embryonic cardiac activity who were randomized between February 2020 and August 2022 were eligible. Participants were contacted 4 to 6 years after treatment (January–February 2026) and invited to a single follow-up visit, which included a structured assessment of gynecologic symptoms, reproductive history, and transvaginal ultrasound evaluation of cesarean scar characteristics, including the presence of a uterine niche. Outcomes included posttreatment gynecologic symptoms, subsequent fertility and pregnancy outcomes, and ultrasound-assessed scar features. Analyses were conducted according to the intention-to-treat principle, with effect estimates reported as relative risks with 95% confidence intervals.

**RESULTS:** Of the 54 women originally randomized, 3 had undergone hysterectomy at the time of the parent trial, leaving 51 women eligible for long-term follow-up. Of these, 26 (51%) were successfully contacted and included in the long-term follow-up analysis, with a median follow-up of 4.59 years. Out of 26 women, 14 also underwent follow-up transvaginal ultrasound assessment. Dysmenorrhea was less frequent in the hysteroscopic resection group than in the ultrasound-guided dilation and evacuation group (6.3% vs 50.0%) (relative risk, 0.13 [95% confidence interval, 0.02–0.92]). No clear differences were observed in other gynecologic outcomes. Among the 9 women who attempted conception, 7 of the 8 women in the hysteroscopic resection group and 1 woman in the dilation and evacuation group achieved a subsequent pregnancy. The only subsequent pregnancy in the dilation and evacuation group was a recurrent cesarean scar pregnancy. On ultrasound follow-up, the frequency of uterine niche was similar between the groups (63.6% vs 66.7%) (relative risk, 0.95 [95% confidence interval, 0.38–2.39]). Niche depth was greater after hysteroscopic resection (mean difference, 1.10 mm [95% confidence interval, 0.04–2.16]), and residual myometrial thickness was thinner than after dilation and evacuation (mean difference, –1.30 mm [95% confidence interval, –2.02 to –0.58]).

**CONCLUSION:** In this secondary analysis with medium- to long-term follow-up, hysteroscopic resection for cesarean scar pregnancy was associated with a lower rate of dysmenorrhea compared with ultrasound-guided dilation and evacuation, and no clear differences were observed in other gynecologic or reproductive outcomes. Although the frequency of uterine niche was similar between the groups, differences in niche depth and residual myometrial thickness were observed.

**Key words:** hysteroscopy, cesarean, delivery, niche, fertility

## Introduction

Cesarean scar pregnancy (CSP) is a rare form of ectopic pregnancy in

which the gestational sac implants within the myometrial defect of a previous cesarean section scar.<sup>1</sup> Although it is uncommon, its incidence has increased in parallel with rising cesarean delivery rates and improved early ultrasound diagnosis.<sup>2</sup>

CSP is associated with a substantial risk of severe maternal morbidity, including massive hemorrhage, uterine rupture, hysterectomy, and progression to morbidly adherent placenta.<sup>3</sup> When CSP is diagnosed in the presence of fetal cardiac activity, expectant management is generally discouraged because of the

high risk of adverse outcomes.<sup>3</sup> Consequently, a variety of therapeutic strategies have been proposed for women who opt for termination of pregnancy. We previously conducted a randomized clinical trial (RCT) comparing hysteroscopic resection with ultrasound-guided dilation and evacuation (D&E), both preceded by systemic methotrexate, for the treatment of CSP with positive embryonic heart activity.<sup>4</sup> That trial demonstrated a significantly higher treatment success rate with hysteroscopic resection than with ultrasound-guided D&E.<sup>4</sup>

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## AJOG MFM at a Glance

**Why was this study conducted?**

Long-term gynecologic, reproductive, and ultrasound outcomes after different surgical approaches for the treatment of cesarean scar pregnancy remain poorly defined, with most available evidence being limited to short-term treatment success.

**Key findings**

At medium- to long-term follow-up, hysteroscopic resection was associated with a lower rate of dysmenorrhea compared with ultrasound-guided dilation and evacuation, and no clear differences were observed in other gynecologic and reproductive outcomes. Although the frequency of uterine niche was similar between the groups, differences in niche depth and residual myometrial thickness were observed.

**What does this add to what is known?**

This secondary analysis of a randomized clinical trial provides long-term data suggesting that potential differences between treatment approaches may be symptom-specific and are accompanied by differences in uterine scar morphology, highlighting the importance of considering long-term outcomes beyond immediate treatment success.

Although these findings support hysteroscopic resection as an effective fertility-sparing approach for the management of CSP, the trial was designed to evaluate short-term outcomes only. Importantly, the long-term gynecologic and reproductive consequences of different surgical approaches for CSP remain largely unknown.<sup>5</sup> Cesarean scar defects (ie, isthmoceles or uterine niche) are increasingly recognized as a potential long-term consequence of cesarean delivery and have been associated with abnormal uterine bleeding, pelvic pain, secondary infertility, and adverse outcomes in subsequent pregnancies. Ultrasound assessment of scar morphology, including the presence and dimensions of an isthmocele and residual myometrial thickness, provides an objective evaluation of uterine healing and may help characterize the long-term anatomical consequences of different surgical approaches for CSP treatment.

Beyond immediate treatment success, women treated for CSP may experience chronic gynecologic symptoms, impaired fertility, or structural uterine abnormalities, including the development or persistence of a uterine niche at the site of the previous cesarean scar.<sup>6</sup>

**Objective**

Therefore, the objective of the present study was to evaluate long-term

gynecologic symptoms and reproductive and ultrasound outcomes in women previously enrolled in the RCT that compared hysteroscopic resection with ultrasound-guided D&E for the treatment of CSP.

**Methods****Study design and population**

This study is a secondary analysis with long-term follow-up of women previously enrolled in a single-center, parallel-group RCT that compared hysteroscopic resection with ultrasound-guided D&E for the treatment of CSP. The terminology D&E is retained throughout this manuscript for consistency with the parent RCT.

The original trial was conducted at the University of Naples Federico II between February 2020 and August 2022 and included women with singleton CSP and positive embryonic heart activity who opted for termination of pregnancy.

The parent RCT was approved by the Institutional Review Board of the University of Naples Federico II (IRB No. 298/19). Before the follow-up assessment, all participants were informed about the purpose and procedures of the visit, and their willingness to undergo the clinical evaluation and transvaginal ultrasound examination was confirmed.

Women randomized in the original trial who had not undergone hysterectomy at the time of the initial treatment were eligible for inclusion in this secondary analysis. Women who had undergone hysterectomy were excluded because the long-term gynecologic, reproductive, and uterine scar outcomes evaluated in this study required uterine preservation. No other exclusion criteria were applied for this follow-up study. Women were contacted between January and February 2026, corresponding to approximately 4 to 6 years after the initial intervention. Detailed descriptions of both surgical procedures have been previously reported in the parent RCT.<sup>4</sup>

**Follow-up procedures**

Eligible women were contacted and invited to participate in a long-term follow-up assessment. During the visit, participants underwent a structured evaluation that included a pelvic examination, an assessment of gynecologic symptoms, reproductive history since the index CSP treatment, and a transvaginal ultrasound scan. Follow-up assessments were performed at a single time point during the follow-up period. Women who could not be reached or who declined to participate were recorded as lost to follow-up for the purpose of this analysis.

**Primary and secondary outcomes**

The outcomes of interest for this secondary analysis were predefined before data collection and included: (1) Gynecologic symptoms, including abnormal uterine bleeding, chronic pelvic pain, dysmenorrhea, dyspareunia, and other self-reported gynecologic complaints, were reported. Abnormal uterine bleeding was defined as any self-reported menstrual bleeding that was excessive in volume, prolonged in duration, or irregular in timing compared with the participant's usual menstrual pattern. Dysmenorrhea was defined as self-reported menstrual pain that occurs during menstruation. Intermenstrual bleeding (ie, spotting) was recorded separately as self-reported vaginal bleeding that occurs between regular menstrual

periods. (2) Reproductive outcomes, including attempts to conceive after the index procedure, diagnosis of infertility, occurrence of subsequent pregnancies, pregnancy outcomes (including miscarriage, ectopic pregnancy, and live birth), and obstetrical complications, when applicable. (3) Ultrasound-assessed uterine scar characteristics, evaluated by transvaginal ultrasound, including the presence or absence of a uterine niche (isthmocele) at the site of the previous cesarean scar. When present, isthmocele characteristics were assessed according to predefined ultrasound criteria, as described by Naji et al.<sup>7</sup>

Detailed definitions of each outcome are provided in the Supplemental Material

### Ultrasound assessment

Transvaginal ultrasound examinations were performed by experienced operators who were not involved in the original surgical procedures. The diagnosis of uterine niche (isthmocele) was based on standard ultrasound criteria, defined as an anechoic or hypoechoic defect at the site of the previous cesarean section scar within the anterior uterine wall, as described by Naji et al.<sup>7</sup> Measurements were obtained in the sagittal plane. The operators performing the ultrasound examinations were aware of the participants' clinical histories but were not involved in the original randomization process.

### Statistical analysis

Analyses were performed according to the original randomized treatment allocation (intention-to-treat principle). Continuous variables were summarized as mean±standard deviation or as median with interquartile range (IQR), as appropriate. Categorical variables were summarized as number and percentage. Follow-up completion was reported as the number and proportion of women successfully contacted and evaluated in each randomized group.

Comparisons between groups were performed using the chi-square test or Fisher exact test for categorical variables and the Student *t* test or Mann-Whitney *U* test for continuous variables, as

appropriate. Effect estimates were reported as relative risks (RR) or mean differences (MD) with 95% confidence intervals (CI).

Given the exploratory nature of this secondary analysis and the limited sample size of the original randomized trial, no formal sample size calculation was performed for the long-term outcomes. All analyses were considered exploratory. A 2-sided *P* value <.05 was considered statistically significant.

Statistical analysis was performed using IBM SPSS Statistics, version 26 (IBM Corp., Armonk, NY).

## Results

### Trial population and follow-up

Of the 54 women originally randomized, 3 underwent hysterectomy; all of whom had been allocated to the D&E group and therefore were not eligible

for the long-term follow-up evaluating gynecologic symptoms, reproductive outcomes, and uterine ultrasound findings.

Of the remaining 51 women, 26 (51%) were successfully contacted and were included in the long-term follow-up analysis.

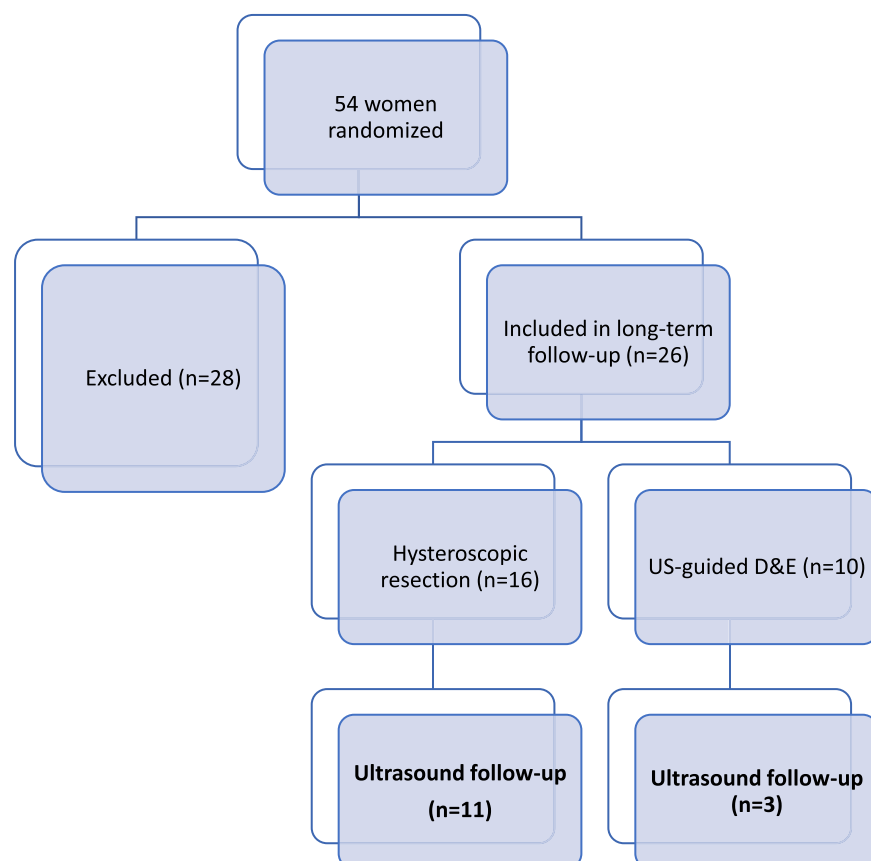
Out of 26 women, 14 also underwent a follow-up transvaginal ultrasound scan (Figure). The median duration of follow-up was 4.59 years (IQR, 4.2–5.1 years). The baseline demographic and clinical characteristics of the women included in the secondary analysis were similar between the 2 treatment groups (Table 1). No participant underwent isthmocele repair.

### Gynecologic symptoms

Follow-up data on gynecologic symptoms were available for all 26 women,

FIGURE

Consolidated Standards of Reporting Trials study flow-chart



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TABLE 1

## Characteristics of the included women

|                                                  | Hysteroscopic resection n=16 | D&E n=10                   | P value |
|--------------------------------------------------|------------------------------|----------------------------|---------|
| Duration of follow-up, median (IQR), (y)         | 4.61 (4.18–5.11)             | 4.51 (4.11–5.35)           | .895    |
| $\beta$ -hCG (mIU/mL) median (IQR), (y)          | 14,472.5 (9120.5–27,155.8)   | 14,900.5 (5272.8–28,518.0) | .747    |
| Age<br>mean $\pm$ SD (y)                         | 35.9 $\pm$ 3.6               | 33.0 $\pm$ 5.1             | .138    |
| BMI<br>mean $\pm$ SD (kg/m <sup>2</sup> )        | 28.1 $\pm$ 9.0               | 23.9 $\pm$ 2.1             | .091    |
| Smoking n (%)                                    | 3 (18.8%)                    | 2 (20%)                    | .990    |
| Previous cesarean delivery mean $\pm$ SD (range) | 1.5 $\pm$ 0.6                | 1.7 $\pm$ 0.8              | .507    |

Data are presented as number (percentage), as mean $\pm$ standard deviation, or as median with IQR.

BMI, body mass index; D&E, dilation and evacuation; hCG, human chorionic gonadotropin; IQR, interquartile range; SD, standard deviation.

Zizolfi. Long-term outcomes after cesarean scar pregnancy surgery. *Am J Obstet Gynecol MFM* 2026.

including 16 in the hysteroscopic resection group and 10 in the ultrasound-guided D&E group. Abnormal uterine bleeding was reported by 2 of 16 women (12.5%) in the hysteroscopic group and by none of the women in the D&E group. Dysmenorrhea was reported by 1 of 16 women (6.3%) in the hysteroscopic group compared with 5 of 10 women (50%) in the D&E group (RR, 0.13 [95% CI, 0.02–0.92]) ( $P=.04$ ). Chronic pelvic pain and dyspareunia were uncommon and did not differ significantly between the groups (Table 2).

### Reproductive outcomes

Among the 9 women who reported attempting to conceive after treatment of the index CSP, 8 were in the hysteroscopic group and 1 was in the D&E group. Infertility was reported by 2 of the 8 women attempting conception in the hysteroscopic group and by none in the D&E group. Among the 2 women with infertility, 1 did not achieve any subsequent pregnancy, whereas the other conceived through in vitro fertilization (IVF). A subsequent pregnancy occurred in 7 women in the hysteroscopic resection group (6 spontaneously and 1 through IVF) and in 1 woman in the D&E group.

Pregnancy outcomes are summarized in Table 2. Among the 7 subsequent pregnancies in the hysteroscopic group, 5 resulted in live births, 1 in spontaneous miscarriage, and 1 in tubal ectopic pregnancy. In the D&E group, the only

subsequent pregnancy was a recurrent CSP, for which the patient opted for voluntary termination of pregnancy.

### Ultrasound-assessed uterine scar characteristics

Among the 14 women who underwent follow-up transvaginal ultrasound assessment, a uterine niche (isthmocele) was identified in 7 of 11 women (63.6%) in the hysteroscopic resection group and 2 of 3 women (66.7%) in the D&E group (RR, 0.95 [95% CI, 0.38–2.39]). Among women with an isthmocele, niche depth was significantly greater in the hysteroscopic group than in the D&E group (MD, 1.10 mm [95% CI, 0.04–2.16]) ( $P=.04$ ). Residual myometrial thickness was significantly less in the hysteroscopic group than in the D&E group (MD,  $-1.30$  mm [95% CI,  $-2.02$  to  $-0.58$ ]) ( $P<.05$ ) (Table 2).

## Discussion

### Principal findings

In this secondary analysis with 4- to 6-year follow-up of a RCT, hysteroscopic resection for CSP did not result in broad improvement in long-term gynecologic or reproductive outcomes when compared with ultrasound-guided D&E. Among the outcomes assessed, dysmenorrhea was the only symptom that was significantly less frequent in the hysteroscopic group, whereas no clear differences were observed in other gynecologic symptoms or reproductive

outcomes. Among women who attempted conception, subsequent pregnancies occurred in both treatment groups; however, the very small and unbalanced numbers of women attempting conception precluded definitive conclusions regarding comparative fertility or obstetrical outcomes.

Ultrasound evaluation during follow-up showed a similar frequency of uterine niche between the groups, but differences in uterine scar morphology were observed, with deeper niches and thinner residual myometrial thickness in women treated with hysteroscopic resection. These findings suggest that, despite the higher short-term success reported in the parent trial, hysteroscopic treatment may be associated with distinct long-term structural characteristics of the uterine scar. Given the small number of women who underwent ultrasound follow-up, particularly in the D&E group, these findings should be interpreted cautiously and require confirmation in larger studies.

This study has several limitations. This secondary analysis was not powered to detect differences in long-term outcomes, particularly for reproductive and obstetrical endpoints. Gynecologic symptoms and reproductive history were self-reported, introducing the potential for recall bias. Loss to follow-up may have contributed to attrition bias. In addition, ultrasound follow-up was available for only 14 women and was markedly unbalanced between

TABLE 2

## Primary and secondary outcomes

|                                                                          | Hysteroscopic resection n=16 | D&E n=10                |                               | P value          |
|--------------------------------------------------------------------------|------------------------------|-------------------------|-------------------------------|------------------|
| <b>Gynecologic symptoms</b><br>N=26                                      |                              |                         |                               |                  |
|                                                                          | Hysteroscopic resection n=16 | D&E n=10                | RR (95% CI)                   |                  |
| <b>Abnormal uterine bleeding</b><br>n (%)                                | 2/16 (12.5%)                 | 0/10                    | 3.24 (0.17–61.21)             | Nonsignificant   |
| <b>Dysmenorrhea</b><br>n (%)                                             | 1/16 (6.3%)                  | 5/10 (50%)              | 0.13 (0.02–0.92) <sup>a</sup> | .04 <sup>a</sup> |
| <b>Intermenstrual bleeding</b><br>n (%)                                  | 6/16 (37.5%)                 | 2/10 (20%)              | 1.88 (0.47–7.54)              | Nonsignificant   |
| <b>Chronic pelvic pain</b><br>n (%)                                      | 1/16 (6.3%)                  | 0/10                    | 1.94 (0.09–43.50)             | Nonsignificant   |
| <b>Dyspareunia</b><br>n (%)                                              | 0/16                         | 1/10                    | 0.22 (0.01–4.83)              | Nonsignificant   |
| <b>Reproductive outcomes</b><br>N=26                                     |                              |                         |                               |                  |
|                                                                          | Hysteroscopic resection n=16 | D&E n=10                | RR (95% CI)                   |                  |
| <b>Attempts to conceive</b><br>n (%)                                     | 8/16 (50%)                   | 1/10 (10%)              | -                             | -                |
| <b>Infertility</b><br>n (%)                                              | 2/8 (25%)                    | 0/1                     | 1.11 (0.08–15.28)             | Nonsignificant   |
| <b>Subsequent pregnancy</b><br>n (%)                                     | 7/8 (87.5%)                  | 1/1                     | 1.11 (0.47–2.60)              | Nonsignificant   |
| <b>Spontaneous miscarriage</b><br>n (%)                                  | 1/7 (14.3%)                  | 0/1                     | 0.75 (0.05–12.34)             | Nonsignificant   |
| <b>Ectopic pregnancy</b><br>n (%) excluding cesarean scar pregnancy      | 1/7 <sup>b</sup> (14.3%)     | 0/1                     | 0.75 (0.05–12.34)             | Nonsignificant   |
| <b>Live birth</b><br>n (%)                                               | 5/7 (71.4%)                  | 0/1                     | 2.75 (0.24–31.72)             | Nonsignificant   |
| <b>Mode of delivery<sup>c</sup></b><br><b>Cesarean delivery</b><br>n (%) | 5/5 (100%)                   | -                       | -                             | -                |
| <b>Voluntary termination of pregnancy</b><br>n (%)                       | 0/7                          | 1/1 (100%) <sup>d</sup> | 0.08 (0.07–1.37)              | Nonsignificant   |
| <b>Recurrent scar pregnancy</b><br>n (%)                                 | 0/7                          | 1/1 (100%)              | 0.08 (0.07–1.37)              | Nonsignificant   |
| <b>Obstetric complications</b><br>n (%)                                  | 1/5 (20%) <sup>e</sup>       | -                       | -                             | -                |
| <b>Ultrasound examination</b><br>n=14                                    |                              |                         |                               |                  |
|                                                                          | Hysteroscopic resection n=11 | D&E n=3                 | RR or MD (95% CI)             |                  |
| <b>Uterine niche</b><br>n (%)                                            | 7/11 (63.6%)                 | 2/3 (66.7%)             | 0.95 (0.38–2.39)              | Nonsignificant   |
| <b>Niche depth</b><br>mean±SD (mm)                                       | 5.1±1.2                      | 4.0±0.7                 | 1.10 (0.04–2.16) <sup>a</sup> | .04 <sup>a</sup> |

(continued)

TABLE 2

## Primary and secondary outcomes (continued)

|                                                                                                     | Hysteroscopic resection n=16 | D&E n=10 |                                     | P value           |
|-----------------------------------------------------------------------------------------------------|------------------------------|----------|-------------------------------------|-------------------|
| Residual myometrial thickness<br>mean±SD (mm)                                                       | 2.6±1.2                      | 3.9±0.1  | −1.30 (−2.02 to −0.58) <sup>a</sup> | <.05 <sup>a</sup> |
| Difference in residual myometrial<br>thickness before randomization to<br>follow-up<br>mean±SD (mm) | 1.4±0.9                      | 0.9±1.2  | 0.50 (−0.96 to 1.96)                | Nonsignificant    |

Data are presented as number (percentage) or as mean±standard deviation.

CI, confidence interval; D&E, dilation and evacuation; MD, mean difference; RR, relative risk; SD, standard deviation.

<sup>a</sup> Statistically significant; <sup>b</sup> Ectopic tubal pregnancy; <sup>c</sup> Among live birth; <sup>d</sup> Voluntary termination of pregnancy due to recurrent scar pregnancy; <sup>e</sup> Gestational diabetes mellitus.

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the treatment groups (11 in the hysteroscopic resection group and 3 in the D&E group), limiting the precision and generalizability of the ultrasound findings. The small number of women who attempted conception and the small number of subsequent pregnancies further limit the strength of any conclusions regarding fertility and obstetrical outcomes. Information regarding abnormal uterine bleeding and dysmenorrhea before the diagnosis and treatment of CSP was not collected prospectively in the parent RCT. Therefore, changes in gynecologic symptoms from before treatment to long-term follow-up could not be assessed.

### Implications

CSP involves implantation of the gestation within the uterine niche or scar of a previous cesarean delivery. CSP is associated with a high risk of maternal morbidity, including abnormal placental implantation with progression to deeper placental invasion as the gestation advances, as well as a risk of uterine rupture and placenta accreta.<sup>3,8</sup> Therefore, early treatment of CSP is essential to reduce adverse maternal outcomes. Among the available surgical and medical approaches, recent data suggest that hysteroscopic surgery represents a valid therapeutic approach<sup>9</sup> and was associated with a higher treatment success rate than ultrasound-guided D&E in the parent RCT.<sup>4</sup>

In long-term follow-up, women treated for CSP may experience chronic gynecologic symptoms, impaired fertility, or structural uterine abnormalities, including the development or persistence of an isthmocele at the site of the

previous scar. Isthmocele has been associated with abnormal uterine bleeding, pelvic pain, secondary infertility, and adverse outcomes in subsequent pregnancies.<sup>10</sup> Whether the surgical approach used to treat CSP influences long-term uterine anatomy, symptoms, or reproductive outcomes is still a subject of debate. Long-term follow-up data after randomized comparisons of CSP treatments remain limited.<sup>11–14</sup> Most available studies focus on short-term outcomes and surgical complications, with limited information on subsequent fertility or gynecologic sequelae.<sup>15</sup> Consequently, clinicians lack robust evidence to adequately counsel women regarding the long-term implications of different CSP treatment approaches.

The present study was designed to address this gap by evaluating long-term gynecologic symptoms, reproductive outcomes, and ultrasound-assessed uterine scar characteristics in women who were previously enrolled in an RCT comparing hysteroscopic resection vs ultrasound-guided D&E for the treatment of CSP. By providing medium- to long-term follow-up data, this study aimed to inform patient counseling and long-term management beyond immediate procedural success. Counseling of women with CSP often emphasizes immediate treatment success and perioperative safety, whereas potential long-term gynecologic, reproductive, and anatomic outcomes receive less attention owing to limited evidence. Our data indicate that hysteroscopic resection may be associated with a lower rate of dysmenorrhea but do not

demonstrate a generalized advantage in long-term reproductive outcomes. However, these findings are exploratory and should be interpreted in light of the small sample. At present, it remains unclear whether the observed differences in scar morphology translate into clinically meaningful differences in gynecologic symptoms, fertility, or outcomes of subsequent pregnancies.

Reproductive findings should also be interpreted cautiously. Only 9 women reported attempting conception after treatment, including 8 in the hysteroscopic resection group and 1 in the D&E group. Of note, 7 of the 8 women who attempted conception after hysteroscopic resection achieved a subsequent pregnancy, as did the single woman who attempted conception after D&E. However, the small number of women attempting conception and the marked imbalance between the groups preclude meaningful conclusions regarding comparative fertility. Similarly, the observation of a single recurrent CSP in the D&E group does not allow conclusions to be drawn regarding the risk of recurrence after either treatment. These findings therefore provide descriptive information on subsequent reproductive outcomes but should not be interpreted as evidence of preserved fertility or a low recurrence risk.

### Conclusions

In this secondary analysis of an RCT with medium- to long-term follow-up, hysteroscopic resection for CSP was associated with a lower rate of dysmenorrhea compared with ultrasound-guided D&E, and

no clear differences were observed in other gynecologic or reproductive outcomes. Ultrasound follow-up showed a similar frequency of uterine niche between the groups but revealed differences in uterine scar morphology, with greater niche depth and reduced residual myometrial thickness after hysteroscopic resection. Although limited by the small sample size, substantial loss to follow-up, limited and unbalanced ultrasound assessment, and exploratory design, these findings suggest that the choice of surgical approach for CSP may have symptom-specific and anatomic long-term implications beyond immediate treatment success. Further studies are needed to confirm these observations and to better define optimal management strategies for long-term uterine health and reproductive outcomes. ■

## CRedit authorship contribution statement

**Brunella Zizolfi:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Gabriele Saccone:** Writing – review & editing, Writing – original draft. **Enrica Mastantuoni:** Writing – review & editing, Writing – original draft, Visualization, Validation, Methodology, Formal analysis, Data curation, Conceptualization. **Maria Chiara De Angelis:** Writing – review & editing, Writing – original draft, Data curation, Conceptualization. **Stella Canciello:** Writing – review & editing, Writing – original draft, Investigation, Data curation, Conceptualization. **Alfonso Manzi:** Writing – review & editing, Writing – original draft, Visualization, Project administration, Methodology, Conceptualization. **Attilio Di Spiezo Sardo:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision,

Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. ■

## Supplementary materials

Supplementary material associated with this article can be found in the online version at [doi:10.1016/j.ajogmf.2026.102096](https://doi.org/10.1016/j.ajogmf.2026.102096).

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