OBSTETRICS

Outcome of cesarean scar ectopic pregnancy continued to viability: data from the international cesarean scar ectopic pregnancy registry

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BACKGROUND: Cesarean scar ectopic pregnancy is a rare but serious complication of a prior cesarean section, in which the gestational sac implants within the previous uterine cesarean scar. Cesarean scar ectopic pregnancy carries a substantial risk of severe maternal morbidity, including life-threatening hemorrhage and hysterectomy.

OBJECTIVE: The aim of this study is to describe the course of cesarean scar ectopic pregnancies that were managed expectantly and identify which ultrasound findings were associated with peripartum hysterectomy.

STUDY DESIGN: An international registry was established to collect ultrasound and clinical data on diagnosis and management of cesarean scar ectopic pregnancy. Data are stored anonymously on a digital secure platform. This study included first-trimester, live cases that were managed expectantly or in which the patient declined pregnancy termination. Numbers of cases reaching viability, developing placenta accreta spectrum, and requiring peripartum hysterectomy were collected. Twenty-one centers across 13 countries contributed data for this specific analysis. Descriptive statistical methods were applied.

RESULTS: Between August 29, 2018 and December 31, 2023, 708 cases were recorded, of which 593 were excluded due to pregnancy termination or nonviability. Of the remaining 115 cases, 38 (33.0%) resulted in pregnancy loss between 13+0 and 22+6 weeks, while 77 (67.0%) progressed to ≥23+0 weeks. Live births occurred in 77/115 (67.0%) cases. A total of 50/115 (43.5%) women underwent peripartum hysterectomy, including 7/115 (6.1%) before 23 weeks. A first-trimester residual myometrial thickness of less than 2.5 mm identified 80% (16/20) of women requiring peripartum hysterectomy with a sensitivity of 64%, specificity of 75%, and positive predictive value of 76%. Enhanced subplacental vascularity in the scar area was significantly more frequent in the hysterectomy group in 25/29 cases (86.2%) compared to those who retained their uterus with 13/22 cases (59.1%) (odds ratio, 4.13; 95% confidence interval, 1.09—18.4; P=.04).

CONCLUSION: Expectant management of cesarean scar ectopic pregnancy carries a substantial risk of second-trimester loss and peripartum hysterectomy. A residual myometrial thickness <2.5 mm and enhanced subplacental vascularity at first-trimester ultrasound are associated with an increased risk of hysterectomy. These findings underscore the importance of early and detailed ultrasound evaluation to identify high-risk cases, guide patient counseling, and optimize management strategies to mitigate maternal morbidity.

Key words: cesarean scar ectopic pregnancy, cesarean section, expectant management, hysterectomy, residual myometrial thickness, subplacental vascularity

Introduction

Cesarean scar ectopic pregnancy (CSEP) is a rare but potentially life-threatening form of ectopic pregnancy, characterized by implantation of the gestational sac within the fibrous scar defect of a previous cesarean section (CS).[1–4] The increasing global CS rates have led to a rising incidence of CSEP, making it an emerging concern in obstetric practice.[4] Advances in early diagnosis and imaging techniques have improved detection; however, optimal management strategies remain a topic of ongoing debate, which has also been explored in a prior publication from the CSEP registry.[5]

Continuing with a live CSEP poses considerable clinical challenges due to the high risk of severe maternal complications, including massive hemorrhage, uterine rupture, and placenta accreta spectrum (PAS) disorders, all of which may necessitate peripartum hysterectomy.[6,7] Despite these risks, some pregnancies progress due to patient preference, delayed diagnosis, or other factors.[8] Managing such cases requires a multidisciplinary approach, carefully balancing maternal safety with fetal viability.[9]

The aim of this study is to describe the course of CSEP that was managed expectantly and to identify which ultrasound findings were associated with peripartum hysterectomy.

Methods

The CSEP registry is an international research platform designed to collect and analyze data on CSEP. It was established through the CSEP Collaborative Network, an international group of experts dedicated to studying the diagnosis, natural history, and management of CSEP. The registry operates under ethical approvals granted by the National Health Service (NHS) Health Research Authority and Health and Care Research Wales (IRAS project ID:

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AJOG at a Glance

Why was this study conducted?
To describe the course of cesarean scar ectopic pregnancy (CSEP) managed expectantly and identify ultrasound findings associated with peripartum hysterectomy.

Key findings
Almost two-thirds of CSEP reached viable gestation but at the cost of peripartum hysterectomy which was required in almost half of the women. Thin first-trimester residual myometrial thickness and increased first-trimester enhanced subplacental vascularity were identified as ultrasound markers associated with a higher risk of hysterectomy.

What does this add to what is known?
The present large multicenter study assessed the value of first-trimester residual myometrial thickness and early abnormal subplacental vascularity in expectantly managed CSEP.

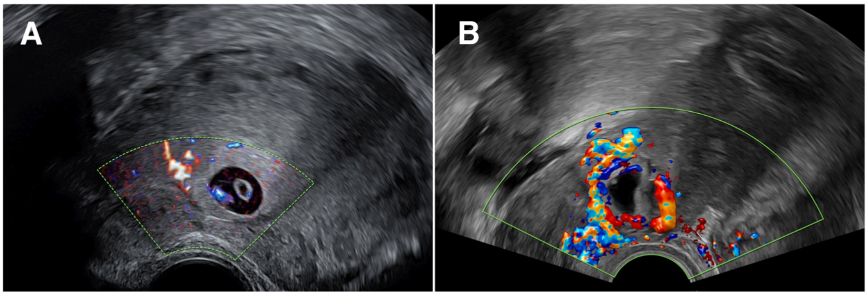
246295), with additional ethical clearance obtained at each participating center in accordance with local regulations. The registry is funded by unrestricted grants from the Freiwillige Akademische Gesellschaft Basel and the Bangerter-Rhyner Stiftung, Basel, Switzerland.

The registry was active from 2018 to 2023, collecting structured, retrospective data on CSEP. There were 32 participating sites from 18 countries across 5 continents contributing to the registry, predominantly consisting of tertiary referral centers and university-affiliated hospitals providing gynecological and reproductive care. Data collection included demographic information, medical and obstetric history, ultrasound findings, clinical management, and pregnancy outcomes. All data were anonymized, coded, and securely stored in a protected database (Adjumed, Zurich, Switzerland). Each case included an uploaded panoramic transvaginal ultrasound image displaying the pregnancy, uterus, and endocervical canal in a longitudinal section. A sample of the data collection form is available in the Supplemental Materials.

All participating ultrasound practitioners have extensive experience and are routinely performing gynecological ultrasound examinations for at least 5 years. Prior to study initiation, all participating centers received written information about the required ultrasound measurements and their standardized acquisition during the onboarding process.

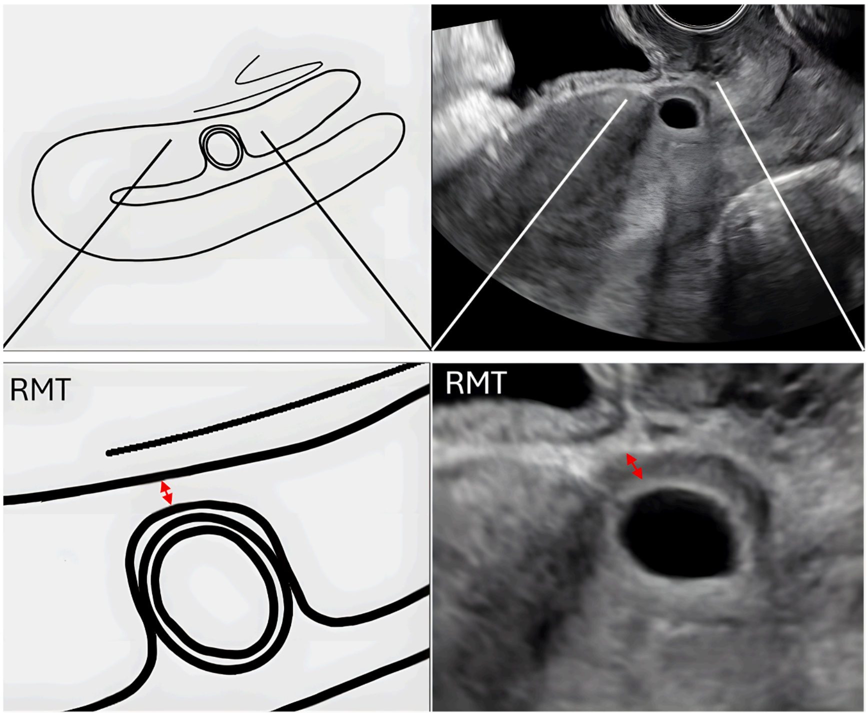
High-frequency transvaginal ultrasound was performed to confirm the pregnancy location and assess embryonic or fetal cardiac activity. CSEP was diagnosed using commonly accepted criteria based on current literature, which include gestational sac implanted anteriorly at the level of the internal os, within the visible or presumed site of the previous lower uterine segment CS scar or the niche left behind after closure of the incision.[10] Presence of peritrophoblastic or periplacental vascularity was ascertained using color Doppler examination of the aforementioned area in patients with a history of CS.[10] Vascularity was assessed subjectively with a Color score 1 to 4 (no flow, minimal flow, moderate flow, and abundant blood flow) at defined ultrasound settings: pulse repetition frequency of 0.9 kHz, gain of 0.8, and low wall motion filter (40 Hz) (Figure 1).[11] The placenta was assessed for early lacunae, which are irregular sonolucent spaces within the placenta. Each CSEP was classified as type 1 when more than 50% of the gestational sac protruded toward the uterine cavity or cervical canal and type 2 when the placenta implanted within a deficient or dehiscent scar, with ≤50% of the gestational sac protruding toward the uterine cavity. First-trimester residual myometrial thickness (RMT) was measured at the thinnest part of the myometrium at initial presentation in a sagittal plane, from the top of the cesarean scar niche to the serosal surface of the uterus, ensuring the measurement is perpendicular to the anterior uterine wall (Figure 2). Adjacent myometrial thickness refers to the normal thickness of the myometrium located next to the niche. For this study, we included all CSEP cases recorded in the registry up until December 31, 2023. Only cases of live CSEP in the first trimester where expectant management was followed were analyzed. We excluded failing pregnancies and induced terminations <13+0 weeks' gestation (Figure 3). Data collection included first-trimester ultrasound

FIGURE 1
Assessment of vascularity in 2 cases of CSEP



Pulse repetition frequency set at 0.9 kHz, gain of 0.8, and low wall motion filter (40 Hz). (**A**) CSEP at 6 weeks' gestation with color score 2 (minimal flow) in the placental bed. (**B**) CSEP at 6 weeks' gestation with color score of 4 (abundant blood flow).
CSEP, cesarean scar ectopic pregnancy.

FIGURE 2
Correct measurement of first-trimester residual myometrial thickness



Transvaginal ultrasound images of a CSEP. The sagittal image shows thin myometrial layer between placenta and bladder with first-trimester residual myometrial thickness (RMT) measurement. In the bottom, the enlarged version of the region of interest needs to be captured enabling a precise measurement of the RMT. In addition, the measurement has to exclude the hyperechoic bladder mucosa and serosa which if included, may lead to an erroneous estimate of the RMT.
CSEP, cesarean scar ectopic pregnancy.

findings, second-trimester and third-trimester outcomes and ultrasound findings (when available), peripartum hysterectomy occurrence, and histopathological findings, where accessible. Management decisions, including expectant management, were made on the basis of informed decision-making between patients and their treating physicians and followed local institutional counseling practices.

Statistical analysis

All statistical analyses were conducted at the Department of Biomedical Statistics, University of Basel, Switzerland. Descriptive statistics are presented as counts and proportions for categorical variables and as medians with minimum and maximum values for ordinal or continuous variables. Group comparisons were performed using the Mann-Whitney U test for continuous variables and the Chi-squared test or Fisher's exact test for categorical variables when the expected frequencies are less than 5 in some cells.

Univariable regression results were presented as odds ratios (ORs) with 95% confidence intervals. Additionally, the dependence of hysterectomy on RMT was modeled nonlinearly using a 3-knot restricted cubic spline and corresponding predicted probabilities were graphically displayed.

All statistical analyses were performed using the R statistical software (version 4.1.3). A P value $<.05$ was considered statistically significant.

Results

Study population

By December 31, 2023, a total of 708 CSEP cases were recorded in the registry. Of these, 593 cases were excluded for non-viability or termination before 13 weeks of gestation. The final analysis included 115 cases of expectantly managed CSEP that continued beyond the first trimester. Twenty-one centers from 13 countries over 4 continents (Europe, North America, South America, and North Africa) contributed data for this analysis.

Among these, 77/115 women (67.0%) had a live birth. In total of 50/115 (43.5%) women underwent peripartum hysterectomy, including 7/115 (6.1%) before 23 weeks. Thirty-eight (33.0%) pregnancies ended between 13+0 and 22+6 weeks of gestation. Seventy-seven (67.0%) cases progressed beyond 23+0 weeks' gestation.

FIGURE 3
Flowchart of the study population with inclusion/exclusion criteria and outcomes

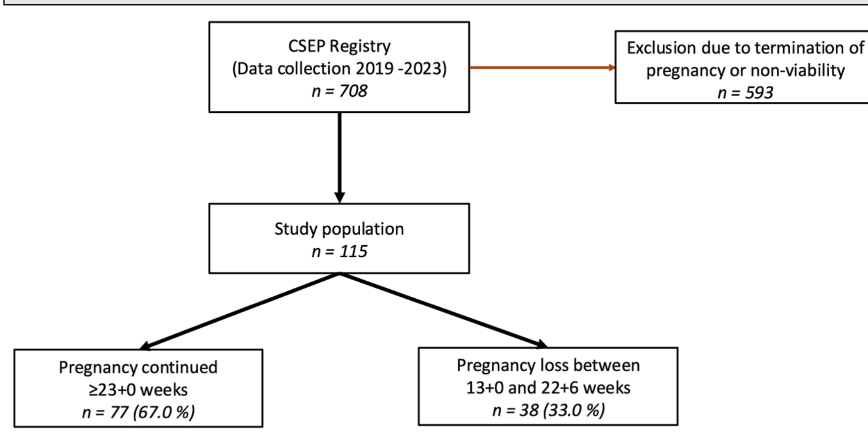


TABLE 1
Demographics of women with live CSEP that progressed to a viable gestation (≥23+0 weeks) (n=77)

Maternal demographics	Nonhysterectomy group Median [minimum, maximum] or (%) n=34	Peripartum hysterectomy group Median [minimum, maximum] or (%) n=43	*P* value	N
Age (y)	34.5 [20.0; 53.0]	36.0 [18.0; 59.0]	.31	77
Ethnicity			.56	71
White	15 (48.4%)	24 (60.0%)		
Middle Eastern	2 (6.5%)	1 (2.5%)		
Asian	4 (12.9%)	3 (7.5%)		
Afro-Caribbean	4 (12.9%)	3 (7.5%)		
Hispanic	3 (9.7%)	2 (5.0%)		
Mixed, other	3 (9.7%)	7 (17.5%)		
BMI	27.5 [20.0; 40.7]	28.1 [18.0; 72.0]	.56	45
Smoking	3 (15.8%)	3 (9.7%)	.55	50
Parity	2 [1; 6]	2 [1; 7]	.40	77
Past miscarriages <24 wks	1 [0; 5]	1 [0; 1]	.07	77
Spontaneous conception	32 (97.0%)	41 (95.3%)	.77	76
Preexisting medical problems	8 (25.8%)	8 (20.5%)	.81	70
Number of previous CS	2 [1; 5]	2 [1; 7]	.30	77
Previous uterine surgery other than CS	5 (14.7%)	15 (34.9%)	.049	77
Gestational age at delivery (wks)	36.5 [28.0; 39.0]	34.0 [23.0; 39.0]	<.001	77

Median and minimum, maximum or percentage (%). Preexisting medical problems include diabetes, hypertension, thyroid problems, and heart conditions.

BMI, body mass index; *CS*, cesarean section; *CSEP*, cesarean scar ectopic pregnancy.

Characteristics of pregnancies that ended between 13+0 and 22+6 weeks

Twenty-one of the 38 cases (55.3%) resulted in spontaneous pregnancy loss, while 17/38 cases (44.7%) underwent surgical treatment for the following indications: hemorrhage in 8 cases, severe abdominal pain in 4 cases, a combination of pain and bleeding in 3 cases, and ultrasound findings suggesting a poor prognosis in 2 cases. In the 2 cases, the RMT was 0 mm with level 4 vascularity and lacunae. Clinicians were concerned that the patient was at an increased risk of uterine rupture as the pregnancy progressed due to the unmeasurable RMT on ultrasound.

Of these 38 cases, management data were available for 32 cases. A total of 7/32 (21.9%) women required hysterectomy during this period. 8/32 (25.0%) had suction evacuation with insertion of Shirodkar suture to secure hemostasis, 2/32 (6.25%) had suction evacuation with uterine artery embolization, and 5/32 (15.6%) had solely suction evacuation. 3/32 (9.4%) received Misoprostol and 4 (12.5%) had a spontaneous vaginal expulsion of pregnancy. One woman (3.1%) had a laparoscopy converted to a laparotomy with CSEP wedge resection and 2 cases (6.25%) underwent other nonspecified treatments.

Among the 7 cases that underwent hysterectomy, the median gestational age was 15+2 weeks (range, 13+2−17+2 weeks). Six were planned hysterectomies, while one patient underwent hysterectomy following a failed laparotomy and resection attempt, which was further complicated by a bladder injury. In all cases, the placenta covered the cervix, with 6 cases having an anterior placenta and one case having a mainly posterior placenta previa with the anterior lip covering the scar. All cases exhibited enhanced subplacental vascularity in the scar area. Regarding implantation type, 5 cases (71.4%) were classified as type 2 CSEP, while 2 cases (28.6%) were type 1 CSEP. All 7 patients had an RMT of less than 2.5 mm. Additionally, all 7 women had a history of multiple CS, with 3 having undergone 2 prior CS and 4 having undergone 3 prior CS.

Pregnancy outcomes of pregnancies that continued beyond 23+0 weeks

Live births occurred in 77/115 (67.0%) cases; there was one early neonatal death due to prematurity.

43/77 (55.8%) required hysterectomy and 3/77 (3.9%) underwent myometrial resection after delivery of the baby. Histopathology confirming PAS was available in 38/43 (88.4%) hysterectomy cases. All deliveries were performed by CS except for one vaginal delivery in the nonhysterectomy group, in which there had

TABLE 2
First-trimester ultrasound findings of women that delivered at a viable gestation (≥23+0 weeks)

Ultrasound parameter	Nonhysterectomy group Median [minimum, maximum] or (%) n=34	Peripartum hysterectomy group Median [minimum, maximum] or (%) n=43	*P* value	OR	n
Calculated gestational age at first scan (wks)	7.0 [4.0; 13.0]	7.0 [5.0; 13.0]	.94	1.01 [0.82; 1.24]	65
Type of CSEP			.09	2.23 [0.87; 5.88]	73
Type 1	19 (57.6%)	15 (37.5%)			
Type 2	14 (42.4%)	25 (62.5%)			
Residual myometrial thickness (mm)	4.8 [0.0; 13.0]	2.00 [0.0; 6.0]	.004	0.63 [0.46; 0.87]	45
Adjacent myometrial thickness (mm)	20.1 [15.0; 25.2]	11.2 [1.6; 33.2]	.49	0.95 [0.82; 1.10]	12
Enhanced subplacental vascularity in the area of the scar	13 (59.1%)	25 (86.2%)	.04	4.13 [1.09; 18.4]	51
Placenta lacunae	6 (31.6%)	16 (59.3%)	.07	3.04 [0.90; 11.3]	46

CSEP is defined as type 1 if >50% of the gestational sac protrudes toward the uterine cavity/cervical canal. CSEP is defined as type 2 when the placenta implanted into a deficient or dehiscent scar and the protrusion of the gestational sac is ≤50%. Residual myometrium thickness is the thinnest distance of the residual myometrium between the gestational sac and the serosa in a sagittal view. Adjacent myometrial thickness (AMT) is the measurement of the myometrium at the base of the protrusion/edge of the gestational sac in a sagittal view and refers to the thickness of the myometrium located next to the niche. Calculation of gestational age at diagnostic scan according to either crown-rump-length or gestational sac diameter.

CSEP, cesarean scar ectopic pregnancy; *OR*, odds ratio.

been no prior antenatal suspicion of PAS and a history of only one previous CS.

Patient demographics associated with hysterectomy in the third trimester

Table 1 compares the patient populations beyond 23+0 weeks that underwent hysterectomy and compared to those that did not require a hysterectomy. Baseline demographics, miscarriage history, and mode of conception were not significantly different between the 2 groups. Prior uterine surgery (excluding CS) was significantly more frequent in the hysterectomy group (15/43, 34.9%) compared to the nonhysterectomy group (5/34, 14.7%) (P=.049). Gestational age at delivery was significantly lower in the hysterectomy group (median, 34.0 weeks [23.0−39.0]) compared to the nonhysterectomy group (median, 36.5 weeks [28.0−39.0]) (P<.001). There were also no significant differences in the geographical region of treatment between patients with and without hysterectomy. Europe's hysterectomy rate was 54.7% (23/42 had a hysterectomy), North America's was 50.0% (9/18), South America's was 84.6% (11/13), and Africa's was 20% (1/5) (P=.053) showing a disparity among regions.

Ultrasound findings associated with hysterectomy after 23+0 weeks of gestation

Table 2 summarizes the first-trimester ultrasound findings in relation to delivery outcome. Type 2 CSEP was more frequently observed in the hysterectomy group (62.5%) compared to the nonhysterectomy group (42.4%), although this difference did not reach statistical significance (P=.09; OR, 2.23 [0.87; 5.88]). First-trimester RMT was significantly thinner in the hysterectomy group, with a median of 2.00 mm (range, 0.0−6.0), compared to 4.8 mm (range, 0.0−13.0) in the nonhysterectomy group (P=.004; OR, 0.63 [0.46; 0.87]). Enhanced subplacental vascularity was significantly more prevalent in the hysterectomy group (86.2%) compared to the nonhysterectomy group (59.1%) (P=.04; OR, 4.13 [1.09; 18.4]). Placental lacunae were more frequently observed in the hysterectomy group (59.3%) than in the nonhysterectomy group preserved (31.6%), but this trend did not reach statistical significance (P=.07; OR, 3.04 [0.90; 11.3]).

Relationship between first-trimester residual myometrial thickness and the risk of hysterectomy

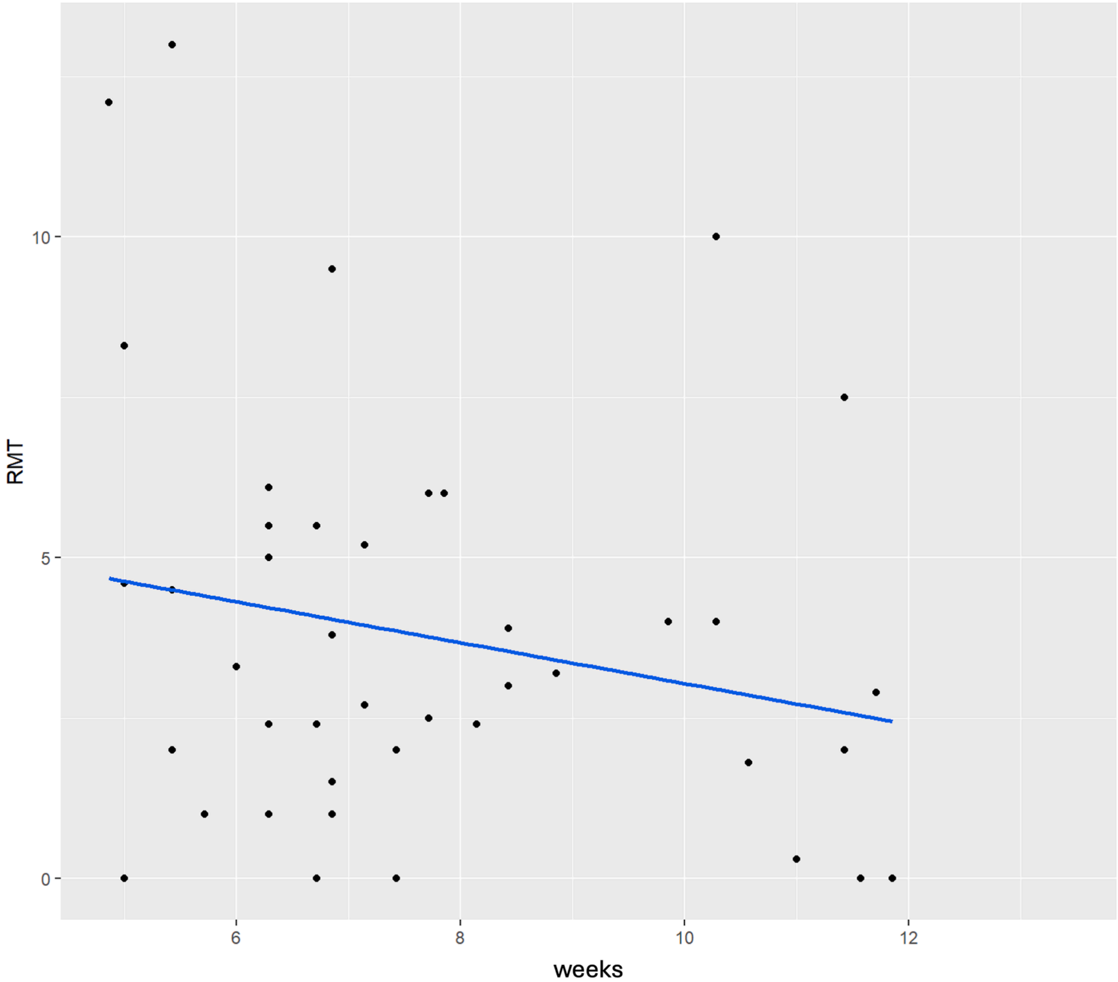
In addition to the univariate analysis, we were interested to further explore the chance of peripartum hysterectomy based on first-trimester RMT measurement. Figure 4 shows the RMT across the first trimester in our population. We did not have a statistically significant difference in RMT across the first trimester (r=−1.382; P=.174) (Figure 4). The probability of hysterectomy increases with decreasing RMT (P=.001) (Figure 5). Using a first-trimester RMT of <2.5 mm, it identified 80% (16/20) of women requiring a hysterectomy (Table 3) with a sensitivity of 64%, specificity of 75%, and positive predictive value of 76%.

Comment

Principal findings

This study provides novel insights into the outcomes of expectantly managed CSEP and highlights key risk factors of peripartum hysterectomy. Our findings show that almost two-thirds of CSEP

FIGURE 4
Residual myometrial thickness across the first trimester in our population



We did not have a statistically significant difference in RMT across the first trimester (r=−1.382, *P*=.174).
RMT, residual myometrial thickness.

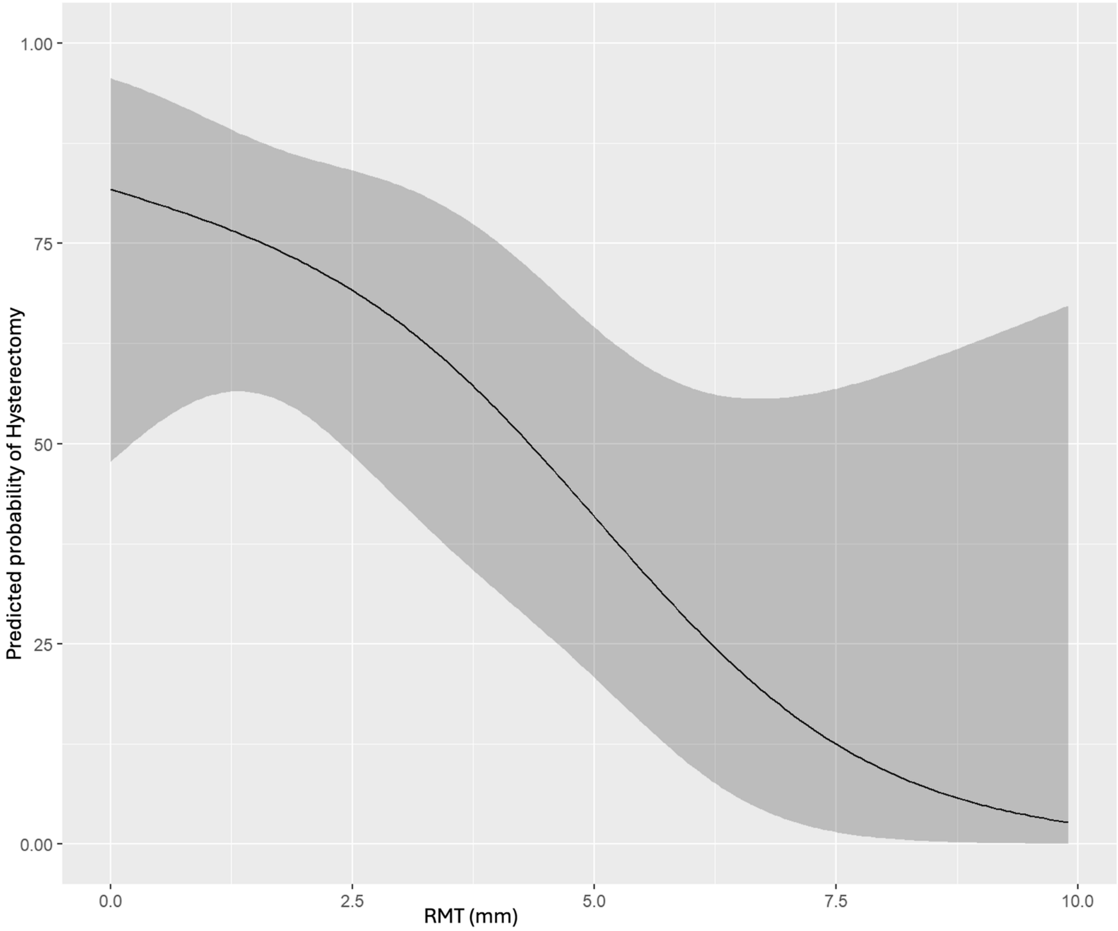
reached a viable gestation but with a substantial risk of peripartum hysterectomy which was required in almost half of the women. Particularly thin first-trimester RMT, a placenta covering the internal os and increased first-trimester enhanced subplacental vascularity were identified as ultrasound markers associated with a risk of hysterectomy. Using a first-trimester RMT of <2.5 mm, it identified 80% (16/20) of women requiring a hysterectomy.

The present large multicenter study, the first of its kind to assess the value of first-trimester RMT and early abnormal subplacental vascularity in expectantly managed live CSEP, demonstrates a significant correlation between thinner RMT and adverse outcomes, particularly the need for hysterectomy ($P = .001$). This finding reinforces the hypothesis that RMT serves as a valuable variable for stratifying CSEP patients at risk for severe complications.

Results in the context of what is known

These results are consistent with smaller case series in the literature, which have also reported a strong association between reduced myometrial thickness and poorer CSEP outcomes.[12] Specifically, a prior study categorizing CSEP into implantation "on-the-scar" and "in-the-niche" revealed that thinner RMT was associated with a higher incidence of PAS disorders. This aligns with our observation that an RMT of less than 2.5 mm in the first trimester is strongly associated with hysterectomy risk at delivery. Furthermore, studies investigating CSEP in the context of pregnancy termination have similarly identified thin RMT, alongside increased blood flow around the gestational sac and CSEP type, as significant factors correlated with increased blood

FIGURE 5
Predicted probabilities of risk of peripartum hysterectomy based on first-trimester RMT for ≥23+0 weeks



Graphical illustration of the relationship between initial first-trimester RMT measurement and the need for peripartum hysterectomy. Line represents predicted probabilities at a given RMT; dark gray area represents 95% confidence interval.
RMT, residual myometrial thickness.

loss and the risk of retained products of conception ($P = .04$).

Cali et al showed that first-trimester ultrasound parameters such as low implantation in the niche are associated with PAS in the third trimester.[13] A systematic review of 551 cases at high risk for PAS confirmed that placenta lacunae and reduced myometrial thickness were reported more frequently in cases affected by PAS.[14] Our study further confirmed that patients with a history of prior uterine surgery other than CS were at an increased risk of hysterectomy. These findings emphasize the importance of meticulous preoperative evaluation in women with a history of uterine interventions.

Technical considerations for residual myometrial thickness measurement

Given the prognostic significance of RMT, its measurement must be performed with high precision as previously published.[10,15,16] Timor-Tritsch et al published a step-by-step protocol for accurate RMT assessment given the inherently thin nature of the RMT means that even small variations in measurement can substantially influence prognosis and clinical decision-making.[16] Another step-by-step protocol by Verberkt et al stresses the importance of finding the correct plane in which the RMT is thinnest.[15] To ensure accuracy, ultrasound images should be obtained using high-frequency transvaginal transducers, with focused and enlarged visualization of the anterior lower uterine segment between the gestational sac and bladder. Multiple measurements should be taken in both sagittal and transverse planes, with the thinnest measurement recorded for clinical consideration. These methodological refinements are crucial in minimizing interoperator variability and enhancing the reliability of RMT as a predictive tool.[16]

Strength and weakness

This study has several strengths, including its comprehensive analysis of a large cohort of expectantly managed

TABLE 3
Cumulative rate of peripartum hysterectomy for selected RMT cutoffs for ≥23+0 weeks

RMT (mm)	Hysterectomy performed < cutoff	Proportion (%)	Sensitivity	Specificity	NPV	PPV
<0.5	6/7	85.7	0.24	0.95	0.50	0.86
<1.0	7/8	87.5	0.40	0.90	0.55	0.83
<1.5	10/12	83.3	0.44	0.90	0.56	0.85
<2.0	11/14	78.6	0.52	0.80	0.57	0.76
<2.5	16/20	80.0	0.64	0.75	0.62	0.76
<3.0	16/23	69.6	0.68	0.65	0.62	0.71
<3.5	19/26	73.1	0.76	0.65	0.68	0.73
<4.0	21/28	75.0	0.84	0.55	0.73	0.70
<4.5	21/30	70.0	0.88	0.55	0.79	0.71
<5.0	22/32	68.8	0.88	0.45	0.75	0.67
<5.5	23/34	67.7	0.96	0.40	0.89	0.67
<6.0	24/36	66.7	1.00	0.35	1.00	0.66

The outcome of interest was the given chance of peripartum hysterectomy at the initial ultrasound in the first trimester.

NPV, negative predictive value; *PPV*, positive predictive value; *RMT*, residual myometrial thickness.

CSEP and the use of ultrasound as a primary diagnostic tool to predict outcomes such as hysterectomy. The findings provide valuable insights into the role of first-trimester RMT, enhanced subplacental vascularity, and placenta location as markers for increased risk for peripartum hysterectomy in CSEP, which can guide clinical decision-making and patient counseling. However, there are also notable weaknesses. The retrospective nature of the study introduces potential biases, particularly in data collection. The study classified CSEP into type 1 and 2 classification only and did not further classify it into type 3 and RMT was not measured in all cases. These data are a subset of the entire CSEP registry including the cases of live CSEP managed expectantly. We also do not have information on blood loss and rate of transfusion. Although this is a large cohort compared with previous studies, once analyzing specific ultrasound features, the numbers available for statistical analysis are still small. The outcomes reported in this study may not be fully generalizable to all CSEP cases as this cohort consisted of a specific subgroup of women that chose to continue despite the known risks and declined termination of pregnancy. Finally, the lack of prospective validation means that these findings should be interpreted with caution until further studies can confirm and expand upon them. However, given the rarity of CSEP and large datasets, these data provide new and important insights when caring for patients undergoing expectant management.

Implications for clinical practice and future research

Given the potentially severe consequences of CSEP, including PAS and life-threatening hemorrhage, our findings advocate for a structured approach to first-trimester assessment of CSEP. Routine measurement of RMT and evaluation of vascularity patterns could enhance early identification of high-risk CSEP cases, facilitating timely intervention and personalized management plans. This information is extremely useful when counseling patients diagnosed with CSEP, as a recent study of the lived experience of parents with CSEP found that uncertainty and lack of clear information contributed to the considerable emotional toll of managing a pregnancy complicated by CSEP.[17] Hence, this large dataset is invaluable in supporting clinicians to more accurately counsel patients on the possible expected outcomes, which is important as patients are often making difficult decisions to end wanted pregnancies. Future research should aim to validate these findings prospectively in larger, multicenter cohorts to refine the predictive accuracy of RMT. Future studies could also assess the outcome of CSEP divided into all 3 types as per Delphi consensus.[10]

Conclusion

This study highlights the pivotal role of first-trimester ultrasound in assessing the risk for peripartum hysterectomy in CSEP cases. Thin RMT, particularly when <2.5 mm, is significantly associated with an increased risk for hysterectomy (P = .001). The presence of enhanced subplacental vascularity further aids in identifying high-risk cases. These findings underscore the importance of precise ultrasound assessment in the early detection and management of CSEP. As the understanding of CSEP evolves, integrating RMT into routine screening and incorporating multidisciplinary decision-making will be essential in optimizing maternal and fetal outcomes in this complex condition. ■

Acknowledgments

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