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Management of cesarean scar pregnancies: Experience of a level II maternity unit

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ABSTRACT

Background: Cesarean Scar Pregnancy (CSP) is a rare but potentially life-threatening form of ectopic pregnancy, whose incidence is rising in parallel with cesarean delivery rates. Prognosis depends on early diagnosis and appropriate treatment. We aimed to report our experience in the management of CSP and to evaluate the outcomes of different therapeutic modalities.

Methods: We conducted a retrospective, descriptive and analytical study including 30 patients with CSP managed in the Department of Obstetrics and Gynecology, Menzel Tmim Regional Hospital, Tunisia, between January 2022 and December 2024 (3-year period). During this period, approximately 8,000 pregnancies were followed in our department. Demographic, clinical, ultrasonographic, therapeutic, and outcome data were collected from medical records and analyzed.

Results: Mean age was 34 years (26–43). All patients had at least one previous cesarean section (two prior cesareans in 70% of cases). The most frequent presenting symptom was isolated vaginal bleeding (60%). Two patients (7%) presented in hemorrhagic shock. Mean gestational age at diagnosis was 7 weeks + 4 days, with a mean initial β-hCG of 42,000 IU/L. Transvaginal ultrasound identified 12 type I (endogenic) and 18 type II (exogenic) CSPs, with a mean residual myometrial thickness of 2.1 mm. Type I CSPs were managed medically in 8 cases and by combined treatment in 4 cases. Type II CSPs were managed surgically in 15 cases, medically in 2 cases, and by combined treatment in 1 case. The overall uterine-preservation rate was 90%. Major complications were observed exclusively in type II CSPs and included intraoperative hemorrhage > 500 mL (n = 4), blood transfusion (n = 3), and hemostatic hysterectomy following uterine rupture (n = 1). Four subsequent pregnancies occurred within one year, including one CSP recurrence.

Conclusion: CSP should be suspected in any early pregnancy in women with a prior cesarean delivery. Early ultrasound diagnosis and individualized management based on a decision algorithm integrating residual myometrial thickness and trophoblastic vascularity allow uterine preservation while minimizing maternal morbidity.

KEY WORDS

Cesarean scar pregnancy; Ectopic pregnancy; Methotrexate; Transvaginal ultrasound; Uterine preservation; Fertility

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Introduction

CSP corresponds to the implantation of the gestational sac at the site of a previous hysterotomy scar [1,2]. Initially considered an exceptional entity, it has progressively become an increasingly frequent form of ectopic pregnancy, now accounting for approximately 6% of ectopic pregnancies in women with a history of cesarean delivery [3].

Its incidence, estimated between 1/1,800 and 1/2,500 pregnancies, is likely underestimated due to underdiagnosis and frequent confusion with low-lying intrauterine pregnancies, cervical pregnancies, or ongoing miscarriages [4,5]. This increase is directly correlated with the rising cesarean section rate, which exceeds 40% in several countries, including Tunisia [6].

Pathophysiologically, CSP implants within the “niche” (defect) of the cesarean scar, an area of fibrosis and poor vascularization. Two types are classically distinguished: type I (endogenic), in which the gestational sac develops toward the uterine cavity with the possibility of progression to a viable pregnancy but with a high risk of placenta accreta; and type II (exogenic), in which the sac grows toward the bladder and uterine serosa, exposing the patient to a major risk of early uterine rupture and catastrophic hemorrhage [7,8]. Several recent studies consider CSP to be the first step in the placenta accreta spectrum (PAS) [9,10].

Diagnosis relies mainly on transvaginal ultrasound , ideally performed before 8 weeks of gestation, according to the Timor-Tritsch criteria: empty uterine cavity and cervical canal, gestational sac implanted within the scar, and a myometrial defect between the sac and the bladder [11,12]. Magnetic Resonance Imaging (MRI) can be a valuable adjunct in equivocal cases or for evaluating extension into adjacent organs [13].

Therapeutic management remains non-standardized. Available options include expectant management, medical treatment (systemic or in situ methotrexate [MTX]), surgical techniques (ultrasound-guided aspiration, curettage, operative hysteroscopy, laparoscopic or laparotomic resection with niche repair), and interventional radiology (uterine artery embolization) [14,15]. A recent meta-analysis concluded that all therapeutic modalities appear broadly equivalent in efficacy, highlighting the need for practice harmonization [16].

Through this retrospective study, we report the experience of the Department of Obstetrics and Gynecology at Menzel Tmim Regional Hospital in the management of CSP. The objectives were: (i) to describe the epidemiological, clinical, and ultrasonographic characteristics of our patients; (ii) to evaluate the outcomes of different therapeutic strategies in terms of success, complications, and subsequent fertility according to CSP type; and (iii) to propose and assess a management algorithm adapted to the Tunisian context.

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Materials and Methods

Study design and setting

This was a retrospective, descriptive, and analytical single-center study conducted in the Department of Obstetrics and Gynecology of Menzel Tmim Regional Hospital between January 2022 and December 2024, covering a three-year period. During this interval, approximately 8,000 pregnancies were followed in our department, among which 33 CSPs were identified, giving an estimated local incidence of approximately 4 per 1,000 pregnancies. The study protocol was approved by the local ethics committee. As this was a retrospective analysis of routinely collected anonymized data, the requirement for individual informed consent was waived by the ethics committee.

Study population

All patients with a history of at least one previous cesarean delivery and a confirmed diagnosis of CSP according to the ultrasound criteria of Timor-Tritsch and the Society for Maternal-Fetal Medicine (SMFM) [11,17] were eligible. The diagnostic criteria were:

- Empty uterine cavity and cervical canal;
- Gestational sac implanted at the site of the hysterotomy scar;
- Myometrial defect between the gestational sac and the bladder wall;
- Peritrophoblastic vascularization on color Doppler.

Exclusion criteria were: an ongoing low-lying intrauterine pregnancy not meeting CSP criteria, ectopic pregnancy of another location (tubal, cervical, cornual), and cases with major missing data precluding analysis.

During the study period, 33 patients with a suspected CSP were initially identified. Three patients were excluded from the final analysis: two because of incomplete medical records (missing initial β-hCG and incomplete follow-up data), and one because the diagnosis of CSP was not confirmed on review (low-lying intrauterine pregnancy without scar involvement). Thirty patients were therefore included in the final analysis.

Study variables

The following data were collected from medical records:

- **Demographic data:** Age, parity, gravidity, body mass index (BMI);
- **Obstetric history:** Number of previous cesareans, indications, time since last cesarean, history of uterine curettage;
- **Clinical presentation:** Functional signs, hemodynamic status on admission;
- **Paraclinical data:** Gestational age at diagnosis, initial β-hCG level, ultrasound features (type I/II, sac diameter, cardiac activity, residual myometrial thickness, Doppler vascularization), MRI when performed;
- **Therapeutic data:** Initial modality, need for additional treatment, length of hospital stay;
- **Outcomes:** Treatment success (defined as no need for additional treatment), major complications (hemorrhage > 500 mL, transfusion, hysterectomy, injury to adjacent organs), subsequent fertility, and recurrence.

Therapeutic strategy and treatment allocation

Treatment was not randomized. The choice of therapeutic modality was made on a case-by-case basis after multidisciplinary discussion, based on objective clinical and ultrasonographic criteria, and after discussion with the patient regarding the available options. The main criteria guiding treatment allocation were: CSP type (I vs II), residual myometrial thickness, presence and significance of trophoblastic cardiac activity, initial β-hCG level, hemodynamic status on admission, and the patient's wish to preserve the uterus. The available therapeutic modalities were:

Medical treatment

Two protocols were used and analyzed separately. (a) Systemic methotrexate (MTX) at 50 mg/m² intramuscularly, single dose, with the possibility of a second dose at day 7 in case of insufficient β-hCG decline. (b) Ultrasound-guided in situ MTX injection (25–50 mg) directly into the gestational sac, with or without intracardiac KCl injection when cardiac activity was present.

Surgical treatment

Ultrasound-guided aspiration, suction curettage, operative hysteroscopy, or niche resection–repair by laparoscopy or laparotomy, depending on CSP type, depth of implantation, and residual myometrial thickness.

Combined treatment

Sequential approach combining initial medical management (systemic or in situ MTX) followed by surgical evacuation, with prophylactic uterine artery embolization in selected high-hemorrhagic-risk cases.

The rationale for the treatment choice was recorded for each case (See Results section).

Statistical analysis

Data were entered and analyzed using SPSS version 25 (IBM, Armonk, NY). Qualitative variables are presented as frequencies and percentages, and quantitative variables as mean ± standard deviation or median [range] according to distribution. Comparisons were performed using the χ^2 test or Fisher's exact test for qualitative variables, and the student's t test or Mann-Whitney test for quantitative variables. The threshold for statistical significance was set at $p < 0.05$.

Results

Demographic characteristics and obstetric history

Thirty patients were included in the final analysis. The mean age was 34 years (range 26–43). Mean gravidity was 3 and mean parity was 2. Mean BMI was 27.5 kg/m². All patients had at least one previous cesarean delivery: two previous cesareans in 21 cases (70%) and three or more cesareans in 6 cases (20%). The mean time since the last cesarean was 3.5 years. A history of uterine curettage was found in 12 cases (40%). The main characteristics are summarized in Table 1.

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Table 1. Demographic characteristics and obstetric history (n = 30).

Variable	Value
Age (years), mean (range)	34 (26–43)
Gravidity, mean	3
Parity, mean	2
BMI (kg/m²), mean	27.5
2 previous cesareans, n (%)	21 (70)
≥ 3 previous cesareans, n (%)	6 (20)
Time since last cesarean (years), mean	3.5
History of uterine curettage, n (%)	12 (40)

Clinical presentation

Isolated vaginal bleeding was the most frequent reason for consultation, reported by 18 patients (60%). Pelvic pain, either isolated or associated with bleeding, was reported in 6 cases (20%). Six patients (20%) were asymptomatic, with the diagnosis made at a routine dating ultrasound. Hemodynamic status on admission was stable in 28 cases (93%); 2 patients (7%) presented in hemorrhagic shock secondary to early uterine rupture (both type II CSPs).

Paraclinical evaluation

The mean gestational age at diagnosis was 7 weeks + 4 days. The mean initial β-hCG level was 42,000 IU/L. Transvaginal ultrasound classified 12 cases (40%) as type I (endogenic) and 18 cases (60%) as type II (exogenic). Embryonic cardiac activity was present in 19 cases (65%). The mean residual myometrial thickness was 2.1 mm. Trophoblastic hypervascularization on color Doppler was noted in 24 cases (80%). Pelvic MRI was performed in 5 cases to confirm type II disease and assess bladder involvement. Ultrasound findings are summarized in Table 2.

Table 2. Clinical and ultrasound characteristics at diagnosis.

Variable	Value
Isolated vaginal bleeding, n (%)	18 (60)
Pelvic pain, n (%)	6 (20)
Asymptomatic, n (%)	6 (20)
Hemorrhagic shock, n (%)	2 (7)
Gestational age at diagnosis (weeks), mean	7 + 4 d
Initial β-hCG (IU/L), mean	42,000
Type I (endogenic), n (%)	12 (40)
Type II (exogenic), n (%)	18 (60)
Embryonic cardiac activity, n (%)	19 (65)
Residual myometrial thickness (mm), mean	2.1
Doppler hypervascularization, n (%)	24 (80)
Pelvic MRI performed, n (%)	5 (17)

Therapeutic management by CSP type

Treatment allocation was guided by CSP type, residual myometrial thickness, the presence of embryonic cardiac activity, initial β-hCG level, hemodynamic status, and the patient's wish to preserve the uterus. The distribution of treatment by CSP type is detailed below and summarized in Table 3.

Type I CSP (n = 12)

These patients were preferentially managed medically. Eight patients (67%) received medical treatment alone: four received systemic MTX (50 mg/m², single or double dose) and four received ultrasound-guided in situ MTX , the latter chosen when embryonic cardiac activity was present. The decision for in situ MTX rather than systemic MTX was based on the presence of cardiac activity and/or initial β-hCG > 10,000 IU/L. The remaining four type I patients (33%) received combined treatment (in situ MTX followed by ultrasound-guided aspiration) because of persistently high β-hCG and/or residual trophoblastic vascularization on follow-up Doppler.No type I patient underwent primary surgery alone.

Type II CSP (n = 18)

These patients were predominantly managed surgically. Fifteen patients (83%) underwent primary surgical treatment: ultrasound-guided aspiration in 6 cases, suction curettage in 3 cases, niche resection–repair by laparoscopy in 4 cases, and laparotomic resection with niche repair in 2 cases (including the patient with uterine rupture on admission). The choice of surgical route was guided by the depth of implantation, residual myometrial thickness, and hemodynamic status. Two patients (11%) received medical treatment alone (in situ MTX): both had thin niche-type implantation but no cardiac activity, stable β-hCG kinetics, and explicit patient preference for non-surgical management. One patient (6%) received combined treatment (systemic MTX followed by laparoscopic resection with prophylactic uterine artery embolization) because of major Doppler hypervascularization and elevated β-hCG (> 80,000 IU/L).

The mean length of hospital stay was 3.2 days for medical treatment alone, 5.1 days for surgical treatment, and 6.4 days for combined treatment.

Table 3. Therapeutic management by CSP type (n = 30).

Treatment modality	Type I (n=12)	Type II (n=18)	Total (n=30)
Medical treatment alone- systemic MTX	4 (33%)	0	4 (13%)
Medical treatment alone- in situ MTX	4 (33%)	2 (11%)	6 (20%)
Primary surgical treatment	0	15 (83%)	15 (50%)
Ultrasound-guided aspiration	0	6 (33%)	6 (20%)

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Suction curettage	0	3 (17%)	3 (10%)
Laparoscopic niche resection	0	4 (22%)	4 (13%)
Laparotomic niche resection	0	2 (11%)	2 (7%)
Combined treatment	4 (33%)	1 (6%)	5 (17%)

Outcomes and complications by CSP type

The overall uterine-preservation rate was 90% (27/30). All three failures of uterine preservation occurred among type II CSPs. Major complications were observed almost exclusively in type II CSPs.

Type I CSP outcomes

Uterine preservation was achieved in all 12 cases (100%). No intraoperative hemorrhage > 500 mL, no blood transfusion, and no hysterectomy occurred. Additional treatment after initial medical management was required in 2 patients (17%), both because of persistently rising β-hCG levels, and consisted of complementary ultrasound-guided aspiration. The mean β-hCG normalization time was 32 days. No bladder or ureteral injury was reported. There were no maternal deaths.

Type II CSP outcomes

Uterine preservation was achieved in 15 of 18 cases (83%). Intraoperative hemorrhage > 500 mL occurred in 4 patients (22%), of whom 3 required blood transfusion (17%). Hemostatic hysterectomy was performed in one patient (6%) who presented with uterine rupture on admission and ongoing hemorrhagic shock; the other two cases of failed uterine preservation involved deep niche-type implantation requiring extended resection. Additional treatment after initial management was required in 2 patients (11%) initially treated medically, because of persistent β-hCG and active bleeding. No bladder or ureteral injuries were reported. No maternal deaths occurred.

Table 4. Outcomes and complications by CSP type (n = 30).

Outcome	Type I (n=12)	Type II (n=18)	Total (n=30)
Uterine preservation, n (%)	12 (100)	15 (83)	27 (90)
Need for additional treatment, n (%)	2 (17)	2 (11)	4 (13)
Intraoperative hemorrhage > 500 mL, n (%)	0	4 (22)	4 (13)
Blood transfusion, n (%)	0	3 (17)	3 (10)
Hemostatic hysterectomy, n (%)	0	1 (6)	1 (3)
Bladder/ureteral injury, n (%)	0	0	0
Maternal death, n (%)	0	0	0
Mean hospital stay (days)	3.5	5.2	4.5

Subsequent fertility

After a minimum follow-up of one year, 4 subsequent pregnancies were observed among the 27 patients who retained their uterus (15%). One CSP recurrence was observed (25% recurrence rate among subsequent pregnancies), requiring further medico-surgical management. The three remaining pregnancies were intrauterine; two led to an elective cesarean delivery at term without notable placental complications, and one was an ongoing pregnancy at the time of last follow-up.

Evaluation of the proposed management algorithm

To evaluate the relevance of the management algorithm proposed in this study, we retrospectively applied its decision rules to our 30 cases and compared the algorithm-recommended treatment with the treatment actually administered.

Concordance between the algorithm-recommended and the actually delivered treatment was observed in 26 of 30 cases (86.7%). The four discordant cases were: two type II patients managed medically despite an algorithm recommendation for surgery (both selected on the basis of patient preference and absence of cardiac activity, with successful outcomes); one type I patient who received combined treatment despite an algorithm recommendation for medical treatment alone (decision driven by rising β-hCG kinetics during follow-up); and one type II patient initially managed by aspiration alone despite an algorithm recommendation for combined treatment with prophylactic embolization (this patient experienced intraoperative hemorrhage > 500 mL requiring transfusion).

When stratified by algorithm concordance, the uterine-preservation rate was 92.3% (24/26) in concordant cases versus 75% (3/4) in discordant cases, and the rate of major complications (hemorrhage > 500 mL, transfusion or hysterectomy) was 11.5% (3/26) versus 50% (2/4) respectively. Although the small number of discordant cases precludes formal statistical inference, these results suggest that adherence to the proposed algorithm is associated with favorable outcomes and provide preliminary support for its clinical applicability.

Discussion

Main findings

Our series of 30 CSPs, collected over three years in a Tunisian level II maternity unit, confirms the rising frequency of this condition and the importance of early diagnosis. We report an overall uterine preservation rate of 90%, limited maternal morbidity, and a single case of hemostatic hysterectomy.

These results are comparable to those of recent international series [18,19]. Importantly, analysis stratified by CSP type showed that all major complications and uterine losses occurred in type II CSPs, while type I CSPs were associated with 100% uterine preservation and no major complications.

Epidemiological data

The mean age of our patients (34 years) is comparable to that reported in large series: 33.2 years in the Chinese multicenter cohort of 955 patients by Zhang et al. [20], and 34 years in the prospective series by Bucak et al. including 53 CSPs managed according to a standardized algorithm [19]. A history of two or

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more previous cesareans, found in 90% of our cases, is a major risk factor identified in all studies, reflecting the progressive deterioration of the scarred myometrium with each intervention [21].

Ultrasound diagnosis

Transvaginal ultrasound remains the reference examination, with sensitivity greater than 85% when performed by an experienced operator before 8 weeks of gestation [11,22]. In our series, the mean gestational age at diagnosis (7 weeks + 4 days) was consistent with current recommendations, which likely contributed to our favorable outcomes. Timor-Tritsch et al. proposed a simple early screening sign: when the center of the gestational sac lies below the midline dividing the uterus between the cervix and the fundus, CSP should be strongly suspected [12]. However, a recent comparative study of 102 patients showed that MRI provides superior diagnostic accuracy and classification, particularly for deep forms and ambiguous cases [13]. In our series, MRI was used sparingly (17%), reserved for suspected type II disease with bladder involvement.

The distinction between type I (endogenic) and type II (exogenic) is crucial because it directly determines the therapeutic strategy and prognosis. Kaelin Agten et al. showed that CSPs implanted "in the niche" (type II) have a significantly poorer prognosis than those implanted "on the scar" (type I), with an increased risk of placenta accreta spectrum during pregnancy progression [23]. A residual myometrial thickness below 2 mm, observed in most of our patients, is recognized as the most robust predictor of hemorrhagic morbidity [24]. Our data, showing concentration of all major complications in the type II subgroup, are fully consistent with this prognostic distinction.

Choice of therapeutic modality

Recent literature does not establish a clear superiority of one therapeutic modality over another. The meta-analysis by Alameddine et al., including more than 100 studies, concludes that all approaches appear equivalent in terms of overall efficacy, with success rates ranging from 70% to 95% depending on the series [16]. This heterogeneity reflects the absence of consensus definitions and the variability of case-mix between centers.

Systemic MTX, long considered a first-line treatment, carries a non-negligible failure rate (20–30%), particularly when cardiac activity is present or β-hCG exceeds 10,000 IU/L [14,15]. In situ MTX injection, with or without intracardiac potassium chloride, yields superior results, with sac resolution in more than 80% of cases [25]. In our series, this distinction was clinically meaningful: among the four patients treated with systemic MTX alone, two required additional aspiration for persistent β-hCG, while the six patients treated with in situ MTX showed satisfactory β-hCG decline without need for additional treatment. This is in line with published data and supports the preferential use of in situ MTX when cardiac activity is present or β-hCG exceeds 10,000 IU/L.

Conservative surgical treatment, whether by ultrasound-guided aspiration, hysteroscopy, or resection with niche repair, is gaining popularity, notably because of its dual effect: evacuation of the products of conception and correction of the scar niche, potentially preventing recurrence [19]. Prophylactic uterine artery embolization, used in our series in combination with surgery in selected highhemorrhagic-risk cases, is a valuable adjunct according to the review by Kłobuszewski et al. ,which suggests a superiority of chemo-embolization over systemic MTX in terms of blood loss and length of hospital stay [26].

Proposed management algorithm and its evaluation

Based on our experience and in agreement with the recent SMFM recommendations [17] and the data of Bucak et al. [19], we propose the following decision algorithm:

- In type I CSP, asymptomatic, with residual myometrial thickness ≥ 3 mm and absence of cardiac activity: first-line medical treatment with systemic or in situ MTX;
- In type I or II CSP with cardiac activity, β-hCG > 10,000 IU/L, and/or residual myometrial thickness < 3 mm: combined treatment (in situ MTX followed by ultrasound-guided aspiration ± embolization);
- In deep type II CSP with bladder involvement, residual myometrial thickness < 2 mm, or major hypervascularization: surgical resection with niche repair (laparoscopy or laparotomy) preceded by prophylactic embolization;
- In case of uterine rupture or hemorrhagic shock: emergency laparotomy with hemostatic management, and hysterectomy if necessary.

As detailed in section, the retrospective application of this algorithm to our 30 cases showed concordance with actual management in 86.7% of cases. The uterine-preservation rate was higher and the major complication rate was lower in algorithm-concordant cases than in discordant cases (92.3% vs 75% and 11.5% vs 50%, respectively). Although the small number of discordant cases precludes formal statistical analysis, these findings provide preliminary internal validation of the algorithm. Prospective external validation in a larger multicenter cohort is now warranted.

Subsequent fertility and recurrence risk

Preservation of fertility is a major concern in these often young patients. Reported recurrence rates in the literature range from 15% to 25%, consistent with our observation (1 recurrence among 4 subsequent pregnancies) [27]. The risk of placenta accreta spectrum in a subsequent pregnancy is also increased, justifying early and close ultrasound follow-up in any future pregnancy [9]. Preconception counseling and discussion of potential surgical correction of the niche (isthmoplasty) before any new conception are recommended [28].

Strengths and limitations

The strengths of our study lie in the size of the series (30 cases), which is rare in a Maghreb setting, the inclusion of subsequent-fertility follow-up, the diversity of evaluated therapeutic modalities, and the internal evaluation of the proposed management algorithm against actual practice. Limitations include the retrospective and single-center design, the absence of randomization in treatment allocation (treatment choice was driven by clinical and ultrasonographic criteria together with patient preference, not by random assignment), the modest sample size limiting statistical power for inter-modality comparisons, the absence of prolonged follow-up beyond one year for definitive fertility assessment, and the fact that algorithm evaluation was performed retrospectively on the same cohort that informed its construction, which precludes formal external validation.

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Conclusion

CSP is an emerging entity whose incidence is rising in parallel with the cesarean section rate. Its diagnosis relies on early transvaginal ultrasound, ideally before 8 weeks of gestation, in any patient with a history of cesarean delivery. Therapeutic management must be individualized, based on a decision algorithm integrating CSP type, residual myometrial thickness, β-hCG level, and the patient's wish for uterine preservation. Our series confirms the feasibility and safety of an individualized uterine-preserving approach, with an overall preservation rate of 90% and acceptable maternal morbidity, while highlighting the marked difference in prognosis between type I and type II CSPs. Prospective multicenter Tunisian studies are needed to harmonize practices and externally validate management protocols adapted to the local context. In parallel, prevention relies on a reasoned policy regarding the indications for primary cesarean delivery, which remains the only way to durably curb the rising incidence of this condition.

Declarations

Conflicts of interest

The authors declare no conflict of interest related to this article.

Funding

This study received no external funding.

Ethical approval

The study was conducted in accordance with the Declaration of Helsinki. The protocol was approved by the local ethics committee of Menzel Tmim Regional Hospital. As a retrospective analysis of routinely collected anonymized data, the requirement for individual informed consent was waived. Data anonymity and confidentiality were preserved throughout.

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