Scar Ectopic Pregnancy: A Growing Concern in Gynaecological Practice

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Introduction

Cesarean scar ectopic pregnancy (CSP) is a rare but dangerous form of ectopic pregnancy in which an embryo implants into the fibrous scar of a previous cesarean section. With rising cesarean delivery rates worldwide, the incidence of CSP appears to be increasing, making this an emerging concern in gynecological practice. Although CSP accounts for less than 1% of all pregnancies, it now represents up to 5–6% of ectopic pregnancies in women with a cesarean history. Early recognition of scar ectopic pregnancy is critical, as delayed diagnosis can lead to severe complications including uterine rupture, catastrophic hemorrhage, loss of future fertility, and even maternal death. This article provides an evidence-based overview of CSP, including its background, pathophysiology, diagnostic approach, management strategies, recent innovations, illustrative cases, and conclusions for clinical practice.

Background

The first known case of pregnancy in a uterine scar was reported in 1978 by Larsen and Solomon. Through the 1980s and 1990s, only a few dozen cases were documented, underscoring the rarity of this condition in earlier decades. However, the steady increase in cesarean section rates – from about 20% of deliveries in the 1990s to over 30% in recent years in the U.S.– has coincided with a rise in CSP diagnoses. Improved ultrasound technology and greater clinician awareness have also contributed to detecting more cases of CSP that might previously have gone unrecognized.

By definition, a scar ectopic is a gestation implanted in the myometrial scar of a prior hysterotomy (typically a lower-segment cesarean). This distinguishes CSP from other ectopic pregnancies, which most often occur in the fallopian tubes. Some debate exists whether CSP should be categorized as an “ectopic” since it is located within the uterus; nonetheless, it behaves like an ectopic due to its abnormal implantation site and associated risks. Key risk factors for CSP include multiple prior cesarean deliveries (which increase scar surface area and fibrotic tissue) and possibly surgical techniques leading to a deficient scar niche. Prior uterine surgery (myomectomy, dilation and curettage) and in vitro fertilization have also been reported in some cases of CSP, but the strongest association is with cesarean scars.

Pathophysiology

Scar ectopic pregnancy is believed to result from implantation of the blastocyst into microscopic tract openings or sinuses in an incompletely healed cesarean scar. Poor scar healing can leave a pocket or deficient area (sometimes called an isthmocele) in the anterior lower uterine segment, where an embryo may abnormally implant. The trophoblast then invades the scar’s fibrous tissue instead of the healthy endometrium, leading to a poorly supported gestational sac prone to expansion into the myometrium. Depending on the orientation of growth, two types of CSP have been described:

- **Type 1 (Endophytic):** The gestational sac grows toward the uterine cavity, potentially plugging into the scar defect. This type may progress longer and even reach the second or third trimester, but often with eventual development of a

placenta accreta spectrum (morbidly adherent placenta) if the pregnancy continues.

- **Type 2 (Exophytic):** The gestation is implanted deeply into the scar and grows outward, toward the serosa and bladder. This form is more likely to lead to early uterine rupture and severe hemorrhage given its invasive nature.

Both types pose significant risk, but Type 2 is considered more immediately dangerous due to early expansion through the uterine wall. In essence, a CSP involves pathologic invasion of the prior cesarean scar site, sharing similarities in histopathology with early placenta accreta (impaired decidualization and placental adherence to scar tissue. If a CSP is not diagnosed and managed in the first trimester, it can progress into a placenta accreta or even placenta percreta as the placenta attempts to sustain growth on the scar, which greatly increases the risk of life-threatening bleeding at the time of attempted placental removal.

Diagnostics

Clinical Presentation: Patients with cesarean scar ectopic pregnancies often present in the first trimester, typically between 5–8 weeks' gestation. Vaginal bleeding is a common symptom, sometimes accompanied by mild abdominal pain or cramping. However, a noteworthy proportion of women with CSP may be relatively asymptomatic early on. The absence of pain does not exclude a scar pregnancy. A history of a prior cesarean delivery (especially multiple) is an important clue, and any early pregnancy in such a patient with bleeding or abnormal ultrasound findings should prompt consideration of CSP.

Ultrasound Imaging: Transvaginal sonography is the diagnostic modality of choice for CSP and can achieve a sensitivity around 86%. Characteristic ultrasound criteria for cesarean scar pregnancy include:

- An **empty uterine cavity** (no intrauterine gestational sac in the fundus or mid-uterus).
- An **empty cervical canal**, distinguishing from a cervical pregnancy.
- A **gestational sac located in the anterior lower uterine segment** at the level of the cesarean scar, often embedded in the myometrium of the scar.
- A **thin or absent layer of myometrium** between the gestational sac and the bladder wall, generally <5 mm in most cases .

On a sagittal ultrasound view, the sac of a CSP may be seen within or near the niche of the scar, sometimes with a Doppler "feeding vessel" from the uterine artery. The presence of fetal cardiac activity in the sac confirms a viable CSP (though many are diagnosed as anembryonic sacs or with only a yolk sac). Three-dimensional ultrasound can further aid in visualizing the exact implantation site within the scar. **Figure 1** illustrates an anatomic depiction of a cesarean scar ectopic pregnancy and the relevant sonographic features.

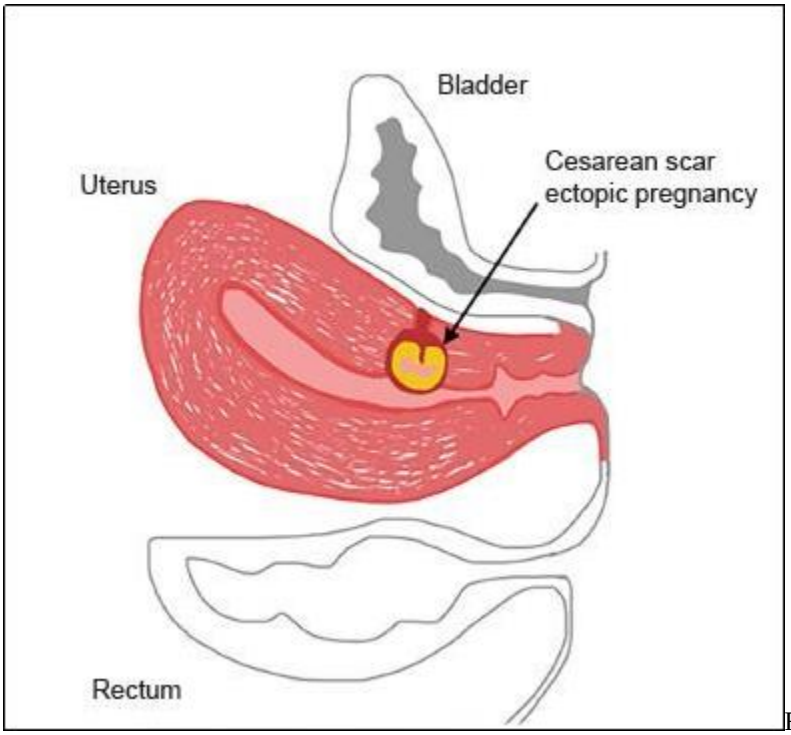

Figure 1

Figure 1: Anatomic illustration of a Cesarean scar ectopic pregnancy. The gestational sac is implanted in the lower anterior uterine segment at the site of the prior cesarean scar, with only a thin myometrial layer separating it from the bladder.

Differential diagnosis on ultrasound includes a cervical pregnancy or an abortion in progress (retained products in the lower uterine segment). In a cervical ectopic, the sac is within the cervical canal (below the internal os) rather than embedded in the anterior uterine wall, and typically the anterior myometrium remains of normal thickness. In a miscarriage in progress, the cervical os may be open or there may be evidence of passage of tissue, and again the myometrial thickness is normal (unlike the thin scar area in CSP). Careful transvaginal scanning by an experienced sonographer, combined with clinical exam (to assess if os is open or closed), usually allows accurate diagnosis. In ambiguous cases or if the sac is large, **MRI** can be a useful adjunct to delineate the extent of invasion into the uterine wall and towards the bladder, which can assist in planning management.

Laboratory: Serum beta-hCG levels in CSP are variable and not diagnostic by themselves. They often rise (or plateau) as in other ectopics. A very high quantitative hCG (e.g. >100,000 mIU/mL) with an empty uterine cavity on ultrasound might raise suspicion of either CSP or cervical pregnancy if the patient is stable. Nonetheless, lab tests mainly help to confirm pregnancy and monitor treatment response rather than make the diagnosis.

Management Strategies

Managing a cesarean scar pregnancy is challenging due to the lack of large trials and the need to balance efficacy of treatment with preservation of the uterus for future fertility. There is no single universally accepted treatment, and practice often depends on the patient's presentation, desire for fertility, available resources, and clinician expertise. Broadly, management options can be categorized into medical, surgical, or combined approaches, all aiming to terminate the abnormal pregnancy while minimizing hemorrhage risk.

Expectant Management: *Not Recommended.* Allowing a CSP to progress without intervention is associated with extremely high risk of severe maternal morbidity. If left to advance, most will either rupture or develop placenta accreta spectrum, often necessitating hysterectomy in the second or third trimester. Therefore, expert guidelines strongly recommend against expectant management of scar ectopics unless perhaps in the context of a very early miscarriage of a CSP that is already in evolution. In rare cases where a patient refuses termination, strict counseling and planning for early cesarean delivery (around 34–35 weeks) and hysterectomy may be undertaken, but with recognition of the formidable risks.

Medical Management: *Systemic or Local Methotrexate.* Methotrexate (MTX), a folate antagonist that halts trophoblastic tissue, has been employed for CSP similar to other ectopic pregnancies. Systemic single-dose MTX (50 mg/m^2) alone has had mixed success in CSP, with many cases requiring additional doses or surgical rescue. In fact, recent recommendations **discourage MTX**

as sole therapy for CSP because of high failure rates. A more effective strategy is **local MTX injection** into the gestational sac under ultrasound guidance, often combined with systemic MTX ("dual therapy"). By injecting MTX (or other embryocidal agents like potassium chloride) directly into the sac, higher concentrations reach the trophoblast. Small case series have reported success with local MTX in achieving cessation of cardiac activity and gradual resorption of the sac. Medical therapy is most suitable when the gestation is early (<8 weeks), sac size is small, and there is minimal bleeding. It can preserve the uterus, but close monitoring is required, as about 40–50% may still need surgical intervention due to persistent mass or bleeding. Other adjuncts described include **uterine artery embolization (UAE)** to cut off blood supply before or after MTX injection, which may reduce hemorrhage risk and aid in resolving the pregnancy. In summary, methotrexate (especially via local injection) is a reasonable first-line approach for hemodynamically stable patients desiring fertility, but rescue surgery must be available.

Surgical Management: *Removal of the Ectopic and Repair of the Scar*. Surgical treatment is often indicated for CSPs that are advanced, have strong cardiac activity, large sac size, or when medical therapy fails. Options include hysteroscopic evacuation, dilation and curettage (D&C) with caution, laparoscopic or open resection of the gestation from the scar, or even hysterectomy in extreme cases. **Dilatation & Curettage alone is generally *not* recommended**, as blind curettage of a scar pregnancy can lead to massive bleeding. If curettage is attempted, it should be done with prior uterine artery embolization and ideally under ultrasound guidance to ensure the scar area is targeted. A more controlled surgical approach is **wedge resection of the scar**: via laparoscopy or laparotomy, the pregnancy tissue is excised from the anterior uterine wall and the defect is repaired. Laparoscopic resection has been successfully performed, especially for Type 2 CSPs that protrude outward. This method allows direct closure of the scar, potentially strengthening it for future pregnancies. **Hysteroscopic resection** is another minimally invasive technique for early CSP, where an operative hysteroscope is used to resect and coagulate the implantation site through the cervix. This has shown success in small case series for Type 1 CSPs that bulge into the uterine cavity. In many instances, a **combined approach** is employed: for example, local MTX injection followed by a few days later by surgical evacuation, or UAE followed by hysteroscopic resection, etc.. A systematic review by Birch Petersen et al. (2016) found that combination therapy (medical plus surgical) had the highest success in resolving CSP with the lowest complication rates. Ultimately, the optimal treatment often involves tailoring to the individual case, and many authors advocate for a **multidisciplinary approach** with involvement of gynecologists, interventional radiologists, and sometimes fertility specialists to both treat the current pregnancy and preserve future fertility.

Adjunctive Measures: Regardless of approach, careful preparation is essential. It is prudent to have blood products on hand and to consider placing uterine artery catheters for possible embolization if heavy bleeding occurs. Use of vasopressin injection in the myometrium around the scar during surgery can reduce bleeding. Rh immunoglobulin should be given to Rh-negative women after treatment. Follow-up beta-hCG levels are tracked to zero to confirm resolution. Additionally, after recovery, patients should be counseled to delay conceiving for perhaps 6–12 months and to have early prenatal care with ultrasound in any subsequent pregnancy to check the implantation site.

Innovations and Emerging Therapies

Because cesarean scar pregnancy is an uncommon condition, high-quality comparative studies are limited. However, recent years have seen initiatives to better understand and manage CSP. One important development is the creation of **international CSP registries** for clinicians to submit data on diagnosis, treatment, and outcomes. These registries (e.g., at the University of Colorado and OHSU) aim to pool global experience to inform evidence-based guidelines for CSP management.

Another innovation is the improvement in **imaging and diagnostic criteria**. Three-dimensional transvaginal ultrasound and power Doppler have enhanced the ability to distinguish CSP from other early pregnancy abnormalities. There are efforts to standardize the sonographic reporting of CSP (for example, defining scar thickness measurements and sac location more uniformly) to facilitate early, accurate diagnosis. Early diagnosis in turn allows for less invasive management.

On the treatment front, **minimally invasive techniques** are continually being refined. For instance, *transvaginal ultrasound-guided aspiration* of the gestational sac combined with local injection of MTX or hyperosmolar glucose is being explored as a fertility-preserving option, essentially vacuuming out the sac from the scar area. In one pilot series, such aspiration under sonographic guidance achieved complete removal in select cases with manageable blood loss. Similarly, **laparoscopic management** has advanced, with surgeons now sometimes using laparoscopy not just for resection but also to temporarily occlude uterine arteries with clips during surgery to mitigate hemorrhage. This approach, akin to a tourniquet, can allow safer resection of the scar pregnancy and then the clips are removed to restore blood flow afterward.

Hysteroscopic removal has also been reported more frequently in recent literature as hysteroscopic equipment and skills have improved. This approach avoids abdominal incisions and can directly visualize the scar niche from inside the uterus, resecting the implanted tissue and coagulating the bed. A 2021 retrospective study found hysteroscopic surgery combined with MTX pretreatment

had high success in terminating CSP with preservation of the uterus, suggesting this may be an ideal approach for Type 1 CSP in experienced hands.

Finally, **preventive strategies** are worth noting as a form of innovation. Given that CSP arises from a prior cesarean scar, efforts to reduce primary cesarean deliveries and to ensure proper surgical technique and healing may eventually lower CSP incidence. Some obstetricians advocate for meticulous two-layer uterine closure and maybe delaying conception for a year or more after a cesarean to allow solid scar formation, though evidence is limited. There is also research into improving scar healing (for example, using adjunctive treatments at cesarean surgery) which could theoretically reduce niches and abnormal implantations in the future.

Case Studies

Case 1 – Rapid Diagnosis and Fertility-Sparing Treatment: A 32-year-old G2P1 woman with one prior low transverse cesarean presents at 7 weeks by dates with light vaginal bleeding. Ultrasound reveals an empty uterine cavity and a gestational sac with a yolk sac embedded in the anterior lower uterine segment at the level of the cesarean scar. The myometrial layer between the sac and bladder measures only 3 mm. No fetal heartbeat is seen (consistent with an early failing pregnancy). The patient is hemodynamically stable. After counseling, she undergoes local injection of 50 mg methotrexate into the sac under ultrasound guidance. This is followed 48 hours later by hysteroscopic evacuation of the residual sac tissue. She also receives intramuscular MTX one week later due to plateauing hCG levels. The hCG eventually trends to zero over 8 weeks. A follow-up ultrasound shows an involuted scar area without retained products. She recovers well, and in a subsequent spontaneous pregnancy two years later, the embryo implanted in the uterine fundus and she delivered at term via repeat cesarean. This case illustrates a combined medical-hysteroscopic approach that successfully treated the CSP and preserved fertility.

Case 2 – Surgical Management of Advanced CSP: A 38-year-old woman, G4P3, with three prior cesareans, is diagnosed with a cesarean scar ectopic at 9 weeks with embryonic cardiac activity. She had significant bleeding at presentation but was stable after fluids. Because the sac was large (≥4 cm) and protruding through the uterine wall (Type 2), the team proceeded with immediate surgical management. Bilateral uterine artery embolization was performed by interventional radiology to reduce blood flow. Then, via laparoscopy, the surgeon made an incision over the scar on the uterine serosa and excised the gestational sac and surrounding scar tissue. The defect was sutured in two layers. Estimated blood loss was 300 mL. The patient's postoperative course was uncomplicated, and pathology confirmed chorionic villi implanted in the scar. She was advised to avoid pregnancy for at least one year. This case demonstrates a proactive surgical approach for a more advanced CSP, with successful removal of the pregnancy and reconstruction of the scar.

Case 3 – Continuation Leading to Accreta: In a cautionary scenario, a 30-year-old with one prior C-section was misdiagnosed initially with a low intrauterine pregnancy. She declined intervention after a second opinion suggested a possible scar pregnancy. The pregnancy was allowed to continue. At ~16 weeks, she was found to have placenta previa with accreta (the placenta fully covering the cervix and inseparable from the anterior uterine wall at the scar). At 26 weeks she had an episode of heavy bleeding and uterine pain, concerning early placenta percreta invasion into the bladder. An urgent cesarean hysterectomy was performed at 27 weeks, delivering a viable but premature infant and requiring transfusion of 4 units of blood. The pathology showed placenta percreta (placental villi penetrating through the uterine wall). The patient recovered, but with loss of her uterus. This case underscores that continuing a CSP can result in placenta accreta spectrum and necessitate hysterectomy with preterm delivery. It highlights why expectant management of CSP is generally avoided.

Conclusion

Cesarean scar ectopic pregnancy has evolved from a clinical rarity to a recognized complication that all obstetricians, gynecologists, and emergency physicians should keep in mind. Early diagnosis through high-resolution transvaginal ultrasound is paramount for preventing severe outcomes. Providers must maintain a high index of suspicion for CSP in any early pregnancy with a history of cesarean delivery and abnormal ultrasound findings or bleeding. Once identified, prompt intervention is required. An individualized treatment plan – often combining medical and surgical modalities – offers the best chance of terminating the ectopic pregnancy safely while preserving the uterus. The optimal management of CSP is still being defined, as evidenced by varying approaches in the literature and the establishment of multicenter registries to gather data. Nevertheless, consensus is clear that untreated CSP poses unacceptable risks to maternal health.

Going forward, continued research and sharing of clinical experience will refine the approach to scar ectopic pregnancies. Advancements in minimally invasive surgery and targeted therapies offer hope for improving outcomes. Just as importantly, prevention of cesarean sections when not medically necessary and ensuring robust uterine scar healing are systemic strategies that

may mitigate the rising incidence of this complication. In summary, scar ectopic pregnancy is a growing concern that demands vigilance and a proactive, skilled response. With careful management, many patients can be spared life-threatening complications and have the opportunity for future healthy pregnancies.

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