

**Case Report****Low implantation of pregnancy: An imitator of cesarean scar ectopic pregnancy****Kavya Paul Udayasuriyan^{1*}, Shanthi Ethirajan¹, Samya Janarthanam¹**¹Dept. of Obstetrics and Gynecology, Saveetha Medical College and Hospital, Chennai, Tamil Nadu, India**Abstract**

Cesarean scar pregnancy (CSP) is a rare but serious form of ectopic pregnancy where implantation occurs at the site of a prior cesarean scar. This condition poses significant risks, including uterine rupture, severe hemorrhage, and complications like placenta accreta spectrum (PAS). Early and accurate diagnosis through transvaginal ultrasonography is essential for timely intervention. Management strategies vary, from conservative approaches such as methotrexate therapy to surgical options like hysteroscopy and uterine artery embolization, tailored to patient circumstances and reproductive goals. This report outlines a case initially suspected to be CSP, highlighting the diagnostic challenges posed by low implantation mimicking cesarean scar pregnancy, management strategies, and long-term considerations. With increasing cesarean delivery rates globally, CSP requires growing awareness among clinicians and improved management frameworks to optimize maternal outcomes.

Keywords: Pregnancy, Ectopic, Cesarean section, Embryo implantation, Placenta accreta, Uterine rupture, Maternal health, Ultrasonography, Prenatal, obstetric surgical procedures, Conservative treatment, Methotrexate, Magnetic resonance imaging, Obstetric emergency.

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1. Introduction

The cesarean section, while often life-saving, has led to a rise in complications in subsequent pregnancies, one of which is cesarean scar pregnancy (CSP). This rare condition occurs when a fertilized ovum implants within the myometrial defect at the site of a previous cesarean section, often resulting in severe complications if undiagnosed or poorly managed.¹

The prevalence of CSP has increased in recent decades, paralleling global cesarean delivery rates. It is estimated to occur in approximately 1 in 2000 pregnancies and accounts for about 6% of ectopic pregnancies in women with prior cesarean sections.² CSP is often misdiagnosed as low-lying or cervical pregnancies, underscoring the importance of accurate and early diagnostic methods.³

Advanced imaging, particularly transvaginal ultrasonography, remains the cornerstone for early detection. Innovations such as 3D ultrasonography and Doppler studies have enhanced diagnostic accuracy, enabling differentiation

between CSP and other forms of abnormal implantation.⁴ Early intervention is critical for preventing complications such as uterine rupture and ensuring reproductive outcomes.

2. Case Presentation

A 25-year-old gravida 2 para 1 woman presented at 11 weeks and 2 days of gestation with complaints of lower abdominal pain and intermittent vaginal spotting. Her medical history included a cesarean section performed four years earlier for non-progressive labor.

On transvaginal ultrasonography, a cystic structure with an echogenic rim was identified near the lower uterine segment, close to the previous cesarean scar (**Figure 1**). The gestational sac lacked cardiac activity, and no sliding sign was observed, raising suspicion of a cesarean scar pregnancy³. Serial beta-HCG levels were monitored, showing a suboptimal rise: 7630 mIU/ml on day 1, 9132 mIU/ml on day 3, and 13,377 mIU/ml on day 5. These

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findings, combined with imaging results, strongly suggested CSP.⁵

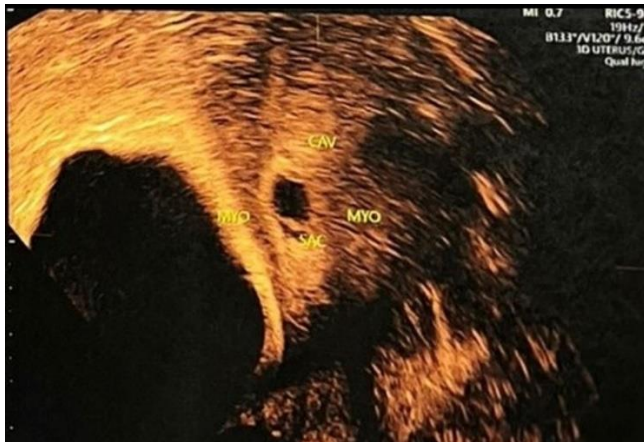


Figure 1: A cystic structure with an echogenic rim was identified near the lower uterine segment, close to the previous cesarean scar

After counseling, the patient opted for conservative management. A week later, follow-up ultrasound revealed a gestational sac in the lower uterine cavity without an embryo, indicative of a missed miscarriage. Medical termination was performed using misoprostol, and post-procedure monitoring confirmed resolution. This case highlights the complexity of diagnosing CSP and the importance of individualized care tailored to the patient's clinical condition and reproductive goals.

3. Discussion

CSP is a unique and challenging condition with significant implications for maternal health. Its pathophysiology, diagnostic criteria, and management require a nuanced understanding to optimize patient outcomes.

3.1. Pathophysiology

CSP results from implantation within a defect at the cesarean scar site. These defects, often termed uterine niches, are thought to arise from incomplete healing of the myometrium after cesarean delivery. Altered vascularization and tissue remodeling create an environment conducive to abnormal trophoblastic invasion, leading to implantation outside the endometrial cavity.⁶ This pathophysiology explains the increased risks of uterine rupture and PAS disorders.

3.2. Clinical presentation

In the initial stages, CSP is frequently asymptomatic, but it may lead to mild vaginal bleeding, lower abdominal discomfort, and, in certain situations, significant bleeding if the pregnancy continues. The symptoms can resemble those of various other early pregnancy issues, such as cervical pregnancy or incomplete miscarriage. Additionally, patients might show unusual beta-HCG patterns, with a less-than-expected increase indicating a possible abnormal implantation.

3.3. Diagnostic advances

Accurate diagnosis of CSP hinges on early imaging. Transvaginal ultrasonography is the first-line modality, offering high-resolution visualization of the uterine cavity. Key diagnostic features include:

1. A gestational sac embedded in the anterior uterine wall at the scar site.
2. Myometrial thinning (<3 mm) between the sac and bladder.
3. An empty endometrial cavity and cervical canal.⁷

Doppler ultrasonography provides additional insights into vascularization, which can predict hemorrhagic risk. In complex or ambiguous cases, MRI offers superior soft-tissue resolution and can delineate the extent of myometrial invasion.⁸ Emerging technologies such as 3D ultrasonography and automated image analysis hold promise for further improving diagnostic accuracy.

3.4. Recent research in diagnostic modalities

3.4.1. Biomarkers and molecular diagnostics

Extracellular vesicles (EVs): Extracellular vesicles, such as exosomes and microvesicles, are essential for communication between cells and are involved in various physiological and pathological processes. Studies suggest that EVs may play a role in the development of different pregnancy-related complications and could potentially act as biomarkers for early diagnosis.⁹

3.4.2. AI-assisted imaging

Deep learning models: AI technologies, particularly those using deep learning algorithms, are being developed to enhance the detection of CSP through the analysis of ultrasound images and the integration of clinical information. Recent studies have shown the promise of these models in autonomously diagnosing CSP, thereby facilitating early detection and improved management.¹⁰

Machine learning for risk assessment: Machine learning methods are also being explored to evaluate the risk of bleeding during surgical procedures for CSP, which can assist in preoperative planning and informing patients effectively.¹¹

3.5. Management strategies

Management of CSP is tailored to the patient's gestational age, symptoms, and future fertility plans.

1. Conservative approaches: Methotrexate therapy is a cornerstone for early, stable CSP cases. It acts by inhibiting trophoblastic cell proliferation, allowing for gradual resorption of the pregnancy.⁹ Methotrexate can be administered systemically or locally via ultrasound-guided injection into the gestational sac.

Close monitoring of beta-HCG levels is essential to confirm treatment success.

2. Surgical interventions

- a) Hysteroscopy: Enables direct visualization and removal of ectopic tissue, often combined with curettage for complete evacuation.
 - a) Laparoscopy or laparotomy: Indicated in cases of significant hemorrhage or advanced gestation. These techniques also allow for scar revision to reduce the risk of recurrence.
 - b) Uterine artery embolization (UAE): Minimally invasive and effective for controlling hemorrhage, UAE preserves fertility and may be used adjunctively with other treatments.¹⁰
3. Combined modalities: In complex cases, a combination of medical and surgical interventions is often necessary. For example, methotrexate may be used to reduce vascularity before surgical removal, minimizing intraoperative risks.

3.6. Short-term outcomes

Timely and appropriate management significantly reduces immediate risks such as uterine rupture and hemorrhage. Surgical techniques and pharmacological therapies have high success rates, but meticulous follow-up is required to ensure complete resolution and avoid complications like retained products of conception.

3.7. Long-term implications

Patients with a history of CSP face heightened risks in subsequent pregnancies, including placenta accreta and uterine rupture.¹¹ Preconception counseling and meticulous antenatal care are critical for optimizing outcomes. Delivery planning should prioritize cesarean sections at tertiary care centers equipped for managing complex obstetric emergencies.

3.8. Psychosocial impact

The diagnosis and management of CSP can be emotionally distressing for patients. Concerns regarding fertility and future pregnancies are common. Integrating psychological support and counseling into the care plan is essential for holistic management.

3.9. Emerging research and innovations

Advances in molecular biology are shedding light on CSP pathophysiology. Biomarkers such as angiogenic factors and inflammatory mediators are being explored for their potential in early diagnosis and risk stratification. Additionally, robotic-assisted surgeries and targeted drug therapies are promising avenues for improving treatment outcomes.

4. Conclusion

Accurate first-trimester ultrasound is crucial for distinguishing between benign and severe complications associated with low pregnancy implantation and cesarean scar ectopic pregnancies. This early diagnosis is vital for ensuring appropriate maternal treatment, follow-up care, and the prevention of future complications related to scar ectopic pregnancies. Recent advancements in ultrasound technology have introduced new parameters that aid in accurately identifying and differentiating these conditions. These advancements not only facilitate prompt diagnosis but also enable healthcare providers to implement effective treatment strategies promptly, thereby optimizing maternal health outcomes and reducing risks associated with abnormal pregnancy implantation. Regular utilization of these advanced ultrasound parameters ensures comprehensive monitoring and management, supporting the health and well-being of both the mother and the developing foetus throughout pregnancy.

5. Source of Funding

None.

6. Conflict of Interest

None.

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