

Pitfalls in Ultrasound Diagnosis of Cesarean Scar Pregnancy

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Abstract Cesarean scar pregnancy (CSP) is a rare kind of ectopic pregnancy implanted in the previous cesarean scar and has an increasing incidence over the past 30 years. As the suspicion is low, the diagnosis may be delayed or

misinterpreted in ultrasound, leading to treatment strategies that might end up in uterine rupture or hysterectomy. The objective here is to review the ultrasound findings in CSP with varied presentations. Transabdominal and transvaginal sonography combined with color Doppler is a reliable tool for the diagnosis of CSP. When the gestational sac is seen in lower part of the uterine cavity, differentiation between threatened miscarriage, cervical pregnancy and CSP could be difficult. Not all cases of CSP present with typical ultrasound findings and a high index of suspicion is needed for diagnosis in these cases. An attempted curettage or MTP pill taken in an undiagnosed CSP often alters the typical findings. The possibility of CSP should also be considered in cases presenting with abnormal uterine bleeding and have a prior history of cesarean section. With lack of awareness about this condition, the diagnosis can often be missed either with MRI or in ultrasound. Correct interpretation and timely diagnosis save the mother from life-threatening complications and also preserves future fertility.

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Table 1 Differentiating points between inevitable abortion, cervical pregnancy and cesarean scar pregnancy

Inevitable abortion	Cervical pregnancy	Cesarean scar pregnancy
<i>Presentation</i>		
Bleeding per vagina associated with pain	Amenorrhea followed by bleeding per vagina not associated with pain	Amenorrhea followed by bleeding per vagina with or without pain May be asymptomatic in the initial phase
<i>Internal os</i>		
Open	Closed	Closed
<i>β-HCG</i>		
Falling titers	As in viable pregnancy	As in viable pregnancy
<i>Position of gestation sac</i>		
Vary, may present in lower uterine segment or in cervical canal	Within cervical canal	Within lower uterine segment over the cesarean scar
<i>Sliding organ sign</i>		
Present	Absent	Absent
<i>Ultrasound appearance</i>		
Absent fetal cardiac activity or absence of fetal pole, may be surrounded by perigestational hemorrhage	Ballooned cervix, hourglass appearance of uterus. Empty uterine cavity	Empty uterus and cervical canal; thin myometrium between bladder and gestation sac
<i>Color Doppler</i>		
Avascular gestation sac	Highly vascular gestation sac	Highly vascular gestation sac; peritrophoblastic perfusion surrounding sac

Sliding organ sign is defined as ability to displace the gestational sac from its position at the level of the internal os by gentle pressure applied by the probe [5]

Keywords Cesarean scar pregnancy · Ultrasonography · Abnormal uterine bleeding · Ectopic gestation · Cervical pregnancy · Scar hematoma

Introduction

Cesarean scar pregnancy (CSP) is a rare type of ectopic pregnancy showing a rising trend of incidence recently, probably attributed to the increasing rate of cesarean sections as compared to the past. The estimated incidence ranges from 1 in 1800 to about 1 in 2216 of all cesarean deliveries [1, 2].

CSP is the pregnancy outside the endometrial cavity implanted in the previous cesarean scar and is thought to be due to the invasion of myometrium through a uterine dehiscence. The dehiscence can be caused by procedures such as curettage, myomectomy, hysteroscopy, metroplasty, cesarean section or even by manual removal of placenta. Local injury to the endometrium causes fibrosis, poor vascularization and incomplete healing. This results in endometrial and myometrial disruption forming a micro tubular tract between the cesarean section scar and endometrial cavity which predisposes the implantation of CSP [2–4].

Diagnosis

Differentiation between threatened miscarriages, cervical pregnancy and CSP could be difficult in a low-lying gestation sac [3, 5]. Clinical presentation may be similar as vaginal bleeding with or without pain may be present in all the three conditions [4]. Salient features in differentiating the three conditions are described in Table 1. Transabdominal ultrasound (US) in cervical pregnancy shows the gestation sac dominantly within the cervix and an empty uterus giving an hourglass shape to the uterus with a ballooned cervical canal. The possibility of a CSP should be thought of when the gestational sac is seen at the level of uterine isthmus in cases with a previous history of cesarean section. In cases of spontaneous miscarriage in progress, avascular gestation sac can be seen either in lower uterine segment or in the cervical canal and has falling serum β-HCG levels.

Transabdominal and transvaginal sonography combined with color Doppler is a reliable tool for the diagnosis of CSP [2, 5–7]. Ultrasound findings in a typical case of CSP are illustrated in Fig. 1. The sonographic criteria for the diagnosis of CSP are (1) development of gestation sac in the anterior wall of the isthmic portion (Fig. 1a); (2) empty uterus and empty cervical canal (Fig. 1b); (3) absent or

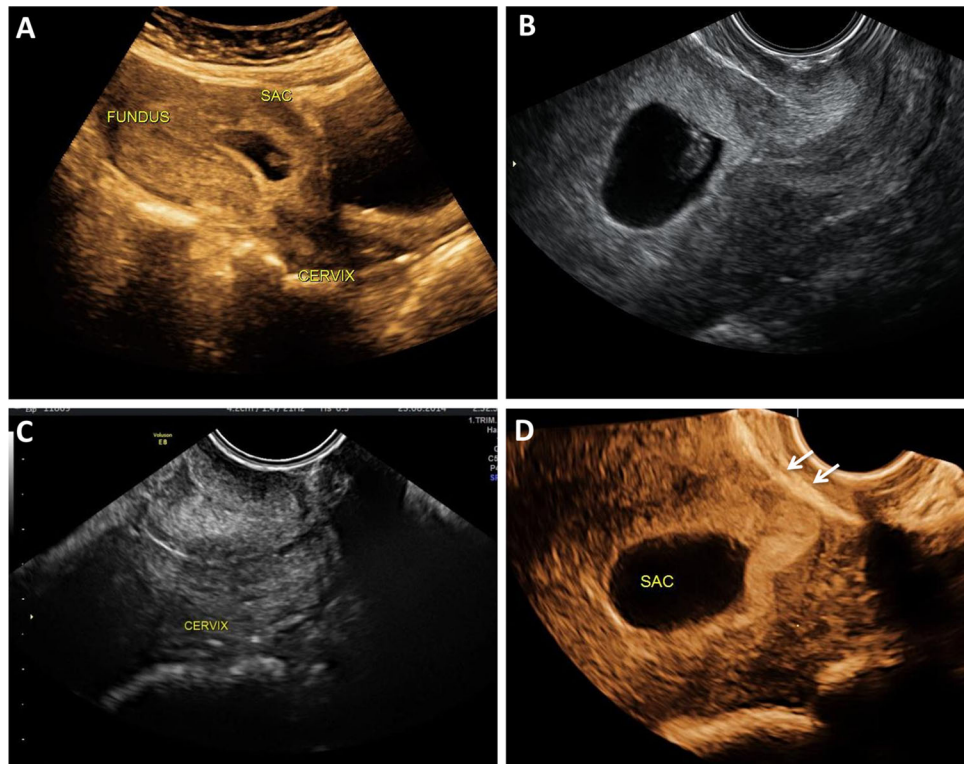


Fig. 1 Typical ultrasound findings in CSP. **a** Low-lying gestational sac seen on trans abdominal examination, **b, c** transvaginal imaging reveals empty cervical canal with sac implanted in the scar site,

d three-dimensional image of CSP—gestational sac with echogenic trophoblastic tissue seen in scar with lack of surrounding myometrium

diminished healthy myometrium between the bladder and the sac (Fig. 1c, d); (4) peritrophoblastic vascular flow seen surrounding the sac [2, 3, 5, 6]. Typical sonographic criteria are not fulfilled in all the cases and are often associated with pitfalls especially in those with atypical presentations which are given in Table 2. Figure 2 illustrates a case where the typical ultrasound findings are masqueraded by a large subchorionic hematoma (Fig. 2a, b). However, the presence of gestation sac (Fig. 2c) in lower uterine segment overlying the cesarean scar with peritrophoblastic flow (Fig. 2d) raised the suspicion of scar pregnancy.

Atypical cases of scar pregnancy can be easily misdiagnosed due to lack of awareness and a poor index of suspicion. An attempted curettage done in an undiagnosed scar pregnancy often alters the typical findings on ultrasound. Patient was referred to us for persistent bleeding after dilatation and curettage (D&C) and ultrasound revealed an echogenic lesion in lower uterine segment (Fig. 3a, b) with an ill-defined endomyometrial junction and no evidence of vascularity was noted in the lesion. The outer contour of the uterus at the lower segment was hazy and irregular (Fig. 3c). However, the anatomical site of lesion and her previous history of cesarean section made us suspicious of a disturbed CSP, and a differential diagnosis

of scar hematoma was given. Later a change in the echo pattern of the lesion was noted due to the resolving scar hematoma which had been misinterpreted as a degenerating anterior myometrial fibroid by her clinician. However, the loss of normal anatomy of lower uterine segment made us to caution that a further attempt to do an invasive procedure would result in uterine rupture and torrential bleeding. Further invasive procedure was deferred based on ultrasound findings and conservative treatment was offered. Follow-up scan after 2 months showed regression of the scar hematoma (Fig. 3e, f) and a small collection with redundant fluid in the scar site with no evidence of fibroid. Her clinical symptoms improved and serum β -HCG value returned to normal. A repeat ultrasound done 5 months later revealed normal uterus (Fig. 3g). Figure 3h depicts normal implantation of the embryo in the subsequent pregnancy which was uneventful and a term baby was delivered by cesarean section at 37 weeks.

Intake of MTP pills in an undiagnosed scar pregnancy also changes the scenario and can lead to a misdiagnosis of anterior myometrial fibroid. Figure 4a, b illustrates the lesion in the lower uterine segment which was incorrectly diagnosed elsewhere as a fibroid in a case which presented with abnormal uterine bleeding. Transvaginal scan (Fig. 4c) along with 3D imaging (Fig. 4d, f) demonstrated

Table 2 Correlation of ultrasound findings with history and clinical presentation in cases of cesarean scar pregnancy

S. no.	History	Presenting complaint	Previous investigations	Referral indication for ultrasound	Ultrasound	Follow-up scan
1	G1—FTND G2—LSCS G3—present pregnancy	Missed period	Gravindex test positive	Confirmation of early pregnancy	Empty cervical canal, echogenic trophoblastic tissue at the level of the scar penetrating the anterior myometrium	Conservative management with methotrexate 3 months later ultrasound of uterus was normal
2	G1—3 years LSCS G2—present pregnancy	Bleeding per vagina	Gravindex test positive Ultrasound—large subchorionic hematoma with low-lying gestational sac	Inevitable abortion patient planned for D&C	Large subchorionic hematoma (Fig. 2a, b)—presence of gestation sac in lower uterine segment overlying the cesarean scar (Fig. 2c) with peritrophoblastic flow (Fig. 2d, f)	Conservative management with methotrexate 3 months later ultrasound of uterus was normal
3	G1—10 years, LSCS D&C done before 10 days	Profuse bleeding per vagina after D&C	Gravindex test positive Ultrasound—bulky uterus with anterior myometrial fibroid and thickened endometrium Hb—6 gm%	To rule out retained products of conception. In view of persistent bleeding per vagina planned for a repeat D&C	Isoechoic ill-defined avascular lesion in the lower uterine segment suggestive of cesarean scar hematoma (Fig. 3a–d)	Conservative management. 2 months later—regression of the scar hematoma (Fig. 3e, f) with a small collection in the scar region (Fig. 3g) 5 months later—normal uterus (Fig. 3h) 6 months later—early IUP of 7 weeks (Fig. 3i)
4	G1—LSCS G2—LSCS Taken MTP pill for missed periods in previous cycle	Abnormal uterine bleeding	Ultrasound—anterior myometrial fibroid	Evaluation for abnormal uterine bleeding	Well-circumscribed hyperechoic lesion in the scar region (Fig. 4a) with perilesional vascularity (Fig. 4b, f) Serum β -HCG was raised (done after suspicion in USG)	Conservative management with methotrexate 3 months later ultrasound of uterus was normal (Fig. 4g, h)

FTND full-term normal delivery, LSCS lower segment cesarean section, USG ultrasound, MTP medical termination of pregnancy, D&C dilatation and curettage, β -HCG β human chorionic gonadotrophin, IUP intrauterine pregnancy

the anatomical site of the lesion with peritrophoblastic flow. The anatomical site and the flow pattern of the lesion gave the clue to the diagnosis which was further supported by her history of taking MTP pills in her previous cycle and the raised serum β -HCG values. Figure 4g, h illustrates ultrasound done 3 months later which revealed normal anatomy of the uterus. The misleading “fibroid” disappeared after conservative management with systemic methotrexate and a serial β -HCG follow-up showed a declining titer.

This emphasizes the point that scar pregnancy should be kept in mind as a diagnostic possibility. A delay in diagnosis or misinterpretation of the scan findings could lead to treatment strategies that might end up in uterine rupture or hysterectomy causing significant maternal morbidity. Though both cases presented late, serious life-threatening complications were avoided by its timely diagnosis.

Transvaginal ultrasound facilitates the diagnosis of location, gestational age and viability of an ectopic pregnancy

within the uterine scar [7, 8]. Color flow Doppler shows a distinct peritrophoblastic perfusion surrounding the gestation sac which also adds to the diagnostic efficacy [3, 6]. With pulsed Doppler evaluation, high-velocity low-impedance peritrophoblastic flow can be obtained. The diagnosis with ultrasound currently has a sensitivity of 80.4% in the literature which is likely to increase with increasing awareness [8, 9]. Lack of surrounding myometrium over the sac had been better delineated with MRI in the past [10]. Transvaginal 3D sonography helps to identify the absence of healthy myometrium surrounding it as illustrated in Fig. 5. Subtle anatomical details of the trophoblastic tissue around the gestational sac can be appreciated with 3D ultrasound (Fig. 4e). The recent paper by Moschos et al. highlights the importance of quantitative biometric measurements in first trimester transvaginal 2D sonography. They have concluded that the smallest distance from the anterior trophoblastic border to uterine serosa if less than 5 mm is highly predictive in identifying caesarean scar pregnancy [11].

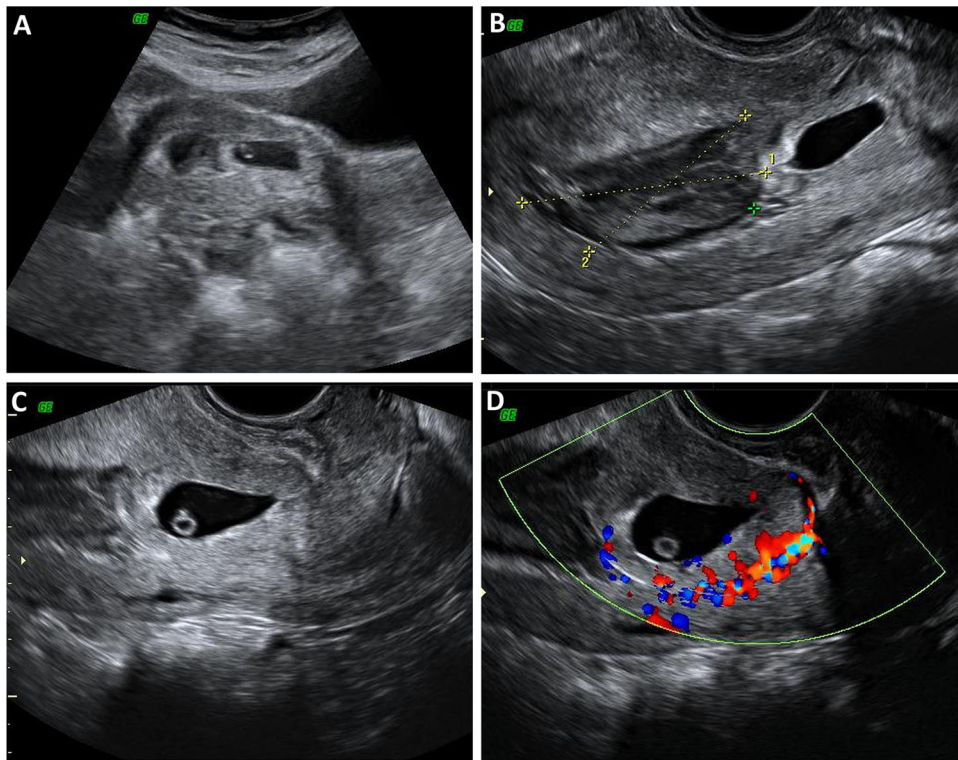


Fig. 2 CSP associated with hematoma. Transabdominal (a) and transvaginal (b) scan revealed large hematoma with the presence of low-lying gestation sac. c, d Transvaginal scan revealed scar pregnancy with increased vascularity seen surrounding sac

Few authors use magnetic resonance imaging (MRI) as an adjuvant to endovaginal ultrasonography [5, 12] but some advocate its usage only if endovaginal ultrasound fails to identify the typical findings of CSP. Annappa et al. had reported a case where a CSP was misinterpreted as a degenerating fibroid both by ultrasound and MRI which ended up in a rupture uterus, resulting in laparotomy. The diagnosis in their case was made retrospectively only after a histopathological examination [13]. Hence, the diagnosis can still be missed by MRI unless the possibility of scar pregnancy is kept in mind.

Discussion

The natural course of a CSP is unclear. Mostly it results in miscarriage in first trimester, but a few may grow getting new vascular connections ending up in a low-lying adherent placenta with or without infiltrating adjacent organs [3]. The risk of placenta accreta is very high in such cases increasing the substantial risk of catastrophic hemorrhage, uterine rupture, hysterectomy and loss of future fertility emphasizing the sonographic and histologic similarities between cesarean scar pregnancy and morbidly adherent placentation [14–17].

Though no consistent management strategy is evident, a variety of surgical and non-surgical interventions have been proposed in order to terminate the ectopic pregnancy [18–20]. Surgical treatment includes combined medical treatment with surgical sac aspiration, hysteroscopic evacuation, laparoscopic removal, primary open hysterotomy or hysterectomy [21, 22]. A curettage is discouraged in CSP as the gestational sac is not within the uterine cavity and trophoblastic tissue is unreachable which can potentially result in a rupture of the uterine scar and massive hemorrhage [5]. Recent studies suggest that uterine artery embolization with or without other treatment modalities could be effective by decreasing vascularisation at implantation site and producing trophoblastic degeneration [7, 23, 24].

Conservative treatment with methotrexate delivery in cases discovered at no more than 6–8-week gestation without fetal cardiac activity may be considered as a safe treatment alternative. Follow-up with ultrasound and monitoring of serum β -HCG levels is advocated to monitor response to therapy. Sometimes there can be an initial rise of serum β -HCG with treatment which must be borne in mind to avoid unnecessary secondary interventions. 3D power Doppler imaging can also be used to monitor the degree of peritrophoblastic perfusion. The serum β -HCG

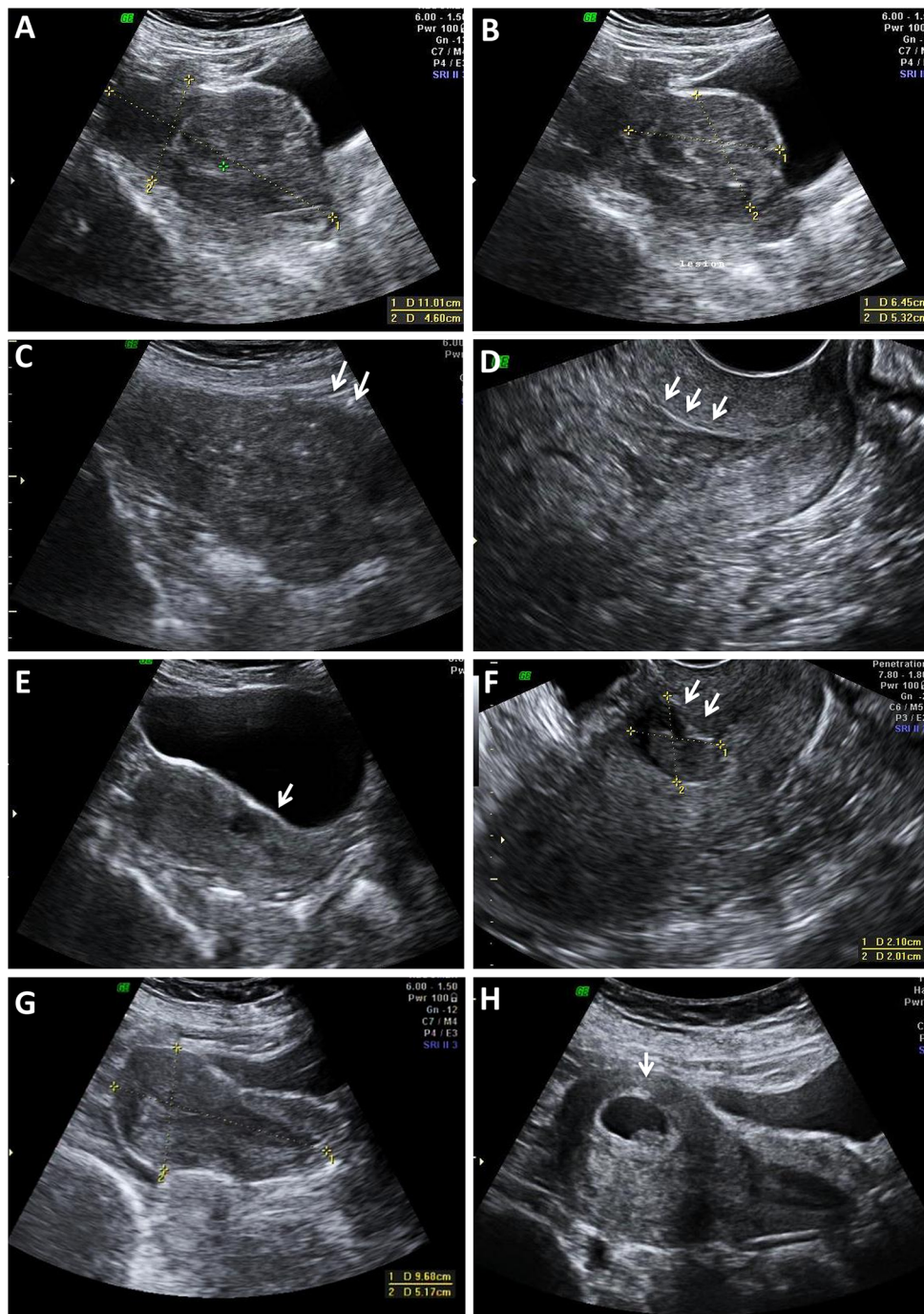


Fig. 3 A typical ultrasound findings in CSP after attempted D&C. **a**, **b** Transabdominal USG revealed echogenic lesion in the lower segment of the uterus. **c** Outer contour of the uterus in the lower segment appeared hazy and irregular with loss of endomyometrial interface. **d** Transvaginal scan depicting isoechoic lesion distending

the cervical canal. **e** Transabdominal scan and transvaginal scan (**f**) done 2 months later revealed resolution of scar hematoma with redundant fluid in the scar site. **g** Subsequent scan after a month revealed normal appearance of uterus. **h** Early pregnancy scan done in the next pregnancy

levels, gestational sac volume and peritrophoblastic vascularization eventually tend to become undetectable.

Conservative treatment options even when successful could be expected to leave the uterine scar defect that will accompany the risk of future cesarean scar

implantation. The potential for an unprepared scar dehiscence that will affect future pregnancies is left to speculation. However, with proper diagnosis and management we have reported a normal outcome and delivery after CSP.

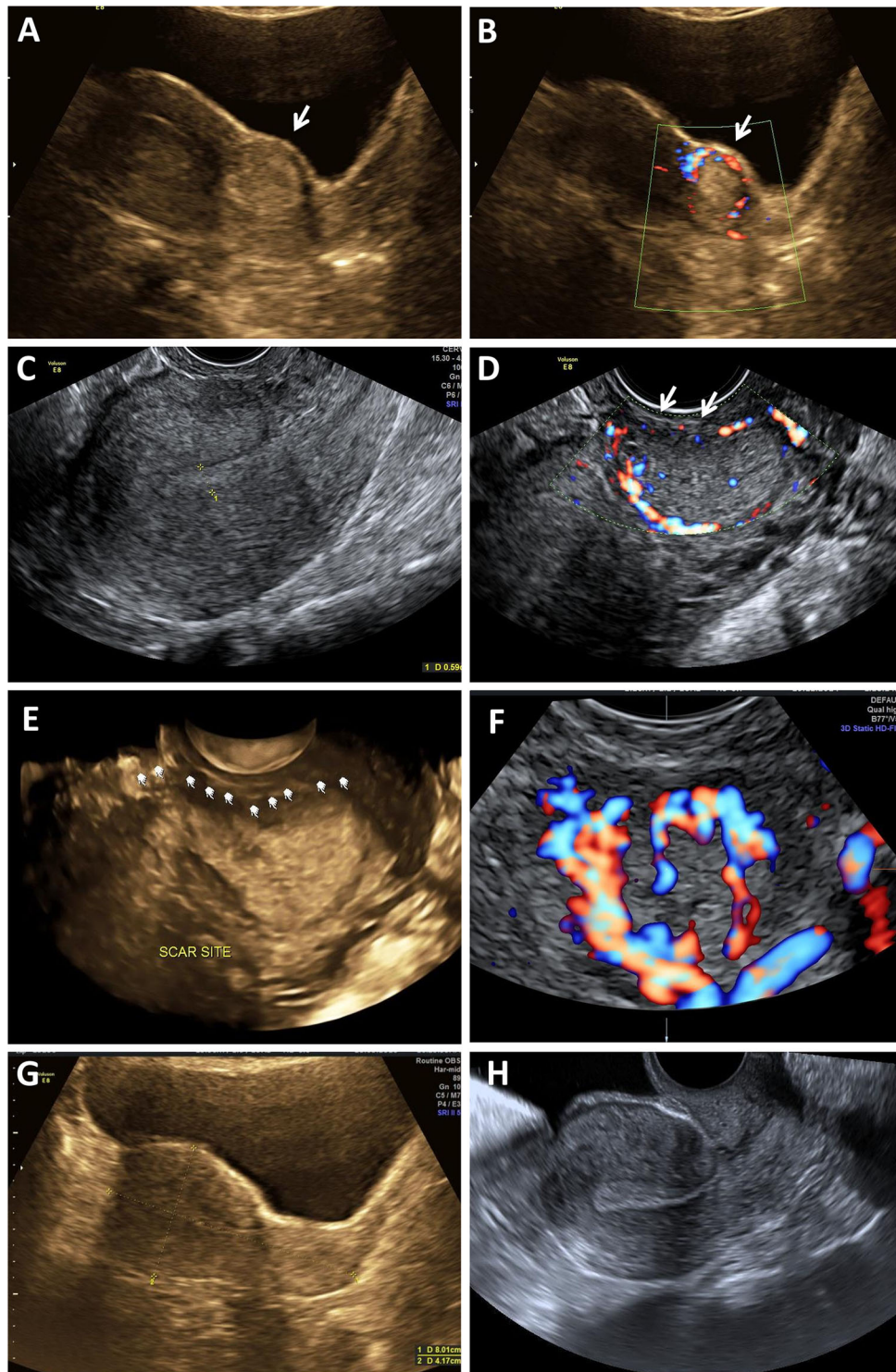


Fig. 4 CSP mimicking anterior myometrial fibroid. **a, b** Transabdominal scan revealed echogenic area in anterior myometrium with increased vascularity, **c** transvaginal imaging reveals empty uterine cavity, **d, e** echogenic trophoblastic tissue seen in scar with lack of

surrounding myometrium, **f** peritrophoblastic increased vascularity in 3D, **g, h** subsequent scan after 2 month revealed normal appearance of uterus

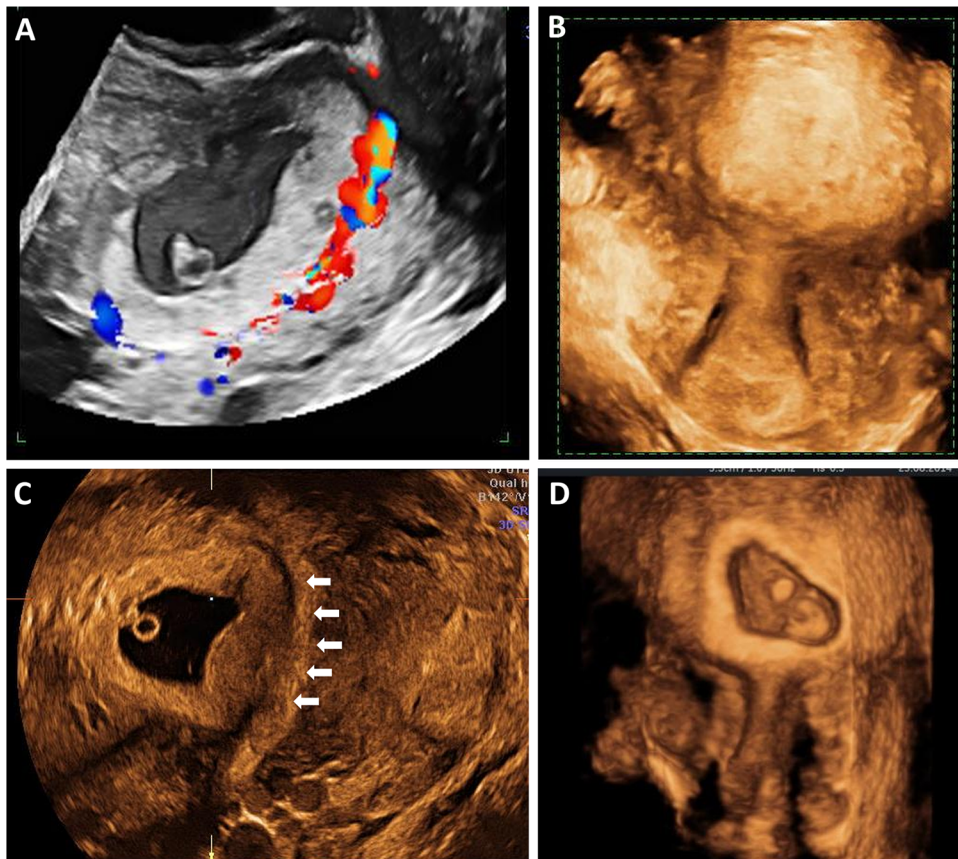


Fig. 5 Three-dimensional imaging in CSP. **a** Peritrophoblastic flow, **b** rendered imaging of gestation sac seen implanted in the scar, **c** multidimensional imaging shows lack of surrounding myometrial

tissue between bladder and sac, **d** rendered image of gestational sac showing empty cervical canal

Modern obstetric care has its set of new challenges as evidenced by the increasing cesarean delivery rate and emergence of complications such as scar pregnancy and the morbidly adherent placenta spectrum. The first step, however, will always be the recognition of the problem. Precise localization of early pregnancy by transvaginal sonography and early recognition of the salient sonographic findings of CSP are critical as a delay can lead to increased maternal morbidity and mortality. Poor awareness about the possibility of gestation in the previous cesarean scar leads to its misdiagnosis and mismanagement, resulting in potentially grave life-threatening complications. Not all cases of CSP present with typical ultrasound findings and may often have varied presentations. Hence, we conclude by saying that a high degree of suspicion of this condition is required for its early diagnosis which can be easily accomplished with ultrasound to avoid catastrophic events later.

Compliance with Ethical Standards

Conflict of interest All authors declare that they have no conflict of interest. Informed consent was obtained from all patients and patient identity not disclosed.

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