

Cesarean scar pregnancy is associated with abnormal implantation but not macroscopic myometrial invasion in early first trimester of pregnancy

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The rise in cesarean section (CS) rate over the last three decades has led to a significant increase in the occurrence of cesarean scar pregnancy (CSP) and placenta accreta spectrum (PAS) disorders. CSP refers to an abnormal implantation of the gestational sac in the area of the prior CS scar. CSP is not a unique condition but encompasses different phenotypes where its severity is likely to be the result of the relationship between the size of gestational sac, residual myometrial thickness, and morphology of the CS scar¹.

CSP may lead to severe maternal complications including uterine rupture, massive hemorrhage and need for emergency hysterectomy. Furthermore, CSP may evolve towards PAS disorders when the pregnancy progresses beyond the first trimester. Currently, there is no reliable ultrasound sign able to fully differentiate those cases which will proceed to the third trimester from those which will experience uterine rupture and life-threatening hemorrhage, thus making individualized management and prenatal counselling challenging.

We have recently proposed that early first trimester assessment of women with a prior CS should be considered in order to improve clinical outcome, although this assumption reflects authors' opinion and is not supported by large longitudinal studies yet². In a systematic review and meta-analysis of the published literature, we have recently reported that CSP treated either surgically or medically in the early stages of the first trimester is associated with a lower incidence of adverse maternal outcome, including massive hemorrhage, need for blood transfusion, uterine rupture, and emergency hysterectomy, thus highlighting the need for large and well-designed prospective studies assessing the potential impact of early first trimester assessment of CS scar on maternal and perinatal outcome³. The reported association between early diagnosis of CSP and a reduced risk of severe complications may be explained by the fact that the smaller size of the gestational sac and reduced placenta vascularization are associated with a reduced risk of developing adverse events associated with severe hemorrhage and uterine rupture.

However, the reduced risk of morbidity associated with CSP in early gestation may also be dependent upon the fact that that placenta invasion in women with CSP may not be present in the first weeks of gestation but occur later in pregnancy.

To test our theory, we prospectively followed up seven women with a prenatal diagnosis of CSP who opted for continuing pregnancy. All these women were assessed in the early first trimester of pregnancy as suggested by the Italian Society of Ultrasound in Obstetrics and Gynecology guidelines on screening for placental invasive disorders. All women underwent transabdominal and trans-vaginal 2D and 3D grayscale and color Doppler examinations using a Samsung Hera W10 system equipped with Crystal Vue and Crystal Vue Flow (Samsung

HealthcareCo Ltd, Seoul, South Korea) at 7-8 weeks' gestation, 11-14 weeks, as well as the second and third trimesters of pregnancy. The placenta was imaged with the maternal bladder partially full, then 3D color Doppler was applied to map the vascularization of the uterine-bladder interface. Volumes were obtained in automatic sweeps from a sagittal section of the uterus bisecting the bladder and processed using Crystal Vue and Crystal Vue Flow by moving the region of interest in the sagittal plane from left to right. In pregnancies not complicated by PAS, the uterine bladder interface has 'tramline'-like appearance; conversely, partial, or complete obliteration of the tramline interface suggests invasion of the myometrium (Figure 1)⁴.

All cases had a CSP in the niche of the prior CS scar. At 7-8 weeks of gestation a normal tramline appearance of the uterine bladder interface was observed in all cases (Figure 1). Conversely, at the time of 11-14 weeks scan all these cases showed an abnormal uterine bladder interface with a partially interrupted tramline or evidence of vascular invasion at 3D Color Doppler (Figure 1). All women had ultrasound signs of severe PAS in the second and third trimester of pregnancy and all were confirmed to be affected by placenta percreta at hysterectomy.

In conclusion, we hypothesize that CSP in the early (<8 weeks) first trimester of pregnancy does not show macroscopic signs of myometrial invasion, which are present at the time of 11-14 weeks scan. These preliminary findings suggest that the lower risk of adverse maternal outcomes observed in women undergoing early first trimester treatment of CSP may be potentially explained by the fact that in the very early stages of pregnancy CSP is not associated with macroscopic myometrial invasion yet, thus leading to a smaller risk of massive hemorrhage or uterine rupture, although microscopic vascular invasion may be present since the very early stages of CSP. The results from this small series need to be validated in large studies in order to assess whether the "tramline" sign can be used to stratify the outcome of women affected by CSP.

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Figure Legend

Figure 1. (a) Assessment of uterine-bladder interface using three-dimensional imaging with Crystal Vue rendering and Crystal Vue Flow in a Cesarean scar pregnancy (CSP) at 7 weeks of gestation. Note the normal tramline appearance of the uterine bladder interface. (b) 2d image showing normal hypoechoic space beneath the placenta. At 11 weeks of gestation there is partial interruption of the tramline, suggesting initial placental invasion (c). (d) Crystal Vue Flow in another case at 12 weeks of gestation showing abnormal vascularity interrupting the bladder line and protruding through the myometrium.

