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GESTATIONAL SAC TO CRL RATIO AS A PROGNOSTIC MARKER IN EARLY PREGNANCY: TWO CASE REPORTS

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ABSTRACT

The aim of this study was to assess whether the relationship between gestational sac (GS) size and crown–rump length (CRL) may have value in predicting early pregnancy outcome.

We report two cases of early intrauterine pregnancy with initially normal ultrasound findings, including the presence of embryonic cardiac activity. Both patients underwent serial transvaginal ultrasound examinations in the first trimester, with measurement of GS, CRL and yolk sac, as well as derived indices including GS–CRL difference and GS/CRL ratio.

In both cases, early scans were reassuring. However, in follow-up examinations the gestational sac failed to keep pace with embryonic growth, resulting in a progressive mismatch between GS and CRL. This preceded pregnancy loss despite previously normal viability parameters. One case was additionally complicated by a subchorionic hematoma, while in the second a relatively small gestational sac was noted before diagnosis of missed miscarriage.

These cases suggest that an unfavorable GS–CRL relationship may precede early pregnancy loss even when cardiac activity is present. The observation is preliminary and requires confirmation in larger prospective studies.

KEYWORDS

Early Pregnancy Ultrasound, Gestational Sac (GS), Crown–Rump Length (CRL), GS–CRL Ratio, First-Trimester Pregnancy Loss, Pregnancy Viability

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Introduction

Ultrasonography is a fundamental diagnostic tool in obstetrics, including the assessment of early pregnancy. In the first trimester, key measurements such as gestational sac (GS) diameter, crown–rump length (CRL), and yolk sac (YS) size are routinely used to estimate gestational age and assess early viability.

An increasing body of evidence suggests that not only the absolute values of these parameters, but also their interrelationships, may have important prognostic value. In particular, a relatively small gestational sac in relation to embryonic size has been associated with an increased risk of pregnancy failure. Both the GS–CRL difference and the GS/CRL ratio have been proposed as potential markers of abnormal implantation and early placental dysfunction.

Although GS and CRL are routinely assessed in early pregnancy, their dynamic relationship over time and its potential prognostic value remain insufficiently defined.

Despite growing interest in this topic, the clinical significance of these parameters and their longitudinal changes in early pregnancy are still not well established.

The aim of this report is to present two cases of early intrauterine pregnancy with initially present embryonic cardiac activity, in which abnormal GS–CRL and GS/CRL dynamics preceded pregnancy loss. These cases highlight the potential prognostic value of these indices in routine clinical practice.

Methods – Case report**Case 1**

A 25-year-old woman in her first pregnancy, with an unremarkable gynecological and obstetric history, presented for an early pregnancy assessment. Her preconception history was unremarkable and she had no known chronic medical conditions.

Transvaginal ultrasound confirmed an intrauterine pregnancy. The gestational sac (GS) measured 2.9 mm, consistent with very early gestation. No embryo or embryonic cardiac activity was visualized at that time, in keeping with gestational age.

At follow-up two weeks later, ultrasound demonstrated a GS of 13.3 mm, a crown–rump length (CRL) of 5.6 mm (corresponding to 6+2 weeks of gestation), and a yolk sac (YS) of 3.2 mm. Embryonic cardiac activity was present. The ultrasound findings were consistent with a normally progressing intrauterine pregnancy.

The patient presented for an unscheduled visit at 8+1 weeks of gestation due to vaginal bleeding. Ultrasound examination showed a GS of 20.0 mm, CRL of 17.5 mm, and YS of 3.6 mm, with normal fetal cardiac activity (FHR 160 bpm) (Figures 1, 2). Cervical length measured 39.1 mm. A subchorionic hematoma was identified.

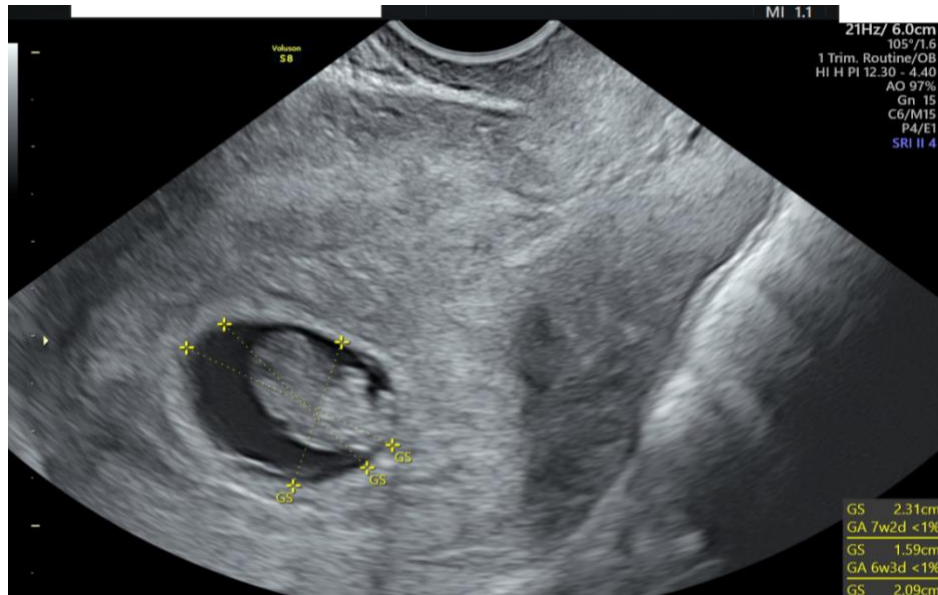


Fig. 1. Transvaginal ultrasound at 8+1 weeks of gestation demonstrating the mean gestational sac diameter (GS)



Fig. 2. Transvaginal ultrasound at 8+1 weeks of gestation demonstrating crown–rump length (CRL) measurement

Table 1. Longitudinal changes in ultrasound parameters – Case 1

Gestational age	GS (mm)	CRL (mm)	YS (mm)	GS-CRL (mm)	GS/CRL
4+0 weeks	2.9	-	-	-	-
6+2 weeks	13.3	5.6	3.2	7.7	2.38
8+1 weeks	20.0	16.0	3.5	4.0	1.25

The clinical course was complicated by progressive vaginal bleeding over the following days. A follow-up transvaginal ultrasound performed approximately three days later demonstrated findings consistent with incomplete miscarriage.

Case 2

A 29-year-old woman in her first pregnancy presented at 8+3 weeks of gestation according to the last menstrual period for confirmation of pregnancy. Her gynecological and obstetric history was unremarkable. Her medical history was notable for maturity-onset diabetes of the young (MODY), with a positive family history of diabetes in her grandparents. The patient was under diabetology care and treated with insulin degludec (Tresiba) at a dose of 2 units daily, with adjustments according to glycemic levels. Body mass index was 19.3 kg/m² (weight 49.5 kg, height 160 cm).

Transvaginal ultrasound demonstrated a gestational sac (GS) measuring 14.0 mm, a crown–rump length (CRL) of 11.2 mm (corresponding to 7+3 weeks of gestation), and a yolk sac (YS) of 4.0 mm. Embryonic cardiac activity was present. The ultrasound appearance was consistent with a viable intrauterine pregnancy (Figure 3).

At follow-up ultrasound performed approximately four weeks later, the gestational sac (GS) measured 27.9 mm, the crown–rump length (CRL) was 32.6 mm (corresponding to 10+1 weeks of gestation), and the yolk sac (YS) measured 4.2 mm. A relatively small gestational sac in relation to CRL was noted. Measurement of CRL was technically challenging due to marked flexion of the embryo (Figures 4, 5).

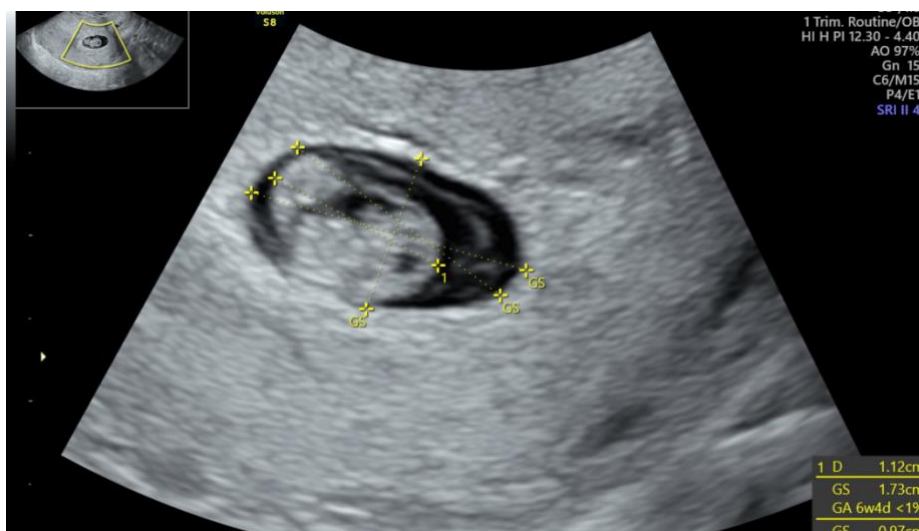


Fig. 3. Transvaginal ultrasound at 8+3 weeks of gestation demonstrating measurement of crown–rump length (CRL) and mean gestational sac diameter (GS)

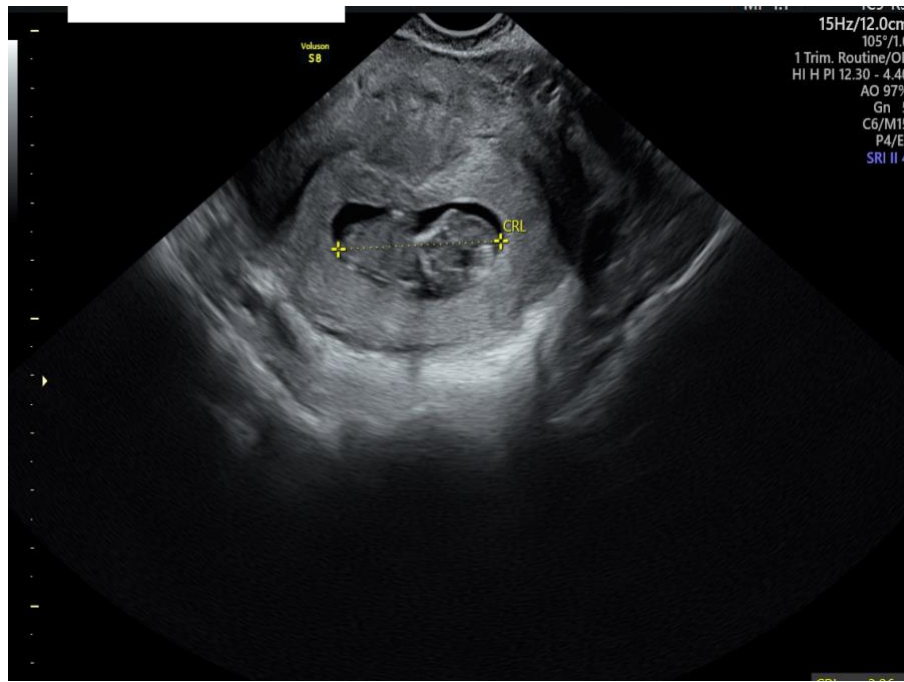


Fig. 4. Follow-up transvaginal ultrasound at 10+1 weeks of gestation demonstrating CRL measurement and a relatively small gestational sac, with reduced GS–CRL difference

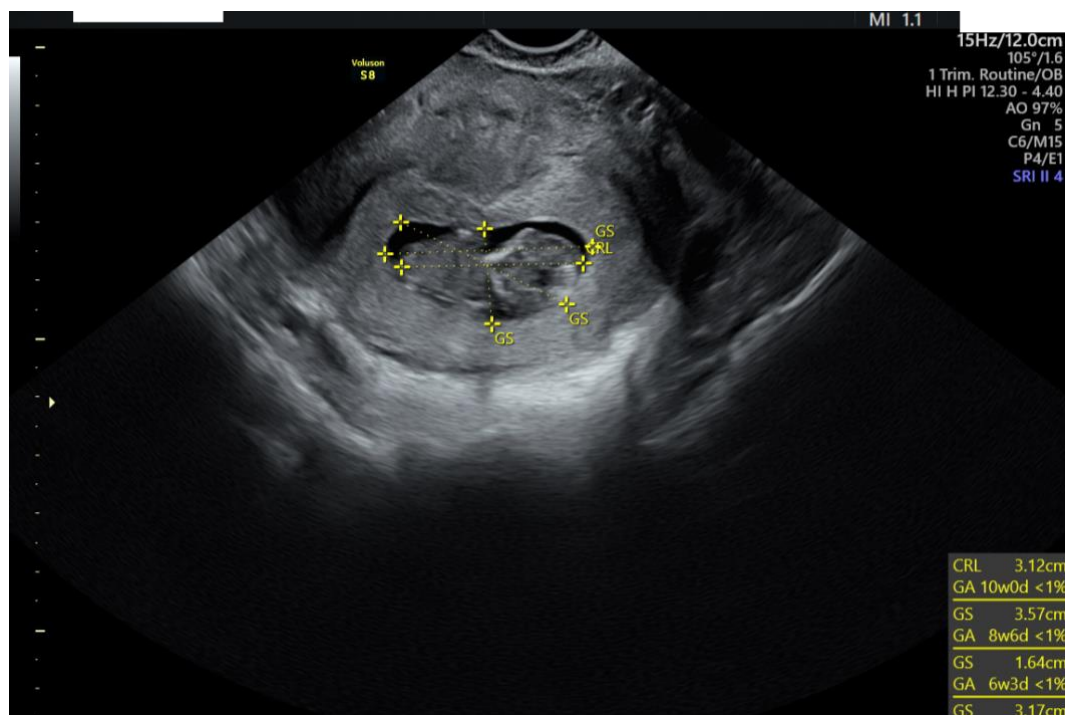


Fig. 5. Transvaginal ultrasound showing disproportion between gestational sac size and embryonic length, with reduced GS–CRL difference.

During first-trimester screening at 11–13+6 weeks of gestation, performed 13 days after the previous ultrasound examination, missed miscarriage was diagnosed, corresponding to 10+3 weeks of gestation. On ultrasound, crown–rump length (CRL) measured 37.9 mm and biparietal diameter (BPD) measured 16.5 mm. No fetal cardiac activity was detected.

Table 2. Longitudinal changes in ultrasound parameters – Case 2

Gestational age	GS (mm)	CRL (mm)	YS (mm)	GS–CRL (mm)	GS/CRL
8+3 weeks	14.0	11.2	4.0	2.8	1.25
10+1 weeks	27.9	32.6	4.2	-4.7	0.85

Discussion

In the present cases, an attempt was made to assess the relationship between gestational sac size and crown–rump length as a potential prognostic marker in early pregnancy. Despite initially normal ultrasound findings, including the presence of embryonic cardiac activity, both cases demonstrated an abnormal trajectory of GS–CRL and GS/CRL parameters preceding pregnancy loss. This highlights the clinical limitation of relying on single ultrasound parameters for viability assessment and the need for more sensitive markers of early pregnancy failure [1,2].

Available evidence suggests that gestational sac size and its relationship to embryonic length may play an important role in early pregnancy prognosis. In particular, a relatively small gestational sac compared with CRL has been associated with an increased risk of miscarriage [3,4]. Both the GS–CRL difference and the GS/CRL ratio have been investigated as potential indicators of abnormal pregnancy development [5]. Proposed mechanisms include implantation disorders, early placental insufficiency, and abnormal trophoblastic development, leading to an inadequate environment for embryonic growth [6].

Despite growing interest in this topic, data regarding threshold values and the significance of dynamic changes in these parameters remain inconclusive. In particular, it remains unclear whether a single measurement or longitudinal trends across serial ultrasound examinations carry greater prognostic value [7].

The present cases are in line with these observations and further support the importance of dynamic assessment of the GS–CRL relationship. In both pregnancies, early embryonic cardiac activity initially suggested normal development; however, detailed ultrasound evaluation revealed progressive abnormalities preceding pregnancy loss. In the first case, a gradual reduction in the GS–CRL difference and GS/CRL ratio was observed, accompanied by clinical symptoms and a subchorionic hematoma. In the second case, despite the absence of symptoms, an early disproportion between gestational sac size and CRL was already evident, reflected in a negative GS–CRL value and reduced GS/CRL ratio.

These observations suggest that abnormalities in the GS–CRL relationship may represent an early marker of adverse pregnancy outcome, independent of clinical symptoms. Importantly, in both cases these changes preceded clear evidence of embryonic demise, supporting their potential prognostic value.

From a clinical perspective, these findings underline that early pregnancy assessment should not be limited to the presence of embryonic cardiac activity, but should also include evaluation of the relationship between GS and CRL and its temporal evolution. Incorporation of these parameters into routine ultrasound assessment may allow earlier identification of pregnancies at increased risk of failure.

The main limitation of this study is the small number of cases, inherent to case report design, which precludes definitive conclusions. Nevertheless, these observations highlight the need for further studies investigating the clinical significance of GS–CRL and GS/CRL parameters and their potential role in routine obstetric practice.

Conclusions

The two cases presented suggest that the relationship between gestational sac size and crown–rump length (GS–CRL), as well as its temporal changes, may have prognostic value in early pregnancy, even in the presence of initially normal embryonic cardiac activity. Given the very limited number of observations, these findings are hypothesis-generating.

They nevertheless indicate that a dynamic assessment of the GS–CRL relationship may provide additional information in early pregnancy evaluation and should be further investigated in prospective studies involving larger patient cohorts.

Conflict of Interest: The authors declare no conflict of interest.

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