



ORIGINAL ARTICLE

Prediction of spontaneous miscarriage risk by the use of first trimester ultrasound measurements and maternal serum progesterone level at the 7th week of pregnancy[☆]



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KEYWORDS

Miscarriage;
Progesterone;
Crown-rump length;
Ultrasonography.

Abstract *Study objective:* To evaluate the accuracy of using first trimester ultrasound markers such as mean gestational sac diameter (MGSD), crown-rump length (CRL), MGSD:CRL ratio and fetal heart rate (FHR), plus progesterone level at the 7th week of pregnancy to predict spontaneous miscarriage risk.

Design: A prospective diagnostic accuracy study.

Setting: Ain Shams University Maternity Hospital.

Materials and methods: Included women were recruited from those attending antenatal outpatient clinics during the 7th week of gestation. Transvaginal sonography was performed for all women for confirmation of the gestational age and measurements of MGSD, CRL and FHR. Blood samples were collected at the same time for the measurement of serum progesterone level. All pregnancies were followed up till the completion of the 20th week of pregnancy.

Abbreviations: CRL, crown-rump length; ELISA, enzyme-linked immunoassay; FHR, fetal heart rate; GSD, gestational sac diameter; MGSD, mean gestational sac diameter; NPV, negative predictive value; PPV, positive predictive value; ROC, receiver operator characteristic; SD, standard deviation; TVS, transvaginal sonography.

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[☆]This study was conducted at Ain Shams University Maternity Hospital, Cairo, Egypt.

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Main outcome measure: Spontaneous miscarriage occurring before or at the 20th week of gestation.

Results: A total of 200 women were divided into two groups: Group 1 ($n = 23$), women who miscarried (miscarriage group) and group 2 ($n = 177$) included women who continued after the 20th week of pregnancy (control group). Women in group 1 had significant lower MGSD, MGSD–CRL ratio, and FHR compared to those of group 2. While, there were no significant differences between both groups regarding CRL and progesterone level. The best cut off point for MGSD is 14 mm with a sensitivity and specificity of 96% and 74%, respectively. The best cut off point for CRL is 5.5 mm with a sensitivity of 58% and specificity of 60%. The best cut off point for MSD–CRL ratio is 9 with sensitivity and specificity of 97% and 73%, respectively. The best cut off point for FHR is 111 beat/min with a sensitivity and specificity of 92% and 91%, respectively. For progesterone, the best cut off point is 27 ng/ml with a sensitivity and specificity of 63% and 56%, respectively.

Major conclusions: To predict spontaneous miscarriage risk at the 7th week of pregnancy, MGSD, MGSD–CRL ratio and FHR, were considered highly valid markers and better positive than negative with higher sensitivity compared to progesterone and CRL.

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Key message: To predict spontaneous miscarriage risk at the 7th week of pregnancy, MGSD, MGSD–CRL ratio and FHR, were considered highly valid markers and better positive than negative with higher sensitivity compared to progesterone and CRL.

1. Introduction

Spontaneous miscarriage is defined as involuntary termination of pregnancy before 20 weeks of gestation or spontaneous expulsion of fetus below 500 g (1). Spontaneous miscarriage accounts for about 15% of pregnancies. Recurrent miscarriage constitutes about 1% of spontaneous miscarriage (2). Many investigators have tried to find some useful sonographic markers in early pregnancy in order to anticipate the prognosis of the ongoing pregnancy; these include gestational sac diameter (GSD), crown-rump length (CRL), fetal heart rate (FHR), and the growth rate of the gestational sac (3).

In very early pregnancy, it is reported that there was no statistical significant difference in GSD when compared with pregnancy outcome; this difference appears from the 5th week forward (4). Nevertheless, the predictive value of smaller than expected GSD per se is variable and relying upon other presenting confounders (5).

CRL is considered as one of the main parameters for the evaluation of gestational age in the early pregnancy (4). Mean GSD (MGSD):CRL ratios have also been used to predict pregnancy outcome with varying degree of accuracy nevertheless, this technique is also of limited usefulness per se (6). Many investigators also, used FHR as a predictor of pregnancy outcome (7). With the broad use of the transvaginal sonography (TVS) during the first trimester, we are able to authenticate accurately the developing process of pregnancy (7).

The aim of the current study was to evaluate the accuracy of using first trimester ultrasound markers such as MGSD, CRL, MGSD:CRL ratio and FHR, plus progesterone level at the 7th week of pregnancy to predict spontaneous miscarriage risk.

2. Materials and methods

The current prospective diagnostic accuracy study was conducted at Ain Shams Maternity hospital during the period from May 2011 to May 2012. The study protocol had been approved by the Ethics Research Committee of Obstetrics and Gynecology Department, Ain Shams University. The purpose and procedures of the study were explained to the participating women and a written informed consent was obtained from each participant. Included women were recruited from those attending antenatal outpatient clinics during the 7th week of gestation with estimated gestational age of 43–49 days (during the 7th week of gestation). Gestational age was calculated at the time of recruitment according to first day of last menstrual period and was confirmed by obstetric ultrasound examination. Smokers, women with multiple pregnancy, hypertensive, diabetic women and women who had threatened abortion were excluded from the study. Thorough general, abdominal, and pelvic examinations were performed for all included women. TVS was performed for all women for confirmation of the gestational age and measurements of MGSD, CRL and FHR.

2.1. 2.1. Ultrasonographic measurements

Ultrasound measurements were carried out transvaginally using SONOACE X4, MEDISON® (Soul, South Korea) with a capability of simultaneous B-mode and M mode scanning. The TVS was performed using a 6.0 MHz vaginal probe.

MGSD was measured by the sum of the length, width, and height of the gestational sac divided by 3 (3).

The MGSD–CRL ratio was calculated as the difference between the MGSD and the CRL (3).

FHR measurements authenticated transvaginally using M mode sonography; the heart rate was calculated as beats per minute using the software of the ultrasound machine after measurement by electronic calipers of the distance between two heart waves on a frozen M-mode image (3).

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