

## EVALUATION OF DOPPLER ULTRASOUND STUDY IN FIRST TRIMESTER THREATENED ABORTION AND ANEMBRYONIC PREGNANCY

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### ABSTRACT

In this study, aimed to evaluate changes in utero-placental circulation in normal as well as abnormal pregnancies, 25 women with first trimester threatened abortion with a living embryo, 5 women with anembryonic pregnancy (Blighted ovum), in addition to 30 women with normal pregnancies were included. In all women, trans-abdominal colour Doppler ultrasound study was performed including measurement of systolic / diastolic (S/D) ratio, resistance index (RI) and pulsatility index (PI) of uterine arteries. Women with threatened abortion showed significantly lower RI ( $P < 0.05$ ) compared to those with normal pregnancies, and significantly lower S/D ratio ( $P < 0.01$ ) and RI index ( $P < 0.01$ ) than women with anembryonic pregnancy. Patients with anembryonic pregnancy showed significantly higher S/D ratio ( $P < 0.01$ ) and RI index ( $P < 0.05$ ) in comparison to those with normal pregnancies. We conclude that first trimester threatened abortion and anembryonic pregnancy are associated with marked changes in uteroplacental circulation. Further studies are needed to clarify whether those alterations are the cause or the result of these conditions.

### INTRODUCTION

Placental circulation is characterized by high volume flow, with an extensive diastolic component. Uterine blood flow increases from 50ml/min. shortly after conception to 500-700ml/min. by term.<sup>[1]</sup> Pregnancy does not produce significant changes in the main uterine branches until there is well-developed intervillous circulation. Approximately 4 weeks after implantation, well-defined, low-resistance vessels are seen at the site of future placenta. Reduction in resistance can be seen in feeding radial arteries as the pregnancy progresses.<sup>[2]</sup> Doppler ultrasound study of umbilical artery waveforms help to identify the compromised fetus in "high risk" pregnancies and therefore, deserves assessment as a screening test in "low risk" pregnancies. One of the main aims of routine antenatal care is to identify the "at risk" fetus in order to apply clinical interventions which could result in reduced perinatal morbidity and mortality.<sup>[3]</sup> In complicated early pregnancy the uteroplacental circulation demonstrates flow characteristics that are strikingly different from those of normal early pregnancy. In abnormal pregnancies, increased flow within the intervillous space is demonstrated by colour Doppler imaging.<sup>[4]</sup> Doppler ultrasound performed in early pregnancy can be useful in predicting the risk of miscarriage. Also, it may be helpful in the prediction of intrauterine growth retardation as well as pregnancy

outcome.<sup>[5-10]</sup> Further more, Doppler study may be useful in choosing the management modality in patients with first trimester miscarriage.<sup>[6]</sup> On the other hand, some studies suggested that Doppler study is not helpful in predicting pregnancy outcome in first trimester threatened abortion.<sup>[11]</sup>

*The aim of this study* was to assess the findings of Doppler study in patients with first trimester threatened abortion and those with anembryonic pregnancy.

### PATIENTS AND METHODS

In this prospective study, that was carried out at Basrah Maternity and Child Hospital extended from July, 2002 through February 2003 30 patients were included. They were 25 patients with first trimester threatened abortion with living embryo, and 5 pregnant women complicated by anembryonic pregnancy. In addition, 30 women with singleton, normally developing first trimester pregnancies were included as a control group.

In patients and controls, Trans-abdominal colour Doppler ultrasound measurement of the systolic-diastolic ratio (S/D ratio), resistance index (RI) and pulsatility index (PI) of the uterine arteries were measured. In all women, these measurements were made by the same examiner (specialist ultrasonographer) at the level of the cervix (uterine arteries).

Statistical analysis was carried out using t-test, P-value<0.05 was considered statistically significant.

**RESULTS**

Table-1, presents the characteristics of the study groups. Age, gestational age and to a lesser extent parity were closely comparable between women with threatened abortion compared to normal women, whereas these parameters were to a lesser extent lower in those with anembryonic pregnancy in comparison to the above two groups.

**Table 1.** Characteristics of the study groups.

Parameter Group	Age (years)	Parity	Gestational age (weeks)
Threatened abortion n=25	27.9 (4.6)	2.4 (1.4)	9.1 (1.0)
Anembryonic pregnancy n=5	25.6 (5.0)	2.0 (1.2)	5.4 (0.6)
Controls n=30	27.9 (6.6)	4.0 (2.7)	9.0 (0.7)

Data is given as mean ± SD

The findings of Doppler study are presented in (Table-2). Patients with threatened abortion have lower figures for S/D, RI and P/I compared to control women. However, the difference was only significant for RI (P<0.05). Women with anembryonic pregnancy have significantly higher S/D ratio (P<0.01) and RI (P<0.05) compared to normal women. On the other hand, patients with threatened abortion have significantly lower S/D ratio and RI than in those with anembryonic pregnancy (P<0.01).

**Table 2.** Doppler study.

Parameter Group	S/D	RI	P/I
Threatened abortion n=25	5.45 (3.02) <sup>**c</sup>	0.75 (0.16) <sup>**c</sup>	1.75 (0.68)
Anembryonic pregnancy n=5	10.43 (3.16)	0.94 (0.05)	1.88 (0.11)
Controls n=30	5.71 (3.04) <sup>**b</sup>	0.83 (0.12) <sup>*ab</sup>	1.97 (0.75)

Data given in X (SD)

\*: P< 0.05, \*\* P<0.01

a: controls vs threatened abortion

b: controls vs. anembryonic pregnancy

c: threatened abortion vs. anembryonic pregnancy

**DISCUSSION**

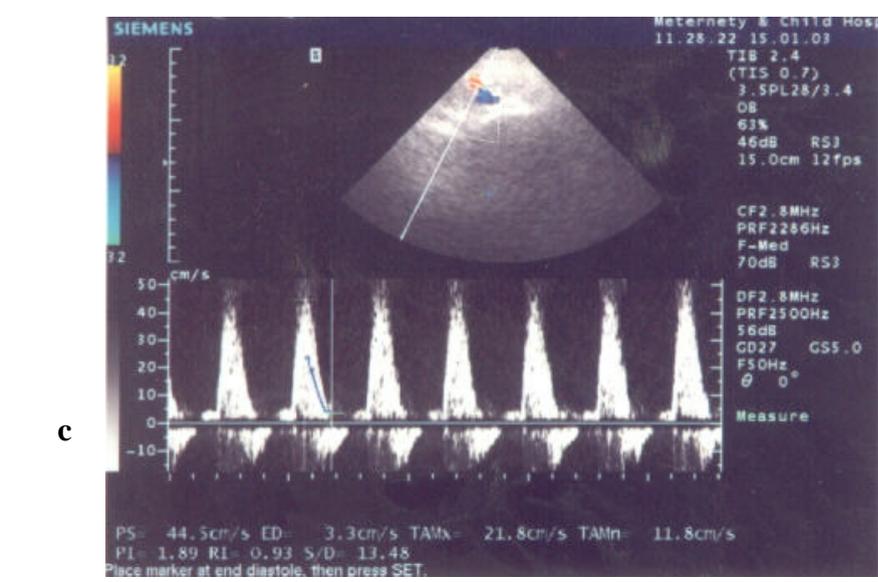
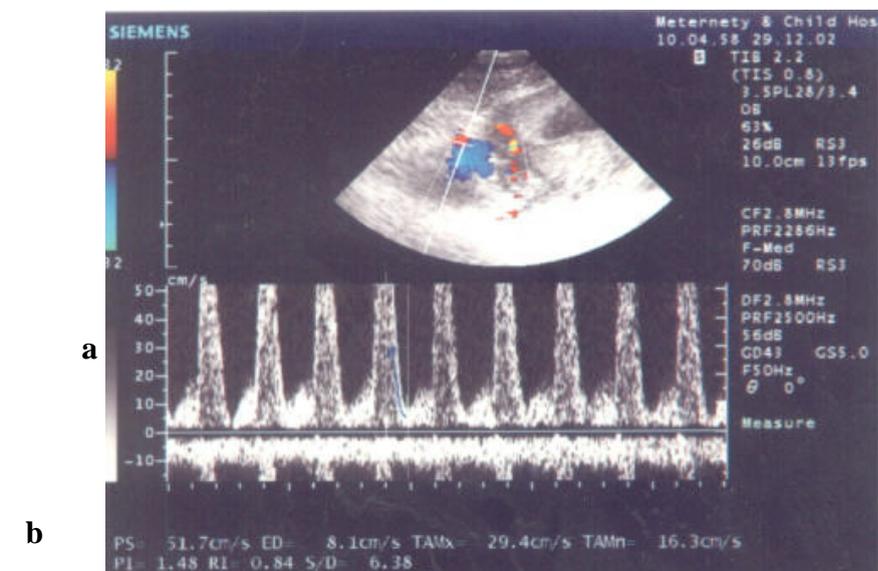
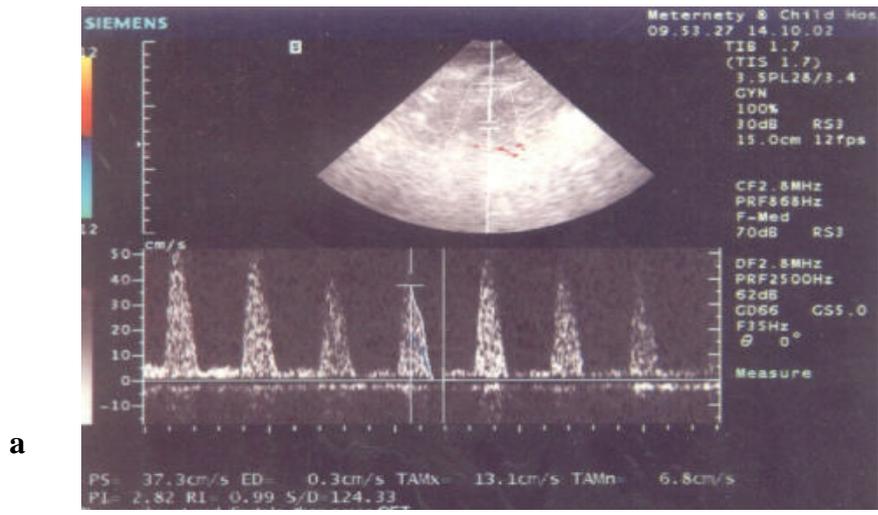
Doppler studies of flow velocity waveforms may be performed to assess both the fetal umbilical and maternal uterine circulation (Figure-1). Study of haemodynamic changes within the intervillous space during pregnancy may have implication in better understanding of the metabolic interchange between maternal and fetal side.<sup>[12]</sup> A wide variety of studies assessed the usefulness of Doppler study both in early and late pregnancy as well as in “low risk” and “high risk” pregnancies. Changes in both yolk sac appearance and vascularization and their subsequent effect's on embryonic development can be assessed accurately by using three-dimensional Doppler ultrasound.<sup>[13]</sup> In addition, it has been found that measurement of uterine artery PI on the day of human chronic gonadotropin (HCG) administration predicts the subsequent implantation rates.<sup>[14]</sup> Furthermore, a variety of adverse perinatal outcomes can be predicted and evaluated with the aid of Doppler ultrasound.<sup>[15-17]</sup>

In this study, we found that patients with first trimester threatened abortion showed marked alterations in uterine circulation, though only significant for RI, compared to normal pregnancies. This finding is in agreement with other reports.<sup>[8,9]</sup> These changes probably suggest an association of some disturbances in utero-placental circulation with the occurrence and/or outcome of threatened abortion in early pregnancy. It has been suggested that abnormal flow velocity waveforms in early pregnancy complicated by embryonic death are related to deficient placental development and dislocation of the trophoblastic shell that follows embryonic demise. The premature entry of maternal blood into the intervillous space disrupts the materno-embryonic interface and is probably the final mechanism causing abortion.<sup>[18]</sup> On the other hand, Alcazar and Ruiz-Perez<sup>[11]</sup> found no apparent alteration in early utero-placental circulation in patients with threatened abortion with a living embryo. Others found that vaginal bleeding with or without subchorionic haematoma increases uterine PI at 7<sup>th</sup> week of pregnancy. However, the persistence of bleeding and/or subchorionic haematoma until the 10<sup>th</sup> week does not influence utero- and umbilicoplacental circulation.<sup>[19]</sup> Changes in uterine circulation in early pregnancy could be

influenced by hormonal factors, progesterone level in particular. This is supported by the finding that before 10 weeks of gestation, uterine blood flow volume, PI and RI are related to serum progesterone level but not to estradiol level.<sup>[20]</sup> On the other hand, some studies suggested that assessment of feto-maternal circulation in early pregnancy does provide information on the physiology of early normal placental formation, but not of the early pregnancy failure.<sup>[21]</sup> It is interesting that patients with anembryonic pregnancy showed marked alterations in both S/D ratio and RI compared to both normal pregnancies as well as those with threatened abortion. These changes may have some relation to early gestational

failure in these patients. It has been shown that abnormalities in size, shape, volume, echogenicity as well as vascularization of yolk sac, as assessed by Doppler ultrasound, are possibly the result of poor embryonic development or even embryonic death rather being a principal cause of early pregnancy failure.<sup>[12]</sup>

*In conclusion*, first trimester threatened abortions with living embryo as well as anembryonic pregnancy are accompanied by alterations in utero-placental circulation. However, it needs to be determined, as well as to study the cause and effect relationship of these changes with the two disorders.



**Fig. 1 Doppler U/S study**  
 a. Normal pregnancy  
 b. Threatened abortion  
 c. Anembryonic pregnancy

## REFERENCES

1. Cunningham FG, Leveno KJ, MacDonald P, et al. Technique used to assess fetal heart. Williams's obstetrics, 20<sup>th</sup> edition, Appleton and Lange 1997; 1037-1040.
2. Sarah J. Bower and Stuart Campbell. Uterine artery as a screening test in pregnancy. In: ultrasound in obstetrics and gynecology, first edition, 1993; 579-586.
3. Bricker L, Neilson JP. Routine Doppler ultrasound in pregnancy (Cohrance review) In: The Cochrane Library, Issue 1.
4. Jaffe R, Jauniaux e, Hustin J. Maternal circulation in the first-trimester human placenta myth or reality? Am. J. Obstet. Gynecol. 1997; 176(3): 695-705.
5. Jason C. Brinholz. Doppler ultrasound predicts risk of miscarriage. A research by the radiological society of North America (RSNA). Internet data. Dep. Of Ultrasound Oak Brook Illinois.
6. Schwarzler P, Holden D, Nielsen S, et al. The conservative management of first trimester miscarriages and the use of colour Doppler sonography for patient selection. Hum Report. 1999; 14: 1341-1345.
7. Kurjak A, Kupesic S, Hafner T, et al. Intervillous blood flow in patients with missed abortion. Croat. Med. J. 1998; 39: 41-44.
8. Kurjak A, Kupesic S. Parallel Doppler assessment of yolk sac and intervillous circulation in normal pregnancy and missed abortion. Placenta. 1998; 19: 619-623.
9. Jauniaux E, Greenwold N, Hempstock J, et al. Comparison of ultrasonographic and Doppler mapping of the intervillous circulation in normal and abnormal early pregnancies. Fertility-Sterility 2003; 79: 100-106.
10. Jaffe R. Development of early uteroplacental circulation. Early pregnancy 2001; 5: 34-5.
11. Alcazar JL, Ruiz-perez ML. Uteroplacental circulation in patients with first-trimester threatened abortion. Fertility Sterility 2000; 73: 130-135.
12. Kurjak A, Dudenhausen JW, Hafner T. et al. Intervillous circulation in all three trimesters of normal pregnancy assessed by colour Doppler. Perinatal Medicine. 1997; 25: 373-380.
13. Kupesic S, Kurjac A. Volume and vascularity of the yolk sac assessed by three-dimensional and power Doppler ultrasound. Early-pregnancy 2001; 5: 40-41.
14. Zaidi J, Pitter R, Shaker A, et al. Assessment of uterine artery blood flow on the day of human chorionic by transvaginal colour Doppler ultrasound in an in vitro fertilization program. Fertility-sterility. 1996; 65: 377-381.
15. Heinonen S, Raynanen M, Kirkinen, et al. Perinatal diagnostic evaluation of velamentous umbilical cord insertion: clinical Doppler and ultrasonic findings. Obstet-Gynecol. 1996; 67: 112-117.
16. Coleman M, McCowan L, North R. Mid-trimester uterine artery Doppler screening as a predictor of adverse pregnancy outcome in high risk women. Ultrasound Obstet Gynecol. 2000; 15: 7-12.
17. Todros T, Ronco G, Fianchino O, et al. Accuracy of the umbilical arteries Doppler flow velocity waveforms in detecting adverse perinatal outcomes in a high-risk population. Acta-Obstet-Gynecol-Scand. 1996; 75: 113-119.
18. Jauniaux E, Zaidi J, Jurkovic D, et al. Comparison of colour Doppler features and pathological findings in complicated early pregnancy. Hum Report. 1994; 9: 2432-2437.
19. Makikallio K, Tekay A, Jouppila P. Effects of bleeding on utero placental, umbilico placental and yolk-sac hemodynamics in early pregnancy. Ultrasound-Obstet-Gynecol. 2001; 18: 352-356.
20. Dickey R, Hower JF. Relationship of estradiol and progesterone level to uterine blood flow during early pregnancy. Early pregnancy. 1996; 2: 113-120 .
21. Lin SK, Ho ES, Lo FC, et al. Assessment of trophoblastic flow in abnormal first trimester intrauterine pregnancy. Zhonghua Yi Xue Za Zhi (Taipei), 1997; 59:1-6.