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Bizarre Blood Flow Patterns Detected by Transvaginal Pulsed and Color Doppler Ultrasonography in Ectopic Pregnancies

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Abstract: The characteristics of blood flow patterns detected by transvaginal pulsed and color Doppler ultrasonography were evaluated in ectopic pregnancies. Two hundred and fifteen patients with surgically and histopathologically confirmed ectopic pregnancies were included in this study. Of 215 patients, 113 (52.5 %) had an ectopic trophoblastic flow. 106 of them (93.8 %) showed a typical trophoblastic flow characterized by a high-velocity and low-impedance flow, whereas 7 (6.2 %) had bizarre blood waveforms including high-impedance and reversed diastolic flow. It was concluded that although

most of the cases with ectopic pregnancy demonstrate a typical flow, a wide range of flow waveforms including some bizarre forms may be detected. In the presence of ectopic trophoblastic flow suggesting an ectopic pregnancy, both ovaries should be visualized separately and it should be clearly demonstrated that this flow is obtained separate from ovaries and uterus.

Key Words: Ectopic pregnancy, ultrasonography, color Doppler, Trophoblastic flow.

Introduction

Ectopic pregnancy still accounts for about 10 % of maternal deaths and delayed diagnosis is the single most important reason for this relatively high morbidity and mortality (1,2). The measurements of B-human chorionic gonadotropin (B-hCG) and ultrasonography have facilitated the early diagnosis of ectopic pregnancy and it is currently possible to make an accurate diagnosis only based on the direct observation by transvaginal ultrasonography (3,4). Recently, studies have mainly focused on transvaginal pulsed and color Doppler ultrasonography and many studies demonstrated that the addition of Doppler studies to the work-up of patients with ectopic pregnancy have increased the diagnostic accuracy (2,5-8). The presence of a trophoblastic flow around the diagnostic sac or adnexial masses, separate from ovaries and uterus, is accepted as diagnostic for ectopic pregnancy (2,5-9). The trophoblastic flow shows the presence of a developing placenta, whether intrauterine or ectopic and it is characterized by high-velocity and low-impedance flow pattern. However, it was shown that a wide range of waveforms from typical trophoblastic flow patterns to some bizarre patterns may

be seen in ectopic pregnancies (2). But, their frequency has not been reported.

The purposes of this study was to evaluate the characteristics of blood flow waveforms detected by transvaginal pulsed and color Doppler ultrasonography in ectopic pregnancies and to find out the frequency of bizarre flow patterns.

Materials and Methods

The study was carried out between 1 January 1989 and 30 June 1995 in Dr. Zekai Tahir Burak Womens' Hospital, Ankara, Turkey. Two hundreds and fifteen cases with surgically and histopathologically confirmed ectopic pregnancies were included the study and all patients were examined by transvaginal pulsed and color Doppler ultrasonography. All sonographic examinations and Doppler studies were performed by one experienced physician (E.E.). A 5 MHz transvaginal probe with pulsed Doppler facilities (Combison 320-5, Kretz) was used in the first 69 cases and a 6 MHz transvaginal ultrasound transducer with pulsed and color Doppler equipment (Toshiba SSH 140 A Color Doppler) was used in the remaining 146 cases. Vaginal

scanning began with conventional B-mode imaging to evaluate the uterus and ovaries. Then, other pelvic structures were examined to detect the presence of any abnormality. The ultrasound finding of an ectopic sac, tubal hematoma, adnexial mass and cul-de-sac fluid were classified as suspected ectopic pregnancy. Both ovaries were visualized and the presence of a corpus luteum was investigated in all patients. At the end of the procedure, pulsed and color Doppler studies were carried out around the ectopic gestational sac and extrauterine masses to see whether a trophoblastic flow was present or not. Typical trophoblastic flow was defined as the presence of a high-velocity and low impedance flow pattern and the detection of this flow separate from ovary and uterus was also accepted as diagnostic for ectopic pregnancy.

Results

Of the 215 patients examined by transvaginal pulsed and color Doppler ultrasonography, 113 (52.5 %) demonstrated a detectable trophoblastic blood flow around the ectopic gestational sac or adnexial masses. 106 (93.8 %) of them showed a typical trophoblastic flow characterized by high-velocity and low impedance flow pattern (Figure 1), whereas 7 patients (6.2 %) demonstrated atypical bizarre flow waveforms. A high impedance flow pattern was obtained in 4 of these patients (Figure 2) and a reversed diastolic flow was detected in 3 (Figure 3).

Discussion

Doppler ultrasonography provide the non-invasive assessment of physiological and pathological changes of blood flow in uteroplacental and other pelvic vessels in both pregnant and nonpregnant subjects. The addition of pulse Doppler to the conventional transvaginal sonography in the diagnosis of ectopic pregnancy was first described by Taylor et al. (9) and they showed that the demonstration of a trophoblastic flow around an adnexial mass increased the diagnostic sensitivity from 53 % to 73 %. They hypothesized that the high-velocity and low-impedance flow around gestations results from the hemodynamics of early placentation and this process has been shown to be the same

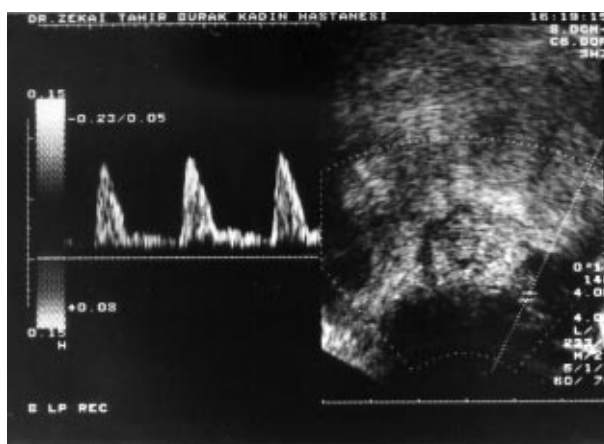


Figure 2. Transvaginal pulsed and color Doppler ultrasonography illustrating a bizarre waveform with high systolic velocity and high impedance around an ectopic mass.

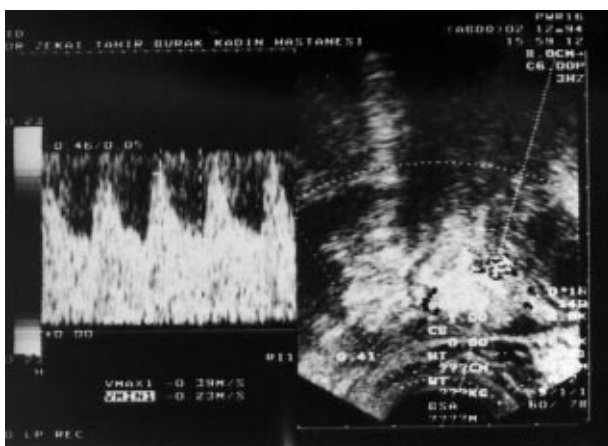


Figure 1. Transvaginal pulsed and color Doppler ultrasonography demonstrating typical trophoblastic blood flow with high-velocity and low-impedance

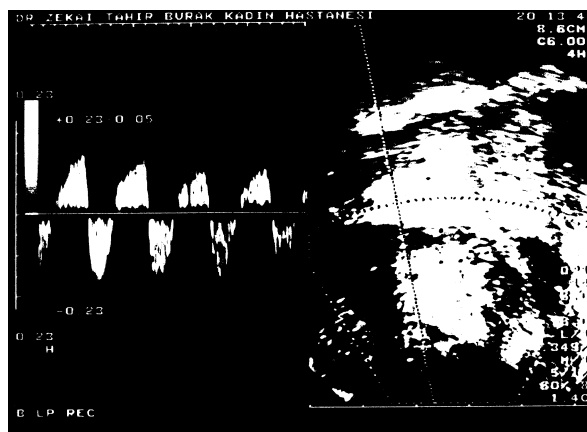


Figure 3. Transvaginal pulsed and color Doppler sonogram shows another bizarre waveform with reversed diastolic flow around an ectopic gestation.

whether the pregnancy is intrauterine or extrauterine. Many studies have further supported that the addition of pulsed Doppler improved the sonographic diagnosis of ectopic pregnancy (2,5-12). Recently, the introduction of transvaginal pulsed and color Doppler has further facilitated studies of blood flow in pelvic vessels (2,5-9,12) and Jurkovic et al (5) reported that up to 94 % of cases with ectopic pregnancy can be detected by the addition of color Doppler. However, according to some authors, its usefulness remains unproven. Frates et al (10) have reported that the use of transvaginal sonography alone for the diagnosis of ectopic pregnancy has proven high sensitivity and specificity. Although the Doppler interrogation, if available, may provide additional information for a limited number of patients, the current literature does not support the addition of color Doppler increase the diagnostic accuracy.

A trophoblastic flow pattern may also occur in the corpus luteum and in some gynecologic tumors. In contrast, the absence of a detectable Doppler signal from an adnexial mass is not enough to exclude the presence of an ectopic gestation. Taylor et al. (9) reported that the absence of trophoblastic flow in ectopic gestation may indicate a nonviable gestation. They showed that those cases with a detectable flow at a mean gestational age of 50 days had a significantly higher serum B-hCG levels than those without a detectable flow at the same gestational age. This hypothesis was supported by Tekay et al (6) and Kurjack (13). It was also shown that those cases with ectopic tubal ring suggesting an intact tubal pregnancy had trophoblastic flow frequently than those cases with an adnexial mass suggesting ruptured tubes.

There is a high impedance flow pattern in ovaries during early follicular phase of cycle. However, a low impedance flow which is the same with trophoblastic flow develops in corpus luteum (9,13,14). Therefore, it may be very difficult to differentiate a corpus luteum from an ectopic pregnancy by only using the Doppler flow waveforms. Careful transvaginal scanning and the demonstration of both ovaries are essential for this differentiation. Although the trophoblastic flow is characterized by a high-velocity and low-impedance flow waveforms, it has been reported that atypical or bizarre flow patterns may be detected in ectopic pregnancies (2). 7 cases (6.2 %) demonstrated bizarre flow waveforms in our series. A high impedance flow was detected in 4 and a reversed flow was seen in 3 of these patients. We had a considerable difficulty in these cases to make a positive diagnosis for ectopic pregnancy. The most important thing in this condition is that these atypical Doppler waveforms may be obtained from ovarian vessels. Therefore, both ovaries should be visualized separately by transvaginal ultrasonography and it should be clear that Doppler flow waveforms are obtained separate from the ovaries and the uterus.

In conclusion, although most ectopic pregnancies with detectable trophoblastic flow show a typical pattern, a wide range of Doppler waveforms including some bizarre forms may be seen. This fact should be kept in mind when evaluating patients with Doppler ultrasonography and the diagnosis of ectopic pregnancy should not be excluded in the presence of atypical blood flow patterns.

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