Umbilical Artery Doppler Velocimetry in Pregnant Women with Iron Deficiency Anemia

Gülcin DİLMEN, Mete F. TOPPARE, Nilgün Ö. TURHAN
Radiologist, Turkish Health and Therapy Foundation Hospital, ANKARA

ABSTRACT
UMBİLİCAL ARTERY DOPPLER VELOCİMETRY İN PREGNANT WOMEN WITH IRON DEFİCİENCY ANEMIA
Obiective: To detect possible fetoplacental vascular compromise by Doppler velocimetry in pregnant vvomen with iron deficiency anemia and to compare the outcomes of pregnancies in vvomen vvith and vvithout iron deficiency anemia.
Methods: 78 vvomen vvith mild iron deficiency anemia Hb: 9.97±0.7 gr/dl, ferritin 9.6±2.1 ugr/L and 156 vvomen vvith normal Hb and ferritin values were evaluated vvith Doppler ultrasonography in the second and third trimester and the outcomes of pregnancies were prospectively evaluated at birth. Ali the cases had adequate nutrition, were nonsmokers and did not consume alcohol or narcotic drugs.
Results: Four vvomen in the study group had pathological indices in Doppler velocimetry, one having intrauterine grovvth retardation, tvvo preterm birth, vvhile in the control group, 9 had pathological indices, resulting in two intrauterine grovvth retardation, three preterm births and tvvo vvith meconium aspiration. The Doppler results and adverse outcome rates were not significantly different from the control group (p for both>0.05).
Conclusion: Mild iron deficiency anemia during pregnancy as objectively demonstrated by Doppler study does not cause fetoplacental vascular insufficiency that may lead to intrauterine grovvth retardation or preterm birth.

Key VVords: Doppler, İron Deficiency Anemia; Pregnancy.

ÖZET
DEMİR EKSİKLİĞİ ANEMİLİ GEBELERDE UMBİLİKAL ARTER DOPPLER VELOSİMETRİ
Amaç: Demir eksikliği anemisi olan gebelerde utero-plasental dolaşım bozukluğunun Dopler çalışması ile ortaya konulması ve gebelik sonuçlarının değerlendirilmesi.
Yöntem: Demir eksikliği olan (Hb: 9.97±0.7 gr/dl, ferritin 9.6±2.1 ugr/lt) 78 gebe, normal Hb ve ferritin değerlerine sahip 156 gebe çalışma kapsamına alındı. Bu gebelere ikinci ve üçüncü trimesterde Doppler yapıldı ve bunların gebelik sonuçları değerlendirildi. Tüm olgular, normal beslenme alışkanlıkları olan, sigara içmeyen, alkol ya da narkotik ilaç kullanmayan olgulardı.
Bulgular: Çalışma grubunda 4 olguda patolojik Doppler bulgusu mevcuttu. Bu dört olgudan biri, intrauterin gelişme geriliği, ikisi ise erken doğum olgusu idi. Diğer taraftan kontrol grubunda 9 olguda patolojik Doppler bulgusu vardı. Bu dokuz olgudan 2'si intrauterin gelişme geriliği, 3'ünde erken doğum ve 2'sinde mekonyum aspirasyonu vardı.
Sonuç: Bu çalışmada, Doppler bulguları, hafif derecede demir eksikliği anemisinin intrauterin gelişme geriliği veya erken doğuma neden olan bir fetoplasenter dolaşım yetersizliğine yol açmamaktadır.

Anahtar Kelimeler: Doppler, demir eksikliği anemisi, Gebelik

Although a consensus is not reached, some studies suggest that anemia during pregnancy may increase the likelihood of poor outcomes, such as increased risk of preterm delivery, low birth weight (SGA) and prenatal mortality (1,2). Furthermore, observational studies report that (3) iron deficient women who are not necessarily anemic showed an increased risk of associated complications during pregnancy such as preeclampsia.

it is known that low birthweight and preterm mortality is associated with uteroplacental insufficiency. We hypothesized that if Fe++ deficiency anemia indeed does cause small for gestational (SGA) birth and preterm delivery, then uteroplacental insufficiency should be revealed by Doppler velocimetry. Thus we proceeded in order to test this hypothesis on anemic pregnant women and controls.

Yaztşma adresi: *Çiftlik Cad. No: 57 Emek 06510, Ankara-TURKEY*

MATERIAL AND METHODS

During a 10 month period, 78 women with iron deficiency anemia (Hb<11.0 gr/dl) in the first and third trimester, <10.5 gr/dl in the second trimester, ferritin <12 pg/L) (4) and MCV 82 fi or less were examined by color Doppler velocimetry. An Aloka

Tablo 1. The Characteristics of the Study and the Control Group (±SD)

	Iron Deficiency Anemia n=78	Control n=156
Age (yrs)	20.9±0.42	20.8±0.40
BMI (kg/M2)	21.8±0.36	23.9±0.31
Monthly income ($)	1107±185	1205±208
Multiparous (%)	52 (69.8)	107 (65.7)
Hb (gr/dl) (range)	9.97±0.71 (7.8-10.9)	12.4±0.54 (11.3-14.2)
Htc (%)	29.2±0.7	36.4±0.6
MCV (fL)	77.2+1.5	89.8+1.8
Ferritin (µgr/L)	9.6±2.1	24.1±3.1

Tablo 2. Doppler Velocimetry Measurements and Outcomes of Pregnancies

	Iron Deficiency Anemia	Control
S/D index (range)	2.46 (2-3.4)	2.51 (1.8-3.8)
Gestational age (wks)	39.5±0.4	39.1±0.6
Gestational age at Doppler±SD (range)	32.4±6.2 (16-39)	33.1±5.8 (16-39)
Birthweight±SD (gr)	3032.4±403	3011.7±305
Doppler abnormal	4	9
Adverse prognosis	3 (1SGA, 2 preterm)	7 (2 SGA, 3 preterm, 2 meconium asp

SD 110 device was used by an experienced radiologist. None of the women were smokers or alcohol or drug users in control and study groups. Body mass index and ages and parity were noted. Only women that were sure of last menstrual date were included in the study. S/D index ≥3.0, reversed or absent end diastolic flow were regarded as pathological Doppler results. Bleeding women, or women with chronic renal, cardiovascular or endocrinological or metabolical diseases (eg. hypertension, diabetes) or postterm delivery, neonates with gross malformations, congenital heart disease, kidney disease or fetal infections were excluded by appropriate tests. The subjects had ali pregnancies exceeding gestational 15 th week (first trimester). The results of Doppler umbilical artery flow characteristics were analyzed according to previously established standards for Turkish mothers (5). A control group consisting of 156 agematched, gestational age matched (±1 week) pregnant women without anemia (Hb>ll.l gr/dl) was also enrolled.

Ferritin was measured by Amersham ferritin kit which utilized the principle of the competition between 1125 ferritin and plasma ferritin for binding to ferritin specific antibody. The minimum value kit could measure was 2.5 µgr/L and the coefficient of variation of the analysis was 3-7%. Blood count was done by using Technicon RA-XT Hl hematology autoanalyser by Oxford-Eppendorf automatic pipetting station.

Prospectively, ali the newborn babies were immediately examined by pediatricians and gestational ages were scored by Ballard maturation test, the birthweights and signs of adverse prognosis were registered. Adverse prognosis criteria were as follows: The SGA babies, prematüre babies, meconium under vocal cords, admittance to neonatal intensive çare unit for reasons other than the above stated exclusion criteria. Çare was taken that nutritional status (Body mass index >20) and socioeconomic status (monthly income>1000$) were appropriate and essentially alike in the two groups. Pearson chi square test was used to compare the number of babies with adverse prognosis and Student's T test were used to compare the parameters and the results of the two groups.

RESULTS

The background characteristics of women with and without second/third trimester iron deficiency anemia are shown in Table 1.

The number of women with abnormal Doppler velocimetry and adverse prognosis were not significantly different (p>0.05) and the parameters (stated in Table 2) of the two groups were similar (p for all>0.05). Among the four cases with abnormal results of Doppler in the anemia group, one had no end diastolic flow and three had S/D index exceeding 3-0 One of these babies had an uneventful delivery, 2 was preterm, born at the gestational ages of 35 and 36 weeks, while the other was born with a birthweight of 2310 gr at 391/2 weeks of gestation. These mothers did not have any distinguishing clinical findings that might explain these births. in the control group, one mother had myoma uteri, and one had abruptio placenta, however the rest of the adverse prognosis births did not have any mentionable clinical findings. in both groups, we did not encounter placenta previa, postpartum hemorrhage or morbidity (such as proglonged hospital stays or infections) or mortality.

DISCUSSION

Although the prevalence of anemia during pregnancy has declined över the past few decades (6), it is stili abundant in developing countries and anemia and spontaneous preterm birth are reportedly related (7). Increased placental weight and a high ratio of placental weight to birthweight which are associated with an increased risk of high blood pressure in inants' later life (8) have been linked to maternal anemia during pregnancy and specifically to maternal iron deficiency anemia (9). On the other hand, a high hematocrit level exceeding 43% was also found to be significantly relevant to SGA and preterm delivery (10).

Doppler velocimetry is known to have a significant predictive value in diagnosing SGA infants prenatally. These infants may have pathological indices of S/D index or diminished or reversed end diastolic flow illustrating the placental vascular insufficiency. Our report which failed to demonstrate an elevated incidence of placental vascular insufficiency may have implicatons in reassessing the present concept of the adverse effects of iron deficiency anemia in pregnancy. Our findings may in part, be due to the fact that the study and control population consisted only

of patients from the second and third trimester since Doppler velocimetry may not be of much predictive value before this period of pregnancy. As Klebanoff et al (7) also pointed, in the second trimester anemia approximately doubled the risk of preterm delivery but the relationship between anemia and preterm birth could not be demonstrated in the third trimester. Moreover, Higgins et al (11) reported that the highest infant birthweights were associated with the lowest third-trimester matemal hemoglobin concentrations. One should also bear in mind that the present study population lacked mothers with severe iron deficiency anemia (Hb<6 gr/dl) which are exceptionally rare and should be treated on an individual basis.

Instead of an effect of anemia or a high hematocrit, the increased risk of preterm delivery and low birthweight may reflects uncontrolled confounding factors related to inadequate nutrition or low socioeconomic status. As these factors were essentially alike in the presendt study, this hypothesis may find some support in our results. in the Camden study of School et al (1) when vaginal bleeding preceded the anemia in 18% of women, the odds of preterm delivery were substantially increased which suggests that an underlying fetal or maternal pathology may have given rise to preterm delivery. Although the number of patients in the present study was small, untoward factors were meticulously excluded and the results suggest that iron deficiency anemia does not cause fetoplacental vascular compromise and probably constitutes a trivial role in the etiology of preterm deliveries and SGA births.

KAYNAKLAR

1. School TO, Hcdiger ML, Fischcr RL, Shcarcr JW. Anemia vs iron deficiency: increased risk of preterm delivery in a prospeetive study. Am J Cliıı Nutr 1992; 122: 1417-24.
2. Klebanoff MA, Shiono PH, Bercndes HW, Rhoads GG. Facts and artifacts about anemia and preterm delivery. JAMA 1989; 262: 511-5.
3. Kitay DZ, Harbort RA. iron and folic acid deficiency in pregnancy. Cliıı Perinatol 1975; 2: 255-73.
4. Ccntcrs for Discasc Control. CDC criteria for anemia in children and childbearing-aged womcn. Morbid Mortal Week Rcp. 1989; 38: 400-4.
5. Dilmen G, Aytaç S, Topparc MF, Öztürk M, Göksin E. Umbilical Artery Blood Flow Characteristics in Normal Prcgnancics. Gynecologic and Obstetric Investigation 1994, 38: 96-99.
6. Scott JM, Goldic H, Hay SH. Anacmia of pregnancy: the changing postwar pattern. Br Med J 1975; 1: 259-61.
7. Klebanoff MA, Shiono PH, Selby JV, Trachtcnberg Al, Graubard BI. Anemia and spontaneous preterm birth. Am J Obstct Gynccol 1991; 164: 59-63.
8. Barker DJ, Bull AR, Osmond C, Simmons SJ. Fetal and placental si ze and risk of hypertension in adult life. Br Med J 1990; 301: 259-62.
9. Godfrey KM, Redman CWG, Barker DJP, Osmond C. The effect of maternal anemia and iron deficiency on the ratio of fetal weight to placental weight. Br J Obstet Gynccol 1991; 98: 886-91.
10. Lu ZM, Goldenberg Rl, Clivcr SP, Cutter G, Blankson M. The rela tionship between maternal hematoerit and pregnancy outeomc. Obstet Gynccol 1991; 77: 190-4.
11. Higgins AC, Pencharz PB, Stravvbridgc JE, Maughan GB, Moxley JK. Maternal haemoglobin changes and their relationship to infant birth vveight in mothers receiving a program of nutritional assessment and rehabilitation. Nutr Res 1982; 2: 641-9.