

Original Article

Umbilical artery Doppler velocimetry in normal pregnancies from 11⁺⁰ to 13⁺⁶ gestational weeks: A Taiwanese study



Chia-Pei Chang^a, Hsing-I Wang^{b, c, e}, Peng-Hui Wang^{a, d}, Ming-Jie Yang^{a, d},
Chia-Ming Chang^{a, d}, Chi-Mou Juang^{a, d}, Yi-Jen Chen^{a, d}, Huann-Cheng Horng^{a, d},
Jen-Yu Tseng^{a, d}, Ming-Shyen Yen^{a, d}, Chih-Yao Chen^{a, b, d, *}, Kuan-Chong Chao^{a, d}

^a Department of Obstetrics and Gynecology, Taipei Veterans General Hospital, Taipei, Taiwan

^b Institute of Clinical Medicine, National Yang-Ming University, Taipei, Taiwan

^c Taipei Mackay Memorial Hospital, Taipei, Taiwan

^d National Yang-Ming University, School of Medicine, Taipei, Taiwan

^e Mackay Medicine, Nursing and Management College, Taipei, Taiwan

ARTICLE INFO

Article history:

Accepted 20 April 2012

Keywords:

ductus venosus
intrauterine growth restriction
pulsatility index
resistance index
umbilical vein

ABSTRACT

Objective: The aim of this study is to investigate the relationship between umbilical artery flow and gestational age (GA) at 11–13⁺⁶ weeks in normal pregnancy in the Taiwanese population.

Materials and methods: Two hundred and fifty-three normal singleton pregnancies with GA ranging from 11 to 13⁺⁶ weeks were included in this study. The velocity of systolic, diastolic, and pulsatility index (PI) of the umbilical artery, and the mean velocity of the umbilical vein were recorded.

Results: One hundred and eighty-seven participants fulfilling the inclusion and exclusion criteria were analyzed. The mean maternal age was 31 (range 19–45) years, with a corresponding GA of 12⁺⁴ (range 11–13⁺⁶) weeks. The absence of end-diastolic velocity of the umbilical artery was observed in most of our cases (90.1%). No significant change was found in the vascular indices with GA for the mean velocity of the umbilical vein (mean velocity = $0.923 \times GA - 1.594$, $r = 0.1497$, $p = 0.115$). The systolic velocity of the umbilical artery and PI, however, behaved differently from the other variables. There was a significant increase in systolic velocity with GA [systolic wave (S wave) velocity = $0.237 \times GA + 2.267$; $r = 0.149$, $p = 0.041$]. By contrast, the PI showed a significant decrease in relation to the GA (PI = $-0.016 \times GA + 4.068$; $r = 0.196$, $p = 0.007$).

Conclusion: The S-wave velocity of the umbilical artery increased with GA. By contrast, the PI of the umbilical artery showed a decreasing trend with GA. This may ensure optimal placental perfusion, which is necessary to accommodate the increased blood flow to the developing fetus. Furthermore, an absence of end-diastolic velocity in the first trimester and early second trimester was usually seen.

Copyright © 2014, Taiwan Association of Obstetrics & Gynecology. Published by Elsevier Taiwan LLC. All rights reserved.

Introduction

Fetal health is one of the important subjects in public health, and congenital anomalies may have a significant impact on families and society. Antepartum fetal surveillance with Doppler ultrasound has shown significant diagnostic efficacy for hemodynamic complications, such as intrauterine growth restriction (IUGR) and pre-eclampsia, especially during the first trimester. Furthermore, it is a

clinical standard to distinguish between small for gestational age (GA) and IUGR by evaluation of placental function [1].

Umbilical circulation is one of the important circulations in the early stage of human embryos. Umbilical circulation supplies embryonic blood to the chorionic villi through two umbilical arteries located in the connecting stalk. Umbilical arteries connect the descending aorta with the capillary nets of the chorionic villi. After asymmetric development and regression of the right umbilical vein, the blood flow returns by only one umbilical vein. Then, the vein anastomoses with the portal vein and runs as a large canal into the inferior vena cava, which supports the main nutrition and oxygen for fetal growth [2].

* Corresponding author. Department of Obstetrics and Gynecology, Taipei Veterans General Hospital, 201, Section 2, Shih-Pai Road, Taipei 112, Taiwan.

E-mail address: zachary.joyce@gmail.com (C.-Y. Chen).

Extreme change in umbilical circulation may reflect severe anomalies, such as reversed end-diastolic flow (REDF) in the umbilical artery in early pregnancy, which, though rare, mostly occurs in association with major fetal vascular anomalies and cardiac defects, particularly tetralogy of Fallot with absent pulmonary valve syndrome, patent ductus arteriosus, cardiac septal defect, and even trisomy 18 or trisomy 13 [3].

Several published studies have shown the trend of hemodynamic change of fetal circulation in the early stage of gestation [2,4,5]. Thus, it is important to establish a database and note the change in trend for Taiwanese pregnant women. The purpose of this study was to investigate the relationship between umbilical artery flow and the GA at 11–13⁺⁶ weeks in normal pregnancy in the Taiwanese population.

Methods

Patients

We evaluated 187 women with normal singleton pregnancy during their gestation from 11 to 13⁺⁶ weeks. Fetal age was calculated based on the last menstrual period and cross checked by sonographic measurement of the crown–rump length. Of the 269 pregnant women, we excluded those patients without regular prenatal surveillance and birth records. Patients were also excluded if they had any disease during the study or received a regimen of tocolytic and antihypertensive agents during pregnancy. Pregnancy outcome was confirmed by reviewing hospital medical records. The study protocol was approved by the Institutional Review Board at Taipei Veterans General Hospital, and each participant in the study submitted a signed and approved informed consent form.

Ultrasound examination

All sonographic examination was performed with a Voluson 730 ultrasound machine (GE Healthcare, Milwaukee, WI, USA) equipped with a 4- to 8-MHz transducer. Color Doppler mode was chosen for evaluation of the umbilical artery. The flow velocities from the umbilical artery were measured with color Doppler imaging in the middle third of the umbilical cord. No angle correction for measuring the Doppler flow velocity was needed. At least three consecutive waveforms were recorded with insonation angle $\leq 30^\circ$ if the typical umbilical artery waveform was observed (Fig. 1A). We adjusted the sensitivity of wave tracing and the constant Doppler spectrum to optimize the velocity measurement, because the systolic wave (S wave) velocity was very sensitive to the angle between the Doppler beam and blood flow. The generated measurements included S wave, diastolic wave (D wave) velocity, pulsatility index (PI), and resistance index (RI) of the umbilical artery. The PI and RI values were generated using the formulae of $(S-D)/TA_{max}$ and $(S-D)/S$, respectively. Because we could not differentiate the systolic phase from the diastolic phase of the umbilical vein, owing to its low variability of velocity, the corresponding mean velocity of the umbilical vein was calculated, which is defined as the mean of corresponding velocities of the umbilical vein recorded at the systolic phase and end-diastolic phase of the umbilical artery (Fig. 1B).

Statistical analysis

The data consolidation was performed with Excel (Microsoft, Redmond, WA, USA), and computation analysis was performed using SPSS for Windows, version 15.0 (SPSS Inc., Chicago, IL, USA). Regression analyses were applied to evaluate the relationships among the Doppler measurements and GA. Pearson's correlation

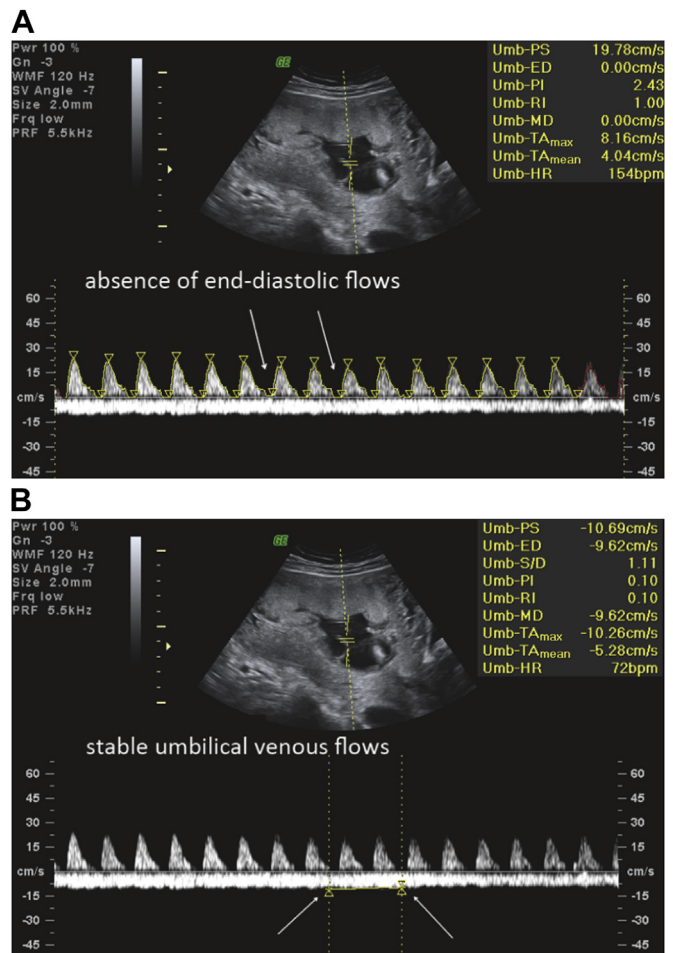


Fig. 1. (A) Doppler ultrasound waveforms of umbilical arterial flows in one of our cases. We measured the fetal site of the umbilical cord, and the waveform showed there were no end-diastolic flows (as indicated by white arrows). (B) Doppler ultrasound waveforms of umbilical vein flows in one of our cases. To measure the umbilical cord, we take the fetal site for measurement. The umbilical vein demonstrates stable flow velocity through systolic and diastolic phases (as indicated by white arrows).

coefficient was selected to show the degree of correlation between measurements.

Results

Data of the 187 eligible participants fulfilling the inclusion and exclusion criteria were analyzed. The mean maternal age was 31 (range 19–45) years, corresponding to a mean GA of 12⁺⁴ (range 11–13⁺⁶) weeks. Maternal and fetal demographic data of this study are shown in Table 1. Reference curves for the umbilical vessels

Table 1
Maternal and fetal characteristics.

No. of participants	187 cases
<i>Maternal characteristics</i>	
Age (y)	31.32 ± 4.09
Gestational age at study (wk)	12.68 ± 0.68
<i>Fetal characteristics</i>	
Fetal body weight (g)	3133.51 ± 376.37
Fetal body length (cm)	47.69 ± 2.44
Apgar score (1 min/5 min)	8/9
<i>Fetal sex</i>	
Male (%)	56.52
Female (%)	43.38

Download English Version:

<https://daneshyari.com/en/article/3975124>

Download Persian Version:

<https://daneshyari.com/article/3975124>

[Daneshyari.com](https://daneshyari.com)