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# RELATIONSHIP BETWEEN UMBILICAL ARTERY DOPPLER VELOCIMETRY AND FETAL GROWTH RESTRICTION IN THIRD TRIMESTER OF PREGNANCY

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**Abstract**

Umbilical artery of fetus, in third trimester of pregnancy is used to make an assessment of fetal well-being. Fetal growth restriction (FGR) means an estimated fetal weight less than the tenth percentile for gestational age by prenatal ultrasound evaluation. Indications to do a doppler examination of umbilical artery are: suspected fetal growth restriction (firstly, small abdominal circumference), preeclampsia, pregnancy induced hypertension, monochorionic twins that share a single placenta, etc. This study aimed to identify fetal growth restriction using doppler velocimetry of umbilical artery, some ultrasound parameters and eventually mother comorbidities. Also, there were observed different placental abnormalities detected during third trimester and their relation with umbilical artery doppler velocimetry. It was founded a significant relationship between third trimester umbilical artery doppler velocimetry (systolic / diastolic ratio, systolic velocity - diastolic velocity / systolic velocity, systolic velocity - diastolic velocity / mean velocity) and subsequent delivery of neonates who have intrauterine growth restriction, than the relationship between fetal biometry, amniotic fluid index, umbilical doppler velocimetry and mother condition as summarized parameters to manage pregnancy termination.

*Keywords:* Fetal growth restriction, doppler umbilical velocimetry,

## 1. Introduction

Fetal growth restriction (FGR) is often defined as an estimated fetal weight less than the tenth percentile for gestational age by prenatal ultrasound evaluation. However, distinguishing between a constitutional small fetus and one with pathologically restricted growth remains a significant challenge. (1)

FGR can result as a consequence of placental, fetal or mother factor that leads to an increased risk for morbidity, preterm birth or fetal mortality. Diagnostic evaluation of FGR comprises ultrasonographic assessment of fetal biometric measurements, primary fetal abdominal circumference, very often amniotic fluid and doppler values, especially the velocimetry of umbilical artery.

The umbilical artery was the first fetal vessel to be evaluated by doppler velocimetry and has since become the most widely investigated component of the fetal circulation. The attention paid to this vessel may be explained partly by its ready accessibility to doppler interrogation, even without guidance by duplex imaging, and because it is a vital component of the fetal circulation, acting as the lifeline between the fetus and the placenta, (2).

Umbilical artery (UA) doppler velocimetry as a very important tool in identifying placental insufficiency, fetal growth restriction (FGR) or other complication that leads to adverse pregnancy outcome.

The most common indications to do a doppler examination of umbilical artery are:

- Suspected fetal growth restriction (firstly, small abdominal circumference).

- Pre-eclampsia, pregnancy induced hypertension.
- Monochorionic twins that share a single placenta.

Maternal comorbidities can interfere with uteroplacental-fetal blood flow and cause FGR. Some pathologies that came from mother are: chronic or gestational hypertension, gestational diabetes mellitus (or diabetes mellitus type I), systemic lupus erythematosus, antiphospholipid syndrome, cardiopulmonary or renal diseases, anemia, etc. Also some substance can be a reason of FGR, for example alcohol, drugs, nicotine, some medication, as well as twin pregnancies, low mother weight, etc.
Placental changes, like placenta bilobate, abruption, infarction, accreta, preterm maturation, previa (all types), etc, are associated with FGR. Also, umbilical cord anomalies, for example single artery, marginal or vilamentosa insertion are associated by FGR. Fetal genetic abnormalities can be a reason for FGR, except other fetal adverse outcome. Additionally, fetal infection is also responsible for FGR cases, including cytomegalovirus, toxoplasmosis, varicella-zoster virus, syphilis, herpes simplex, etc.
Umbilical artery Doppler velocimetry should be used in the management of the intrauterine growth restricted fetuses, as it helps in differentiating fetuses with pathological growth restriction at risk for perinatal complications from small and healthy fetuses.(3)
All these abnormal findigs impact fetal growth due to their adverse effects on placental perfusion and the same result with FGR.

**Objective of the study**

Identifying fetuses with fetal growth restriction.
Identifying the etiology of fetal growth restriction.
Improve management and care of pregnant women with FGR till the termination of pregnancy.
Assess the best termination of pregnancy in women with FGR.

**Material and methos**

This study consists of 135 women that came at our hospital for routine examination. Normal doppler group included 110 and the study doppler group 25 pregnancies with suspected FGR. The study doppler group consisted end or/and low diastolic flow group (n=19) and absent or reversed end diastolic flow (REDF) group (n=6)
In this retrospective observational study, 25 pregnant women with growth restricted fetuses confirmed by ultrasound were evaluated by umbilical artery Doppler velocimetry after 28 weeks of gestation, and the same were observed every two weeks till pregnancy termination. As recommended by FIGO an EFW finding consistent with SGA (ie, less than the tenth percentile) were prompt for further evaluation for FGR. Other useful biometric studies were HC/AC and FL/HC ratios, which helped for differentiation between symetrical and asymetrical FGR.
The ratios of the resistance to blood flow (impedance) are calculated automatically by the ultrasound machine (Voluson 22), wich means:
S/D ratio = (systolic / diastolic ratio)
Resistance index (RI) = (systolic velocity - diastolic velocity / systolic velocity
Pulsatility index (PI) = (systolic velocity - diastolic velocity / mean velocity)

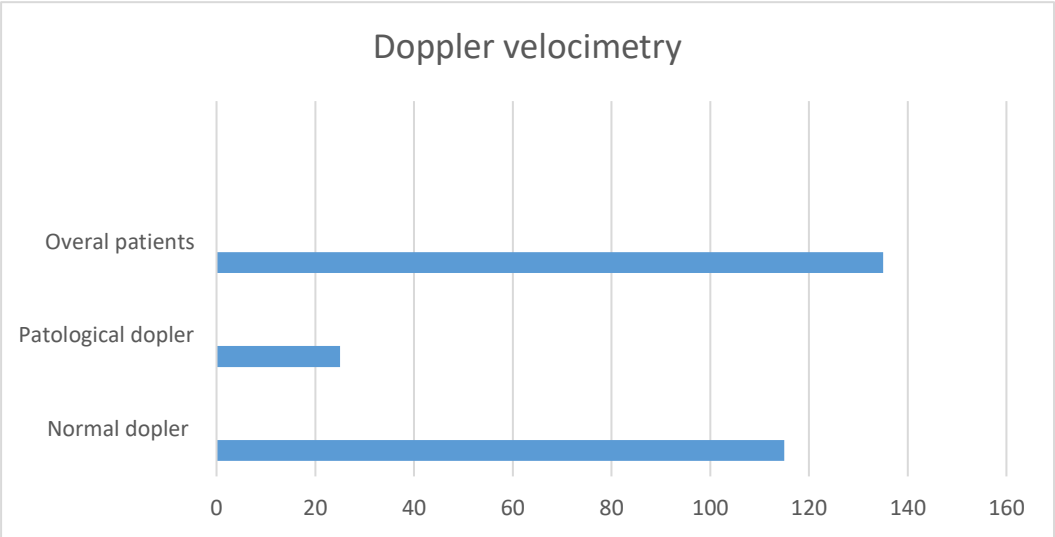



**Figure 1.**

## 4. Results

From 135 women that came at our hospital for routine examination 25 had a suspicios doppler values so they consist the study group with end or/and low diastolic flow group (n=19) and absent or reversed end diastolic flow (REDF) group (n=6).




**Figure. 2**

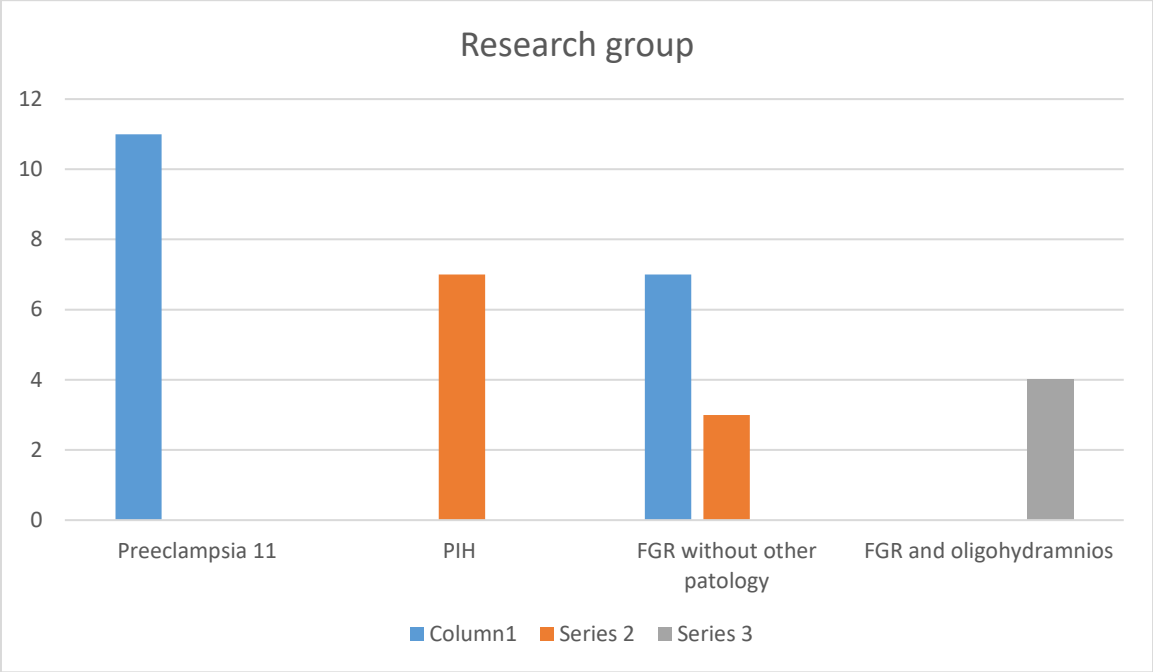



**Fig. 3**

From those 25 pregnant women 11 of them developed preeclampsia and FGR, 7 of them PIH, 7 SGA (4 of those 7 also oligohydramnios).

## 5. Discussion and conclusions

There is a significant relationship between third trimester umbilical artery doppler resistance index (RI), pulsatile index (PI) and the subsequent delivery of neonates who have fetal growth restriction.
Also, it was found that the frequency of third trimester umbilical artery Doppler is greater for FGR with preeclampsia and pregnancy induced hypertension than it is for FGR without any changes and marked that this difference could be the result of different placental abnormalities that are detected on third trimester umbilical artery Doppler velocimetry.
The other conclusion is that series of ultrasound examinations and umbilical artery velocimetry are excellent guide for optimal timing of pregnancy finalization.
Fetal biometry, amniotic fluid index, umbilical doppler velocimetry and mother condition are good summarized parameters to manage and find the right time of pregnancy termination.

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