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Uterine Artery Doppler in the Second Trimester as a Predictor of Preeclampsia in High Risk Pregnancy

Thesis

Submitted for Partial Fulfillment of Master Degree in Radiodiagnosis

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List of Abbreviations

Abb.	Full term
AT1-AA	Receptor autoantibody
AT-I	Anti-Thrombine I
AUC	Area under curve
CW	Continuous wave
EOPE	Early-onset PE
ET-1	Endothelin-1
GFR	Glomerular filtration rate
IUGR	Intrauterine growth restriction
LOPE	Late-onset PE
NK	Natural Killer
NPV	Negative predictive value
PE	Re-eclampsia
PI	Pulsatility index
PPV	Positive predictive value
PRF	Pulse repetition frequency
PW	Pulsed wave
RBF	Renal blood flow
RI	Resistance index
ROC	Receiver operating characteristic curve
ROS	Reactive oxygen species
sFlt-1	Soluble Fms-Like Tyrosine Kinase1
SPSS	Statistical Package for Social Science
TPR	Total peripheral resistance
VEGF	Vascular Endothelial Growth Factor

INTRODUCTION

Pre-eclampsia (PE) is major cause of maternal and perinatal morbidity and mortality affecting approximately 2% of all pregnant women ***(Eastwood et al., 2017).***

It refers to the occurrence of elevated blood pressure and proteinuria after 20 weeks of gestation, and the symptoms include

(a) Proteinuria

(b) Dysfunctions of maternal organs which can be renal insufficiency, hepatic impairment, And neurological Complications.

(c) Uteroplacental dysfunctions: fetal growth restriction; changes in the Doppler velocimetry studies of the umbilical artery, especially if combined with alterations in uterine arteries ***(Mayrink et al., 2018).***

The etiology of preeclampsia is still unknown, although an excessive maternal systemic inflammatory response and an imbalance between circulating angiogenic and anti-angiogenic factors have been described. The pathophysiology of preeclampsia is based on the incapability of the trophoblast to invade properly the myometrium causing a limited remodeling of spiral arteries.

The impaired placental perfusion caused by vascular abnormalities precedes clinical manifestations of preeclampsia

and it can be detected by Doppler ultrasound ***(Mendez et al., 2013).***

Doppler ultrasound is now widely used in clinical practice to detect uteroplacental insufficiency.

This investigation allows the identification of pregnancies that are at high risk for developing preeclampsia and occurance of maternal and fetal complications ***(Chilumula et al., 2020).***

The normal course of pregnancy is characterized by increased diastolic blood flow velocity and diastolic notch loss in the second trimester of pregnancy, around the gestational age of 22 weeks. Pregnancy with persistent notch and increased blood flow resistance may have a high risk of preeclampsia, premature birth, and intrauterine growth restriction ***(Stoenescu et al., 2021).***

Maternal Complications of preeclampsia include: Eclampsia, stroke, Abruptio placenta, DIC, Hemolysis, Pulmonary edema and death.

Fetal complications include fetal growth restriction, Preterm delivery, Hypoxia/acidosis and Perinatal death ***(Barton and Siabi, 2008).***

AIM OF THE WORK

The aim of the work is to evaluate the role of uterine artery Doppler in the second trimester as a predictor of preeclampsia in high risk pregnancy.

PREECLAMPSIA

Preeclampsia is a complex cardiovascular disorder of pregnancy with underlying multifactorial pathogeneses; however, its etiology is not fully understood. It is characterized by the new onset of maternal hypertension after 20 weeks of gestation, accompanied by proteinuria, maternal organ damage, and/or uteroplacental dysfunction ***(Aneman et al., 2020).***

-Etiology:

The underlying etiology of preeclampsia is not well-understood. A widely accepted cause of preeclampsia stems from the theory of abnormal placentation leading to significant maternal physiologic dysfunction. Despite these obstacles, the well-supported etiologic origin of preeclampsia has been shown to arise to abnormal placentation, leading to aberrant spiral arteries remodeling, placental ischemia, hypoxia, and oxidative stress ***(Phipps et al., 2019).***

- Epidemiology:

Preeclampsia is one of the most common medical disorders of pregnancy, it has an incidence of 2–7% and can cause maternal and neonatal morbidity and mortality. According to the new terminology ***(ACOG, 2014)***, preeclampsia without evidence of end-organ damage is termed as preeclampsia without severe features. However, the presence of end-organ damage defines preeclampsia with severe features ***(Chilmula et al., 2020).***

In the African region, 5.6% of pregnancies are estimated to be complicated by preeclampsia and 2.9% by eclampsia and hypertensive disorders in pregnant women are responsible for almost one in ten maternal deaths ***(Abalos et al., 2013).***

Preeclampsia is a major indication for preterm delivery, accounting for about 15% of all preterm deliveries ***(Saleem et al., 2014)*** and is a cause of increased healthcare costs through the prolonged stay of the mother or newborn in intensive care units ***(Antwi et al., 2020).***

- Risk factors:

There are several risk factors and predeterminants of preeclampsia that include:

- Nulliparity,
- Multi-gestation pregnancy,
- Advanced maternal age greater than 35 years old,
- In-vitro fertilization or other forms of assisted reproductive technology,
- Maternal comorbidities (chronic hypertension, chronic kidney disease, diabetes mellitus, thrombophilia, obstructive sleep apnea, obesity with pre-pregnancy BMI greater than 30),
- Family history,