Middle cerebral /umbilical artery resistance index ratio as sensitive parameter for fetal well-being and neonatal outcome in patient with preeclampsia

A PROTOCOL OF THESIS SUMITTED FOR
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INTRODUCTION

Preeclampsia is a pregnancy-specific syndrome. The reported incidence of Preeclampsia is 5-8%. (Cunningham FG et al., 2001). This condition is a leading cause of maternal mortality and is responsible for considerable perinatal morbidity and mortality. **(Lewis G & Drife J., 2001)**

The signs of preeclampsia are best considered as secondary to a uteroplacental disorder, affecting specific maternal target organs. The target organs include the maternal cardiovascular, renal, coagulation and hepatic systems. **(Redman CW, 2002)**

Preeclampsia is characterized by failure of trophoblast invasion into the myometrium and the maternal spiral arteries do not undergo their physiological vasodilatation. **(Brosens IA,1977)**. The diminished dilatation of spiral arteries is associated with increase resistance in the utero-placental circulation and an impaired intervillous blood flow probably results in an inadequately perfused placenta. (Roberts JM et al., 1989)

As a result of impaired utero-placental blood flow, manifestations of Preeclampsia may be seen in fetal placental unit. These include intra uterine growth restriction (IUGR), oligohydraminos, placental abruption, and non reassuring fetal status found on ante-partum surveillance by Doppler ultrasound. **(ACOG committee on obstetric practice, 2002)**

High flow resistance in the capillaries of terminal villi leads to a low end-diastolic velocity in the umbilical artery and a subsequent hypoxia. **(Weiner Z et al., 1994).** And during chronic fetal hypoxia there is continuous reduction of

cerebral vascular resistance resulting in decrease Middle cerebral artery resistance index values gradually **(Mimica M et al., 1995)**

The use of Doppler umbilical wave forms as a fetal surveillance test had gained a wide popularity, especially in high risk cases **(Alfirevic Z, Nelison JP, 1995).** With more advances in Doppler ultrasonography, the fetal cranial circulation became an interesting subject to study, together with the umbilical artery, as it represents the fetal adaptation to changes in circulation **(Divon MY, 1996).**

Considering that C/U RI reflects not only the circulatory insufficiency of the placenta by alteration in the umbilical resistance index, but also the adaptive changes resulting in modification of the middle cerebral artery resistance index.

It seemed to be a potentially useful tool in predicting adverse perinatal outcome in high risk cases. **(Ebrashy A et al., 2005)**

Aim of work

To evaluate the accuracy of middle cerebral/umbilical artery resistance index (C/U RI) ratio in predicting acidemia and low Apgar score at 5 minutes after birth in neonates of women with preeclampsia.

Patient and methods

This study will be performed at El-Galaa teaching maternity Hospital and Ain Shams University hospital, where 100 pregnant women with preeclampsia with or without IUGR will be enrolled in prospective study .

Inclusion criteria

100 pregnant women with viable singleton pregnancies who did not have any obstetric or other morbidity except for preeclampsia.

Preeclampsia will be diagnosed according the criteria of the International Society for the study of hypertension in pregnancy: a previous normotensive woman after the 20th week with

- Diastolic blood pressure measurement of ≥90 mm Hg measured twice or more consecutive occasions ≥4 hours apart.
- Diastolic blood pressure ≥110 mmHg on any one occasion of pregnancy.

Along with protienuria of

- ≥300 mg/L in 24-hour urine or
- Two 'clean-catch-midstream' or catheter specimens of urine collected ≥4 hours apart with ≥1+ on reagent strip.

(13th world congress of the international society for the study of hypertension in pregnancy,2002)

Doppler studies on the middle cerebral artery and the umbilical artery of the fetus of preeclamptic woman should show middle cerebral/umbilical artery resistance index (C/U RI) <1.0 to be included in the study as The middle cerebral/umbilical artery resistance index (C/U RI) cut-off value will be 1.0 only C/U RIs <1.0 will be considered abnormal. **(Arias F., 1994)**

The pregnant woman should not to be in labour and will be delivered by caesarean section for any indication but fetal distress.

All cases will undergo:

- Detailed history
- Full clinical examination including
  A) General examination
  B) Abdominal examination
  C) Pelvic examination
- Laboratory testing including
  A) complete blood count
  B) liver function test
  C) kidney function test
  D) Two 'clean-catch-midstream' or catheter specimens of urine collected ≥4 hours apart.
- Ultrasound for:
  A) Gestational age
  B) Estimated fetal weight (EFW)
  C) Umbilical and middle cerebral resistance index Doppler studies

Gestational age and estimated fetal weight will be determined on the basis of fetal biparietal diameter, abdominal circumference, and femoral length.

All fetal blood pH measurement will be done within 5 minutes of delivery. Apgar scores will be determined at 5 minutes after birth.

Neonatal morbidity will be established if

- Apgar score<6 at 5 minutes
- Neonatal academia of pH<7.2
- Newborn will be admitted to the neonatal intensive care unit (NICU).

Results

The results will be tabulated and will be statistically analyzed

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Introduction

Pre-eclampsia is a pregnancy-specific syndrome. The reported incidence of Pre-eclampsia is 5-8%. ***(Cunningham FG et al., 2001)*** This condition is a leading cause of maternal mortality and is responsible for considerable perinatal morbidity and mortality. ***(Lewis G & Drife J, 2001)***

The signs of pre-eclampsia are best considered as secondary to an uteroplacental disorder, affecting specific maternal target organs. The target organs include the maternal cardiovascular, renal, coagulation and hepatic systems. ***(Redman CW, 2002)***

Pre-eclampsia is characterized by failure of trophoblast invasion into the myometrium and the maternal spiral arteries do not undergo their physiological vasodilatation. ***(Brosens IA,1977)*** The diminished dilatation of spiral arteries is associated with increase resistance in the utero-placental circulation and an impaired intervillous blood flow probably results in an inadequately perfused placenta. ***(Roberts JM et al., 1989)***

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The use of Doppler umbilical wave forms as a fetal surveillance test had gained a wide popularity, especially in high risk cases. ***(Alfirevic Z & Nelison JP, 1995)*** With more advances in Doppler ultrasonography, the fetal cranial circulation became an interesting subject to study, together with the umbilical artery, as it represents the fetal adaptation to changes in circulation. ***(Divon MY, 1996)***

Considering that MCA RI/UA RI ratio reflects not only the circulatory insufficiency of the placenta by alteration in the umbilical resistance index, but also the adaptive changes resulting in modification of the middle cerebral artery resistance index.

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Aim of work

To evaluate the accuracy of middle cerebral/umbilical artery resistance index (C/U RI) ratio in predicting acidemia and low Apgar score at 5 minutes after birth in neonates of women with pre-eclampsia.

Pre-eclampsia

Pre-eclampsia is a pregnancy-specific syndrome. This condition is a leading cause of maternal mortality and is responsible for considerable perinatal morbidity and mortality. ***(Lewis G & Drife J, 2001)***

Pre-eclampsia and eclampsia have been recognized as a clinical entity since the times of Hippocrates. ***(Walker JJ, 1998)***

History:

The word eclampsia dates from the 17th century. It is derived from a Greek word meaning ' to shine forth ' because of the visual phenomenon accompanying the condition. The associated seizures were believed to be due to blood poisoning or toxins derived from the pregnancy; hence it was termed toxaemia of pregnancy. Modern scientists attempted to explain the disease process based on observed patho-physiological changes.

Alexander Hamilton (1781) described eclampsia as a condition associated with seizures. Bright in 1827 recognized albuminurea in addition, dropsy, relating it to renal disease and eclampsia. In 1896 when the sphygmomanometer was invented, arterial hypertension was found associated with eclampsia. Uteroplacental ischaemia and infarction reduction in maternal uteroplacental blood flow and uterine distension leading to hypertension and Protienuria through utero-renal

reflex all have been implicated in pre-eclampsia. ***(Breger et al., 1963)***

Later, with the advancement of science, the emphasis was laid more on genetic, haematological, biochemical, hormonal and immunological explanations. ***(Davey DA, 1986)***

Pathophysiology:

Pre-eclampsia has been dubbed the "disease of theories" because of the multiple hypotheses proposed to explain its occurrence. It is recognized that abnormal placentation and placental vascular insufficiency are core features of pre-eclampsia, Among the many proposed causes are immunologic derangements (a maternal immune reaction to paternal antigen in the placenta), genetic factors, increased insulin resistance (and associated elevations in the levels of insulin, free fatty acids, and triglycerides), dietary calcium deficiency, increased oxidative stress, and prostaglandin imbalance (an increased ratio of thromboxane levels to prostacyclin levels). Pre-eclampsia is likely to be multifactorial in origin, and characteristics of the mother and the placenta may interact to lead to its development. ***(Solomon G & Selly E, 2004)***

Any satisfactory theory on the pathophysiology of pre-eclampsia must account for the observation that hypertensive disorders due to pregnancy are very much more likely to develop in the woman who:

1. Is exposed to chocrionic villi for the first time.
2. Is exposed to superabundance of chorionic villi, as with twins or hydatidiform mole.
3. Has preexisting vascular disease.
4. Is genetically predisposed to hypertension developing during pregnancy**.** ***(Cunningham FG et al.,2005)***

Endothelial cell dysfunction:

Recent research has focused on endothelial dysfunction as a central abnormality in pre-eclampsia. ***(Solomon G & Selly E, 2004)***

In pre-eclampsia the maternal syndrome is surprisingly variable, in time of onset, speed of progression and the extent to which it involves different systems. It can cause hypertension, renal impairment and proteinuria, hepatic dysfunction, jaundice, abdominal pain, disseminated intravascular coagulation (DIC) and convulsions (see table no.1). Until recently it was impossible to explain this astounding variability by a single underling pathological process; certainly hypertension could not account for all these features. ***(Redman C, 2002)***

But the concept that the maternal endothelium is the target organ for the pre-eclampsia process has resolved this difficulty ***(Roberts et al. 1989)***. In short the maternal syndrome can be explained if it is seen, not as a hypertensive