

**Fetal doppler ultrasound findings in preeclamptic women attending antenatal services  
at Muhimbili national hospital**

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DEPARTMENT OF RADIOLOGY**



**FETAL DOPPLER ULTRASOUND FINDINGS IN PREECLAMPITIC WOMEN  
ATTENDING ANTENATAL SERVICES AT MUHIMBILI NATIONAL HOSPITAL**

**By;**

**Mussa Ally**

**A Dissertation Submitted in Partial Fulfillment of the Requirement for the Degree  
of Master of Medicine (Radiology) of the  
Muhimbili University of Health and Allied Sciences  
October, 2017**

**CERTIFICATION**

The undersigned certifies that she has read and hereby recommends for acceptance by Muhimbili University of Health and Allied Sciences for the dissertation entitled, “*Fetal Doppler Ultrasound findings in Preeclamptic Women attending Antenatal Services at Muhimbili National Hospital* ”, in (partial) fulfillment of the requirements for the degree of Master of Medicine-Radiology of Muhimbili University of Health and Allied sciences.

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**Dr. Zuhura Nkrumbih**

Supervisor

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Date

**DECLARATION AND COPYRIGHT**

**I, Mussa Ally,** declare that this **dissertation** is my own original work and it has not been presented and will not be presented to any other University for similar or any other degree award

**Signature**.....

**Date**.....

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## **DEDICATION**

This dissertation is dedicated to the memory of my late Father, Mzee Mussa Nyankongo Makori.

## ABSTRACT

**Background:** Preeclampsia (PE) is among the leading causes of maternal and fetal morbidity and mortality. Developing countries are more affected, Tanzania being among them. We need more efforts to study this area in order to improve maternal and fetal wellbeing. Doppler Ultrasound to pregnant women attending maternity services was the screening method used.

**Objective:** Fetal Doppler Ultrasound findings in Preeclamptic Women attending Antenatal Services at Muhimbili National Hospital.

**Material and Methods:** Cross sectional hospital based study was conducted from July 2016 to December 2016 involving 143 pregnant women at MNH. The consented candidates from 20weeks of gestation to term were included in the study. Structured, close ended questionnaires were used to get patient information and fetal Grey scale and Duplex color Doppler ultrasound were used to obtain biophysical profiles and Doppler / indices.

**Results:** The candidates were aged between 16 and 42years, with the mean age of 29years. Among them the majority were married 82.5%, primary education 54.5% and 44.1% were self-employed. Preeclampsia affected 15.4% of the candidates. The age group more affected was between 20-35years. The risks for preeclampsia were previous Preeclampsia 22.7%(P-value 0.002) and family history of hypertension 63.6%(P-value 0.0001). The history of previous abortion carries 31.8%(P-value 0.175) in patients with preeclampsia but not statistically significant.

The results showed that, there were statistically significant alteration of Doppler indices in preeclampsia. The percentage shown below indicate the patients who showed a particular named alteration in Doppler studies: Umbilical artery pulsatility index(UAPI) 36.4%, Umbilical artery resistive index(UARI) 31.8%, Middle cerebral artery index(MCARI) 54.5%, MCA/UAPI 27.3%, MCA/UARI 31.8%.The low birth weight accounts 20% of the total births. There was statistically significance association between abnormal Doppler indices alteration and Low birth weight, UAPI,UARI,MCARI and MCARI,in which the number of patients

were 42.2%,42.9%,71.4% and 57.1% respectively( P-Value 0.0001) also MCAUAPI 32.1% and MCAUARI 35.7%.The Systolic/diastolic ratio( SD ratio) was increasing with gestational age.

Among the Preeclampsia women studied 18.2% fetuses experienced Absent end diastolic velocity(AEDV) and 4.6% Reverse flow pattern, which indicates high level of hypoxia (placental insufficiency). These fetuses were born prematurely and all had low birth weight.

**Conclusion:** The Prevalence of Preeclampsia was 15.4% among pregnant women attending MNH which is higher compared to other places. Factors related to Preeclampsia were previous preeclampsia and family history of preeclampsia. Umbilical artery Doppler indices were more affected than MCA indices in Preeclampsia, however alteration of MCA indices were much more related to low birth weight.

**Recommendation:** Doppler Ultrasound Scanning should be one of the basic investigation in the antenatal care services, particularly in high risk pregnancies.



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**LIST OF ABBREVIATIONS**

MNH	Muhimbili National Hospital
BP	Blood Pressure
WHO	World Health Organisation
MCA/UARI	Middle Cerebral Artery/Umbilical Artery Resistance Index
MCA/UAPI	Middle Cerebral Artery/Umbilical Artery Pulsatility Index
IUGR	Intrauterine Growth Restriction
MCA	Middle Cerebral Artery
NICU	Neonatal Intensive Care Unit
PI	Pulsatility Index
RI	Resistance Index
S/D ratio	Systolic/Diastolic Ratio
SGA	Small for Gestational Age
UA	Umbilical Artery
USG	Ultrasonography
MDG	Millenium Development Goal
DM	Diabetic Mellitus
BMC	Bugando Medical Centre
HT	Hypertension
PIH	Pregnancy Induced Hypertension
AEDV	Absent End Diastolic Velocity
PO <sub>2</sub>	Partial Pressure of Oxygen
FL	Femur length
BPD	Biparietal diameter
HC	Head circumference
AC	Abdominal circumference
EFW	Estimated fetal weight
RCH	Reproductive and Child Health
ANC	Antenatal Clinic

## DEFINITION OF TERMS

**Eclampsia**- refers to the onset of convulsions in a woman with preeclampsia that cannot be attributed to other causes.

**Preeclampsia**- is defined as a blood pressure of at least 140mmHg systolic pressure and 90mmHg diastolic pressure measured on two occasions 6 hours apart, accompanied by proteinuria of at least 300 mg per 24 hours, or at least 1+ on dipstick testing after 20 weeks.

**IUGR**-Is a condition where a baby's growth slows or ceases when it is in the Uterus.

**Nulliparity** - A woman who has never carried a pregnancy beyond 20weeks in developed countries and 28weeks in developing countries.

**Primiparous** -A woman who has given birth once before.

**Multiparous**- A woman who has given birth two or more times.

**Primigravida**- A woman with a first pregnancy.

**Multigravida**- A pregnant woman who have conceived more than twice.

**Fetal Outcome**-This is perinatal outcome which might have positive or negative effects/impact.

**Positive effect**-Normal baby with appropriate birth weight and Apgar score

**Negative effects/impact**- Prematurity, Low Apgar score/birth asphyxia, IUGR, SGA, perinatal death etc.

**Resistive index (RI)**-Is a measure of pulsatile blood flow that reflects the the resistance to blood flow caused by microvascular bed distal to the site of measurement.

**Pulsatility index** –Is a measure of the variability of blood velocity in a vessel equal to the difference between the peak systolic and minimum diastolic velocities divided by the mean velocity during the cardiac cycle.

## CHAPTER ONE

### 1.0 INTRODUCTION

#### 1.1 Background

Hypertensive conditions such as Preeclampsia complicate 7-10% of all pregnancies. Preeclampsia limits the availability of substrates necessary for growth of the fetus resulting in IUGR manifesting as birth weight less than 2.5 kg<sup>(1)</sup>.

Hypertension is defined as a sustained systolic blood pressure higher than 140mmHg and/or diastolic pressure greater or equal to 90mmHg. Hypertension can also be defined by elevation of systolic blood pressure by 30mmHg above the normal and/or 15mmHg of diastolic blood pressure above the normal. Preeclampsia is defined as a blood pressure of at least 140mmHg systolic pressure and 90mmHg diastolic pressure measured on two occasions 6 hours apart, accompanied by proteinuria of at least 300 mg per 24 hours, or at least 1+ on dipstick testing after 20 weeks<sup>(2)(3)</sup>.

Eclampsia refers to the onset of convulsions in a woman with preeclampsia that cannot be attributed to other causes. The seizures are generalized and may appear before, during, or after labor. It's a serious manifestation that is associated with increased risk of mortality and morbidity in the pregnant women and poor perinatal outcomes<sup>(4)</sup>.

The development of hypertension with proteinuria with or without edema, induced by pregnancy after the 20th week of gestation is a sign of pre-eclampsia. Severe preeclampsia manifests when one or more of the following are present, blood pressure of at least 160/110 mmHg measured on two occasions 6 hours apart, proteinuria of at least 5 g per 24 hours, or at least 3+ on dipstick testing, oliguria of less than 500 ml per 24 hours, cerebral or visual disturbances, pulmonary edema or cyanosis, Epigastric or right upper quadrant pain, impaired liver function, thrombocytopenia, or fetal growth restriction<sup>(5)(7)(8)(9)</sup>.

### **Causes of Preeclampsia**

Etiology of hypertensive disorders of pregnancy remains unknown. Currently plausible potential causes include the following abnormal trophoblastic invasion of uterine vessels (in normal implantation uterine vessels undergo remodeling and invaded by endovascular trophoblasts), immunological intolerance between maternal and fetoplacental tissues, maternal maladaptation to cardiovascular or inflammatory changes of normal pregnancy, dietary deficiencies and genetic influences<sup>(3)(5)(6)(7)(8)</sup>.

### **Risk factors/indicator for preeclampsia**

The risk factors associated with pre-eclampsia/eclampsia include nulliparity, extremes of age (<20 and >35 years), essential hypertension, positive family history of hypertension, multiple pregnancies, low socio-economic status, history of previous pre-eclampsia, obesity, illiterate, low educational level, housewife, single<sup>(5)(9)(10)(11)(12)</sup>.

The incidence of pre-eclampsia/eclampsia in hospital practice varies widely from 5-15%, in primigravidae is about 10% and in multigravida 5%. In developing countries, the incidence is expected to be higher; comparative low figures are reported in the hospital statistics due to inclusion of only severe degrees of the syndrome, the minor being ignored<sup>(5)</sup>.

### **Consequences of Pre-Eclampsia**

Worldwide it is estimated that Maternal Mortality caused by Preeclampsia/Eclampsia ranges between 50000-100000 yearly, majority being from limited resource countries which have low standard of health care<sup>(2)(13)</sup>. The Maternal Mortality in UK and Nigeria is 1.8% and 43.1% respectively<sup>(14)</sup>. The prevalence of Eclampsia in MNH is high ( $\approx 6\%$ ) and the case fatality of 5.1%<sup>(13)</sup>. The Morbidity caused by Eclampsia/Preeclampsia can lead to acute renal failure, pulmonary oedema, cardiopulmonary arrest, aspiration ultimately death.

Perinatal mortality from eclampsia is reported to be 5% - 11.8% in developed countries and higher in developing nations such as Tanzania which is approximately 40%<sup>(14)</sup>.

The causes of perinatal death are chronic placental insufficiency, preterm delivery, and placental abruption<sup>(1)</sup>.



**Diagnosis of preeclampsia**

The current practice of antenatal care is insufficient as a prevention strategy for eclampsia/preeclampsia in a low-resource setting with high incidence of eclampsia/preeclampsia<sup>(15)</sup>. Routinely Preeclampsia is diagnosed by using BP machine for measuring Blood pressure and Dipstick for proteinuria which detects it in late stages. The use of Doppler Ultrasound for screening Preeclampsia pregnancies is becoming a routine practice. It can detect Preeclampsia earlier before adverse effects start on the mother and fetus<sup>(1)</sup>.

**Management**

Management of pre-eclampsia involves aggressive control of the raised blood pressure and prevention of the seizures. Commonly used antihypertensive are methyldopa, nifedipine and hydralazine<sup>(3)</sup>.

Anticonvulsants used for controlling/preventing seizures is magnesium sulphate the recommended standard regime. There is documented support that magnesium sulphate reduces maternal death and maternal morbidity<sup>(3)(15)</sup>.

## 1.2 Literature Review

Worldwide preeclampsia (PE) is the first cause of maternal mortality, intrauterine growth retardation (IUGR), and fetal prematurity. PE affects 5-10% of pregnancies and is clinically manifested after 20 weeks of gestation<sup>(16)</sup>.

Maternal age has been proved to be one of the important factor for the development of preeclampsia, particularly for the extremes of age less than 20 and above 35 years<sup>(9)(17)(18)(19)</sup>.The study done in Canada showed the rates of Preeclampsia was increasing with age<sup>(20)</sup>.In other studies conducted in America and India it was found that age was not a determining factor for the development of Preeclampsia<sup>(21)(22)</sup>.

Null parity has been confirmed as a risk factor for preeclampsia. Pregnancy exerts a protective effect against the risk of preeclampsia which may have an immunological basis. Among nulliparous women, the risk of preeclampsia is increased with history of abortion, changed paternity and high body mass index<sup>(10)(18)</sup>.

A prior birth confers a strong protective effect against Preeclampsia, whereas a prior abortion confers a weaker protective effect<sup>(18)</sup>. In a study conducted in Indonesia revealed that nulliparous women have 1.78 increased risk of Preeclampsia compared to Prim parous women<sup>(10)</sup>.In Pakistan it was found that the risk of Preeclampsia was 26% in nulliparous patients versus 17% in parous subjects<sup>(18)</sup>.

In the studies done in USA it was found that multiparous women are 0.6 times less likely to develop preeclampsia compared to prim parous women<sup>(23)</sup>.Another study done in Tanzania showed the majority of patients with preeclampsia were primigravida 60.5% and multiparous accounted 39.5%<sup>(24)</sup>. Contrary to the above findings the study done in Tokyo Japan showed that the majority of pregnant mothers suffered from preeclampsia were multiparous which accounted 57% of the patients.

It was shown that the change of sexual partner and if the mother is not living with the baby's father increased the risk of developing Preeclampsia<sup>(10)(23)(25)(26)(27)</sup>.In a study conducted in Argentina showed that a woman's marital status was not associated with the increased risk of

the development of preeclampsia<sup>(28)</sup>. A prior birth confers a strong protective effect against Preeclampsia, whereas a prior abortion confers a weaker protective effect<sup>(18)</sup>.

A study done in Jakarta Indonesia showed that women with lower education have greater risk of developing Preeclampsia when compared to women with middle and high education<sup>(10)</sup>.

A study conducted in Iran showed a significant relationship was found between education level and preeclampsia so that the risk of preeclampsia increased 4 times in illiterates women compared to women with Academic education<sup>(9)</sup>. A study conducted in Uganda showed women with low level of education had 1.7 times risk of developing preeclampsia<sup>(12)</sup>.

In a study done in Jakarta Indonesia showed that unemployment and being a housewife have increased risk of developing preeclampsia<sup>(10)</sup>. Although in another study conducted in Iran showed that there is no association between occupation and development of preeclampsia<sup>(9)</sup>.

There are many risk factors which have been associated with the development of Preeclampsia namely Previous PE, Essential hypertension, family history of hypertension, Obesity, Cigarette smoking, Alcohol consumption, Late Antenatal attendance and irregular attendance, Fetal malformations, Cardiac, Renal disease<sup>(9)(12)(17)(23)(29)</sup>.

Several research studies done in different Countries have shown that in patients with Preeclampsia more than 50% have elevated S/D ratio, PI and RI indices. Other findings include absence or reversal of end diastolic blood flow<sup>(16)(30)(31)(32)(33)(34)</sup>. Also, several studies have shown MCAPI in the second trimester for most of Preeclamptic patients is normal but it decreases in some patients during the third trimester<sup>(16)(32)(35)(36)(37)</sup>.

Umbilical artery pulsatility index, resistance index and S/D ratio increase in preeclampsia and these changes tend to be greater in severe preeclampsia. These factors have worse fetal outcome namely low birth weight, low Apgar score and higher ICU admission, the cut-off values were 0.98 for PI and 0.64 for RI Index<sup>(31)</sup>.

A number of studies showed that Middle cerebral artery indices are mostly normal because of Brain sparing effect<sup>(32)(36)(37)</sup>.

### 1.3 Problem Statement

Worldwide pre-eclampsia (PE) is the first cause of maternal mortality, intrauterine growth retardation (IUGR), and fetal prematurity. PE affects 5-10% of pregnancies and is clinically manifested after 20 weeks of gestation <sup>(7)</sup>.

The incidence of pre-eclampsia/eclampsia in hospital practice varies widely from 5-15%, in primigravidae it is about 10% and in multigravida 5% <sup>(3)</sup>.

In case of Bugando Hospital preeclampsia causes Maternal and Perinatal case Fatality of 7.895% and 20.73% respectively(14). At MNH maternal case fatality rate for Eclampsia is 5.1% <sup>(13)</sup>.

Pre eclampsia can be detected by measuring blood pressure, urine for protein and even doing Doppler ultrasonography. Doppler ultrasound is more sensitive and specific in detecting pre eclampsia even before it is detected by BP machine and dipstick<sup>(1)</sup>.

Currently in our setting Investigations used for diagnosing Preeclampsia/Eclampsia are BP machine for blood pressure and dipstick for proteinuria. Hence there is limited experience in the use of Doppler ultrasound to detect pre eclampsia other pregnancy adverse outcome<sup>(1)</sup>.

#### **1.4 Rationale**

Ultrasound is a noninvasive relatively cheap, available almost in every district hospital in Tanzania. It became part of routine Antenatal surveillance in Obstetrics during the past decade.

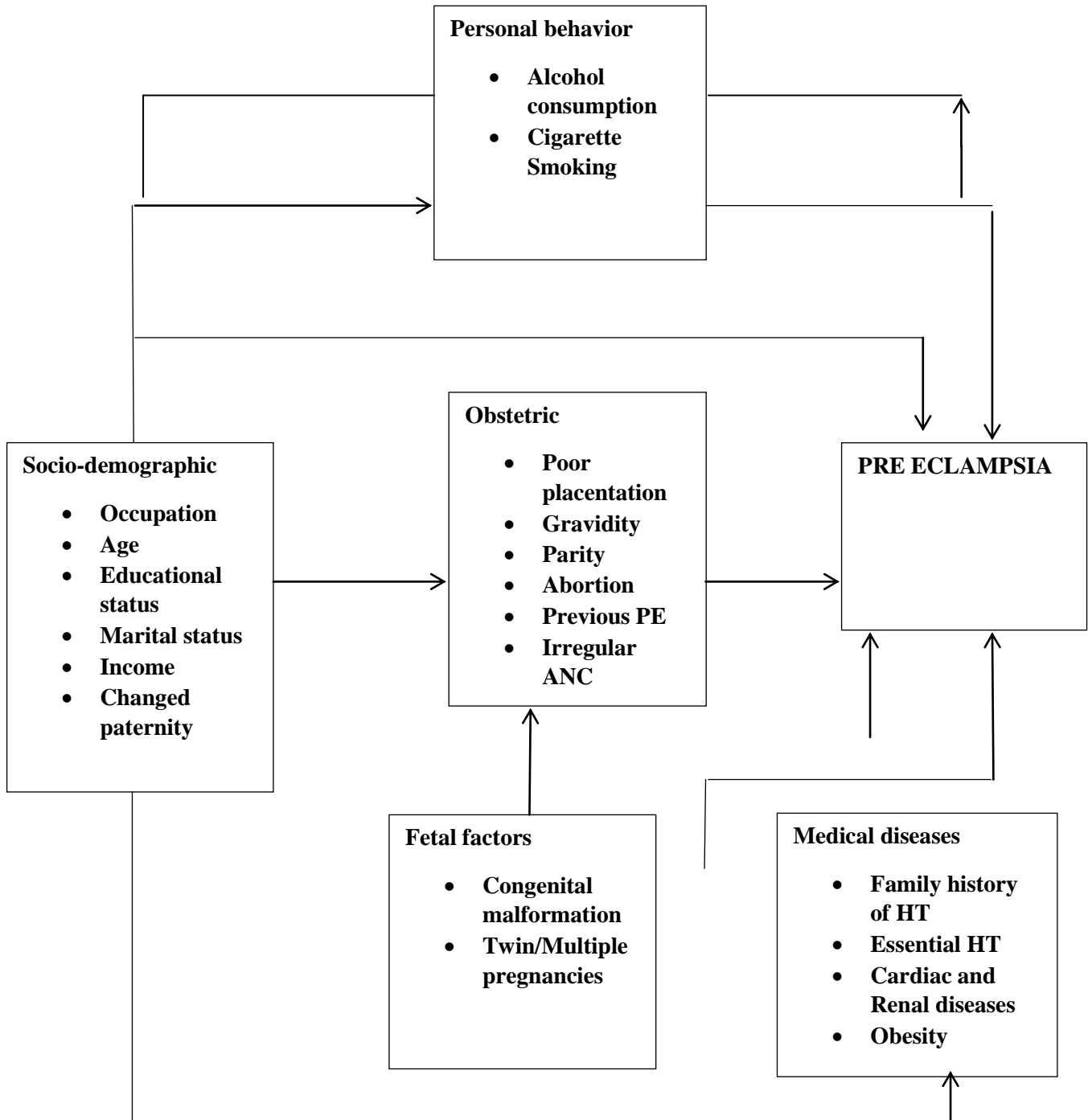
In Muhimbili obstetric department, Ultrasound and Doppler ultrasound equipment are primarily used for anatomical screening and biophysical profile assessment. Blood flow measurement in the uteroplacental vessels in order to screen for high risk pregnancies has not become a routine practice yet.

The introduction of Doppler screening methods to distinguish low and high risk pregnancies is desirable, for complementing the existing investigations of BP for blood pressure and dipstick for proteinuria.

This research work is also a requirement as part of the partial fulfillment of my studies in Master of Medicine degree program in Radiology and Imaging.

## 1.5 Conceptual Frame Work

Risk factors/indicators for developing preeclampsia



## **1.6 Research Questions**

1. What are the demographic characteristics among pregnant women attending maternal service?
2. What is the Prevalence of preeclampsia among patients attending maternal services?
3. What are the risk indicators among patients with pre-eclampsia/Eclampsia?
4. What are the Doppler indices among patients attending maternal services?
5. What is relationship between Doppler indices and fetal outcome among patients attending maternal services?

## **1.7 Objectives**

### **1.7.1 Broad objective**

Fetal Doppler Ultrasound findings in Preeclamptic Women attending Antenatal Services at Muhimbili National Hospital Dar- es-salaam Tanzania from July to December 2016.

### **1.7.2 Specific objectives**

1. To examine Socio-demographic characteristics among pregnant women attending Antenatal services at MNH from July to December 2016.
2. To determine the prevalence of Preeclampsia among Pregnant women attending Antenatal services at MNH from July to December 2016.
3. To examine the risk indicators for preeclampsia among pregnant mothers attending Antenatal services at MNH from July to December 2016.
4. To examine the fetal Doppler Ultrasound of Umbilical and Middle Cerebral arteries indices in Preeclamptic women attending Antenatal services at MNH from July to December 2016.
5. To examine the relationship between Doppler Ultrasound indices and fetal weight among pregnant women attending Antenatal services at MNH from July to December 2016.

## **CHAPTER TWO**

### **2.0 RESEARCH METHODOLOGY**

#### **2.1 Study design**

This was a Cross-sectional hospital based study.

#### **2.2 Study duration**

This was conducted from July 2016 December 2016.

#### **2.3 Study area**

The study was conducted at Maternity Blocks of Muhimbili National Hospital, used Obstetric Ultrasound unit; candidates were obtained from Antenatal wards and clinics. MNH is the biggest government hospital in Tanzania and it receives referrals from all over the country. The hospital serves as a teaching hospital for MUHAS.

The hospital has eight obstetric wards located within two maternity blocks. It runs five maternity clinics every week, namely Firm I, Firm II, Firm III, Firm IV and IPPM. From Medical Records, it is shown that about 600 pregnant women are attended per week.

The Radiology and Imaging Department of Muhimbili National Hospital is well equipped with almost all Imaging modalities namely Radiography, Fluoroscopy, Ultrasound, MRI and CT units. There are 8 Radiologists ,32 Radiographers and 15 supporting staffs. Almost 2million patients are attended in the Department annually.

#### **2.4 Study population**

The study included pregnant mothers attending Antenatal services at Obstetric and Gynecological Department within the study period who consented.

##### **2.4.1 Inclusion criteria**

Pregnant Mothers at Obstetric Department /ANC with equal or more than 20 weeks gestation age who consented to participate in the study.



### 2.4.2 Exclusion criteria

Pregnant mothers who attended Antenatal services but too sick to participate in the study.

### 2.5 Patients involved

All pregnant mothers who fulfilled inclusion criteria and signed the consent form.

### 2.6 Sampling technique

Convenience sampling method was used where all patients meeting inclusion criteria and consented were included. The total of 143 candidates were obtained and scanned within the specified period.

### 2.7 Sample size

The sample size was calculated from Fisher's formula;

$$n = Z^2 P (1-P) / E^2$$

Where: n= sample size,

$$Z = (1.96)$$

P = prevalence = 10%. This was the prevalence of Pre eclampsia Worldwide<sup>(16)</sup>.

95% confidence interval will be used.

E = margin error 5%

Therefore  $n = (1.96)^2 \times 0.1 (1 - 0.1) / (0.05)^2 = 138$  Patients

We will sample an extra 5% to account for possible non-response

$$n = 138 + 7(5\% \text{ of } 138)$$

Thus the sample size in this study is **145** pregnant women.

## **2.8 Collection of data, Imaging and Evaluation**

Data were collected through structured questionnaires which were filled by the Principal Investigator or Research assistants. The Research assistants were recruited and trained on overview of the research, how to recruit participants, ethical considerations to ensure quality of data collected to minimize information bias. Questionnaires were given unique codes for confidentiality and were translated into Swahili Language. Data collected included socio-demographics, Risk indicators, Doppler indices and fetal weight, clinical signs and symptoms including, Edema (+-), Severe headache, Abdominal pain, Convulsions/fits and Proteinuria. Risk factors were assessed through inquiring history of previous preeclampsia, diabetes, cigarette smoking, Alcohol consumption, Essential hypertension, family history of hypertension, Obesity, Late Antenatal attendance and Fetal malformation. Sonography was performed by the Principal Investigator.

### **Ultrasound scan**

Ultrasound machine Siemens, KT-LM150XA, Seoul Korea Inc. was used for scanning eligible candidates. Scanning was performed using broadband curvilinear with frequency of 3.5MHZ, which is routinely used at Muhimbili National Hospital.

Fetal Gray scale and Duplex ultrasonography information (data) were evaluated. The Principal Investigator and Consultant Radiologist looked at the Radiological findings and upon reaching consensus the information was recorded. The information recorded included, fetal wellbeing, Doppler indices, fetal weight and BPP in general. The pregnant women were examined at least once before delivery.

Longitudinal, Transverse and Oblique views were obtained while the patient lying in semi recumbent position with left lateral or supine position with head elevated in semi cardiac position to reduce the risk of compressing the IVC, thus compromising venous return.

### **Umbilical Artery Doppler flow measurement**

Flow velocity waveforms from the umbilical cord have a characteristic saw-tooth appearance of arterial flow in one direction and continuous umbilical venous blood flow in the other. The transducer was placed on the mother's abdomen overlying the fetus and was systematically

manipulated to obtain the characteristic waveforms from the umbilical artery and vein, a free floating portion of the cord was identified and the Doppler sample volume was placed over an artery and the vein. The PI, RI and S/D ratio were obtained automatically. The measurements were repeated and finally verified by the Radiologist.

### **Middle cerebral Artery Doppler flow measurement**

A transverse view of the fetal brain was obtained at the level of the biparietal diameter. The transducer was moved towards the base of the skull at the level of the lesser wing of the sphenoid bone. Using color flow imaging, the middle cerebral artery was seen as a major lateral branch of the circle of Willis, running anterolaterally at the borderline between the anterior and the middle cerebral fossae. The pulsed Doppler sample gate was then placed on the middle portion of the vessel to obtain flow velocity waveforms using an angle of insonation which was less than  $10^\circ$ . The PI, RI and S/D ratio were obtained automatically. The measurements were repeated and finally verified by the Radiologist.

### **Fetal weight measurement**

The Estimated Fetal Weight (EFW) was obtained by a combination of BPD, HC, AC and FL. These measurements were fed into the Ultrasound machine computer, after computation it gives out the estimated fetal weight (EFW) in grams.

## **2.9 Data analysis**

Data analysis was done using the Statistical Package for Social Sciences (SPSS) version 20. Analyzing the data focusing on the Socio-demographic factors, Risk factors, Ultrasonographical findings (Grey scale and Doppler Indices). The analyzed data presented by using cross tabulations, graphs for easy understanding, interpretation and for discussion. The participant's analyzed results on demographics and an outcome variable was summarized using descriptive summary measures, Mean (SD) for continuous variables and percentage for categorical variables. The chi-square test was used for measuring the strength of association between variables, with a p-value of  $< 0.05$  considered statistically significant. The Linear Regression was used to check for Confounding factors in the risk factors category.

### **2.10 Ethical consideration**

The Ethical clearance was obtained from MUHAS-1RB (Institutional Review Board) and permission to conduct the study in the Obstetric department at ultrasound unit was obtained from the Director of research of MNH. An informed consent (verbal and written) was provided to patients. Confidentiality was observed during interview and when performing Obstetric ultrasound in the Ultrasound Room. Patients' information's by using code numbers, images and Data were handled confidentially and stored in a secured place.

### **2.11 Disposal of study patients and results**

All results obtained from the study will be readily available to the obstetricians and radiology staffs. The final report is submitted to the Muhimbili University of Health and Allied science as part of the fulfillment for the award of the Master of Medicine in Radiology. Later on, presentation at the conferences and publication in a scientific Journal with the assistance from the supervisor.

### **2.12 Study Limitation**

Being hospital based, the findings of this study cannot be generalized to the general population.

## **CHAPTER THREE**

### **3.0 RESULTS**

#### **3.1 Socio-demographic characteristics**

The number of pregnant mothers who participated in this study was 143, their mean age was 28.86 years old, with a range 26-42) years and standard deviation of 5.8. The mean age of preeclampsia women was 27.6 years, with a range of 18-37 years.

The Pregnant women with Preeclampsia were 22(15.4%)

The low birth weight babies were 28(19.5%).

**Table 1: Percentage distribution of preeclampsia showing Age, Marital status, Education level and Occupation**

		Preeclampsia			P value (Pearson's $X^2$ ) at 95%CI
		Yes	No	Total	
Patient Age Group	Below 19	1 (4.5%)	3 (2.5%)	4 (2.8%)	0.3000
	20-35	18 (81.8%)	99 (81.8%)	117 (81.8%)	
	36+	3 (13.7%)	19 (15.7%)	22 (15.4%)	
	Total	22 (100.0%)	121 (100.0%)	143 (100.0%)	
Marital status	Married	17 (77.3%)	101 (83.5%)	118 (82.5%)	0.602
	Cohabiting	4 (18.2%)	11 (9.1%)	15 (10.5%)	
	Single	1 (4.5%)	8 (6.6%)	9 (6.3%)	
	Widow	0 (0.0%)	1 (0.8%)	1 (0.7%)	
	Total	22 (100.0%)	121 (100.0%)	143 (100.0%)	
Education level	No formal education	0 (0.0%)	7 (5.8%)	7 (4.9%)	0.123
	Primary education	17 (77.3%)	61 (50.4%)	78 (54.5%)	
	Secondary education	3 (13.6%)	32 (26.4%)	35 (24.5%)	
	Higher education	2 (9.1%)	21 (17.4%)	23 (16.1%)	
	Total	22 (100.0%)	121 (100.0%)	143 (100.0%)	
Occupational	Unemployed	1 (4.5%)	4 (3.3%)	5 (3.5%)	0.962
	Housewife	7 (31.8%)	34 (28.1%)	41 (28.7%)	
	Self- employed/Business	9 (40.9%)	54 (44.6%)	63 (44.1%)	
	Peasant	1 (4.5%)	3 (2.5%)	4 (2.8%)	
	Formal employment	4 (18.2%)	26 (21.5%)	30 (21.0%)	
	Total	22 (100.0%)	121 (100.0%)	143 (100.0%)	

CI = confidence interval (N=143)

Table 1 above shows that most of the Pregnant women with Preeclampsia were under the age group 19 to 35 years old, they were 18 which accounted for 81.8%, married were 17 accounted 77.3%, those with Primary education were 17 accounted 77.3% and self-employed were 9 accounted 40.9% of the Pre-eclamptic women. This data did not show any statistical significance.

### 3.2 Prevalence of Preeclampsia

The Prevalence of pregnant women with preeclampsia was 22(15.4%)

**Table 2: Risk factors for preeclampsia by previous preeclampsia, Abortion, Gravidity and parity**

		Preeclampsia			P value (Pearson's X <sup>2</sup> ) at 95%CI
		Yes	No	Total	
Previous pre- eclampsia	Yes	5 (22.7%)	5 (4.1%)	10 (7.0%)	0.002
	No	17 (77.3%)	116 (95.9%)	133 (93.0%)	
	Total	22 (100%)	121 (100%)	143 (100.0%)	
Abortion	Yes	7 (31.8%)	18 (14.9%)	25 (17.5%)	0.175
	No	15 (68.2%)	103 (85.1%)	118(82.5%)	
	Total	22 (100%)	121 (100%)	143 (100.0%)	
Gravidity	Prim gravida	5 (22.7%)	33 (27.3%)	38 (26.6%)	0.810
	Multigravida	17 (77.3%)	88 (72.7%)	105 (73.4%)	
	Total	22 (100.0%)	121 (100.0%)	143 (100.0%)	

CI = confidence interval (N=143)

### 3.3 Risk indicators for preeclampsia

This results showed that there was significant association between previous preeclampsia and preeclampsia (p=0.002) as shown in table 2 above.

**Table 3: Risk factors for preeclampsia by Essential HT, Family history of HT and BMI**

		Preeclampsia			P value (Pearson's $X^2$ ) at 95%CI
		Yes	No	Total	
Essential HT	Yes	1 (4.5%)	1 (0.8%)	2 (1.4%)	0.172
	No	21 (95.5%)	120 (99.2%)	141 (98.6%)	
	Total	22 (100.0%)	121 (100.0%)	143 (100.0%)	
Family history HT	Yes	14 (63.6%)	18 (14.9%)	32 (22.4%)	0.0001
	No	8 (36.4%)	103 (85.1%)	111 (77.6%)	
	Total	22 (100.0%)	121 (100.0%)	143 (100.0%)	
BMI	Normal weight	4 (18.2%)	36 (29.7%)	40 (27.9%)	0.473
	Over weight	10 (45.5%)	42 (34.7%)	52 (36.4%)	
	Obese	8 (36.3%)	43 (35.6%)	51 (35.7%)	
	Total	22 (100.0%)	121 (100.0%)	143 (100.0%)	

CI = confidence interval (N=143), HT=hypertension, BMI=body mass index

The results showed that the family history of hypertension was significantly associated with preeclampsia 14(63.6%) P=0.0001 as shown in table 3 above.



**Table 4: Doppler Ultrasound of Umbilical and Middle Cerebral arteries indices in preeclampsia**

		Preeclampsia			P value (Pearson's X <sup>2</sup> ) at 95%CI
		Yes	No	Total	
UAPI category	Abnormal	8 (36.4%)	8 (6.6%)	16 (11.2%)	0.0001
	Normal	14 (63.6%)	113 (93.4%)	127 (88.8%)	
	Total	22 (100.0%)	121 (100.0%)	143 (100.0%)	
UARI category	Abnormal (0.7+)	7 (31.8%)	7 (5.8%)	14 (9.8%)	0.0001
	Normal (<0.7)	15 (68.2%)	114 (94.2%)	129 (90.2%)	
	Total	22 (100.0%)	121 (100.0%)	143 (100.0%)	
MCAPI category	Abnormal (<1)	17 (77.3%)	98 (81.0%)	115 (80.4%)	0.686
	Normal (1-1.45)	5 (22.7%)	23 (19.0%)	28 (19.6%)	
	Total	22 (100.0%)	121 (100.0%)	143 (100.0%)	
MCARI category	Abnormal (<0.7)	12 (54.5%)	38 (31.4%)	50 (35.0%)	0.036
	Normal (0.7-0.9)	10 (45.5%)	83 (68.6%)	93 (65.0%)	
	Total	22 (100.0%)	121 (100.0%)	143 (100.0%)	
MCAUAPI category	Abnormal (<1)	6 (27.3%)	4 (3.3%)	10 (7.0%)	0.0001
	Normal (1>)	16 (72.7%)	117 (96.7%)	133 (93.0%)	
	Total	22 (100.0%)	121 (100.0%)	143 (100.0%)	
MCAUARI category	Abnormal (<1)	7 (31.8%)	4 (3.3%)	11 (7.7%)	0.0001
	Normal (1>)	15 (68.2%)	117 (96.7%)	132 (92.3%)	
	Total	22 (100.0%)	121 (100.0%)	143 (100.0%)	

CI = confidence interval (N= 143), UA=umbilical artery, MCA=middle cerebral artery,

PI = pulsatility index; RI = resistive index.

### 3.4 Doppler Ultrasound of Umbilical and Middle Cerebral arteries indices in Preeclampsia

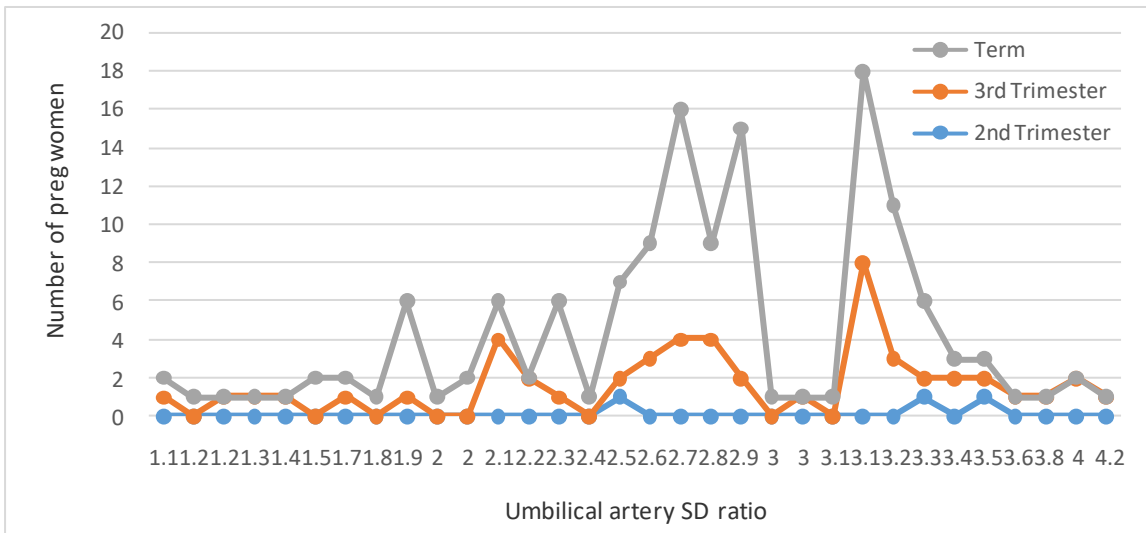
Table 4 above shows that there were significant abnormal resistive and pulsatility indices in the following vessels:

Umbilical artery PI 8(36.4%), P-value 0.0001, RI 7(31.8%) P-value 0.0001

Middle cerebral artery RI 12(54.5%) P-value 0.036

Middle cerebral and Umbilical arteries PI 6(27.3%) P value 0.0001

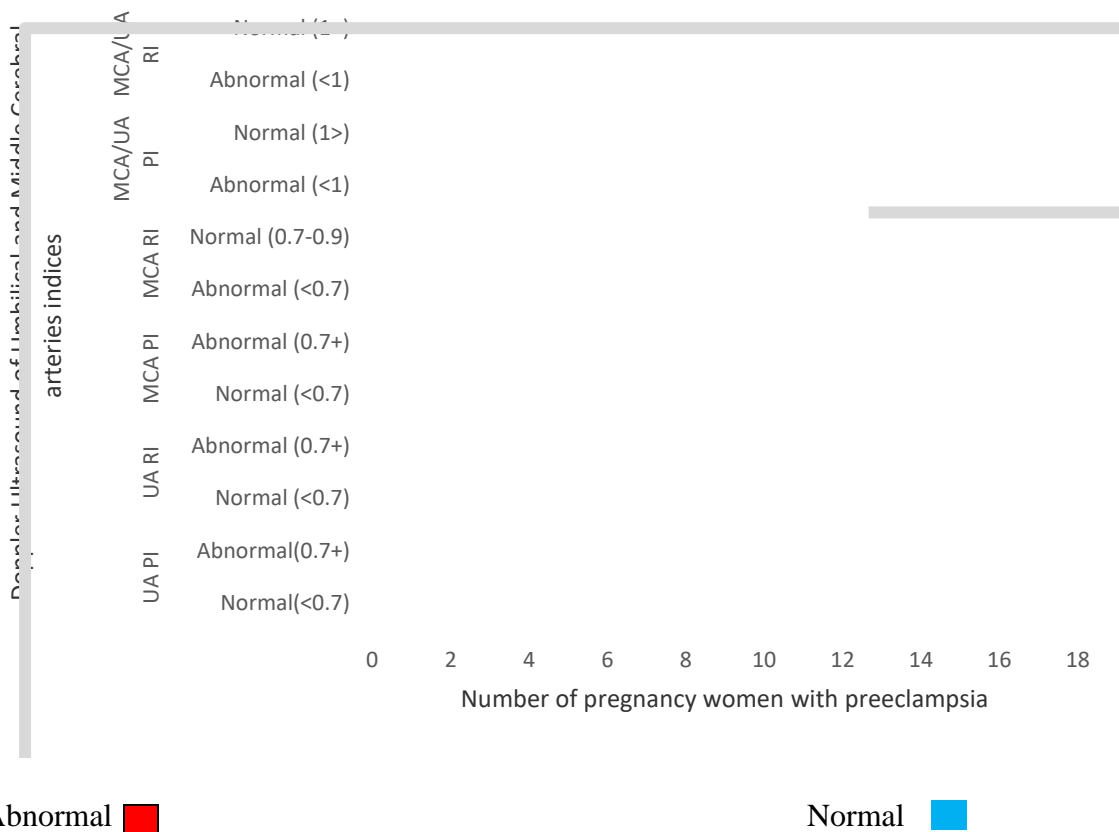
Middle cerebral and Umbilical arteries RI 7(31.8%) P-value 0.0001



**Figure 1: The relationship between umbilical artery SD ratio and gestation age**

This shows that the SD ratio increases with Gestation age

### Doppler indices and Preeclampsia



**Figure 2: Doppler Ultrasound of Umbilical and Middle Cerebral arteries indices in preeclampsia**

These results revealed that the Umbilical artery PI and RI indices are more affected than Middle Cerebral arteries indices as in figure 2 above.

**Table 5a: Umbilical artery flow pattern and preeclampsia**

	Preeclampsia		Total	P value (Pearson's X <sup>2</sup> ) at 95%CI
	Yes	No		
UAD flow pattern	Normal flow	17 (77.2%)	115 (95%)	132 (92.3%)
	AEDV	4 (18.2%)	4 (3.3%)	8 (5.6%)
	Reverse flow	1 (4.6%)	2 (1.7%)	3 (2.1)
<b>Total</b>	<b>22 (100%)</b>	<b>121(100%)</b>	<b>143 (100%)</b>	<b>0.013</b>

CI=confidence interval (N=143), AEDV= absent end diastolic velocity

**Table 5b: Umbilical artery flow pattern and preeclampsia**

		Preeclampsia			P value (Pearson's X <sup>2</sup> ) at 95%CI
		Yes	No	Total	
UAD flow pattern	Normal flow	17 (77.3%)	115 (95.0%)	132 (92.3%)	<b>0.004</b>
	Abnormal flow	5 (22.7%)	6 (5.0%)	11 (7.7%)	
	<b>Total</b>	<b>22 (100%)</b>	<b>121 (100%)</b>	<b>143 (100%)</b>	

#### **Umbilical Artery Flow Pattern and Preeclampsia**

These results showed that there was significant abnormal flow pattern in patients with Preeclampsia 5(22.7%) P value 0.004, more marked in AEDV 4 (18.4%) P=0.013 as show in Table 5 (a) and (b) above.

**Table 6: Doppler Ultrasound of Umbilical, Middle Cerebral arteries indices and birth weight status.**

		Birth weight (kg)			P value (Pearson's X <sup>2</sup> ) at 95%CI
		low birth weight (<2.5)	Normal weight (2.5- 3.9)	Total	
UAPI category	Abnormal	12 (42.9%)	4 (3.5%)	16 (11.2%)	0.0001
	Normal	16 (57.1%)	111 (96.5%)	127 (88.8%)	
	Total	28 (100%)	115 (100%)	143 (100.0%)	
UARI category	Abnormal (0.7+)	12 (42.9%)	2 (1.7%)	14 (9.8%)	0.0001
	Normal (<0.7)	16 (57.1%)	113 (98.3%)	129 (90.2%)	
	Total	28 (100%)	115 (100%)	143 (100.0%)	
MCAPI category	Abnormal (<1)	20 (71.4%)	95 (82.6%)	115 (80.4%)	0.0001
	Normal (1-1.45)	8 (28.6%)	20 (17.4%)	28 (19.6%)	
	Total	28 (100%)	115 (100%)	143 (100.0%)	
MCARI category	Abnormal (<0.7)	16 (57.1%)	34 (29.5%)	50 (35.0%)	0.0001
	Normal (0.7-0.9)	12 (42.9%)	81 (70.5%)	93 (65%)	
	Total	28 (100%)	115 (100%)	143 (100.0%)	
MCAU API category	Abnormal (<1)	9 (32.1%)	1 (8.7%)	10 (7.0%)	0.0001
	Normal (1>)	19 (67.9%)	114 (91.3%)	133 (93%)	
	Total	28 (100%)	115 (100%)	143 (100.0%)	
MCAU ARI category	Abnormal (<1)	10 (35.7%)	1 (8.7%)	11 (7.7%)	0.0001
	Normal (1>)	18 (64.3%)	114 (91.3%)	132 (92.3%)	
	Total	28 (100%)	115 (100%)	143 (100.0%)	

CI=confidence interval (N=143), RI=resistance index, PI=Pulsatility index, MCA=middle cerebral artery, UA=umbilical artery

### 3.5 Doppler Ultrasound indices and fetal outcome

These results showed almost all low birth weight babies had significantly abnormal indices p=0.0001, more detected by MCAPI 20(71.4%) p=0.0001 as shown in Table 6 Above.

## CHAPTER FOUR

### 4.0 DISCUSSION

In Obstetrics, the use of Ultrasound modality is currently more advanced, it goes beyond the simple display of anatomy and Biophysical profile. Ultrasound can currently be used in the detection of adverse pregnancy outcome for example in Pre-eclampsia where Doppler indices and spectral wave forms are used<sup>(33)(38)</sup>.

Preeclampsia is the leading cause of Maternal Mortality, intrauterine growth retardation and Prematurity Worldwide<sup>(16)</sup>. This study looked into the use of Doppler ultrasound for detecting adverse pregnancy outcome including low birth weight in preeclamptic women.

This research included 143 pregnant women who attended Antenatal Clinic and referral cases from the wards. The studied population ranged from 16 – 42 years of age with the mean of 27.6 years, this reflects the reproductive age group. This age range is almost the same as the study which was conducted in Colombia on Doppler ultrasound evaluation in Preeclampsia with the age range of 15-42years<sup>(16)</sup> and another conducted in London on Doppler changes in Preeclampsia with the age range of 21-40years<sup>(30)</sup>.

This study revealed that the big number of patients who were affected by preeclampsia, were in the age ground between 20-35 years (81.8%). This was contrary to other studies, conducted in America which revealed that preeclampsia affects more extremes of age, less than 20years and above 35years<sup>(17)</sup> and the same was seen in study conducted in Pakistan on Epidemiology and risk factors for Preeclampsia<sup>(18)</sup>.

In this study, the prevalence of preeclampsia was 15.4% which is higher compared to the study conducted in Colombia which gave the prevalence of the World as 5-10%<sup>(16)</sup>, also is higher to the study conducted at Bugando Hospital which came out with the prevalence of 7.9%<sup>(24)</sup>. This can be explained by the fact this study was conducted in a tertiary referral Hospital (National Hospital) where most of the complicated cases are referred to.

In this study the risk of developing preeclampsia was seen in previous preeclampsia 22.7% and family history of hypertension 63.2%, which were significantly associated with Preeclampsia, the same was demonstrated by a study conducted in Yerevan, Armenia<sup>(23)</sup> and a study done in Uganda<sup>(12)</sup>.

The study showed that there was significantly abnormally detected Doppler indices almost in all categories in pregnant women with preeclampsia, more in MCARI 54.5% P-value of 0.0001. This is almost similar to a study conducted in France, on Hypertensive pregnancies using internal carotid and umbilical artery indices which demonstrated a sensitivity and specificity of 86% and 98% respectively<sup>(33)</sup>. The reason is that in pathological pregnancies (Hypertensive pregnancies and in IUGR) there is a reduction in placental perfusion and an increase inflow toward the brain, a phenomenon called "Brain sparing effect" which is supposed to compensate for fetal hypoxia.

The study showed that almost all low birth weight babies had significantly altered Doppler indices, more detected in MCAPI 71.4% P-value 0.0001. In this study the low birth weight babies were 19.5% with detected abnormal indices in all categories, mostly in MCAPI (<1) 14%, P-value 0.0001 of the studied clients, this is almost similar to the study conducted in London on Changes observed in Doppler studies of the fetal circulation in Pregnancies complicated by Preeclampsia where small for gestational age (SGA) accounts to 18.9% with abnormal MCAPI (<1) of 16.8% of the studied clients. This means that Doppler indices are able to detect adverse pregnancy outcome including intrauterine growth retardation.

## **CHAPTER FIVE**

### **5.0 CONCLUSION AND RECOMMENDATION**

#### **5.1 Conclusion**

The Prevalence of Preeclampsia was 15.4% among pregnant women attending MNH which is higher as compared to other places. Factors related to Preeclampsia were previous preeclampsia and family history of preeclampsia. Umbilical artery and Middle cerebral arteries indices were more altered in Preeclampsia and low birth weight respectively.

#### **5.2 Recommendation**

I recommend Doppler ultrasound indices to be one of the basic investigations in the antenatal services, particularly in high risk pregnancies.



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## APPENDICES

### Appendix I: Questionnaire

**MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES**

**SCHOOL OF MEDICINE - DEPARTMENT OF RADIOLOGY**

**P.O.BOX 65001 MUHIMBILI**

**DAR ES SALAAM**

**TANZANIA**

**Identity number .....Interviewee initials.....address.....ward.....**

**Phone.....Tribe.....Religion.....Gravidity.....para....Abortion....cause.....**

**Death.....cause.....**

### **PART I**

#### **(i) Presenting symptoms**

- |    |                |              |
|----|----------------|--------------|
| a) | Headache       | 1. Yes 2. No |
| b) | Blurred vision | 1. Yes 2.No  |
| c) | Abdominal pain | 1. Yes 2.No  |
| d) | Oedema         | 1. Yes 2.No  |
| e) | Convulsion     | 1. Yes 2.No  |

#### **(ii) Measurements and investigations**

- |    |                       |
|----|-----------------------|
| a) | Blood pressure .....  |
| b) | Patient weight .....  |
| c) | Patient height .....  |
| d) | Albumin in urine..... |
| e) | Gestational Age.....  |

## 1. Socio-demographic factors

i) **Patient age** .....

ii) **Parity and Gravidity**

a. Nulliparous 1.Yes 2.No

b. Multiparous 1.Yes 2.No

c. Primigravida 1. Yes 2.No

(iii) **Marital status**

a) Married 1.Yes 2.No

b) Cohabiting 1.Yes 2.No

c) Single 1.Yes 2.No

d) Divorced 1.Yes 2.No

e) Widow 1.Yes 2.No

(iv) **Educational level**

a) Illitelite/No formal Education 1.Yes 2.No

b) Primary Education 1.Yes 2.No

c) Secondary Education 1.Yes 2.No

d) Higher Education 1.Yes 2.No

(v) **Occupational**

a) Unemployed 1.Yes 2.No

b) Housewife 1.Yes 2.No

c) Self-employed/Business 1.Yes 2.No

d) Peasant 1. Yes 2.No

e) Formal employment 1.Yes 2.No

## 2. Risk Indicators

- |                                   |            |
|-----------------------------------|------------|
| i) Previous preeclampsia          | 1.Yes 2.No |
| ii) Type of pregnancy             |            |
| a) Single pregnancy               | 1.Yes 2.No |
| b) Multiple pregnancy             | 1.Yes 2.No |
| iii) Smoking                      | 1.Yes 2.No |
| iv) Alcohol drinking              | 1.Yes 2.No |
| v) Diabetes                       | 1.Yes 2.No |
| vi) Essential HT                  | 1.Yes 2.No |
| vii) Family history of HT         | 1.Yes 2.No |
| <br>                              |            |
| <b>(vi) Body weight</b>           |            |
| a) Underweight                    | 1.Yes 2.No |
| b) Normal weight                  | 1.Yes 2.No |
| c) Overweight                     | 1.Yes 2.No |
| <br>                              |            |
| <b>(vii) Antenatal attendance</b> |            |
| First attendance GA.....          |            |
| a) Regular attendance             | 1.Yes 2.No |
| b) Irregular attendance           | 1.Yes 2.No |
| c) (Missing(Never))               | 1.Yes 2.No |
| <br>                              |            |
| <b>(viii) Fetal malformation</b>  | 1.Yes 2.No |





**Appendix II: Dodoso**

CHUO KIKUU CHA TIBA NA SAYANSI SHIRIKISHI-IDARA YA RADIOLOJIA  
 S.L.P 65001-MUHIMBILI  
 DAR-ES-SALAAM  
 TANZANIA

Namba ya Utambulisho ..... Vifupisho vya jina la  
 mtafiti.....Anwani.....wodi.....

**SEHEMU: I**

## (i) Dalali za mgonjwa

- |                      |         |          |
|----------------------|---------|----------|
| (a) Kuumwa kichwa    | 1. Ndio | 2.Hapana |
| (b) Kuona mawilewile | 1.Ndio  | 2.Hapana |
| (c)Kuumwa tumbo      | 1. Ndio | 2.Hapana |
| (d)Kuvimba miguu     | 1.Ndio  | 2.Hapana |
| (e)Kupata degedege   | 1.Ndio  | 2.Hapana |

## (ii) Measurements and investigations (VIPIMO).

- |                                   |                 |
|-----------------------------------|-----------------|
| (a) Msukumo wa damu .....         |                 |
| (b) Uzito wa mgonjwa .....        |                 |
| (c) Urefu wa mgonjwa .....        |                 |
| (d) Protein kwenye mkojo.....     | 1.Ndio 2.Hapana |
| (e) Umri wa mimba kwa Tarehe..... |                 |

## 1. Taarifa za mgonjwa

(i) Umri wa mgonjwa .....

(ii) Taarifa za Uzazi

(a) Hajawahi kujifungua 1.Ndio 2.Hapana

(b) Amejifungua zaidi ya mara moja 1.Ndio 2.Hapana

(c) Mimba ya kwanza 1.Ndio 2.Hapana

(iii) Hali ya ndoa ya mama

(a) Ameolewa 1.Ndio 2.Hapana

(b) Anaishi na mume bila ndoa 1.Ndio 2.Hapana

(c) Hajaolewa 1.Ndio 2.Hapana

(d) Ameachika 1.Ndio 2.Hapana

(e) Mjane 1.Ndio 2.Hapana

(iv) Kiwango cha Elimu.

(a) Hakusoma 1.Ndio 2.Hapana

(b) Elimu ya msingi 1.Ndio 2.Hapana

(c) Elimu ya Sekondari 1.Ndio 2.Hapana

(d) Elimu ya juu 1.Ndio 2.Hapana

## (v) Kazi ya mama mjamzito

- |                           |         |           |
|---------------------------|---------|-----------|
| (a) Hana kazi             | 1. Ndio | 2. Hapana |
| (b) Mama wa nyumbani      | 1. Ndio | 2. Hapana |
| (c) Mjasiriamali/Biashara | 1. Ndio | 2. Hapana |
| (d) Mkulima               | 1. Ndio | 2. Hapana |
| (e) Ana ajira Rasmi       | 1. Ndio | 2. Hapana |

2. Risk indicators/factors (**Vichocheo vya kifafa cha mimba**)

## (i) Kifafa/Dalili za kifafa cha mimba

Kwa mimba iliotangulia	1.Ndio	2.Hapana
------------------------	--------	----------

(ii) **Aina ya mimba**

- |  |         |           |
|--|---------|-----------|
| (a) Mtoto mmoja                                  | 1.Ndio  | 2.Hapana  |
| (b) Mapacha                                      | 1.Ndio  | 2.Hapana  |
| (iii) Uvutaji sigara                             | 1.Ndio  | 2.Hapana  |
| (iv) Unywaji wa pombe                            | 1.Ndio  | 2.Hapana  |
| (v) Kisukari                                     | 1.Ndio  | 2.Hapana  |
| (vi) Shinikizo la damu                           | 1.Ndio  | 2.Hapana  |
| (v) Historia ya shinikizo la damu kwenye familia | 1. Ndio | 2. Hapana |

(vi) **BMI (Uwiano wa uzito na Urefu wa mama)**

- |                                  |         |           |
|----------------------------------|---------|-----------|
| (a) Uzito chini ya kiwango ..... | 1. Ndio | 2. Hapana |
| (b) Uzito wa kawaida .....       | 1. Ndio | 2. Hapana |
| (c)Uzito uliokithiri .....       | 1.Ndio  | 2.Hapana  |



**Appendix III: Consent Form (English Version)****MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES****DIRECTORATE OF RESEARCH AND PUBLICATIONS, MUHAS****ID-NO.....**

Consent to Participate in a Study

My name is Dr. Mussa Ally; I am conducting a study on Role of Doppler Ultrasound in patients with Preeclampsia/Eclampsia at MNH.

**Study Purpose**

The study is conducted as partial fulfillment of the requirements of MMed Radiology at MUHAS. The study is also conducted to establish reference parameters which can be used for diagnosis and follow up in our department.

**How to be involved**

Patients who agree to participate in this study will be required to sign the consent form, then interviewed and investigated after that.

**Confidentiality**

The information obtained from the patient will be confidential. No name will appear on any document of this study instead Identification numbers will be used.

**Participation and right to Withdraw**

Involvement in this study is voluntary. The patient can participate or refuse to participate in this study. Refusal to participate from this study will not interfere with the patient management.

**Benefits**

The information obtained will help us to detect early adverse outcomes among pregnant mothers with Preeclampsia, as well as other associated risk and presenting symptoms. Thus the study outcomes will help to improve patients' management thus improve quality of life.

**Contact Personally**

If you ever have questions about this study, you should contact the Principal Investigator, Dr. Mussa Ally, Muhimbili University of Health and Allied Sciences, P. O. Box 65001, Dar es Salaam, Tel. 0767 235125.

OR in case you have questions about your rights of participation in this study you may contact

**Prof. Said Aboud**, Chairperson of the Senate Research and Publications Committee,

P. O. Box 65001 DSM. Telephone: +255 022 2152489

Dr. Zuhura Nkrumbh who is the supervisor of this study.

Tel. +255 789 384790

Participant agrees .....

I ..... have read the contents in this form. My questions have been answered. I am willing to participate in this study.

Signature of participant .....Date.....

Signature of Researcher .....Date.....

**Appendix IV: Consent Form (Swahili Version)**

CHUO KIKUU CHA SAYANSI ZA AFYA MUHIMBILI

KURUGENZI YA TAFITI NA UCHAPISHAJI

FOMU YA RIDHAA

Namba ya utambulisho ---

**Ridhaa ya kushiriki kwenye utafiti**

Jina langu ni Dr.Mussa Ally nafanya utafiti wenye lengo la kuangalia Umuhimu wa Sonologia ya rangi (Doppler Utrasound) kwa Wajawazito wenye dalili za kifafa cha mimba katika Hopitali ya Taifa Muhimbili.

Madhumuni ya Utafiti huu ni pamoja na kutimiza sehemu ya matakwa ya shahada ya uzamili ya matibabu katika kitengo cha vipimo vya mionzi Chuo Kikuu cha Afya na Sayansi ya Tiba Muhimbili. Hali kadhalika kupata vipimo ambavyo vinaweza kutumika kwenye matibabu ya wajawazito.

**Jinsi ya kushiriki**

Mgonjwa akikubali kushiriki katika utafiti huu, atasailiwa halafu atatakiwa kujibu maswali kutoka kwenye dodoso lililoandaliwa na ataendelea na kipimo kama kawaida.

**Usiri**

Taarifa zote zitakazokusanywa kupitia dodoso hili zitakuwa ni siri. Jina la mgonjwa halitatumika badala yake tutatumia namba ya utambulisho.Uhuru wa kushiriki na haki ya kujitoa

Kushiriki kwenye utafiti huu ni hiari. Mgonjwa anaweza kushiriki au kukataa kushiriki na hii haitamwondole ahaki ya kupata matibabu yake.

**Nani wa kuwasiliana naye**

Kama una maswali kuhusia na na utafiti huu, wasiliana na mtafiti mkuu, Dr. Mussa Ally wa Chuo Kikuu cha Afya na Sayansi ya Tiba Muhimbili, S. L. P. 65001, Dares Salaam. Simu 0767235125



Prof Said Aboud, Mwenyekiti wa kamati ya Utafiti na Uchapishaji, S.L.P 65001,

Dar es Salaam. Simu +255 022 2152489

Au msimamizi wa utafiti huu Dr.Zuhura Nkurumbh. Simu 0789384790.

Kama umekubali kushiriki weka sahihi

Mshiriki nimekubali .....

Mimi..... nimesoma maelezo ya fomu hii nimeyaelewa na  
nimekubali kushiriki katika utafiti huu.

Sahihi ya mshiriki.....

Tarehe ya kutia sahihi.....

Sahihi ya mtafiti.....

Tarehe ya kutia sahihi.....