PLACENTA ABNORMALITIES; SONOGRAPHIC PATTERNS AND ASSOCIATED FACTORS IN PREGNANCY AT MUHIMBILI NATIONAL HOSPITAL.

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By

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A Dissertation submitted in partial fulfillment of the requirements for the Degree of master's in medicine (Mmed Radiology) at

Muhimbili University of Health and Allied Science

October, 2024

CERTIFICATION

The undersigned certifies that he has read and hereby recommends for examination the dissertation entitled “Sonoof placenta abnormalities and associated factors in pregnant women attending Muhimbili National Hospital” in fulfillment of the requirement for the degree of Master of Medicine (Radiology) of Muhimbili University of Health and Allied Sciences.

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(**Supervisor)**

Date: _____

_____

Dr. Flora Lwakatare
(Co-Supervisor)

Date: _____

DECLARATION AND COPYRIGHT

I, **Dr. Samson Nyanda** declares that this **dissertation** is my original work and that it has not been presented and will not be presented to any other University for a similar or any other degree award.

Signature ……. Dates …….

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ABSTRACT

Background. Placenta pathologies are often overlooked and receive attention only when complications arise. In most settings, placenta reporting is often limited to the location and presence of calcification. A complete fetal ultrasound should include a full assessment of the placenta for any possible abnormalities. Placental diseases range from abnormal morphology, size, location, extent, and degree of placentation, to abruption and the presence of rare placental neoplasms of benign or malignant nature. Familiarity with the placenta's normal and abnormal imaging appearance is necessary for the radiologist and physician. Abnormalities of the placenta will lead to poor maternal and fetal outcomes.

Objective: To demonstrate the sonographic patterns and proportions of placenta abnormalities and their associated factors among pregnant women at Muhimbili National Hospital (MNH)

Methodology: A hospital-based cross-sectional prospective study was carried out between January and March 2023 at MNH. Real-time placenta ultrasound findings were taken and documented from all pregnant women who met the inclusion criteria using a standard ultrasound machine with similar optimal settings on each visit until the sample size was reached. A bivariate analysis was performed to find placenta abnormalities associated factors

Results: A total of 220 pregnant women were enrolled in a study. Prevalence of placenta pathologies were 32.7 %, 27.3% and 35.4 % for placenta morphology, placenta parenchyma and placenta maternal surface respectively. Placenta pathologies excluding those related to location and abruption were overlooked in 200 (91.7%) pregnant women. Pathologies related to placenta parenchyma and morphology had a strong association with chronic illness and chronic medication both with $p < 0.001$. Placentomegally was very strongly associated with chronic illness ($p < 0.001$) which was highly associated with fetal complications. Unexplained fetal loss and neonatal death had a strong association with placenta parenchyma pathologies (p -value < 0.001)

Conclusion: There was a high prevalence of placenta abnormalities. Placenta abnormalities patterns should be evaluated documented and followed up in subsequent scans to improve fetal and maternal outcomes.

Recommendation: A study with large sample size will add more value.

A Standardized placenta reporting format based on the reported placenta patterns should be established to ensure practitioner examines and report all possible placenta pathologies

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LIST OF ABBREVIATIONS

IRB **:** Institutional Review Board

MNH **:** Muhimbili National Hospital

MAP **:** Morbidity Adherent Placenta

US **:** Ultrasound

SPSS **:** Statistical Package for Social Science

PIH : Pregnancy Induced Hypertension

DEFINITION OF KEY TERMS

Etiology : the cause, a group of causes, or a method of causation for a symptom or disease

Placenta : A vital organ through which material passes from the maternal circulation to the fetal circulation by passive diffusion or active transport and vice versa.

Pregnancy : a state of having implanted products of conception located either in the uterus or elsewhere in the body that ends through either spontaneous or elective abortion or delivery

Trimester : any of three periods of approximately three months each into which a human pregnancy is divided

Ultrasound : a medical imaging technique where scanners use sound waves at a higher frequency and their returning echoes to generate images of the organs and the physiological processes of the body

Risk Factors : any quality or introduction of a person which increases the probability of getting sickness or damage

Treatment : restorative consideration given to a debilitated individual

Gray scale ultrasonography; Ultrasonography that displays small differences in an acoustical impedance as if they were different shades of gray.

CHAPTER ONE

1.0 BACKGROUND

1.1 Introduction

In order for a fetus to develop and function normally, the placenta is essential. Numerous placental anomalies suggest the potential for fetal impairment in the future and should be viewed as a red flag. Beginning with blastocyst implantation, the placenta develops into the growing fetus's respiratory, excretory, and endocrine organs while also serving as its source of nutrition and immune support. Both maternal and embryonic components are present. The outermost embryonic membrane is where the embryonic part originates. The decidua basalis of the uterus is where the maternal part develops. Although the placental membrane divides the mother's blood from the embryonic blood, it is nevertheless permeable enough to allow for the diffusion and movement of nutrients and waste. A typical placenta measures 22 cm in diameter and has a round or oval shape. A healthy placenta is essential for the smooth growth of the embryo and fetus. It is 2 to 2.5 cm thick and weighs about 0.5 kilograms. [1,2]

An increased risk of antepartum, intrapartum, and postpartum hemorrhage results from placental anomalies. Additionally, they may interfere with maternal or fetal health and placental processes. These abnormalities' etiology is poorly understood, and they are becoming more common, primarily as a result of the increased cesarean section rate. Placenta previa affects 5.2 per 1000 births on average, and it seems to have become more common in tandem with the rise in cesarean sections. 2.7 out of every 1000 pregnancies in Sub-Saharan Africa have placenta previa. 1 in 2,500 to 1 in 5,000 pregnancies result in vasa previa. Seventy-five percent of all placentation disorders are caused by placenta accreta. In high-income countries, the prevalence of placenta anomalies appears to be sharply increasing, and this is likely to be due to similar reasons approximately 5 to 6 percent of pregnancies result in succenturiate lobes, and the prevalence rises with mother age and in vitro fertilization. Less than 1% of gestations experience placental abruption, a common cause of vaginal bleeding in the second part of pregnancy. [3-9]

Other factors for placental abnormalities include increased maternal age, multiparty, previous intrauterine maneuvers (such as hysteroscopy and multiple dilatation and curettage) endometriosis, smoking, and previous placenta previa [2,3].

Placental abnormalities are related to its (i) morphology: succenturiate lobe, circumvallate placenta, placentomegaly, venous lakes, placental infarcts, and intervillous thrombi location, (ii) location: Placenta previa (iii) extent of placentation (morbidity adherent placenta): placenta accrete, increta, and percreta, (iv) abruption: and very uncommonly due to (v) the presence of tumors [1].

These abnormalities can lead to severe maternal and fetal complications such as pregnancy-induced hypertension, fetal growth restriction, or fetal loss. Compromise of fetoplacental circulation is suspected in approximately 20% of stillbirths at the time of autopsy [1].

For diagnosis of these abnormalities, the patient's history is highly relevant. However, the most important measure in decreasing these potentially fatal complications is the prenatal ultrasound diagnosis (2). A methodical sonographic evaluation of the placenta is vital and should include: location, visual estimation of the size, implantation, morphology, and anatomy, as well as a search for anomalies, such as additional lobes and tumors. Multiple gestations require additional assessment of the intervening membranes. [2,10].

US is a widely available diagnostic technique useful for the non-invasive visualization of the uterus, ovaries, and other structures with the ability to produce high-quality imaging. The lack of irradiation is important since the ovaries and fetus are particularly sensitive to radiation in patients of reproductive age. It is necessary to be aware of US limitations such as the operator-dependency, the small field of view, and the altered body habitus of a pregnant woman [11,13].

The incidence of placental abnormalities is increasing, but treatment options and preventive strategies are limited. It is crucial to understand the etiology of placental abnormalities in location and anatomy. Therefore, the purpose of this study was then to describe the sonographic pattern of the placenta in 218 randomly obtained participants in pregnant women attending

Muhimbili National Hospital who consented to the study, with high consideration of he privacy of patient information by using numbers for identification, their social demographic characteristics, maternal conditions, risk factors real-time placenta ultrasound findings obtained was analyzed. Comparison with these results and with what has been reported in other studies was made where a standardized reporting format for placenta evaluation was established.

1.2 Statement of the Problem

The placenta and umbilical cord play important roles in the development of the growing fetus. The placenta can be identified by the 14th gestational week and should be evaluated during each obstetric ultrasound examination. However, it is often overlooked during routine ultrasound evaluations of normal pregnancy [14].

Malformations in development, positioning, and vascularity can have profound implications for both maternal and fetal well-being. Undiagnosed vasa previa is associated with up to a 60% rate of perinatal mortality. Women with placenta previa are at an approximately 10-fold increased risk of antepartum vaginal bleeding [4,15].

Placental adherence, placenta increta and placenta percreta should be strongly suspected when thinning of the myometrium, protrusion of the placenta into the bladder interface, and increased vascularity of the uterine serosal bladder interface are observed

Currently, in most health facilities in the country, there is no agreed standardized placenta reporting format that ensures any sonographer and radiologist explores different important placental predictors which can have profound maternal and fetal outcomes during the prenatal, natal, and postnatal period.

Having knowledge of the placental findings which are predictors of different fetal and maternal conditions will help the obstetrician and gynecologist to plan management or intervene earlier so as to avoid and improve maternal and fetal outcomes.

1.3 Rationale

Understanding the placental abnormalities and their development during implantation can have a profound impact on patient management. To our knowledge, there are no current studies describing the sonographic pattern of placenta abnormalities in pregnant women attending Muhimbili National Hospital henceforth presenting a need to conduct this study.

This study aims to establish a standardized tool for placenta evaluation for multiple conditions to be used in primary, secondary, and tertiary health facilities.

The findings will also demonstrate and emphasize the role and involvement of the sonographer/radiologist in the Maternal and Perinatal Death Surveillance and Response (MPDSR) campaign and quarterly meetings.

Since US scans provide an accurate safe non-invasive diagnosis of the placenta, this study is an eye opener and help early identify and monitor progress of placenta abnormalities and their complication in term of timely intervention hoping to enable clinicians to plan the best management for placenta abnormalities and their complications. Also, it aims to increase awareness and facilitate early diagnosis of these abnormalities to reduce morbidity and mortality.

1.4 Conceptual Framework

The figure below illustrates the conceptual framework that will be used to conduct the study. It comprises five major parameters namely, social demographic data, risk factors, maternal conditions, placental conditions which all interact to affect the maternal and fetal outcome, and the placenta being the major channel of communication, the social demographic may predispose to risk factor and maternal condition which may all lead to placental conditions that will affect the fetal and maternal outcome from manageable condition to mortality if appropriate management was not taken timely.

Shape of the placenta, circumvallate placenta may predispose the mother to increased risk of bleeding, while affecting the fetus and lead to conditions such as low birth weight, Intrauterine growth restriction, oligohydramnios, preterm labor, placenta abruption and perinatal mortality, A succenturiate lobe has increased incidence in placenta infarction and velamentous insertion of the umbilical cord leading to vasa previa, a life threating fetal condition [28, 29, 30].

Premature or accelerated placental calcifications is also associated with several factors including chronic maternal hypertension, pre-eclampsia, intrauterine growth restriction, maternal cigarrate smoking history, [31, 32]

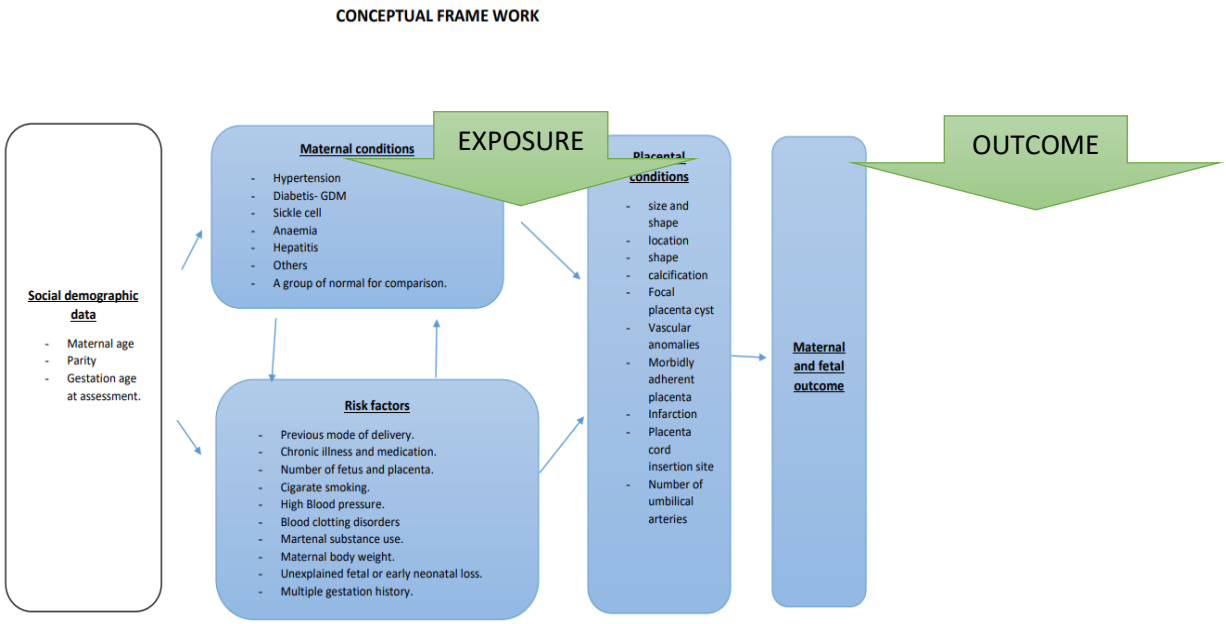
Focal placenta cyst commonly noted after 25 weeks of gestation is associated with pathologies like intervillous thrombus (IVT) and decidual septal cysts, hypoechoic placenta lesion i.e placenta lakes are reported in association with maternal and fetal Rh Incompatibilities, elevated maternal alpha fetal protein and edematous placenta. [33, 34]

The incidence of abnormally invasive placentas increases with the number of previous cesarean deliveries. Maternal morbidity and mortality can occur because of severe and sometimes life-threatening hemorrhage. Ideally, abnormally invasive placentas are diagnosed antepartum, since it may lead to massive hemorrhage that requires emergency peripartum hysterectomy. Antepartum diagnosis with the use of sonography has a sensitivity of 77%-87% and a specificity of 96%, hence early diagnosis is of high value.

Vascular abnormalities may cause placenta infarction which is a localized area of ischemic villous usually taking a triangular appearance with its base along the basal plate, this is associated with post term pregnancies, maternal hypertension and anticardiolipin antibodies, most of the infarction are due to thrombolytic occlusion of uteroplacental artery, early detection of this can help prevent fetal and maternal complications.

Maternal floor infarction associated significantly with fetal risk and are reported to recur in subsequent pregnancies histologically result from massive deposition of fibrin in basal plate encasing the villi which become avascular and necrotic are crucial to diagnose early as in maternal diabetes mellitus may result to fetal artery thrombosis which are associated with maternal coagulation disorder and serve as a marker of coagulation elsewhere in fetal vascular system. (35)

Figure 1: conceptual frame work



1.4.1 Main Research Question

What are the sonographic patterns of placenta abnormalities and associated factors in pregnancy at Muhimbili National Hospital?

1.4.2 Specific Research Questions

i. What are the socio demographic characteristics of pregnant women with placenta abnormalities attending MNH?.
ii. What are the risk factors associated with the placenta abnormalities seen in the pregnant women attending MNH?.
iii. What are the sonographic patterns of placenta abnormalities seen in the pregnant woman attending MNH ?

1.5 Objectives

1.5.1 Broad Objective

To demonstrate the sonographic pattern of placenta abnormalities and their associated factors in pregnancy at Muhimbili National Hospital from January to March 2023

1.5.2 Specific Objectives

i. To determine the socio demographics characteristic of pregnant women with data placenta abnormalities attending MNH from January to March 2023
ii. To determine the risk factors associated with placenta abnormalities in trimester pregnancy at MNH from January to March 2023
iii. To determine the sonographic patterns of placenta abnormalities in pregnancy at MNH from January to March 2023

1.7 Literature Review

Globally, the global prevalence of placenta previa to be 5.2 per 1,000 pregnant women this is according to a study done by a study by J. A. Cresswell et al, although it was highlighted that there is a significant regional variation. whereby the prevalence was highest among Asia studies and lower in Sub-Saharan Africa with variation being accounted for by differences in ethnicity or other unknown factors.

In Sub-Saharan Africa, studies have found the prevalence of placenta previa to be 2.7 per 1000 pregnant women.

In Tanzania, A study done in the Northern Tanzania by Senkoro et al depicted the prevalence of placenta previa to be 0.6%

1.7.1 Demographic Characteristics and Risk Factors

There is a direct correlation between the number of prior cesarean deliveries and the likelihood of placenta previa, as well as maternal age, parity, multifetal gestation, prior elective and spontaneous pregnancy terminations, prior uterine surgery, and prior myometrial scarring. [16].

After one previous cesarean section, the chance of placenta accreta increases fourfold, and after two, the relative risk increases by 11.3 times. Additionally, individuals who have undergone a previous cesarean section and placenta previa implantation are five times more likely to experience placenta accrete[10].

According to Tikkanen's research, placental abruption is highly correlated with maternal and paternal smoking, alcohol usage, placenta previa, pre-eclampsia, and chorioamnionitis. The likelihood of abruption is inversely correlated with the number of cigarettes smoked. The risk of placental abruption was 2.7 times higher in pre-eclampsia than in chronic hypertension or pregnancy-induced hypertension (PIH). When compared to women who had a vaginal first birth, women who had their first child by cesarean delivery have an increased risk of placental abruption in subsequent pregnancies, according to at least two recent population-based retrospective cohort studies [9,17,18].

Risk factors for chronic intervillositis have been identified as maternal diabetes, maternal hypertension, intravenous drug misuse, preeclampsia, and systemic lupus erythematosus.
Asian race, advanced maternal age, and a prior history of gestational trophoblastic illness are the main risk factors for the condition. [1,2,17]

1.7.2 Sonographic Findings

i. Location: Placenta Previa

Placenta previa is characterized by improper placenta implantation in the lower uterine segment, either directly over or close to the internal os of the uterine cervix. The traditional manifestation is painless bleeding in the second trimester. The majority of placenta previa instances present with no symptoms at first and are discovered during a regular ultrasound examination [10,19].

Placenta previa has traditionally been divided into four types: full placenta previa, in which the internal os is entirely encased by the placenta; partial placenta previa, which only happens when the internal os is somewhat dilated and in which the placenta partially covers the internal os; the internal os is only slightly covered by marginal placenta previa, which; Low-lying placenta that reaches the internal os but not the lower uterine section [20].

Transvaginal ultrasound, which offers a clear view of the internal os of the cervix, is the best diagnostic technique for placental previa. The placenta migrates from the internal os over time in around 85% of the pregnancies identified as having probable placental previa during second trimester screening, and at term it is classified as a low-lying placenta. During the ultrasound scan in the first and early second trimester, the placenta's position must be noted. A second ultrasound examination at the start of the third trimester allows for the definitive diagnosis if the placenta is very low. [2,19,21].

ii. Vassa Previa

Vasa previa are fetal vessels that are not covered by the placenta or umbilical cord and that pass through the fetal membranes, over, or close to the endocervical os. On gray scale ultrasonography, typical findings include a straight tubular echolucent body covering the os. [4].

Vasa previa appears as linear echolucent structures overlaying the cervix in grayscale sonography. Pulsed Doppler will show a fetal umbilical arterial or venous waveform, and color or power Doppler can show flow through these veins. To get the fetal presenting portion out of the pelvis, the Trendelenburg posture may be useful. In contrast, when there is a vasa previa, the vessels do not migrate. The majority of vasa previa instances with prenatal diagnoses are found by chance in women undergoing transvaginal sonography for the assessment of **low-lying** placentas. The best diagnostic precision is probably achieved by combining transabdominal and transvaginal ultrasonography. [4,20,22].

iii. Extent of Placentation (Morbidity Adherent Placenta - MAP): Placenta Accreta

Placenta accreta is defined as aberrant placental adhesion to the uterus, most often as a result of a lack of Nitabuch's layer or the decidua's spongy layer. Placenta increta is the word used when the placenta invades the myometrium, whereas placenta percreta describes a placenta that has invaded through the serosa and myometrium, occasionally reaching nearby organs like the bladder. [10,20].

The presence of placenta previa, loss of the typical hypoechoic retroplacental-myometrial zone, multiple vascular lacunae, an extension of the villi into the myometrium or beyond, disruption of the uterine serosa-bladder interface, and decreased retro placental space (less than 1 mm) are all associated with accretes in the second trimester. Vessels connecting the placenta to the uterine border, turbulent lacunar blood flow, increased placental vascularity, and gaps in myometrial blood flow are all Doppler findings connected accrete. The results that are most frequently associated with accreta are placental lacuna and turbulent flow. [4].

iv. Morphology:

a. Succenturiate Lobe

The placenta can develop a distinct lobule that is discontinuous from the main body, known as a succenturiate lobe, as opposed to the typical discoid look. Compared to the typical eliptiform placental shape, this seems unique. In 5% of pregnancies, this variation is present. Vessels supplying the succenturiate lobe may cross the internal cervical os thus identified as vasa previa, Identification of any connecting vessels, notably the vasa previa is crucial and should be done with caution as it poses an increased risk incidence of placenta infarction and velamentous insertion of the umbilical cord both which are crucial for fetal well-being. Focal myometrial contraction and an iso-echoic hematoma caused by a placental abruption may also be differential diagnoses. Due to retained placental tissue, there is a higher chance of vasa previa and postpartum hemorrhage, which could lead to complications [6,17].

b. Circumvallate Placenta

The placental periphery is not covered when the chorionic plate is smaller than the placenta's basal plate, which causes some of the placenta to be extrachorial. A placenta with raised edges that has an annular form and is made of a double fold of chorion, amnion, deteriorated decidua, and fibrin deposits is known as an extrachorial placenta. A circumvallate placenta can be suspected during an ultrasound scan if there is a peripheral rim of chorionic tissue that appears as an echodense ridge (placental shelf) and has a "tire sign" appearance on the 3D examination. However, the placenta is examined after delivery to make the diagnosis. If antenatal suspicion of a circumvallate placenta exists, the pregnancy should be categorized as high-risk, and specific safety measures should be taken, in order to avoid preterm labor. There is a strong correlation between a circumvallate placenta and a single umbilical artery which predisposes the fetus to low birth weight and intrauterine growth restriction, other fetal complication includes oligohydramnios, preterm labor and deliveries, placenta abruption and perinatal mortality**.** Although neither the amniotic band syndrome nor the limb body wall complex have been linked to circumvallate placentas. There is no chance of fetal malformation with this syndrome.

Another extrachorial placenta type with no clinical importance is circummarginate, which has a flat transition from membranous to villous chorion. [2,10,23]

b. Placenta Membranacea

A rare and sometimes undiagnosed placental condition is placenta membranacea. Vaginal bleeding usually first becomes apparent in patients during the second or third trimester. The majority of pregnancies end with a healthy preterm neonate, while outcomes might also include stillbirth and a live birth. Postpartum hemorrhage and/or poor placental adhesion could make placenta membranacea worse. The majority of placenta membranacea instances in the past have been identified through postpartum placental investigation. On ultrasound, it is challenging to determine any distinctive features of placenta membranacea. [24,25].

c. Chronic intervillositis

A relatively uncommon placental condition known as chronic intervillositis, often referred to as extensive chronic intervillositis or chronic histiocytic intervillositis, is characterized by a diffuse histiocytic infiltration in the intervillous region and an inflammatory placental lesion. This syndrome has an 80% perinatal fatality rate due to the increased risk of recurrent spontaneous abortion, fetal development limitation, and fetal death. Recurrence rates are considered to be higher than 60%.[2].

v. Abruption:

Since ultrasonography only has a sensitivity of up to 50%, it is of little use in the clinical diagnosis of abruption. However, there is a very high chance that an abruption actually exists when the ultrasonogram appears to show one. [10,18,26].

The size, position, and amount of time between the abruption and the sonographic test all affect how the bleed appears on the image. Sub chorionic and retro placental hematomas, as well as placental edge separation, may be visible on ultrasound. The area of detachment may seem hyperechoic during the acute phase before going hypoechoic after a few days. Ultrasound is not sensitive for detecting placental abruption due to the somewhat similar sonographic appearance

of uterine contractions, myomata, or vascular plexuses, but a positive finding is linked to more aggressive care and a worse newborn outcome.[26].

vi. The Presence of Tumors:

a. Gestational trophoblastic disease

A broad range of proliferative abnormalities of the placental trophoblast are referred to together as gestational trophoblastic disease (GTD). Malignant and benign trophoblastic diseases exist. On sonography, uterine venous plexus or focal or diffuse dilatation of pelvic veins, such as tortuous and serpentine vessels in the myometrium, are typically present in gestational trophoblastic neoplasms. The development of uterine vascular malformations is linked to these highly vascular malignancies. An enlarged uterus and the absence of fetal parts are frequent appearances. [27].

The enlarged hydropic placental villi can be seen as a grape-like cluster of clusters or as a snowstorm of echogenic endometrial material. On color Doppler imaging, there is a noticeably increased vascularity. Large ovarian theca-lutein cysts may be detected in up to 50% of cases as a result of ovarian b -HCG Overstimulation of b- HCG [17,20].

b. Chorioangioma

The most prevalent benign nontrophoblastic placental neoplasm is chorioangioma. It is a single or occasionally numerous hypervascular cystic lesion with arterial and venous flow that emits colored signals. They are often located close to the fetal surface of the placenta, close to the cord insertion, and sonographically, they are heterogeneous, appearing either hypo- or hyperechoic with internal flow on color Doppler. A variegated appearance can be caused by internal bleeding and infarction [2]. Arteriovenous shunting can happen, however most cases are accidental and harmless, leading to fetal development restriction because of prolonged hypoxia. [2,10,17].

CHAPTER THREE

2. METHODOLOGY

2.1 Study Design

This hospital-based study adopted a quantitative cross-sectional prospective sonographic study between July and December 2022

2.2 Study Area

The study was conducted in Dar Es Salaam region at Muhimbili National Hospital which is a tertiary health facility in Dar es Salaam, Dar-es-Salaam has five district hospitals with well-established health facilities. MNH is the National Referral Hospital and University a research Centre and university teaching hospital with a 1,500-bed facility, attending 1,000 to 1,200 outpatients per day, admitting 1,000 to 1,200 inpatients per week, the facility receives and attend various clients including women with various obstrectic and gynaecological conditions, radiology department is well established with various investigation modalities i.e. Magnetic Resonance imaging, Computed Tomography , X rays , Ultrasound e.t.c the facility also offers Interventional Radiology services e.t.c the radiology department is facilitated by the qualified personnel offering various radiological services

2.3 Study Population

The study targeted pregnant attending MNH who are referred for US Imaging during the period between January to March 2023

a. Inclusion Criteria

i. Pregnant women above 14 weeks of gestation.

b. Exclusion criteria will be;

i. Extremely ill patients who required emergency ultrasound and were unable to cooperate.

2.4 Sample Size and Sampling Method

Random sampling technique with a consecutive series approach was used, all pregnant women above 14 weeks of gestation who were found at the ultrasound clinic on each day the principal investigator visited the clinic were examined and included in the study until the calculated sample size is reached, the findings obtained according to the collecting tool was documented and analyzed, severely ill patients were not included in this study.

The sample size of the study (n) was calculated using a finite population formula proposed by Yamane (45) to maintain a 95% confidence interval;

$$n = \frac{N}{1 + N (e)^2}$$

Whereby:

n = Minimum required sample size.

N = Population size data obtained in December 2022 showed a total of 400 pregnant women (Targeted population) were registered at the MNH Ultrasound clinic

e = Margin of error (5%)

Therefore:

$$n = \frac{400}{1+ 400 (0.05)^2}$$

n = 200 pregnant women

Adjusting for non-response, 10% of the estimated sample size was added, leading to

$$n = (200+20) = 220$$

The maximum estimated sample size was 220 pregnant women,

2.4 Data Collection and Study Duration

A study tool, which included the socio demographic and clinical characteristic section, placenta conditions, and placenta ultrasound findings as shown in the conceptual framework, was utilized to direct data collection.

Data for this study was direct form the clients by a random sampling with a consecutive series approach, all data was collected by the principal investigator ultrasound findings conducted by trained personnel for patients referred for ultrasound at Muhimbili National hospital during the course of the study using the ultrasound findings during the study period. Taking into consideration sample inclusion criteria. Interpretation was made by the Principal Investigator, putting the findings in The Data Entry and monitoring tool entrenched all the required information of US scan findings. Data Entry and Monitoring MS excel spreadsheet tool.

2.5 Data Management and Statistical Analysis

The Microsoft Excel file containing the collected data was extracted from the database, cleaned, and coded before being imported into IBM SPSS Statistics version 23 for data analysis. Descriptive statistics, including frequency for categorical variables and mean (± SD) for numerical variables, were used to describe the socio-demographic and clinical characteristics of the study participants. The Chi-square test of association and Fisher's exact test, when appropriate, were employed to assess the association between independent variables and placental abnormalities. Both univariable and multivariable robust Poisson regression models were used to control for potential confounders. Variables that demonstrated an association with placental abnormalities with a p-value < 0.2 in univariate analysis were included in the multivariate analysis. Any variable that showed an association with placental abnormality with a p-value of < 0.05 in the multivariable analysis was considered to have an independent association with the outcome

2.6 Ethical Consideration

Ethical clearance to conduct the study was obtained from the MUHAS Institutional Review Board Ref. No. DA.282/298/01.C/ Date: 25/11/2022 Permission to collect data from MNH departments was obtained from the MNH Administration. Privacy and confidentiality was highly observed in data collection, personally identifying information was not collected from the patient's electronic records and clinical forms was used only for the study and not otherwise.

2.7 Dissemination Plan

The study findings will be presented at different local and international conferences and symposia such as the MUHAS Annual Scientific Conference, National Conference on Non-Communicable Diseases, and Tanzania Health Summit. Additionally, the study findings will be published in a peer-reviewed journal.

CHAPTER THREE

4.0 RESULTS

A total of 220 pregnant women were enrolled in this study. Their socio-demographic and clinical characteristics are shown in table 1.

Table 1 : Socio-demographic and clinical characteristics of the study participants

Variable	Frequency (n)	Percent (%)
Maternal age group (years)		
14 – 19	3	1.4
20 – 34	161	73.5
35 – 44	55	25.1
Mean age in years (± SD)	31 (± 5)	
History of cigarrate smoking		
Yes	6	2.8
No	211	97.2
Maternal substance abuse		
Yes	13	6.1
No	190	89.2
Not known	10	4.7
Gravida		
1	55	25.2
2 – 3	110	50.5
≥ 4	53	24.3
Para category		
0	64	29.2
1	76	34.7
≥ 2	79	36.1
Number of living children		
0	76	34.9
1	77	35.3
≥ 2	65	29.8
History of chronic disease		
Yes	64	29.4
No	154	70.6
Chronic medication before /during pregnancy		
Yes	45	20.6
No	173	79.4

The majority of the participants (73.5%) were aged between 20 and 34 years, with a mean age of 31 (± 5) years. Only a few (2.8%) had a history of smoking, while the majority (89.2%) had no history of substance abuse. Approximately half (50.5%) reported a gravida of 2-3, and about 29.4% of the participants reported having a chronic illness, with 20.6% reporting the use of chronic medications before or during pregnancy.

The distribution of obstetric characteristics of the study participants is shown in Table 2. Approximately 33% of the participants reported a history of pregnancy or fetal loss, while a small percentage (5.1%) reported having had an assisted delivery in their previous pregnancies. The majority (90.0%) had a history of attending antenatal ultrasounds at least once, with very few (4.2%) being aware of having a placental problem. Around 22.2% reported a history of undergoing a cesarean section in their previous pregnancies, and 9.7% had a history of delivering using both normal and cesarean section methods. A small number (9.7%) of participants reported having undergone two or more cesarean sections, and over 12% reported having undergone a manual vacuum aspiration. About 9.0% had a history of undergoing uterine surgery that was non-caesarean section

Table 2: Distribution of the study participants according to the risk factors and associated factors

Variable	Frequency (n)	Percent (%)
Unexplained pregnancy loss	72	33.2
Assisted Delivery methods	11	5.1
Number of Antenatal /Ultrasound care visits prior		
None	18	8.3
< 3	41	18.8
≥ 3	159	72.9
Mode of delivery of previous pregnancy		
First pregnancy/Not yet delivery	52	24.0
Normal	96	44.2
C/S	48	22.1
Both (Normal and C/S)	21	9.7
Number of CS prior to this gestation		
0	146	67.0
1	46	21.1
≥ 2	26	11.9
Number of MVAs done		
None	176	80.4
One	28	12.8
Greater or equal to two (≥ 2)	15	6.8
Other uterine surgery non-C/S		
None	199	90.9
One	15	6.8
Two	5	2.3
Number of fetuses in this gestation		
One	209	96.3
Two	8	3.7
History of Ceasarian delivery		
Yes	56	26.2
No	158	73.8
History of placenta problem		
Yes	9	4.2
No	133	61.9
Not known	73	34.0

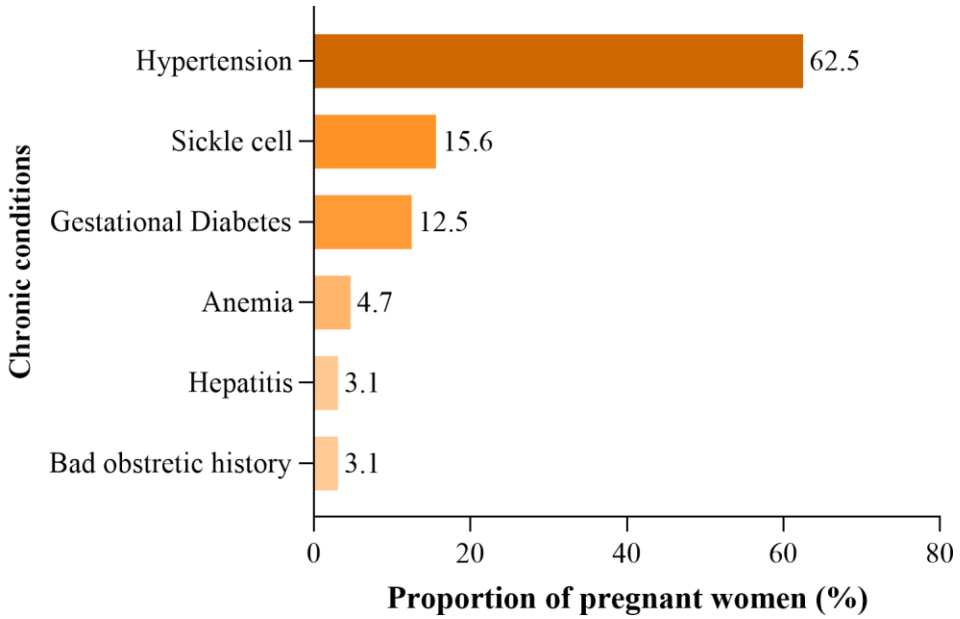


Figure 2: Proportion of participants with chronic condition (n = 64); note hypertensions had highest frequencies of occurrence.

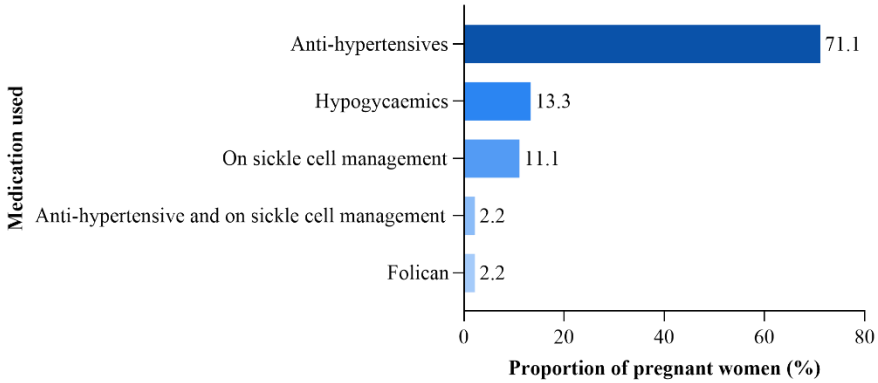


Figure 3: Proportion of participants on medication use; (n = 45); Majority of the participants (71.1%) reported to use antihypertensive, followed by Hypoglycaemics (13.3%)

The distribution of sonographic patterns of placenta abnormalities are shown in the table 3; Placenta morphology abnormalities were thickness of placenta which were found among (14.2 %) of the study participants, while (7.8 %) of participants were found to have thin placenta. In term of shape; bilobed, circumvallate, and succenturiate lobe were found to 6.4%, 7.3%, 0.9% and 83.5% of the participants respectively, 2.7% of the study population had placenta mass. Few (2.8%) participants were found to have placenta previa, and placenta parenchyma abnormalities with cystic and cystic like lesions participants had a cystic lesion, multiple lacuna infarcts their proportions is 8.2 % for 1-3 cysts, 2.3% for 4-6 cyst and 4.1% for multiple lacuna infarct respectively.

Placenta parenchyma abnormalities based on placenta vascurality were 11.4% for decreased, 28.7 % for increased and 77.8 % for placenta vascurality 16.9% of the study participants had marked placenta echogenicity.

The distribution of Placenta Martenal Surface abnormalities i.e Placenta Accrete Spectrum features (some) were as show on the table below.

Table 3; The distribution of sonographic patterns of placenta abnormalities among study participants.

Pattern	Frequency (n)	Percentage (%)
Placenta thickness *		
Normal	169	77.2
Thickened	31	14.2
Thinned	17	7.8
Placenta thickness (median IQR)	3.5 (3.2-3.9)	
Shape of placenta *		
Bilobed	14	6.4
Circumvallate	16	7.3
Succenturiate lobe	2	0.9
Oval (Normal)	183	83.5
Placenta Previa[$]		
Yes (low lie and central)	6	2.8
No (free)	210	95.9
Placenta Cystic lesion **		
1-3	18	8.2
4-6	5	2.3
Multiple lacuna infarct	9	4.1
none	176	80.4
Placenta Vascularity **		
decreased	25	11.4
Disorganized prominent vascularity	5	22.8
Increased	13	5.9
Normal	171	77.8
Placenta mass *		
Present	6	2.7
Not present	209	95.4
Placenta echogenicity **		
Marked	37	16.9
Normal	178	81.3
Placenta Accrete Spectrum (features) ***		
Focal loss of clear space	60	27.4
Dilated vascular channels	25	11.4
Focal segmental disruption	65	29.6
Partially visible myometrium contour	71	32.4

Key: *Placenta morphology, ** Placenta parenchyma, ***Placenta maternal surface [$]Placenta location

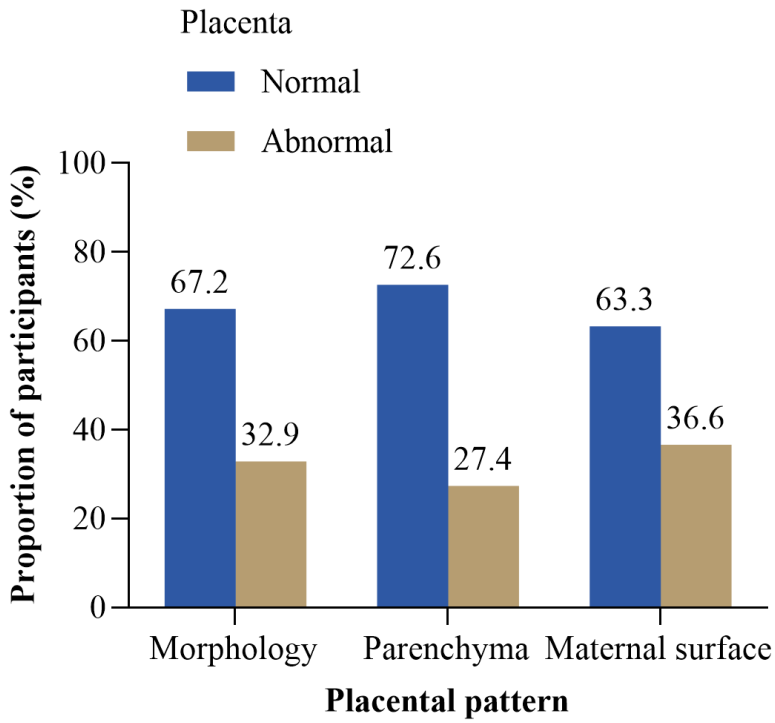


Figure 4; The proportion of participants according to the Major Placenta patterns

In this study, the occurance of placenta abnormalities in terms of morphology, Parenchyma and maternal surface were found in 32.9%, 27.4% and 36.6% of the study participants respectively, as shown in Figure 3.

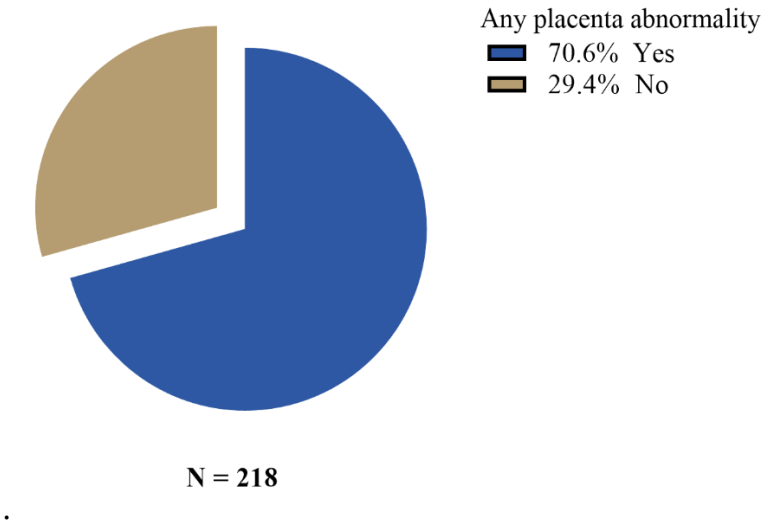


Figure 5: The proportion of participants with any type of placenta abnormality.

Overall placenta abnormality was found to be 70.6% in this study population.

Table 4; shows the factors associated with the placenta abnormalities in the study population; In this study we found that previous mode of delivery, number of caesarian section performed on pregnant women and unexplained pregrancy or fetal loss were significantly associated with the placenta abnormalities.

Those with two or more c/s had higher proportion of of overall placenta abnormalities 92.0% compared to those who had no prior history of Caesarian section

Participants with chronic illness had higher proportion of overall placenta abnormality 79.4% compared to those who had chronic illness.

Those with unexplained pregnancy loss had a higher proportion of overall placenta abnormality (84.5% compared to those who had no that history,

Table 4: Factors associated with placenta abnormalities among study participants

Variable	Placenta Sonographic pattern		P - value
	Normal (%)	Abnormal (%)	
Maternal age group (years)			
14 – 19	1 (50.0)	1 (50.0)	0.364
20 – 34	50 (31.1)	111 (68.9)	
35 – 44	13 (23.6)	42 (76.4)	
Gravida			
1	22 (40.7)	32 (59.3)	0.109
2 – 3	29 (26.4)	81 (73.6)	
≥ 4	13 (24.5)	40 (75.5)	
Previous Mode of delivery			
First pregnancy/ Not yet	22 (42.3)	30 (57.7)	**0.003**
Normal	32 (33.3)	64 (66.7)	
C/S	7 (14.9)	40 (85.1)	
Both (Normal and C/S)	2 (9.5)	19 (90.5)	
Number of C/S done prior			
0	54 (37.0)	92 (63.0)	**0.001**
1	7 (15.2)	39 (84.8)	
≥ 2	2 (8.0)	23 (92.0)	
Other uterine operation (non-C/S) prior			
Yes	4 (21.1)	15 (78.9)	0.405
No	60 (30.2)	139 (69.8)	
History of chronic illness			
Yes	13 (20.6)	50 (79.4)	0.067
No	51 (33.1)	103 (66.9)	
Chronic medication before and/or during pregnancy			
Yes	10 (22.7)	34 (77.3)	0.270
No	54 (31.2)	119 (68.8)	
Unexplained pregnancy loss			
Yes	11 (15.5)	60 (84.5)	**0.001**
No	53 (36.6)	92 (63.4)	
Assisted delivery methods			
Yes	2 (20.0)	8 (80.0)	0.727
No	60 (29.4)	144 (70.6)	

Table 5 shows the univariable and multivariable analysis of the factors associated with placenta abnormalities. In univariate analysis, previous mode of delivery, history of chronic illness, and unexplained pregnancy loss were significantly associated with placenta abnormalities. However, in multivariable analysis, only previous mode of delivery and unexplained pregnancy or fetal loss remained statistically significantly associated with placenta abnormalities.

Table 5: Univariable and multivariable analysis of the factors associated with placenta abnormalities

		Univariable analysis			**Multivariable analysis**		
Variable	**Category**	**cPR**	**95% CI**	**P - value**	**aPR**	**95% CI**	**P - value**
Age (years)	35 – 44	1.11	0.93 – 1.33	0.250	1.03	0.85 – 1.26	0.742
	14 – 34	1[a]					
Gravida	1	1[a]					
	2 – 3	1.24	0.97 – 1.59	0.086	0.94	0.63 – 1.40	0.743
	4	1.27	0.97 – 1.67	0.078	0.83	0.53 – 1.29	0.401
Previous Mode of delivery	Both normal & C/S	1.57	1.20 – 2.06	**0.001**	1.59	1.01 – 2.51	**0.046**
	C/S	1.48	1.14 – 1.92	**0.004**	1.54	1.01 – 2.36	**0.046**
	Normal	1.16	0.88 – 1.52	0.298	1.20	0.79 – 1.82	0.398
	First pregnancy	1[a]					
Other uterine operations (non-C/S)	Yes	1.13	0.88 – 1.45	0.336			
	No	1[a]					
History of chronic illness	Yes	1.19	1.01 – 1.40	**0.046**	1.11	0.93 – 1.34	0.256
	No	1[a]					
Chronic medication	Yes	1.09	0.95 – 1.25	0.241			
	No	1[a]					
Unexplained pregnancy loss	Yes	1.33	1.14 – 1.56	**< 0.001**	1.28	1.08 – 1.53	**0.005**
	No	1[a]					
Assisted delivery methods	Yes	1.13	0.82 – 1.56	0.447			
	No	1[a]					

Key: cPR: crude Prevalence Ratio, aPR: adjusted Prevalence Ratio, 1[a]: Reference Category

In univariable analysis, participants who had a history of giving birth by C/S were 1.48 times more likely to have placenta abnormalities compared to those who had not yet delivered (crude PR = 1.48, 95% CI [1.14 – 1.92], p = 0.001). This association persisted in multivariable analysis, where they were found to be 1.54 times more likely to have an overall placenta abnormality (adjusted PR = 1.54, 95% CI [1.01-2.36], p = 0.046).

In univariate analysis, participants with unexplained pregnancy loss were 1.3 times more likely to have overall placenta abnormalities compared to those who had no unexplained pregnancy loss (crude PR = 1.33, 95% CI [1.14 - 1.56], p < 0.001). This association also persisted in multivariate analysis, where they were 1.28 times more likely to have placenta abnormalities (adjusted PR = 1.28, 95% CI [1.08-1.53], p = 0.005)

CHAPTER FOUR

4.0 DISCUSSION

These results indicate that there is a considerable proportion of placenta patterns in the assessed population which can have a profound impact on maternal and fetal well outcomes when diagnosed antenatally, early detection of these placenta abnormalities will ensure preparation and planning of the mode of delivery.

Placenta patterns vary significantly with maternal age, mode of delivery, number of uterine operations, and history of manual vacuum aspiration or dilatation and curettage procedure. Delivery history, chronic illness, and medications.

This study involved participants aged 14 - 44 years, the majority (64%), were less than 33 years, and the median age was 31 years.

Study findings show that the majority of participants, 200 (91.7%) had at least one ultrasound examination done on this or previous pregnancies, however, they were not told /aware of any placenta abnormality during and after the antenatal period, the rest 8.3% were reported to have placenta abnormalities and this was limited to placenta location and abruption placenta after the onset of symptoms.

These findings are in keeping with a study done by Elsayes et al, which reported that placenta pathologies although uncommon are often overlooked and receive attention only when complication arise (37)

In addition to that, ultrasound is the mainstay of placenta imaging in the antepartum period. (38)

Our study findings indicate that among the study participants, 18.3% had an abnormality in the placenta morphology.

In those with abnormality in placenta shape 50% had complete circumvallate of the placenta, this is equivalent to 7.4 % of the whole study population, complete circumvallation is highly associated with abruption placenta, bleeding, low birth weight, and intrauterine growth restriction.

These findings are lower in comparison to the study done by Khaled M et al and Chris Glanys et al and this is attributed to the inclusion criteria in which, compared to our study that had no consideration of clinical symptomatology, they only included those who were clinically suspected to have the outcome of interest. (37) (39)

Among those with abnormality in morphology, 55.8% had an abnormal placental degree of thickness (thinned or thickened), In those with abnormality in the degree of placenta thickness 31 out of 48 (64.5%), equivalent to 22% of the study participant had thickened placenta and rest 17 had thinned placenta.

Thus, 22% of our study participants had thickened placenta (more than 4cm at any gestation age) and it was found more in both gestational and non-gestation onset of diabetes.

Thickened placenta at any gestation had a strong association with chronic illness p-value <0.001 and chronic medication p-value < 0.001 fetal hydrops.

Our findings are consistent with the study done by Dombrowski et al that reported the prevalence of thickened placenta is not rare, **(40)**

The overall abnormality in placenta morphology was found to be associated with chronic illness and medication with an overall p-value of < 0.001.

Our study also observed 10.5 % of the study population had intervillous vascular spaces of variable sizes and numbers randomly on the placenta parenchyma some near the cord insertion which was termed as placenta cystic placenta lakes.

Study findings were slightly higher compared to other reported findings by Elsayes et al reported to be 2-7% and this slight deviation may be due to the characteristics of the study participants. Although simple placenta cysts may be rare and go unnoticed lesions of more indicative of chronic illness. (**37) (41).**

Our study also revealed 4.1% of the study population had lesions that appeared wedge-shaped and intrinsic hyperechoic contents and decreased surrounding placenta parenchyma perfusion which was randomly distributed in the liver parenchyma consistent with placenta infarction,

however, no subsequent ultrasound was done to follow up fetal parameter finding revealed a significant association between unexplained pregnancy loss and fetal death history to have a p-value of 0.001

Similar to our study, these findings were also observed in the other study population by Barclay et al, however, different to ours, their study followed up placenta Doppler parameters and found to be deteriorating in a subsequent ultrasound scan, (42)

Additionally, five of the pregnancies with histological confirmation of the hemorrhagic placenta infarction were reported to die, and one of the remaining pregnancies with one fetus delivered by emergency caesarian section due to abruption placenta**.** (43)

In general, all features comprising the abnormality in placenta parenchyma had a significant association with chronic illness with a p-value of <0.001.

Finally, our study findings explored and revealed retro placenta and parenchyma features which are highly associated with morbid adherence status of the placenta in different frequencies.

More features were described to be associated with this condition at different distributions and these were gaps in myometrial blood flow (37)

Thereby other studies different from our study may be attributed to our inclusion criteria which were not focused only on the risky group for morbid adherence status, whereas in another study clinical symptomatology attributed to the outcome of interest was considered.

Maternal surface pathologies were more associated with risk factors with a p-value of <0.001

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATION

5.1 Conclusion

There was a high prevalence of placenta abnormalities. Placenta abnormalities patterns should be evaluated documented and followed up in subsequent scans to improve fetal and maternal outcomes.

5.2 Recommendation

A study with large sample size will add more value.

A Standardized placenta reporting format based on the reported placenta patterns should be established to ensure practitioner examines and report and follow up all possible placenta pathologies.

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APPENDECES

Appendix I: An informed consent form (Swahili Version)

Muhimbili University Health and Allied Sciences

FOMU YA RIDHAA KUSHIRIKI KWENYE UTAFITI KUHUSU HALI / VIASHIRIA VYA KISONOGRAPHIA KUHUSU KONDO LA NYUMA LA UZAZI WAKATI WA UJAUZITO.

Habari!

Jina langu ni **Dr Samson S Nyanda** ni mwanafunzi wa shahada ya uzamili kutoka chuo kikuu cha tiba na afya Muhimbili katika idara ya Radiologia ninafanya utafiti kuhusu mambo yanayohusiana na kuangalia viashiria / hali zisizo za kawaida katika kondo la nyuma wakati wa kipindi cha ujauzoto kupitia kipimo cha sonographia. (ultrasound), utafiti huu utatuwezesha kugundua mapema na kupanga njia mapema namna ya huduma kwa manufaa ya mama na mtoto.

Ikiwa huu ni utafiti wa sayansi ya tiba unapaswa ufahamu yafuatayokabla ya kushiriki;

Dhumuni la Utafiti huu

Kama nilivyo sema hapo awali Dhumuni ni kufanya utafiti mambo yanayohusiana na kuangalia viashiria / hali zisizo za kawaida katika kondo la nyuma wakati wa kipindi cha ujauzito kupitia kipimo cha sonographia. (ultrasound), utafiti huu utatuwezesha kugundua mapema na kupanga huduma kwa manufaa ya mama na mtoto.

Namna ya kushiriki

Kushiriki kwako kwenye utafiti huu ni wa hiyari kabisa na unaweza kukataa kushiriki au kusitisha mahojiano wakati wowote. Kukataa kushiriki hakutaingilia huduma zako za tiba wala faida unazotakiwa kuzipata.

Usisite kuuliza swali lolote pale unapoona kuna sababu. Kama ukikubali kushiriki mahojiano yataendeshwa kwa kutumia dodoso maalumu. Mahojiano haya yatutumia chini ya nusu saa kukamilika.

Madhara

Ikiwa wakati unajieleza ukipata kikwazo na kuona unahitaji mshauri nasaha au mtoa huduma wa afya kwa mazungumzo zaidi tutakuwa tayari kusaidia.

Usiri

Taarifa zako utakazozitoa hazitawekwa hadharani kwa namna yeyote ile kwa hiyo ushiriki wako hautafahamika. Jina lako au taarifa zozote zinazo kutambulisha hazitaambatanishwa na taarifa zako utakazozitoa.

Mwisho wa ufafiti taarifa hizi zitafungiwa na baadaye kuharibiwa baada ya kuwekwa na kutunzwa kwenye mfumo wa elektroniki.

Kumbuka

Hakutakuwa na faida ya moja kwa moja kwako kutokana na utafiti huu ila matokeo ya utafiti yatasaidia katika mpango wa kubaini mapema dalili / viashiria katika kondo la nyuma vinavyoweza kuhatarisha afya ya mama na mtoto, hivyo kuboresha huduma za uzazi.

Nani wa kumuuliza

Kama una maswali zaidi ambayo ungependa kuuliza kuhusiana na utafiti huu, tafadhali wasiliana na Mtafiti Mkuu **Dr Samson S Nyanda (068704900)**. Idara ya afya ya Radiolojia, Chuo Kikuu cha afya Muhimbili Mwenyekiti wa kamati ya utafiti na machapisho ya chuo. S.L.P. 65001 Dar -es -salaam, Tanzania Sahihi.

Unakubali Kushiriki ?.

Mshiriki amekubali.

Nimesoma au nimeambiwa kuhusu yaliyomo humu ndani.

Maswali yangu yamejibiwa.

Nakubali kushiriki katika utafiti huu.

Sahihi ya mshiriki……

Sahihi ya mtafiti……..

Appendix II: Data Collection Tool

SONOGRAPHIC PATTERNS OF PLACENTA ABNORMALITIES AND ASSOCIATED FACTORS IN PREGNANCY AT MUHIMBILI NATIONAL HOSPITAL.

PART A; SOCIAL DEMOGRAPHIC DATA.

Entry number …… Date of assessment ……..

1. Maternal age in years …….
2. Parity
   a. Gravida (0), (1), (2), (3), (4), (5), (6), (7), (8), ( )
   b. Para (0), (1), (2), (3), (4), (5), (6), (7), (8), ( )
   c. Living (0), (1), (2), (3), (4), (5), (6), (7), (8), ( )
   d. Abortions

3. Gestational age at assessment *(state in weeks)* …….

PART B; RISK FACTORS

4. Unexplained pregnancy loss or fetal death history
   a. YES
   b. NO ☐

5. Assisted Delivery methods / history
   a. YES
   b. NO ☐

6. Number of Antenatal care visits prior
   a. More than 3
   b. Less than 3 ☐
   c. None

7. Mode of delivery of previous pregnancy
   a. Normal
   b. C/S /Operative ☐
   c. Both *(C/S and Vaginal delivery)*
   d. 1St Pregnancy /Not yet delivered

8. Number of C/S done prior to this gestation.
   a. 1
   b. 2
   c. 3 ☐
   d. 4
   e. ( )

9. Number of MVA done prior to this gestation.
    a. 1
    b. 2
    c. 3
    d. 4
    e. ( )

10. Number of other operation (non C/S) prior to this gestation
    a. 1
    b. 2
    c. 3
    d. 4
    e. ( )

11. Number of placentas in this gestation
    a. ONE
    b. TWO

12. Number of fetus in this gestation.
    a. One
    b. Two
    c. More than Two

13. Chronic illness history
    a. Hypertension
    b. Diabetis –GDM
    c. Sickle cell
    d. Anaemia
    e. Hepatitis
    f. None
    g. Others
    Specify……..

14. Chronic medication before and during pregnancy.
    a. Local Medications.
    b. ART
    c. Anti TB
    d. Anti-psychotics
    e. Hypogyrcaemics
    f. Hypertensives
    g. None
    h. Others specify…….

15. Cigarette Smoking history.
    a. YES
    b. NO

16. Multiple gestation pregnancy.
    a. YES
    b. NO ☐

17. Known maternal blood-clotting disorders.
    a. YES
    b. NO ☐

18. Cesarean delivery history.
    a. YES
    b. NO ☐

19. Placental problems history.
    a. YES
    b. NO
    c. NOT KNOWN ☐

20. Maternal substance abuse
    a. YES
    b. NO ☐

21. Unexplained fetal, early neonatal loss.
    a. YES
    b. NO ☐

PART D; PLACENTA FINDINGS

MORPHOLOGY

22. Placenta thickness
    a. Normal
    b. thinned
    c. Thickened ☐

23. Shape
    a. Oval/normal
    b. Bilobed
    c. Succenturiate lobe ☐
    d. Circumvalate Other abnormalities

24. Location
    i. Wall
        a. Anterior
        b. Posterior
        c. Right lateral ☐
        d. Left lateral

ii. Height
- a. Fundal ☐
- b. Fundal and upper segment
- c. Upper segment Upper and lower uterus

iii. Lower segment
- a. Free
- b. Low lie previa
- c. Central ☐
- d. Complete previa.

PLACENTA PARENCHYMA

25. Grade
- a. 1 *(periphery around the placenta)* ☐
- b. II *(focal areas within the placenta)*
- c. III *(multiple calcification in circular form with in the placenta)*

26. Cystic lesions
- a. None
- b. 1 - 3,
- c. 4 -6 ☐
- d. Multiple Lacunae throughout *(infarcts)*
- e. Diffuse Multicystic appearance

i. Shape
- a. Rounded
- b. Wedge shaped ☐
- c. Irregural
- d. Mixed *(rounded, wedge and irregular)*

ii. Location
- a. Mid substance
- b. Near fetal surface ☐
- c. Near basal plate.

iii. Wall
- a. None *(imperceptibl*e)
- b. Echogenic wall ☐

iv. Content
- a. Anaechoic
- b. Turberant echos ☐
- c. Doppler flow

27. Placental vascularity
    a. Normal
    b. Increased
    c. Disorganised prominent vascularity

28. Placental Mass
    a. No mass
    b. Mass present

MARTENAL SURFACE

29. Echogenicity;
    a. Normal /mild
    b. Marked

30. Retroplacenta clear space
    a. Intact
    b. Focal loss of clear space

31. Subplacental vascularity on Doppler
    a. Focal segmenta disruption
    b. Dilated vascular channels

32. Placental myomentrial interface
    a. Complete visible,
    b. Partially none visible placental contour
    c. Smooth
    d. Focal bulge
    e. Bulge beyond the uterine contour

33. Uterine contour
    a. Smooth
    b. Abnormal bulge

34. Myometrium
    a. No thinning
    b. Gradual thinning over lower uterine segment
    c. Focal myometrial thinning
    d. Focal indistinct myometrium
    e. Fibroids
    f. Contraction.

Appendix II: Ethical Clearances

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

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Ref. No.DA.282/298/01.C/

Date: 25/11/2022

MUHAS-REC-11-2022-1460
DR. SAMSON SAMWEL NYANDA
MMed - Radiology, School of Medicine
MUHAS

RE: APPROVAL FOR ETHICAL CLEARANCE FOR A STUDY TITLED: SONOGRAPHIC PATTERNS OF PLACENTA ABNORMALITIES AND THEIR ASSOCIATED FACTORS IN SECOND TRIMESTER PREGNANT WOMEN ATTENDING AT MUHIMBILI NATIONAL HOSPITAL

Reference is made to the above heading.

I am pleased to inform you that the Chairman has on behalf of the University Senate, approved ethical clearance of the above-mentioned study, on recommendations of the Senate Research and Publications Committee meeting accordance with MUHAS research policy and Tanzania regulations governing human and animal subjects research.

APPROVAL DATE: 25/11/2022
EXPIRATION DATE OF APPROVAL: 24/11/2023

STUDY DESCRIPTION:
Purpose:
This hospital-based study will adopt a quantitative cross-sectional prospective sonographic study is to demonstrate the sonographic pattern of placenta abnormalities and their associated factors in second trimester women attending Muhimbili National Hospital from July to December 2022.

The approved protocol and procedures for this study is attached and stamped with this letter, and can be found in the link provided:
https://irb.muhas.ac.tz/storage/Certificates/Certificate%20-%2014238.pdf and in the MUHAS archives.