SUDAN UNIVERSITY OF SCIENCE &TECHNOLOGY

COLLEGE OF POSTGRADUATES' STUDIES

Estimation of Gestational Age by measuring Placenta and Umbilical Cord thickness in second and third trimester by Using Ultrasonography

تقدير عمر الحمل عن طريق قياس سمك المشيمة والحبل السري في الثلث الثاني والثالث من الحمل بإستخدام التصوير بالموجات فوق الصوتية

A thesis Submitted for Partial Fulfilment of the Requirement of the M.Sc. Degree in Medical Diagnostic Ultrasound

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2020

الآية

بسم الله الرحمن الرحيم

لقد خلقنا الإنسان في أحسن تقويم

ا

Dedication

To my family
My teachers
And my friends

Acknowledgment

First of all, I would to thank Allah for all support. Special thanks to my husband who support me all the time. Also Special thanks to professor. Mohamed Al fadil who provided guidance, encouragement, useful suggestion throughout the course of preparing for research.

I finally would like to thank all people who participated in completion of this study.

Abstract

The periods of pregnancy, from fertilization to the moment of birth is one of the important things that the medical field is seek to evaluate and follow-up them in order to preserve the health of the mother and fetus during all its stages.

This study descriptive cross-sectional study was done on 60 normal pregnant women in second and third trimester selected randomly from women who were referred to the ultrasound department in different Obstetrical Hospitals and medical centres in Khartoum for sonographic examination between May 2019 and October 2019. The data used in the study were collected using two ultrasound machines models, alpinione E-cube 9 and Mindray – DC-60, 3.5MHz convex probe.

The study aimed to assess the correlation between the placenta thickness and Umbilical Cord and gestational age in the second and third trimester.

The study concluded that Imaging studies assist to found that the placenta thickness and umbilical cord thickness increase with gestational age and there is statistically significant positive correlation between Placenta Thickness and umbilical cord thickness and gestational age.

It recommended that uses the placental thickness and umbilical cord thickness as a parameter in estimating gestational age need as further testing in order to be applicable and installed in ultrasound machine. It is also recommended to estimate the gestational age using placenta thickness and umbilical cord thickness with abnormal pregnancies.

ملخص البحث

تعتبر فترة الحمل بدءً من الاخصاب إلي لحظة الولادة من الأشياء الهامة التي يحرص عليها المجال الطبي لتقييمها ومتابعتها من أجل الحفاظ علي صحة الأم والجنين خلال جميع مراحلها.

الدراسة الحالية عبارة عن دراسة وصفية مقطعية أجريت على 60 إمراة من السيدات السودانيات ذات حمل طبيعي خلال الفترة الثانيه والثالثة من حملهن، تم اختيارهن بشكل عشوائي من اللاتي تم تحويلهن إلى اقسام الموجات فوق الصوتية لإجراء فحص الموجات فوق الصوتية بعدد من مستشفيات النساء والتوليد والمركز طبية بمنطقة الخرطوم في الفترة ما بين مايو 2019م إلي أكتوبر من العام 2019 . ولقد جمعت البيانات بإستخدام جهازي موجات فوق الصوتية ماركة ميندراي وألبينون بتردد مستخدم 3.5 ميقا هيرتز

تهدف الدراسة إلى تقدير عمر الجنين عن طريق دراسة علاقة سمك المشيمة والحبل السري بعمر الجنين.

خلصت الدراسة أن القياسات باستخدام الموجات فوق الصوتية بوجود علاقة خطية موجبة بين سمك المشيمة والحبل السري وعمر الجنين، وبأن سمك المشيمة والحبل السري يزدادان مع تقدم فترة الحمل .

أوصت الدراسة بإستخدام قياسات سمك المشيمة والحبل السري في تقدير مراحل عمر الجنين نظرا لأهميته والحوجة اليهما، وبتضمينهما وتوفير استخدامهما ضمن تطبيقات جهاز الموجات فوق الصوتية. كما أوصت الدراسة أيضا بالقيام بالمزيد من الدراسات الإضافية مستقبلا يستخدم فيها سمك المشيمة والحبل السري لتقدير عمر الجنين على السيدات الحوامل اللاتي لديهم مشاكل في الحمل في الفترة الثانية والثالثة للحمل.

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LIST OF ABBREVIATIONS

AC	Abdominal Circumference
BPD	Biparietal Diameter
CRL	Crown-rump length
FL	Femur length
GA	Gestation age
IUGR	Intrauterine growth retardation
LMP	Last Menstrual Period
PT	Placenta thickness
TAS	Trans abdominal Scan
UC	Umbilical Cord
UT	Umbilical cord thickness
HC	Head circumference

Chapter One

Introduction

1.1 Introduction

Fetal age in normal pregnant women during periods of pregnancy, strated before of beginning of fertilization because the gestational age is calculated from the first day of the last menstrual period (LMP) to the moment of birth. Fetal age is one of the important things that we should be more accurate with it. The accurate knowledge of the Gestational Age (GA) is the key for the good antenatal care and successful deliveries of babies.

There was several sonographic parameters of the fetus are used to assess gestational age. Some of these Fetal growth parameters such as BPD, and AC are used in the sonographic estimation of gestational age and weight of the fetus in the second and third trimesters. Common fetal parameters for gestational age (GA) estimation have pitfalls especially in advanced pregnancy and pregnancy complicated by fetal structural anomaly. So, there is a need of another parameter for supplementing the gestational age estimation with minimal error.

Several sonographically derived fetal parameters used to date pregnancy include fetal crown-rump length (CRL)bipariatal diameter (BPD), head circumference (HC), femur length (FL) and abdominal circumference (AC). Placental thickness measured at the level of the umbilical cord insertion and can be used as a new parameter to estimate gestational age of fetus (*PeterW.callen,2007).*

There was some previous studies evaluate the placental thickness as a parameter for estimation of gestational age and also to assess the growth pattern of placenta with advancing gestational age that said Placental thickness in millimeters correspond to the gestational age in weeks between 20 and 32 weeks. Placental thickness can be used as another parameter for determining gestational age in case of unknown dates in the

later half of second trimester. Positive correlation suggested that as placental thickness increases, the fetal weight also increases so that the placental growth directly influences the fetal weight. (*Pak Armed 2016).*

Also, on other hand there were other one assessed the relationship between umbilical cord size and GA of the fetus *(Relationship between sonographic umbilical cord size and gestational age among pregnant women in Enugu, Nigeria) Afr Health Sci. 2014 Jun*. Which find Umbilical cord size had strong positive correlation with fetal biometric parameters in the population studied. Sonographic measurement of umbilical cord size could be a reliable method of assessing fetal growth and prediction of GA especially between 14 - 35 weeks GA among the population studied

The placenta is an organ with important endocrine, metabolic and immunologic functions. Placental formation begins in the later half of second month of pregnancy and is completed by the fourth month. Maximum growth of placenta is attained at term. Placental thickness measured at the level of umbilical cord insertion can be used as a parameter to estimate the gestational age of fetus.

The actual connection between the placenta and embryo, and later the fetus, is through the umbilical cord , which develops from the connecting stalk and is usually about 2 cm (1 in.) wide and about 50–60 cm (20–24 in.) in length. The umbilical cord consists of two umbilical arteries that carry deoxygenated fetal blood to the placenta, one umbilical vein that carries oxygen and nutrients acquired from the mother's intervillous spaces into the fetus. In some cases, the umbilical vein is used to transfuse blood into a fetus or to introduce drugs for various medical treatments.

1.2 Problem of the study:

The purpose of this study is to assess the relationship between the placental thickness and umbilical cord estimated fetal age in normal pregnant women.

1.3 Objectives of the study:

1.3.1 General objective:

To assess the relationship between the placental thickness &umbilical cord and fetal age in the third trimester. Also To reduce the estimation error.

1.3.2 Specific objectives:

➢ To find the LMP and Scan date and age

➢ To measurement FL and BPD and AC and PT and UC

➢ To estimate gestational age using FL and BPD and AC

➢ To estimate GA using PT and UC

➢ To find significance between the GA/ LMP and FL/BPD/AC

1.4 overview of the study:

Thee research will be formed of five chapters. Chapter one deal with the general introduction about the research , problem statement and the objectives of the study. Chapter two will deal with literatures review cover the theoretical background and previous studies. Chapter three will deal with the methodology of the study, including materials , method and equipment . Chapter four will cover the results. And chapter five will cover discussion, conclusion, recommendations and references.

Chapter two

Literature Review and Previous Studies

2.1 Anatomy of placenta

The placenta is a vascular structure by which an unborn child is attached to its mother's uterine wall and through which respiratory gas and metabolic exchange occurs (Figure 2.1). The placenta is formed in part from maternal tissue and in part from embryonic tissue. The embryonic portion of the placenta consists of the chorion frondosum, whereas the maternal portion is composed of the area of the uterine wall called the decidua basalis, into which the chorionic villi penetrate. Blood does not flow directly between these two portions, but because their membranes are in close proximity, certain substances diffuse readily. When fully formed, the placenta is a reddish-brown oval disc with a diameter of 15 to 20 cm and a thickness of 2.5 cm, it weighs between 500 and 600 g, about one sixth as much as the fetus. (Graaff.v.d,2001)
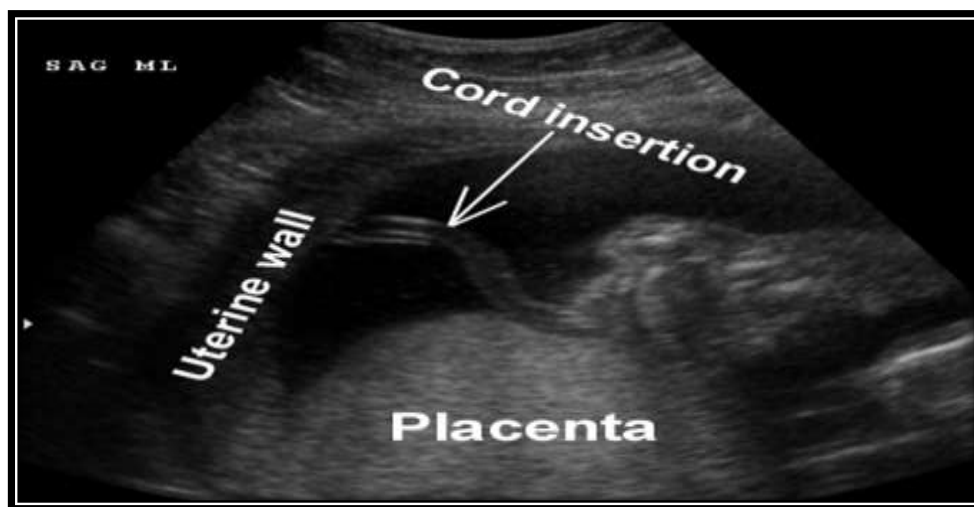
Figure 2.1 shows of placenta and umbilical cord insertion.

The early developing embryo is surrounded by amnion and chorion. Villi cover the entire surface of the chorion up to about 8 weeks of gestation. The villi, which are the basic structures of the placenta, initially form by 4- or 5-weeks' gestation. The villi next to the decidua capsularis degenerate, forming the chorion leave. The villi contiguous with the

decidua basalis become the chorionic fondosum and later the placenta, Placental length is approximately six times its maximal width at 18 to 20 weeks' gestation (Figure 2.2). The mean thickness of the placenta in millimetres in the first half of pregnancy closely approximates the gestational age in weeks, If the placenta thickness is greater than 4 cm (40 mm) before 24 weeks, an abnormality should be suspected. These abnormalities include ischemic-thrombotic damage, intra placental haemorrhage, chorioangioma, and fetal hydrops. (Rumack,2011)
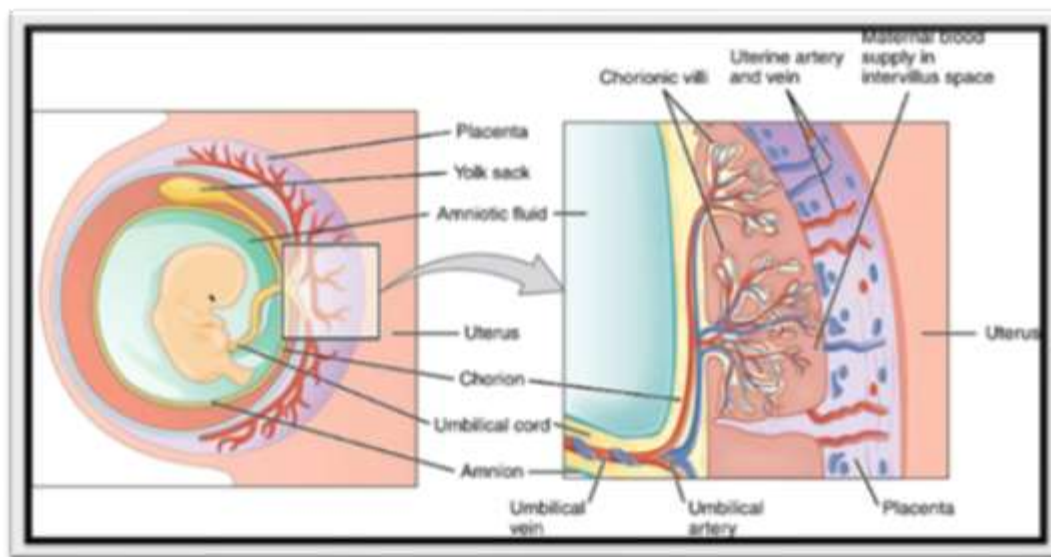
Figure 2.2 shows Anatomy of placenta

The placenta develops from the chorionic villi at the implantation site at about the fifth week of gestation and by the ninth or tenth week the diffuse granular echotexture of the placenta is clearly apparent at sonography. (PeterW.callen,2007). Accurate estimation of fetal age is important for appropriate antenatal management. The estimation of fetal age by ultrasound is based to know the relationship between fetal age and weight. Placental length is approximately six times its maximal width at 18 to 20 weeks' gestation. The mean thickness of the placenta in millimeters in the first half of pregnancy closely approximates the

gestational age in weeks. (Tongsong T, 2004) If the placenta thickness is greater than 4 cm (40 mm) before 24 weeks, an abnormality should be suspected. These abnormalities include ischemic-thrombotic damage, intra placental haemorrhage, chorioangioma, and fetal hydrops the placenta dramatically increases in size until approximately 15 to 17 weeks' gestation. From this point, there is a fourfold increase in placental size until delivery, whereas the fetus has a 50-fold increase in size until delivery. (Hafner,2001) Trimester placental volume is associated with maternal nutritional status, birth weight, and pregnancy outcome. (Thame M,2000) .A very small placenta may be associated with growth retardation. More than 3cm thickness before 20 weeks and more than 5cm before 40 weeks is consider abnormal. (Wolf H, 1989)

An excessively large placenta may be associated with infection, anaemia or triploidy and there are usually other markers of fetal compromise. (Smith PA,2006) (Before the availability of the ultrasound, manual examination of maternal the abdomen was the only approach that could be used to estimate fetal size. The physical examination, however, provides only a general approximation of fetal weight because the palpated dimensions of the uterus are affected by several factors other than fetal size, including amniotic fluid volume, placental bulk, presence of fibroids and maternal obesity. Sonographic measurements of the fetus provide information about fetal age and growth. These data are used to assign gestational age, estimated fetal weight and diagnose growth disturbance. The measurements of fetal body parts provide a direct way of assessing fetal size. Numerous formulas have been published for estimating fetal weight from one or more of these fetal body measurements: head, (biparietal diameter BPD or head circumference HC), abdomen (abdominal diameter AD or abdomen circumference (AC), and femur (FL). (Rumack,2011)
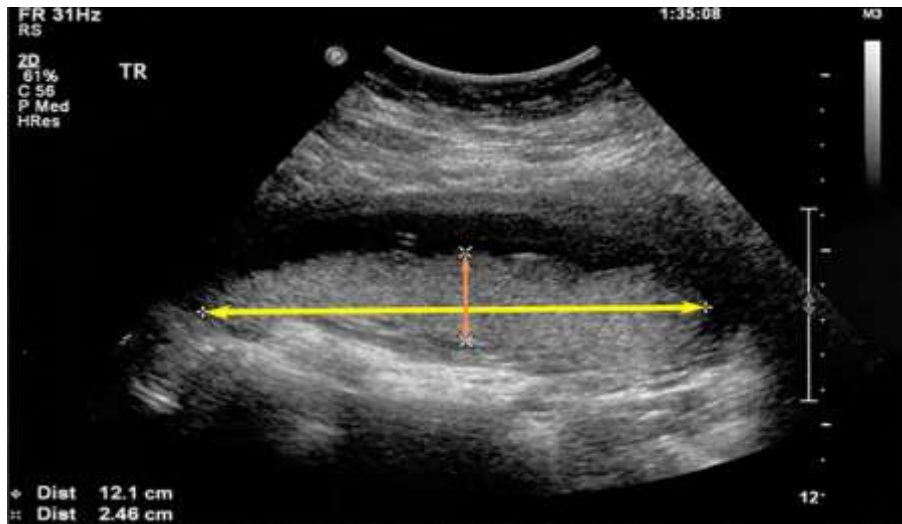
Figure 2.3 shows the volume of posterior placenta

2.2 Physiology of Placenta

Transfer of nutrients and oxygen to the fetus. Conditions like maternal diabetes or anaemia can increase or decrease the supply of nutrients resulting in macrosomia or growth restriction. Excretion of waste products like carbon di oxide, urea and uric acid. Transfer of passive immunity to the baby. (Figure 2.4)

Acts as an endocrine organ secreting human chorionic gonadotrophin, human placental lactogen, oestrogens and progesterone. The placental lactogen level is directly proportional to the size of the placenta. Cloacking from the immune system of mother. Acts as a reservoir of blood for the fetus. (hall, 2005)

Figure 2.4 shows physiology of placenta

2.3 Umbilical Cord

The Umbilical Cord The umbilical cord, which normally inserts into the middle of the placenta, has two arteries and one vein. These vessels are surrounded by a gelatinous material called Wharton's jelly, all of which is covered by a single layer of amnion. (Nyberg D, 2003). The cord develops from the fusion of the yolk stalk and the vitelline duct (omphalomesenteric duct) early in gestation. (Figure 2.5)
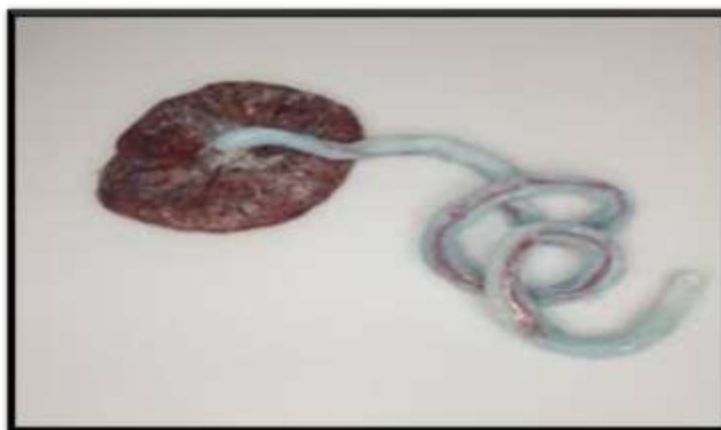
Figure 2.5 Shows umbilical cord attached to placenta

2-4 Physiology of umbilical cord

The umbilical vein, which carries oxygenated blood from the placenta to the fetus, enters the fetal abdomen and proceeds cephalad to connect to the left portal vein within the liver. The umbilical arteries enter the fetal abdomen and carry deoxygenated blood from the fetus to the placenta. The arteries, once they enter the abdomen, proceed caudal around the bladder to connect to the fetal internal iliac arteries. Therefore, color Doppler can establish that there is a three-vessel cord (3VC), by placing the color Doppler box over the fetal bladder and identifying both arteries adjacent to the bladder. A 3VC may also be obtainable in the transverse view of the umbilical cord (Figure 2.6). A single umbilical artery has been sited as the most common abnormality of the umbilical cord (Nyberg D, 2003). It has been reported in association with abnormalities of all major organ systems and intrauterine growth restriction. (Callen P,2008). The umbilical cord normally inserts into the central portion of the placenta. Abnormal cord insertion sites are described as eith er marginal or velamentous. Marginal cord insertion is at the edge of the placenta. This is also referred to as a battledore placenta. (Callen P,2008). Velamentous cord insertion denotes the insertion of the umbilical cord into the membranes beyond the placental edge. This type of abnormal insertion is often seen in association with vasa previa. (Nyberg D, 2003)
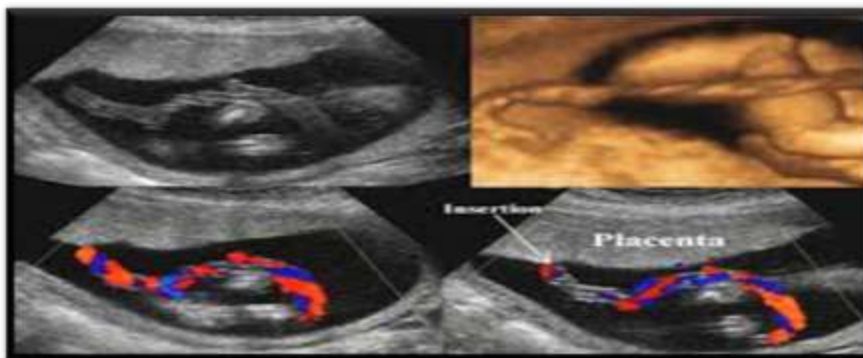
Figure 2.6 Shows color doppler ultrasonography of umbilical cord and insertion .

Occasionally, the umbilical cord may be seen encircling the fetal neck. This is termed nuchal cord. A nuchal cord can be confirmed with color Doppler. It does not always indicate fetal distress, even though on occasion multiple loops of cord may be noted around the neck. (*Nyberg D,1999)* Nonetheless, this abnormality should be documented particularly if additional signs of fetal distress are evident. Cystic masses of the umbilical cord may be seen with sonography. An allantoic cyst is a mass that may be noted in the umbilical cord adjacent to the umbilical vessels. These cysts are most often found near the fetal abdomen and have been seen in connection with omphalocele and aneuploidy. (Doubilet PM,2003) The hemangioma is the most common tumor of the umbilical cord, although it is exceedingly rare. (Callen P,2008). These masses, unlike allantoic cysts, appear as solid hyperechoic masses and are more often located near the cord insertion site into the placenta(Figure 2.6).

2.5 Previous Study

Charles Eze,1 Mabel Ugwuja,2 Cletus Eze,3 George Ugwu,4 Kennedy Agwuna,5 and Ituk-Ozalla6 studied Relationship between sonographic umbilical cord size and gestational age among pregnant women in Enugu, Nigeria. They find that the mean umbilical cord diameter and cross-sectional area were 14.5mm + 7.2mm and 201.6mm + 139.5mm2 respectively. Umbilical cord growth rate of 1.0mm/week was noted between the 14th and 35th week of pregnancy. There were significant correlations (p < 0.001) between umbilical cord size and other fetal parameters for GA estimation. It was concluded umbilical cord size had strong linear relationship with common fetal GA estimation parameters and could be used to compliment these parameters for GA estimation. *Afr Health Sci. 2014*

Dr Patsy Varghese1, Dr Lakshmi BS2 studied the association between Placental Thickness and Gestational Age, the result of the study is Between 20 to 32 weeks of gestation, there is almost perfect correlation between placental thickness and gestational age. Placental thickness in millimetres correspond to the gestational age in weeks between 20 and 32 weeks. Placental thickness can be used as another parameter for determining gestational age in case of unknown dates in the later half of second trimester. *Journal of Medical Science And clinical Research Volume 05 Issue 12 December 2017*

correlation of sonographic placental thickness with gestational age in normal singleton pregnancies *Aisha Kiran, Muhammad Nafees, Ghulam Abbas 2016; 66(0): S104-S108.* A total of 200 women with singleton pregnancy in 2nd and 3rd trimester was included in this study. The mean age of the women was 25.43 ± 2.63 years, average gestational age and placental thickness was 26.18 ± 7.91 weeks and 29.10 ± 7.027 mm. Total of 104(52%) patients were in2nd trimester and 96(48%) were in 3rd trimester. A linear relationship was observed between gestational age and placental thickness. There were 104 women with 2nd trimester, correlation between placental thickness and gestational age was positive and significant (r=0.959 and p=0.0005), similarly 96 women with 3rd trimester, correlation between placental thickness and gestational age was positive and significant (r=0.858 and p=0.0005). Strong positive correlation between placental thickness and gestational age was observed (r= 0.985 and p= 0.0005). Positive correlation suggested that as placental thickness increases, the fetal weight also increases so that the placental growth directly influences the fetal weight.

In 2015*(Ridhi Adhikari, Pravin Kumar Deka, Ashok Tayal, Pramod Kumar Chettri)*, studied ultrasonographic Evaluation of Placental

Thickness in Normal Singleton Pregnancies for Estimation of Gestation Age It was observed that the placental thickness gradually increased from approximately 11 mm at 11 weeks to 38.33 mm at 40 weeks of gestation. From 11 to 34 weeks of gestation, the placental thickness (in mm) almost matched the gestational age in weeks, thereafter from 35 to 40 weeks; the placental thickness was lower by 1 to 2 mm. Conclusion: The relationship between the placental thickness and gestational age was linear and direct. Placental thickness (in mm) measurement can be an important additional parameter for estimating gestational age along with other parameters especially from 11 to 34 weeks of gestation.

A correlative study to evaluate the gestational age by sonological measurement of placental thickness in normal second and third trimester pregnancy *(Sujit Pant1, Sunita Dashottar2)2017,* The mean values of placental thickness show a perfect positive relationship (increasing trend) with gestational age and the mean value of placental thickness almost correspond to the gestational age till 35 weeks of the gestational age and fall marginally from 36 weeks. Placental thickness showed positive and significant correlation with gestational age (P-value<0.001) and Pearson's correlation coefficient (r) of 0.990. Conclusions: Placental thickness can be an additional parameter for estimation of the gestational age as it almost corresponds with the gestational age in second and third trimesters. Also, any abnormal placental thickness for the particular gestational age should raise the suspicion of underlying fetal or maternal disease condition which can cause an increased or decreased in the placental thickness and should be addressed in time.

A sonographic parameter for estimation of gestational age Meenambiga Balakrishnan*, Thendral Virudachalam *IJRCOG 2017*, Out of 2100 women, 120 didn't turn up. Hence 1980 patients were included. Using

Pearson correlation, correlation between placental thickness and maternal age, gestational age was analysed. There is statistically significant correlation between GA and placental thickness (p < 0.01). The value of mean placental thickness increases with advancing gestational age almost matching from 20th to 35th week. There is no statistically significant difference between placental thickness with advancing gestational age based on implantation site (p=0.16). The measurement of placental thickness is an important parameter for estimation of fetal age, it is helpful in cases where exact duration of pregnancy is not known (between 20 and 35 weeks) where the placental thickness almost matches with gestational age. It can also be used as a predictor of LBW, IUGR, hydrops fetalis.

Arafa Ahmed et al 31 (2014) included 110 pregnant women in third trimester. Study was done in Sudan from 2009-2010. There was a significant positive correlation of placental thickness with FL and

BPD

Chapter three

Material and Methods (Material, equipment and Technique)

3. 1. Material

3.1.1 Study design: Descriptive cross-sectional study was done to evaluate the relationship between placenta thickness and fetal biometry in third trimester.

3.1.2 Study area: The study was held in ultrasound department in different Obstetrical Hospitals and medical centres in Khartoum for sonographic examination such as, Al-saudi hospital and Obstetrics and Gynecology Hospital

3.1.3 Duration of study: The study was conducted in 6 months from May to October 2019.

3.1.4 Study population: The study population were including Sudanese normal pregnant women in second and third trimester came to the ultrasound department for regular check-up. The selecting women attended with viable singleton and uncomplicated pregnancy.

3.1.5 sampling: The sample size consists of 60 pregnant Sudanese women in second and third trimester with regular, viable singleton pregnancy and uncomplicated pregnancy.

3.2 Method of data collection

3.2.1 Data collection: All data collection during study was collected in sheets of paper (data collecting sheet) which were designed especially for the study and U/S images.

3.2.2 Data presentation: The data was presented in tables, figures and grafts.

3.2.3 Data storage: All data collected during the study was stored on Flash ,sheets and ultrasound images.

3.3. Statistical Methods

3.3.1 Data Analysis: The data was analyzed using Statistical Package for Social Sciences SPSS version 21. The chi square-test should be used to test the association between two categorical variables, the significance level was set at p=0.05.

3.4 Ethical consideration:

No identification or individual details were published, the objective of the study was explained to individuals participating in this study. No information or patient details was disclosed or used for other reasons than the study.

3.5 Equipment used:

The data used in the study were collected using two Diagnostic ultrasound machines models, alpinione E-Cube 9, and Mindray – DC-6, Transabdominal convex probe with frequency of 3.5 MHz used.

Other accessories used printer, thermal papers, computer for saving data and ultrasound gel. Quality control maintenance check was routinely performed on the equipment by the medical physicist of the department prior to measurements.

Figure (3-1): Mindray ultrasound machine – DC-6", 3.5MHz

3.6 Scanning technique:

Three fetal biometric parameters will be done biparietal diameter (BPD), femur length (FL) and abdominal circumference (AC). Placental thickness (PT) measure at cord insertion by using ultrasound measurements and the measurements will be compare with biometric parameters. Umbilical Cord Thickness (UT) measure were obtained in a cross-sectional plane of the umbilical cord at a point, 2.0 cm away from point of insertion into the fetal abdomen.

3.7 Variables of study: Maternity, Gravity, Last Menstrual Period (LMP), biparietal diameter (BPD), Femur length (FL), Abdominal circumference (AC), Placental thickness (PT), Umbilical Cord thickness (UT).

3.8 Inclusion Criteria:

The pregnant women in the second and third trimester which icclud 14+ _40+ weeks with viable singleton fetus ,n coexisting. • Antenatal mothers with LMP known.

Exclusion Criteria:

• Irregular periods.

• LMP not known.

• Polyhydramnios.

• Diabetes mellitus.

• Hypertensive disorders of pregnancy.

• Heart disease complicating pregnancy.

• Anemia complicating pregnancy.

• Jaundice complicating pregnancy.

• Renal disease.

• Diagnosed Intrauterine growth restriction(IUGR).

• Hydrops fetalis.

• Multiple pregnancy.

• Fetal anomalies.

• Placental anomalies.

3.9 Patient Preparation

No preparation the patient scanned by Transabdominal probe After checking that the pregnancy is normal,

The fetal age estimated by Last measuring the biparietal diameter (BPD), femur length (LF) and abdomen circumference (AC). Placental thickness (PT) should be measured if the placenta appears to be either thick or thin. The placental thickness was measured in longitudinal section at the point of umbilical cord insertion. with one calliper placed at the amniochorionic surface (chorionic plate) and the second calliper placed at the basal surface perpendicular to the amniochorionic surface. The measurement should exclude retroplacental veins, myometrium, fibroids, and contractions of the uterus that might incorrectly increase the measurement.

## 3.10 Scanning technique Umbilical cord:

Only trans-abdominal sonographic examinations, a high resolution, real time scanner with a 3.5 MHz convex probe. Examinations were carried out with subjects in supine position. All measurements were made on still images captured with the freeze facility of the ultrasound scanner with the on-screen electronic calliper of the ultrasound unit. All sonographic measurements were obtained by an experienced obstetric sonographer. Commonly measured fetal parameters for GA estimation such as the BPD, FL, HC and AC were all measured following the departmental protocols for such measurements. Furthermore, images of the umbilical cord used for measurements were captured only when outer edges of the umbilical cord were outlined in a longitudinal plane. From this plane, the probe is turned to obtain a transverse scan image. Umbilical cord diameters were measured only on the transverse section, as described by Ghezzi et al. (Gehzzi F,2001). Measurements of the umbilical cord diameter, were obtained in a cross-sectional plane of the umbilical cord at a point, 2.0 cm away from point of insertion into the fetal abdomen. (Figure 3-2) (Masaji U.2006)

Diameters obtained from these measurements were used to compute the cross-sectional area of the umbilical cord (Figure 3-3). The GA estimation was based on reliable recollection of the date of onset the last menstrual period (LMP) and the GA calculated from LMP was validated by ultrasound scan done within the first trimester.

Figure (3-2): Shows the Umbilical Cord insertion.
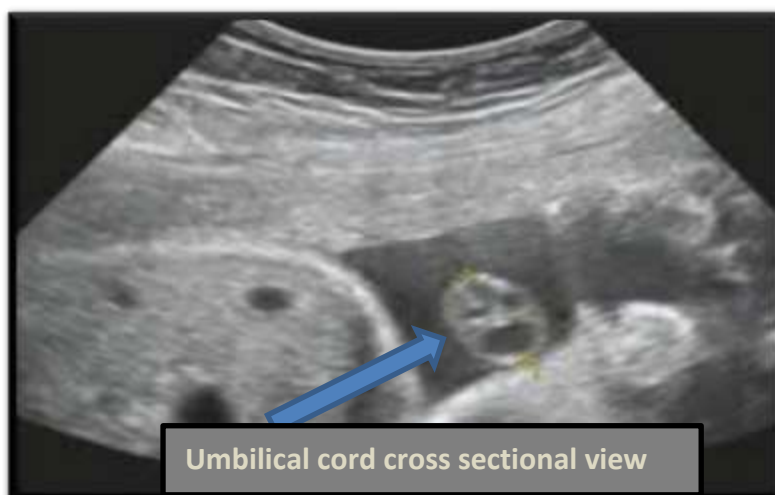
Figure (3-3) Shows cross sectional views of umbilical cord

Chapter Four

Results

Results

The results are enumerated below Tables & figures:

Table (4-1): Age distribution for all pregnant women

Age	Cases NO	Percent %
< 20	10	16.6 %
20-25	14	23.3 %
26-30	23	38.3 %
31-34	6	10 %
>35	7	11.6
Total	60	100 %

Table (4-2): Gestational Age distribution for all pregnant women

Gestational Age	Cases No.	Percent %
Up to 13w	0	0 %
14 w-27w	21	35 %
28w-above	39	65 %
Total	60	100 %

Table (4-3) Placenta Cites distribution for all pregnant women

Placenta Location	Cases No.	Percent %
Anterior	20	33.3 %
Posterior	23	38.3 %
Lateral	11	18.3 %
Fundal	6	10 %
Total	60	100 %
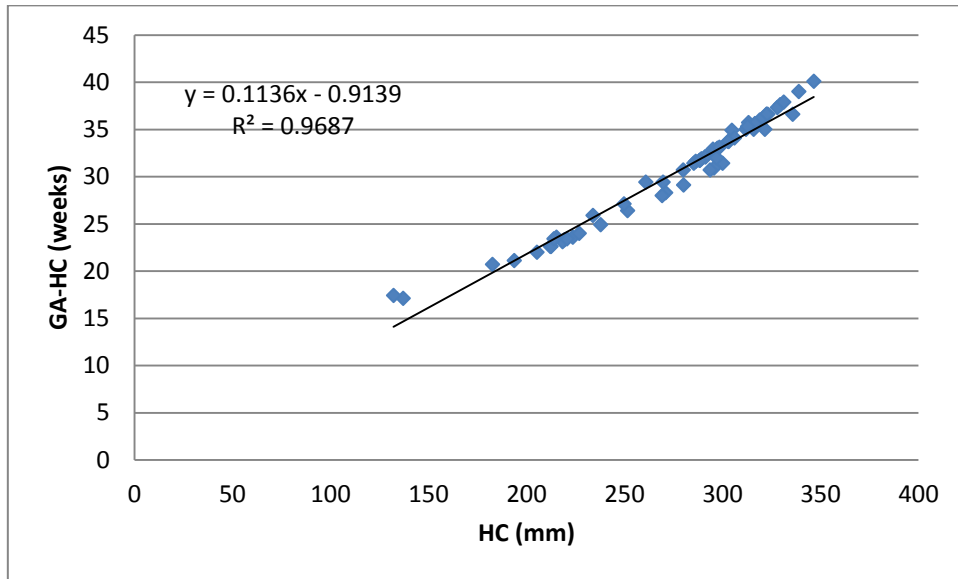
Figure (4- 4): Scatter plot shows direct linear relationship of HC caliper with gestational age.
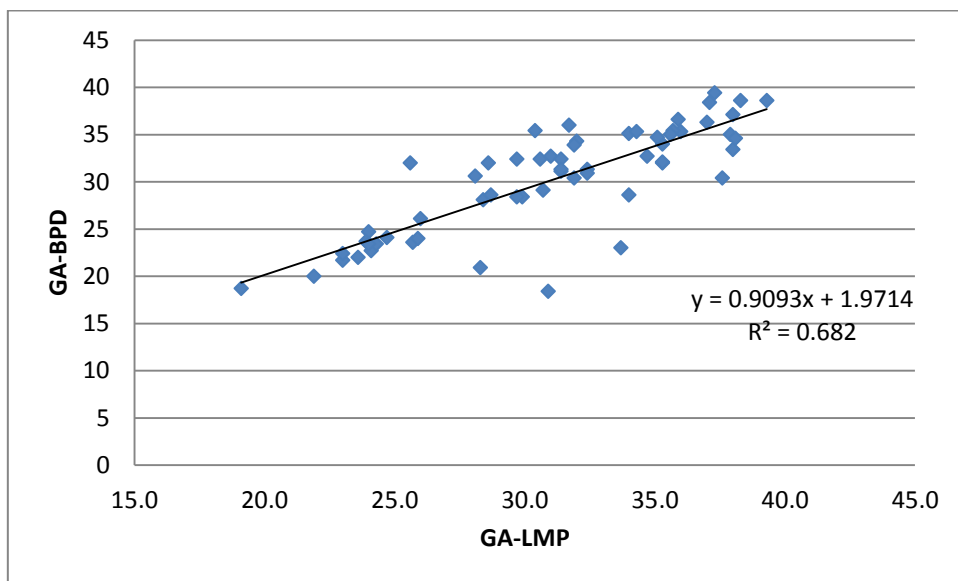
Figure (4-5): Scatter plot shows direct linear relationship of BPD caliper with gestational age by LMP.
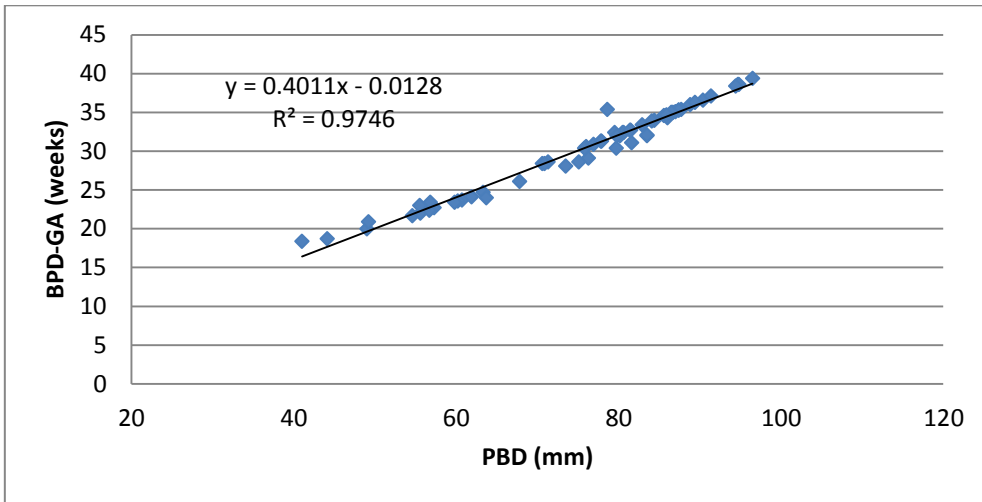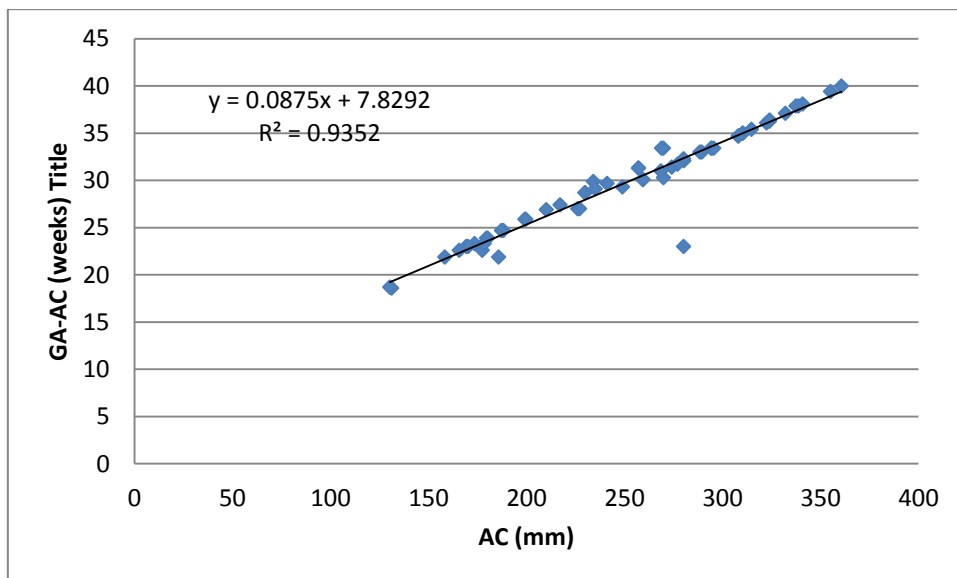
Figure (4 -6): Scatter plot shows direct linear relationship of BPD caliper with gestational age.

Figure (4-7): Scatter plot show direct linear relationship of AC caliper with gestational age.

Figure (4-8): Scatter plot show direct linear relationship of AC caliper with gestational age by LMP.

Figure (4-9): Scatter plot shows direct linear relationship of AC caliper with gestational age by LMP,

Figure (4-10): Scatter plot shows direct linear relationship of FL caliper with gestational age.
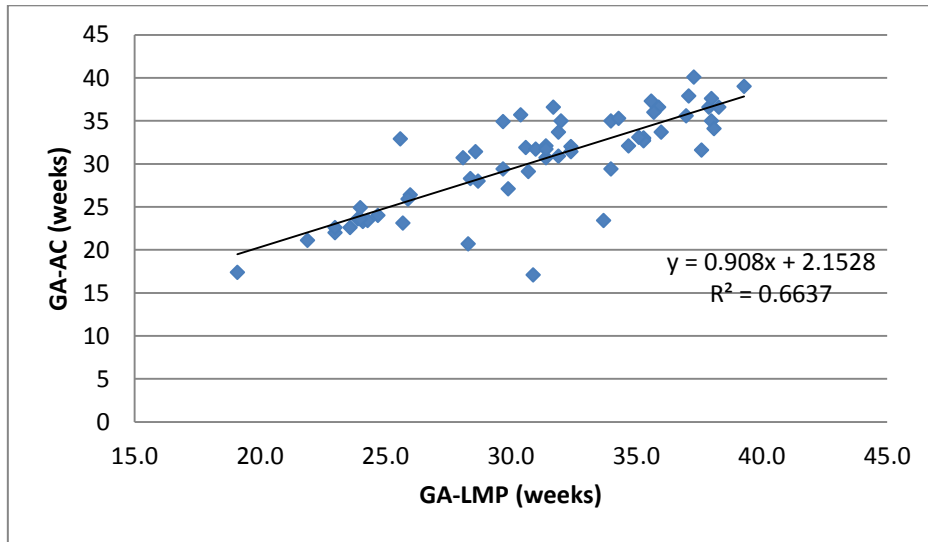

Figure (4-11): Scatter plot shows direct linear relationship of FL caliper with gestational age by LMP.
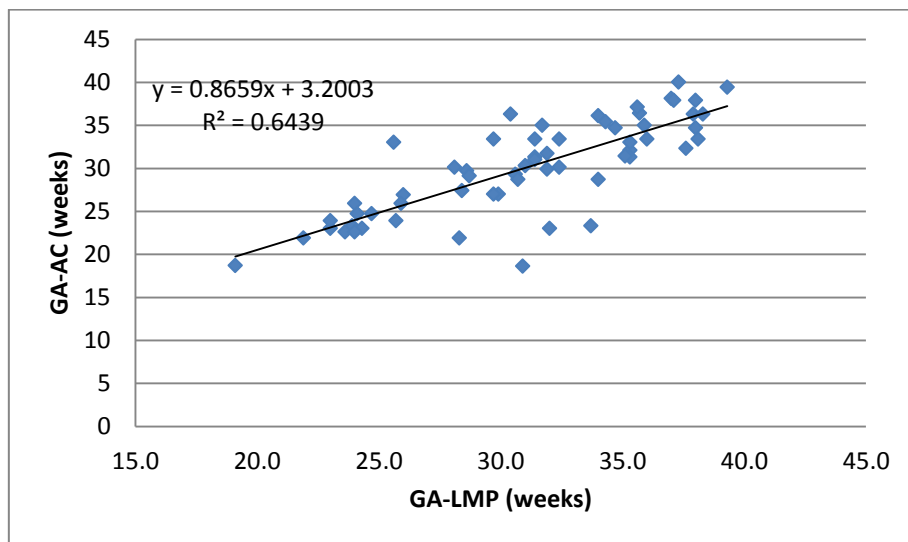
Figure (4-12): Scatter plot shows direct linear relationship of GA /LPM caliber with AVG of placenta thickness
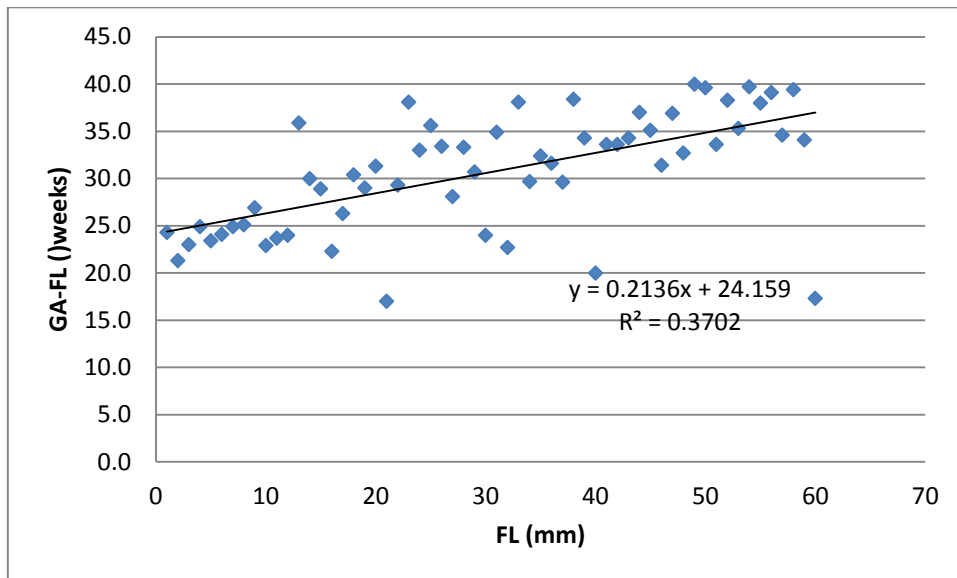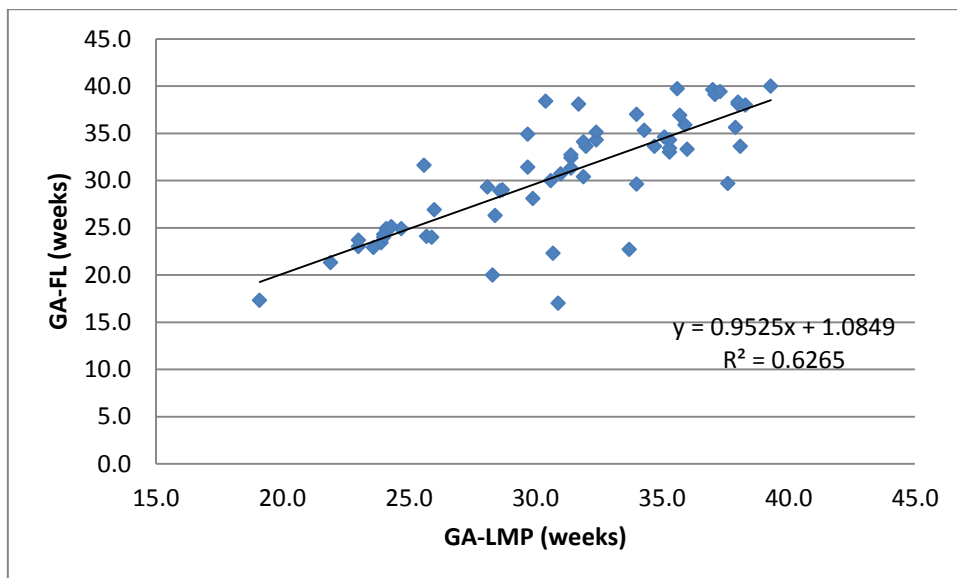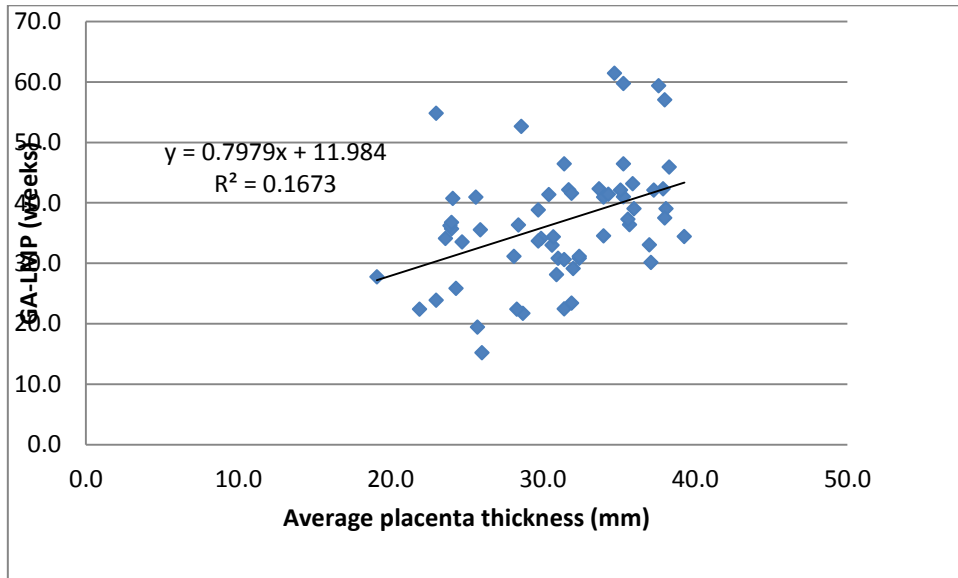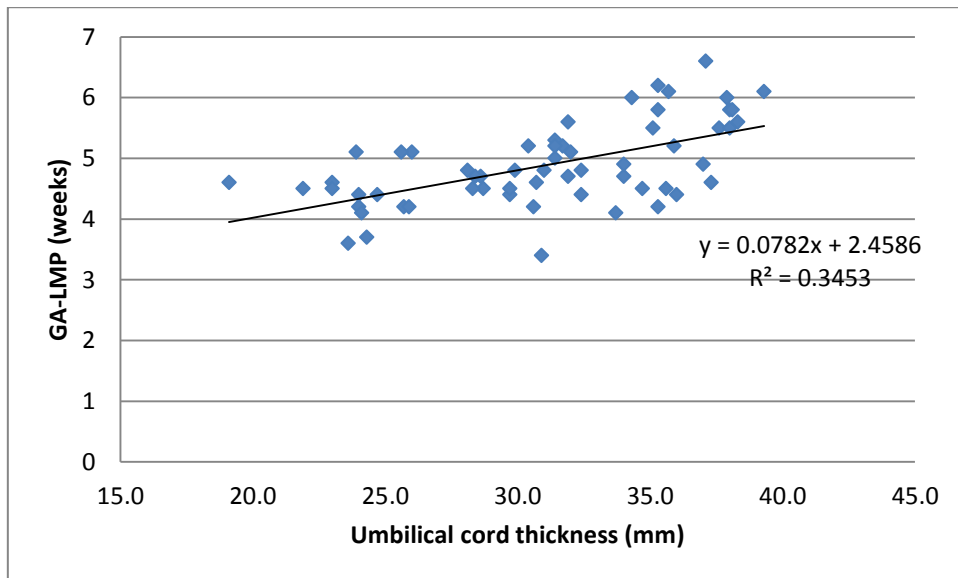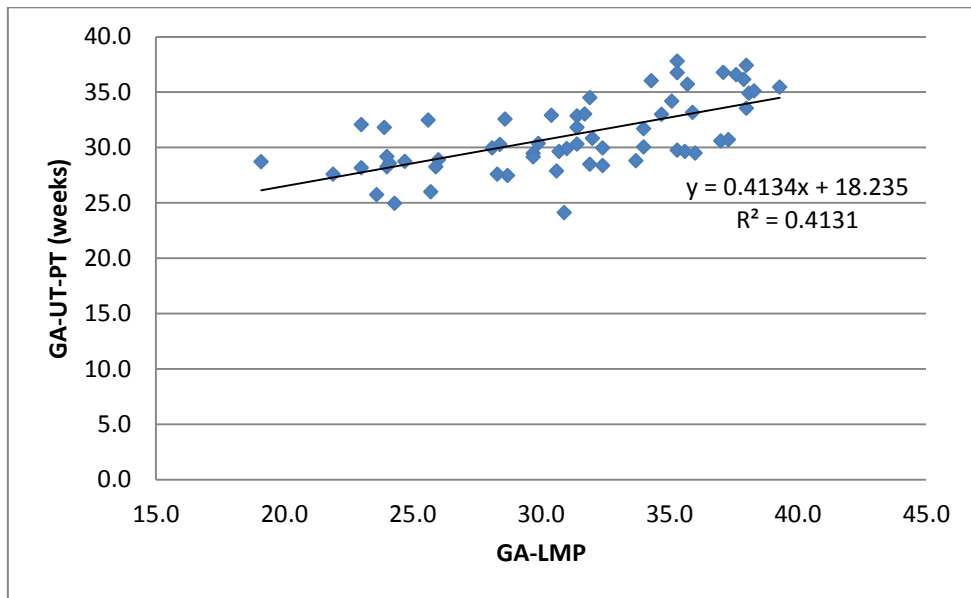

Figure (4- 13): Scatter plot shows direct linear relationship of UT caliper with gestational age.

Figure (4-14): Scatter plot shows direct linear relationship of GA-UT & GAPT caliper with gestational age by LMP.

Chapter Five

Discussion, Conclusion and Recommendations

5.1 Discussion

Sonologic assessment of gestational age is most accurate in the first trimester when it can be calculated within 2 - 3 days. Usual measurements taken for assessing gestational age are CRL in first trimester and BPD, FL and AC in second and third trimester.

The purpose of this study was to investigate the relationship between the placental thickness and estimated fetal age in normal Sudanese pregnant women in third trimester. The study includes 60 pregnant women their age range (16-45) years. From the collected data, the placental thickness (PT), umbilical cord thickness (UT), biparietal diameter (BPD), Femur length (FL), abdomen circumference (AC) and Last menstrual period (LMP). Other variables such as maternity age and gravidity are also included in the study.

The data reported in the present study showed the Age distribution ranged from 16 years to 45 years. We found that there were 10 cases below 20 years old, 14 cases between 20-25 years old, 23 cases between 26-30 years old, 6 cases between 31-34 years old and 7 cases above 35 years old (table 4-1).

In our study population, most of cases that we detect the gestational age from 14 weeks to 42 weeks. There were 21 women in the second trimester 35 % and 39 with 65% women in third trimester table (4-2).

Also, in our study placenta Cites disturbed between anterior was 33.3%, posterior 38.3%, fundal 10% and lateral 11.3% for all pregnant women. table (4-3).

According to our study scatter plot shows direct linear relationship of HC caliper with gestational age. There is a direct linear relationship between

HC caliper and the gestational age in weeks, where the GA increases by 0.1 weeks ($\approx 0,7$ days) per each mm of HC Figure (4-4)

On other side scatter plot shows direct linear relationship of BPD caliper with gestational age by LMP. There is a direct linear relationship between BPD caliper and the gestational age by LMP in weeks, where the GA increases by 0.9 weeks ($\approx 0,6$days) per each mm of PBD Figure (4-5).

The scatter plot shows direct linear relationship of BPD caliper with gestational age. There is a direct linear relationship between BPD caliper and the gestational age in weeks, where the GA increases by 0.4 weeks ($\approx$ 3 days) per each mm of PBD Figure (4 -6).

The study found direct linear relationship of GA /LPM caliber with AVG of placenta thickness, there is a direct linear relationship between PT caliber and the gestational age in weeks, where the GA increases by 0.7 weeks ($\approx$ 0,5 days) per each mm of PT Figure (4-12).

One of the previous studies said between 20 to 32 weeks of gestation, there is almost perfect correlation between placental thickness and gestational age. *Association between Placental Thickness and Gestational Age Dr Patsy Varghese1, Dr Lakshmi BS2,*

Other studies found the average gestational age and placental thickness was 26.18±7.91 weeks and 29.10±7.027 mm. A linear relationship was observed between gestational age and placental thickness. correlation between placental thickness and gestational age was positive and significant (r=0.959 and p=0.0005), similarly 96 women with 3rd trimester, correlation between placental thickness and gestational age was positive and significant (r=0.858 and p=0.0005). Strong positive correlation between placental thickness and gestational age was observed (r= 0.985 and p= 0.0005). *CORRELATION OF SONOGRAPHIC PLACENTAL THICKNESS*

Also, they found the mean umbilical cord diameter and cross-sectional area were 14.5mm + 7.2mm and 201.6mm + 139.5mm2 respectively. Umbilical cord growth rate of 1.0mm/week was noted between the 14th and 35th week of pregnancy. There were significant correlations (p < 0.001) between umbilical cord size and other fetal parameters for GA estimation. *Relationship between sonographic umbilical cord size and gestational age among pregnant women in Enugu, Nigeria. Eze CU1, Ugwuja MC2, Eze CU3, Agwuna KK2, Ugwu GO4.*

Other variables such as maternity age and gravidity are also included in the study.

5.2 Conclusion:

This study deals mainly with normal singleton pregnancies in the second and third trimester to measure placental thickness and compare it with gestational age.

The study found that there is significant correlation between placental thickness in millimetres and gestational age in weeks in the third trimester for this reason measurement of placenta thickness is an important parameter for estimating fetal age it helpful in cases with the exact duration of pregnancy is not known in the third trimester. The study found that there was strong linear relationship between placental thickness and gestational age calculated from biparietal diameter (BPD), femur length (FL), last menstrual period (LMP) and abdomen circumference (AC). There was no correlation between maternal age, location of placenta, and maternal gravity with placenta thickness in third trimesters.

It concluded that Imaging studies assist to found that the placenta thickness and umbilical cord thickness increase with gestational age and

there is statistically significant positive correlation between Placenta Thickness and umbilical cord thickness and gestational age.

The study concluded that the placental thickness and umbilical cord thickness must be used to estimate gestational age in normal pregnancy.

5.3 Recommendations

➢ Ultrasound is one of the most commonly used imaging modalities for study and evaluate the gestational age

➢ Imaging studies assist the Sonologist to use the placental thickness as a parameter to follow the fetal development and wellbeing in addition to other parameters.

➢ Another research that follows the fetal weight by placental thickness measuring, and weights the same fetus after delivery and study the relationship between them to confirm the role of placental thickness in assessing fetal weight.

➢ The present study was limited by insufficient sample size. We did not use corrections for multiple comparisons because the findings from this analysis were general associations rather than affirmative findings

➢ Further studies are needed on this issue, as well as more studies to focus Estimate the gestational age by using placenta thickness with abnormal pregnancies on possible modalities of treatment.

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Appendices

APPENDIX (A) Cases

CASE (1): Shows anterior placenta and umbilical cord measures, 33ys- 20wks.

CASE (2): Shows posterior placenta and umbilical cord measures, 21ys- 17 wks.

CASE (3): Shows fundal placenta and umbilical cord measurements, 30ys- 37wks.

CASE (4): Shows anterior placenta, 25ys- 24wks.

CASE (5): Shows posterior placenta and umbilical cord measures, 33ys- 29wks.

CASE (6): Shows anterior placenta measures, 34ys- 20wk.

CASE (7): Shows anterior placenta measures, 22ys- 30wks.

CASE (8): Shows anterior placenta measures, 36ys- 35wks.

CASE (9): Shows umbilical cord measures, 30ys- 29wks.

CASE (10): Shows lateral placenta and umbilical cord measures, 28ys- 25wk.

APPENDIX (B) Data collection and sheet

The Data was collected in the tabulated database sheet and analyzed by SPSS

The table for data collection

BPD	HC-GA	HC	AC-GA	AC	FL-GA	FL	PT	Avergae-PT	UT	Wks by LMP	Wks by US	GA-PT-UT