Sudan University of Science & Technology

College of Graduate Studies

A Study of Relationship between Placental Thickness and Fetal Age In 3rd trimester in Sudanese Women

دراسة العلاقة بين سمك المشيمة وعمر الجنين في الثلث الثالث من الحمل لدى النساء السودانيات

A Thesis Submitted For Partial Fulfillment For the Requirements of M.Sc. Degree In Medical Diagnostic Ultrasound

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December 2018

الآيـــة

قال الله تعالي:

(وَإِنْ مِنْ قَرْيَةٍ إِلَّا نَحْنُ مُهْلِكُوهَا قَبْلَ يَوْمِ الْقِيَامَةِ أَوْ مُعَذِّبُوهَا عَذَابًا شَدِيدًا كَانَ ذَلِكَ فِي الْكِتَابِ مَسْطُورًا)

صدق الله العظيم

سورة الإســراء الايه (58)

Dedication

To the soul of my mother…

To my dearest father **KAMAL ELTAYB** who strives to provide comfort to pushed me in the success way who taught me to promote life stairs to step my life wisely and patiently….

To my dearest beloved uncle **ELFATIH AHMED** for his support , guidance and valuable idea to complete this work.

Finally To my sweet sister **HIBA** for her continuous inspiration and Support and to my **FAMILY** …

Acknowledgement

I would like to express my deepest gratitude and sincere appreciation to my faithful supervisor **Dr. Ekhlas abdelaziz** for her continuous help, support, guidance and encouragement to complete this work. Without her supervision and contious help this dissertation would not have been possible.

My gratitude and appreciation extend to **Dr. Basher ELgaily** the sonologist in university of Khartoum Hospital, for his patience and greater help during the practical part of this study.

I like to thanks my friends who supported me to accomplish this work.

Abstract

This study was conducted to evaluate the placental thickness, measured at the insertion of the umbilical cord, as a parameter for estimating gestational age of the fetus.The study was conducted on 100 women with normal singleton pregnancies in the third trimester at Khartoum University Hospital from 1/9/2018 to 1/12 /2018. Ultrasonogaphy was done using " mindray – digiprince DP-6600 with 3.75 MHz convex probe . After estimating the fetal age (in weeks) by using biparital diameter (BPD) and Femur length (FL) .The placental thickness was calculated (in millimeter) during third trimester. The study showed that the placental thickness in millimeters in all patients along with the third trimester has positive linear correlation with gestational age in weeks. The researcher concluded that the measurement of the placental thickness is an important parameter for estimating gestational age in the third trimester in normal singleton pregnancies along with other parameter like BPD, FL, AC, HC where the exact duration of pregnancy is not known.

The study was recommended that Placental thickness should be used in to estimate fetal age in the third Trimester of pregnancy. Also

Equipment companies should install placental thickness as an indicator for gestational age in their machines

المستـخلـص

أجريت هذه الدراسه بغرض قياس سمك المشيمة من نقطة التقائها بالحبل السري و كمؤشر لتقدير عمر الحمل بالنسبه للجنين . قد تم إجراء هذه الدراسه على مائة من النساء الحوامل حملا أحاديا طبيعيا في الثلث الثالث من فترة الحمل وذلك بمستشفى جامعه الخرطوم في الفترة من 1/9/ 2018 والى 1/ 2018/12 . تم إستخدام جهاز ماينـدري 500 للكشف بالموجات فوق الصوتيه مع مجس (مسبار) محدب 3.75 ميقاهيرز .

لقد تم حساب سمك المشيمه (بالملميتر) في الثلث الثالث من عمر الحمل بعد تقدير عمر الجنين (بالأسابيع) بإستخدام قطر جانبي الدماغ وطول عظم الفخذ و أوضحت الدراسه أن سمك المشيمة بالمليمترات في كل النساء السودانيات اللآتي حملن حملا أحاديا طبيعيا يتطابق تطابقا تاما مع عمر الحمل بالاسابيع .

ومن هنا نخلص الى أن مقياس سمك المشيمة يعد مؤشرا مهما من مؤشرات تقدير عمر الحمل , هذا بالإضافه الى مؤشرات أخرى مثل قياس القطر الجانبي للدماغ , طول عظم الفخذ , محيط البطن وغيره من غير أن تكون مدة الحمل معروفه بالضبط .

قد أقترحت الدراسه بأن يتم إستخدام سمك المشيمة في تقدير عمر الجنين في الثلث الثالث من الحمل وأن يتم برمجة أجهزة الموجات فوق الصوتيه بحيث تتمكن من أخذ هذه القياسات بدقة.

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List of Abbreviations

AC	Abdominal circumference
BPD	Biparietal Diameter
FL	Femur Length
HC	Head Circumference.
HCG	Human Chorionic Gonadotropin.
IgG	Gamma Globulins.
LMP	Last Menstrual Period
PT	Placenta Thickness.
U/S	Ultrasound.

Chapter One

Introduction

1.1 Introduction:

The placenta is a fetal organ which provides the physiological link between pregnant woman and the fetus. The placenta is highly vascularized organ and its main functions are to exchange of metabolic, gaseous products between maternal and fetus blood stream and production of hormones.

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 echo texture of the placenta is clearly apparent at sonography. (Peter, 2007).

The placenta is a fetal organ with important metabolic, endocrine and immunologic functions besides being responsible for nutrition, respiration and excretion for the fetus. Lastly acting as a barrier, it has a role in protecting the fetus from noxious agents (Holland,1998).

The estimation of the fetal age by ultrasound is based to know the relationship between fetal age and weight. Several sonographically derived fetal parameters used to date pregnancy include fetal crown-rump length (CRL),biparietal diametr (BPD),head circumference(HC),femer length(FL) and abdominal circumference(AC)…, Placenta thickness measured at the level of the umbilical cord insertion and can be used as a new parameter to estimate gestational age of the fetus. (peter,2007).

With the new advances in grey scale and doppler sonography, we are able to study the placental sonographic appearance and its relationship to uteroplacental blood flow measurement and intrauterine growth. Presently the most effective way to date pregnancy is by use of ultrasound. Several sonographically derived fetal parameters used to date pregnancy include fetal crown - rump length (CRL), biparietal diameter (BPD), head circumference (HC), femur length (FL),and abdominal circumference (AC) (Cunningham 2001).

Placental thickness measured at the level of the umbilical cord insertion can be used as a new parameter to estimate gestational age of the fetus. The present study was undertaken to evaluate the relationship between placental thickness and gestational age of the fetus.

1.2 Problem of the study:

There is some error in estimating the fetal age by FL, BPD which are affected by fetal movement , and LMP which is unkown for most of women. So we need to increase parameters and take the medium of all of them.

1.3 Objectives of the study:

1.3.1 General objective:

To asses relationship between placental thickness and gestational age using ultrasound in third trimester.

1.3.2 Specific objectives:

- To measure of placental thickness in the third trimester.
- To correlate placental thickness with average GA.
- To measure and correlate placental thickness in different placental location.
- To optimize chart for placental thickness in different GA per weeks.

1.4. Overview of the study:

This study falls in to five chapters, chapter one was introduction which included problem of study, objectives of study and overview of study, while chapter two included literature review and previous studies. Chapter three deals with material used in collection data methods of data and analysis .Chapter four presented the results of the study and finally chapter five included discussion of the results ,conclusion and recommendations.

Chapter Two

Literature review

2.1 Theoretical background:

2.1.1 Anatomy of placenta:

The placenta is a fetomaternal organ that has two components: A fetal part that develops from the chorionic sac. And maternal part that is derived from the endometrial.

The fetal part of the placenta (villous chorion) is attached to the maternal part of the placenta (decidua basalis) by the cytotrophoblastic shell, the external layer of trophoblastic cells on the maternal surface of the placenta. The chorionic villi attach firmly to the decidua basalis through the cytotrophoblastic shell and anchor the chorionic sac to the decidua basalis. Endometrial arteries and veins pass freely through gaps in the cytotrophoblastic shell and open into the intervillous space.

Shortly after birth, the placenta and fetal membranes are expelled from the uterus as the afterbirth. (moore, presaud, 2008).

The Decidua refers to the gravid endometrium, the functional layer of the endometrium in a pregnant woman that separates from the remainder of the uterus after parturition (childbirth). The three regions of the deciduas are named according to their relation to the implantation site :

The deciduas basalis is the part of the decidua deep to the corcepts that forms the maternal part of the placenta. The decidua capsulitis is the superficial part of the decidua overlying the conceptus.And the decidua parietalis all the remaining parts of the decidua.

In response to increasing progesterone levels in the maternal blood, the connective tissue cells of the decidua enlarge to form pale-staining decidual cells. These cells enlarge as glycogen and lipid accumulate in their cytoplasm. The cellular and vascular changes occurring in the endometrium as the blastocyst implants constitute the decidual reaction. Many decidual cells degenerate near the chorionic sac in the region of the syncytiotrophoblast and, together with maternal blood and uterine

secretions, provide a rich source of nutrition for the embryo. The full significance of decidual cells is not understood, but it has also been suggested that they protect the maternal tissue against uncontrolled invasion by the syncytiotrophoblast and that they may be involved in hormone production. Decidual regions, clearly recognizable during ultrasonography, are important in diagnosing early pregnancy.

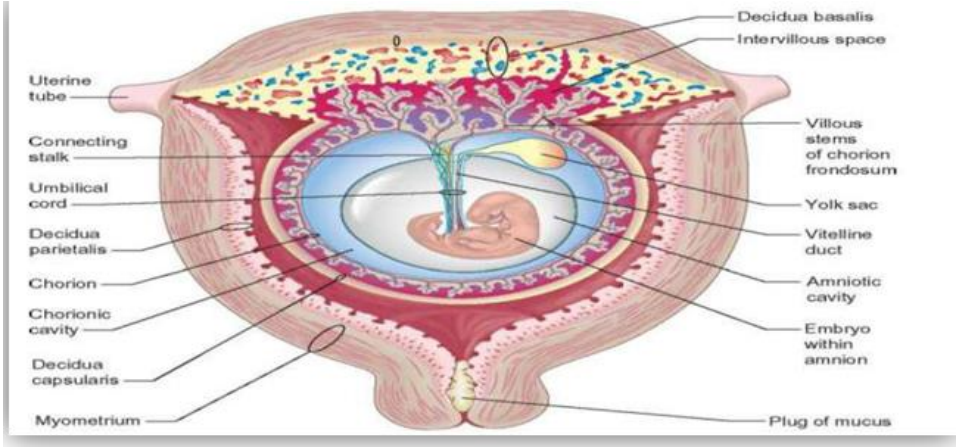

Fig (2.1)The gravid uterus in second month adapted from" Susan, 2008"

2.1.1.1 Placental Development:

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 chorion frondosum and later the placenta. The fetal side of the placenta consists of the chorionic plate and chorionic villi. The maternal side consists of the decidua basalis, which open up into large cisterns, the intervillous spaces. The fetal villi are immersed in maternal blood located in the intervillous spaces. Anchoring villi develop from the chorionic plate. These attach to the deciduas basalis, holding the placenta in place.(Moore KL ,1982) By the end of pregnancy, the villi have a surface area of 12 to 14 square meters(Kanne JP, et al, 2005)

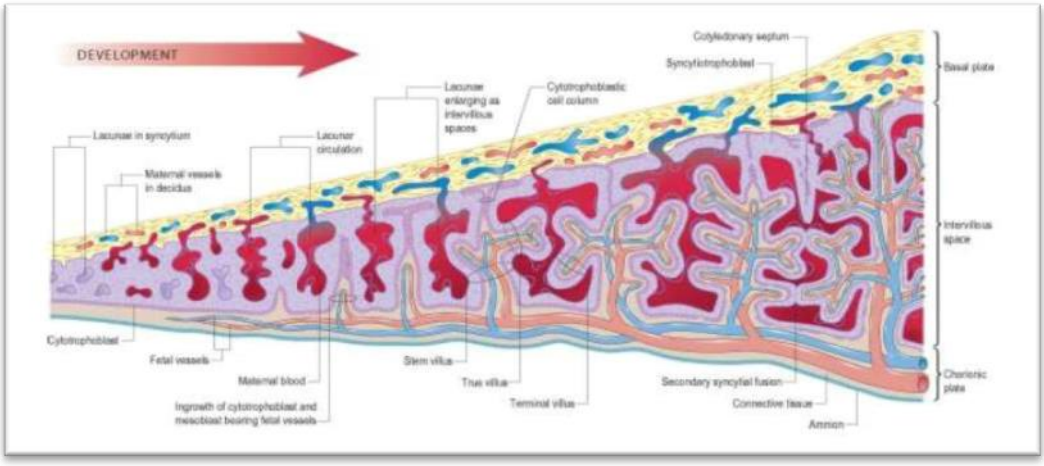

Fig (2.2) Placental development is shown from left to right. Adapted from (susan,2008)

2.1.1.2 Placental size:

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, Boonyanurak, 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, intraplacental hemorrhage, 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 E,et al,2001) dtrimester placental volume is associated with maternal nutritional status, birth weight, and pregnancy outcome.(Thame M, et al,2000, Wolf H, et al,1989).

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. An excessively large placenta may be associated with infection, anemia or triploidy and there are usually other markers of fetal compromise. (Smith NC and smith A P M 2006). Primary maternal CMV

(cytomegalovirus) infection and fetal or neonatal disease are associated with sonographically thickened placentas ,which respond to disease administration of fetal and neonatal disease are caused by placental insufficiency (La Torre et al,2006)

Sonographaically thick placenta is associated perinatal risk with increased mortality related to fetal anomalies and higher rates of both small for gestational age infants at term. (Elchalal et al,2000).

2.1.1.3 Placental Localization:

The placenta is best identified by scanning the uterus longitudinally and is easily recognized by its more echogenic pattern compared with that of the underlying myometrium. Careful inspection will demonstrate the chorionic plate as a bright linear echo between the homogeneous echoes of the body of the placenta and the amniotic fluid (Fig. 2.2). The actual internal os might be difficult to identify transabdominally but its position can be assumed by visualizing the slight dimple at the upper end of the cervical canal. The cervical canal is best imaged by placing the probe in the midline, with its lower end just above the symphysis, slight dextrorotation may be necessary. The cervical canal lies directly posterior to the bladder,typically at about 45 to the horizontal. The placenta can be fundal , anterior,posterior or lateral in which case it will be visualized on both the anterior and posterior walls of the uterus. It might lie completely within the upper part of the uterus, with its lower edge >5 cm from the internal os – such a position is usually described as ‘upper’ or ‘not low’. If the leading edge of the placenta lies within 5 cm of the internal os and/or appears to cover the internal os then its position should be described as ‘low’ and/or ‘covering the os’. The term ‘placenta praevia’ should only be used after 28 weeks . It is unnecessary to ask women to attend with a full bladder at the time of the 20–22 week scan as the majority will have an obviously fundal placenta. It is frequently possible to visualize

the lower placental edge and the internal os, thus making the diagnosis of alow-lying placenta possible even with a partially filled bladder. If such views are suboptimal and a low lying placenta is suspected, then a transvaginal examination should be performed or the woman should be scanned with a full bladder.(Chudleigh T. ,Thilaganathan B-2004).

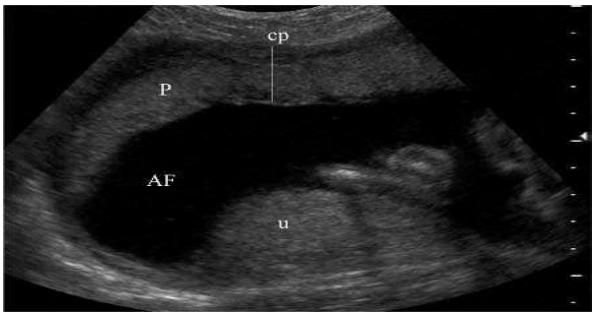

Fig (2.3) Localizating of placenta from a longitudinal, midline swction of the uterus. Note the homogenous echo pattern of the anterior wall placenta (P) and the bright echoes produced from the chorionic plate (CP) that demarcates the interface between the placenta and amniotic flulid (AF) Posterior uterine wall (U) . adapted from Chudleigh T. Thilaganathan 2004.

2.1.1.4 Placental Circulation:

The placenta is a unique vascular organ that receives blood supplies from both the maternal and the fetal systems and thus has two separate circulatory systems for blood: The maternal-placental (uteroplacental) blood circulation, and the fetal-placental (fetoplacental) blood circulation.

2.1.1.5 Maternal-placental blood circulation:

The uteroplacntal circulation starts with the maternal blood flow into the intervillous space through deciual spiral arteries. Exchange of oxygen and nutrients take place as the maternal blood flows around terminal villi in the intervillous space. The in-flowing maternal arterial blood pushes

deoxygenated blood into the endometrial and then uterine veins back to the maternal circulation

2.1.1.6 Fetal Placental Circulation

The fetal-placental circulation allows the umbilical arteries to carry deoxygenated and nutrient-depleted fetal blood from the fetus to the villous core fetal vessels. After the exchange of oxygen and nutrients, the umbilical vein carries fresh oxygenated and nutrient-rich blood circulating back to the fetal systemic circulation. At term, maternal blood flow to the placenta is approximately 600-700 ml/minute. It is estimated that the surface area of syncytiotrophoblasts is approximately 12m2 and the length of fetal capillaries of a fully developed placenta is approximately 320 kilometers at term. The functional unit of maternal-fetal exchange of oxygen and nutrients occur in the terminal villi. No intermingling of maternal and fetal blood occurs in the placenta .

2.1.2 Physiology of the Placenta:

The placenta has three main functions:

Metabolism (e.g., synthesis of glycogen) Transport of gases and nutrients Endocrine secretion (e.g., human chorionic gonadotropin [hCG])

These comprehensive activities are essential for maintaining pregnancy and promoting normal fetal development.

2.1.2.1 Placental Metabolism:

The placenta, particularly during early pregnancy, synthesizes glycogen, cholesterol, and fatty acids, which serve as sources of nutrients and energy for the embryo/fetus. Many of its metabolic activities are undoubtedly critical for its other two major placental activities (transport and endocrine secretion).

2.1.2.2 Placental Transfer:

The transport of substances in both directions between the fetal and maternal blood is facilitated by the great surface area of the placental membrane. Almost all materials are transported across the placental membrane by one of the following four main transport mechanisms: simple diffusion, facilitated diffusion, active transport, and pinocytosis (moore, presaud, 2008).

Passive transport by simple diffusion is usually characteristic of substances moving from areas of higher to lower concentration until equilibrium is established. In facilitated diffusion, there is transport through electrical gradients. Active transport against a concentration gradient requires energy. Such systems may involve carrier molecules that temporarily combine with the substances to be transported. Pinocytosis is a form of endocytosis in which the material being engulfed is a small amount of extracellular fluid. This method of transport is usually reserved for large molecules. Some proteins are transferred very slowly through the placenta by pinocytosis

2.1.3 Pathology of placenta:

There are a number of placental shape abnormalities, some quite rare.

2.1.3.1 Circumvallate placenta

In circumvallate placenta the membranes of the chorion leave, instead of inserting at the margin of the placental disc, insert more toward the center of the disc. Circumvallate placenta has the sonographic appearance of a rolled edge of membranes at the placental edge inserting toward the center of the placental chorionic disc(fig 2.8) (Rumack … et al.,2011).

Fig (2.4) Transabdominal sonogram in the early third trimester shows rolled edges of the placenta.(Carol M. Rumack [et al.],2011).

2.1.3.2 Succenturiate lobe:-

Succenturiate lobes, or accessory lobes, of the placenta can be a single lobe or multiple lobes in addition to the main placental lobe Given that placental tissue is present in the accessory lobe, there must be arterial and venous connections to the main portion of the placenta (Rumack et al.,2011)

(Fig 2.5) Transabdominal sonogram of a third-trimester pregnancy shows a portion of placenta (arrow) separate from the main placental disc (succenturate lobe) adapted from Rumack [et al.],2011.

2.1.3.3 Bilobed Placenta

Bilobed placentas consist of two similarly sized placental lobes separated by intervening membranes (fig 2.11). There must be some vascular connection between the lobes, and the umbilical cord may insert between the lobes in the membranes.

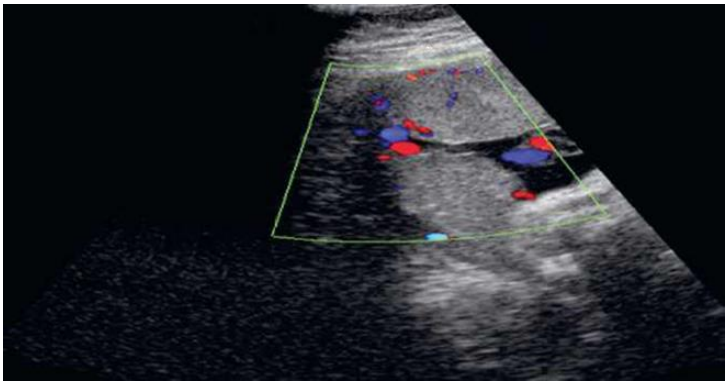

Fig (2.6) Transabdominal sonogram of a third-trimester bilobed placenta. Both placental discs are ofcomparable size (bilobed placenta)) adapted from Rumack *[et al.],*2011.

Figure (2.7) Placental lakes in an anterior placenta. Note the lakes lie within the bulk of the placenta ."adapted from Chudleigh T. , Thilaganathan B., 2004

2.1.3.4 Placental cysts

These are found immediately beneath the chorionic plate (Fig 2.13). The smaller ones are blood vessels viewed in cross-section. The larger ones are distinct entities caused by the deposition of fibrin in the intervillous space. They have no apparent significance (Chudleigh T, Thilaganathan B.2004).

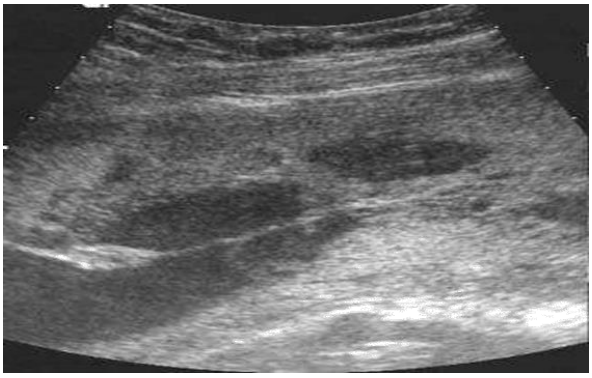

Fig (2.8) Placental cyst. Note the position of the mass, immediately beneath the chorionic plate. .."adapted from Chudleigh T. , Thilaganathan B., 2004.

2.1.3.5 Placenta previa:

The term "placenta previa" refers to a placenta that is "previous" to the fetus in the birth canal. The incidence at delivery is approximately 0.5% of all pregnancies. Bleeding in the second and third trimesters is the hallmark of placenta previa. This bleeding can be life threatening to the mother and fetus. With expectant management and cesarean delivery, both maternal and perinatal mortality have decreased over the past 40 years. Accurate diagnosis of placenta previa is vital to improve the outcome for mother and neonate. The differentiation of placental positions has historically been performed by digital assessment of the lower uterine segment and placenta through the cervix. Using this potentially hazardous method of evaluation, placental position was classified as complete placenta previa, partial placenta previa, incomplete placenta previa, marginal placenta previa, low-lying placenta, and placenta distant from the internal cervical os. These classifications donot directly apply to the ultrasound examination of placental position relative to the cervix. The use of ultrasound to evaluate the position of the placenta in the uterus has both improved knowledge of the placenta within the uterus and simplified terminology withrespect to placental

position (Fig2.14). Complete placenta Previa describes the situation in which the internal cervical is totally covered by the placenta. Marginal placenta previa denotes placental tissue at the edge of or encroaching on the internal cervical os. A low placenta is one in which the placental edge is within 2 cm, but not covering any portion, of the internal cervical os. Transabdominal scanning can be used to visualize the internal cervical os and to determine the relation of the placenta to the cervix in most cases . (Rumack … et al.,2011).

(Fig2.9)Complete placenta previa (arrow). The maternal cervix is demarcated by the calipers. adapted from Rumack *[et al.],*2011.

2.1.3.6 Placenta accreta:

The normal placenta invades the inner third of the myometrium. At delivery, the placenta separates at the decidual plane, with an abrupt cessation of intraplacental flow as the myometrium contracts. A placenta that is abnormally adherent to the uterine wall after delivery is termed placenta accreta. Placenta increta occurs if the placenta invades the myometrium more deeply, and placenta percreta refers to a placenta that at least in part protrudes through the uterine serosa. Placenta accreta, increta, and percreta are serious complications of pregnancy associated with maternal blood loss, need for hysterectomy, and retained products of conception. With ultrasound, placenta accreta can be identified

antenatally so that delivery plans can be made prospectively, improving the outcome for mother and child. (Rumack … et al.,2011)

Fig (2.10)Placenta accreta with placental lakes. , Transabdominal sonogram of a third-trimester placenta shows aPlacental (venous) lake. . adapted from Rumack *[et al.]*,2011.

2.1.3.7 Placental abruption :

About 3% of the pregnant population will bleed after 28 weeks' gestation. Approximately one-third of these women will have suffered a placental abruption, in which all or some of the placenta separates from the underlying myometrium before the fetus has been delivered. If this is a major abruption, it is usually clinically apparent because of abdominal pain and a peculiar 'woody hardness' to the uterus. Ultrasound has no place in the diagnosis of major abruption, although it might be needed to determine whether the fetus is still alive.(Chudleigh T, Thilaganathan B.2004).

2.1.3.8 Chorioangioma

This is a very rare vascular tumor of the placenta . Such tumors vary both in appearance and in size and occasionally appear to be separate from the placenta. They are usually benign and, if less than 5 cm in diameter, rarely cause a problem. Larger tumors are very vascular and can act as a fetal arteriovenous anastomosis. In this situation, a fetal hyperdynamic circulation can result in highoutput cardiac failure with subsequent

polyhydramnios and hydrops fetalis. (Chudleigh T, Thilaganathan B.2004)

2.1.4 Placental appearance:

The placenta in the first and second trimesters is slightly more echogenic than the surrounding myometrium (fig 2.3).

Fig (2.11) At 18 weeks, note the uniformly echogenic appearance of the placenta and a uterine contraction deviating the placenta." adapted from carol m. rumack *[et al.],*2011.

The attachment site, or base of the placenta, should be clearly delineated from the underlying myometrium. The edges of the placenta usually have a small sinus, the marginal sinus of the placenta , where intervillous blood drains into the maternal venous circulation. This structure should not be confused with placental separation. As the placenta matures, areas of echogenicity within the placenta are visualized (Fig 2.4)

(Fig 2.12) Increasing echogenicity in the placenta as it matures Carol M. Rumack *[et al.],*2011

2.1.4.1 Placental Grading:

This is a classification of the normal changes that occur in the placenta during the course of a pregnancy; it is often known as Grannum grading, after its author. It used to be thought that a Grannum grade III placenta was associated with mature fetal lungs and placental dysfunction. This concept has been largely rejected and Placental grading is rarely used. It is included here for completeness and because it illustrates the varying appearances of the normal placenta. Figure 9.7 illustrates the Grannum grading criteria and Figure 9.8 the ultrasound appearances associated with a Grannum grade III placenta**.**

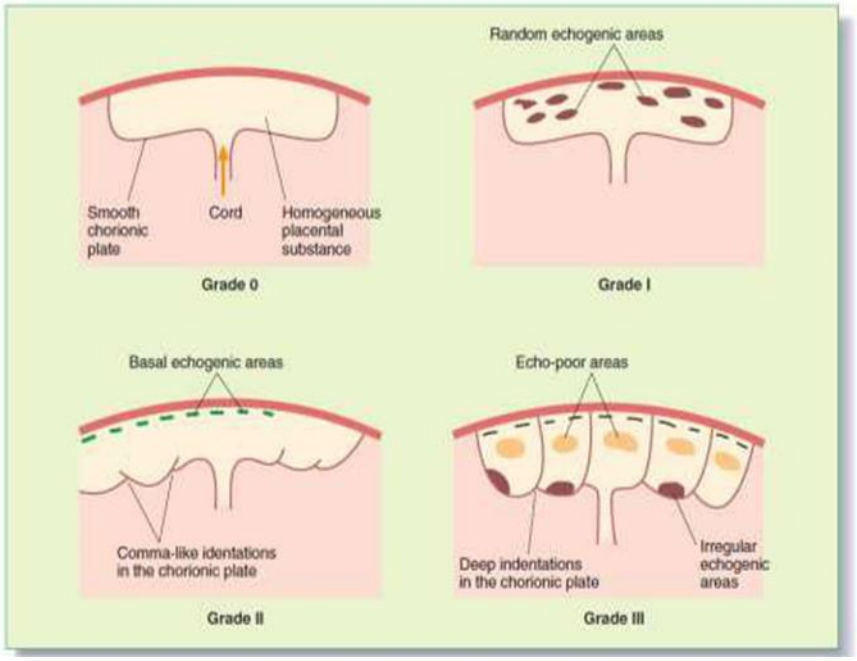

Fig (2.13) the ultrasound appearances of placental grading (adapted from Grannum et al 1982).

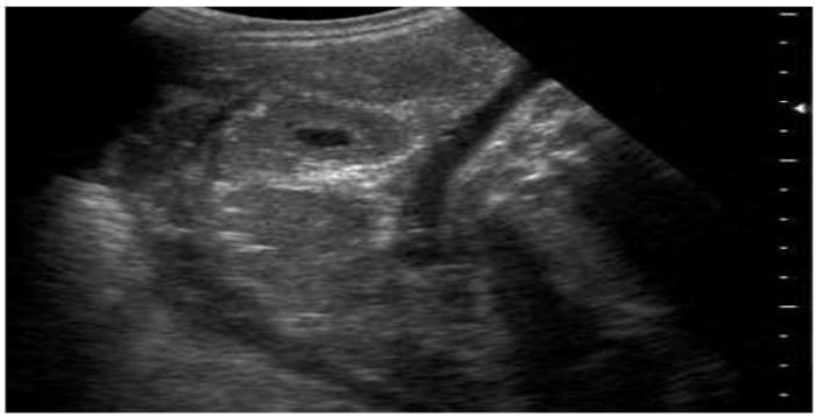

Fig (2.14) Grannum grade III anterior placenta at 38weeks' gestation. Rumack *[et al.],*2011

2.1.4.2 Assessment of gestational age:

The first trimester examination is performed either within the routine obestetric visit of pregnant women or as aresult of the patient complaining of bleeding or pain.Accordingly ,sonography has following emergency clinical questions to answer; where is pregnancy localized (is intrautrine or ectopic),is the embryo / fetus alive and what is probability of consequent demise of aliving embryo /fetus ??

The other goal of first trimester sonography are estimation of menstrual age of pregnancy, assessment of multible pregnancy evaluation of nuchal thickening and nasal bone and screening at 14 weeks.

2.1.4.3 Importance of accurate gestational age assessment :

Accurate assessment of gestational age is fundamental in managing both low and high risk pregnancies. In particular, uncertain gestational age has been associated with adverse pregnancy outcomes including low birth weight, spontaneous preterm delivery and perinatal mortality, independent of maternal characteristics.(Hall MH,Carr-Hill RA-1985) Making appropriate management decisions and delivering optimal obstetric care necessitates accurate appraisal of gestational age. For example, proper diagnosis and management of preterm labor and post-

term pregnancy requires an accurate estimation of fetal age. Many pregnancies considered to be preterm or postterm are wrongly classified. Unnecessary testing such as fetal monitoring and unwarranted interventions including induction for supposed postterm pregnancies may lead to an increased risk of maternal and neonatal morbidity. In addition, pregnancies erroneously thought to be preterm may be subject to avoidable and expensive hospitalization stays as well as excessive and potentially dangerous medication use including tocolytic therapy.

In one study by Kramer et al that assessed over 11,000 pregnant women who underwent early ultrasound, one-fourth of all infants who would be classified as premature and one-eighth of all infants who would be classified as postterm by menstrual history alone would be misdiagnosed.(Kramer Mset al 1988) Accurate pregnancy dating may also assist obstetricians in appropriately counseling women who are at imminent risk of a preterm delivery about likely neonatal outcomes. Precise knowledge of gestational age is also essential in the evaluation of fetal growth and the detection of intrauterine growth restriction. During the third trimester, fundal height assessment may be helpful in determining appropriate fetal growth by comparing the measurement to a known gestational age. In addition, dating a pregnancy is imperative for scheduling invasive diagnostic tests such as chorionic villus sampling or amniocentesis, as appropriate timing can influence the safety of the procedure. Certainty of gestational age is also important in the interpretation of biochemical serum screening test results and may help avoid undue parental anxiety from miscalculations and superfluous invasive procedures, which may increase the risk of pregnancy loss. Assessment of gestational age is also crucial for counseling patients regarding the option of pregnancy termination.

2.1.4.4 Assessing of GA using last menstrual period :

Traditionally, the first day of the last menstrual period (LMP) has been used as a reference point, with a predicted delivery date 280 days later. The estimated date of confinement (EDC) can also be calculated by Nägele's rule by subtracting three months and adding seven days to the first day of the last normal menstrual period. However, there are inherent problems in assessing gestational age using the menstrual cycle. One obstacle in using the LMP is the varying length of the follicular phase and the fact that many women do not have regular menstrual cycles. Walker et al evaluated 75 ovulatory cycles using luteinizing hormone levels as a biochemical marker and found that ovulation occurred within a wide range of 8–31 days after the LMP)(Walker EM,Lewis M,CooperW, et al 1988).Similarl y, Chia zz al collected over 30,000 recorded menstrual cycles from 2316 women and found that only 77% of women have average cycle lengths between 25 and 31 days(Chiazze L Jr,et al 1968). Another barrier in using a menstrual history is that many women do not routinely document or remember their LMP. Campbell et al demonstrated that of more than 4000 pregnant women, 45% were not certain about their LMP as a result of poor recall, irregular cycles, bleeding in early pregnancy or oral contraceptive use within two months of conception.(Campbell S , et al 1985).

2.1.4.5 Clinical method for determining gestational age :

Other methods used to assess gestational age have included uterine size assessment, time at quickening and fundal height measurements. However, these clinical methods are often suboptimal. Robinson noted that uterine size determination by bimanual examination produced incorrect assessments by more than two weeks in over 30% of patients.(Roninson Hp ,1993) Similarly, fundal height estimation does not provide a reliable guide to predicting gestational age. Beazley et al found

up to eight weeks variation in gestational age for any particular fundal height measurement during the second and third trimesters. (Beazley JM, Underhill RA 1970) In addition, quickening, or initial perception of fetal movement can vary greatly among women. While these modalities may be useful adjuncts, they are unreliable as the sole tool for the precise dating of a pregnancy.

2.1.4.6 Ultrasound assessment of gestational age :

In recent years, ultrasound assessment of gestational age has become an integral part of obstetric practice. (Kalish RB, Chervenak FA2002).

Correspondingly, prediction of gestational age is a central element of obstetric ultrasonography. Fetal biometry has been used to predict gestational age since the time of A-mode ultrasound.(Campbell S ,1969) Currently, the sonographic estimation is derived from calculations based on fetal measurements and serves as an indirect indicator of gestational age. Over the past three decades, numerous equations regarding the relationship between fetal biometric parameters and gestational age have been described and have proven early antenatal ultrasound to be an objective and accurate means of establishing gestational age.(Hadlock FP et al 1984) (Persson PH weldner BM 1986)

2.1.4.7 First trimester ultrasound:

Ultrasound assessment of gestational age is most accurate in the first trimester of pregnancy. During this time, biological variation in fetal size is minimal. The gestational sac is the earliest unequivocal sonographic sign of pregnancy.(Goldstein I, et al 1991) (Bernaschek G,et al1988) Historically, gestational sac size and volume had been used as a means to estimate gestational age.(Koorn El ,Kaufman M1967) (donald I,abdulla U,1967) This structure sonographically resembles a fluid filled sac surrounded by a bright echogenic ring, the developing chorionic villi,

within the endometrial cavity. This sac can be visualized as early as five menstrual weeks using transvaginal sonography.(Hellman LM et al,1979)(De Cripingy LC,et al ,1989) More recently, reliable, with a prediction error up to two weeks. Another imprecise yet often used modality is the sonographic visualization of distinct developing structures.(Steinkampf MP ,1997) During the fifth menstrual week, the yolk sac, the earliest embryonic structure detectable by sonography, can be visualized prior to the appearance of the fetal pole. And, by the end of the sixth menstrual week, a fetal pole with cardiac activity should be present. Subsequently, the presence of limb buds and midgut herniation can be seen at approximately 8 weeks gestation. However, these developmental landmarks can only provide rough estimates to the actual fetal age. In 1973, Robinson reported using the crown-rump length (CRL) for determining gestational age.(Ropinson HP ,Fleming JEE 1975)Since that time, ultrasound equipment, techniques and prediction formulas have substantially improved and allow for more rapid and precise measurement of the crown rump length and determination of gestational age.(Daya s. 1993)(Mac Gregor SN 1987)For the best results, the fetus should be imaged in a longitudinal plane. The greatest embryonic length should be measured by placing the calipers at the head and rump of the fetus. Three adequate CRL measurements should be taken and the average used for gestational age determination.(Filly RA,Hadlock FP,2000) The accuracy of the CRL measurement has been well documented in the medical literature. Specifically, gestational age can be estimated safely with a maximal error of three to five days in the first trimester.(Wisser J etal 1994) (drumm JE , etal ,1976)In summary, first trimester ultrasound is a useful and reliable tool in the assessment of gestational age. In particular, sonographic measurement of the CRL

during the first trimester is the best parameter for estimating gestational age and is accurate within five days of the actual conception date.

Fig (2.15) The longitudinal axis of fetus using trans abdominal method Ultrasound image demonstrating the fetal crown-rump length measurement in the first trimester "adapted from Trish Chudleigh and Basky 2008.

2.1.4.8 Second trimester ultrasound:

Although routine ultrasonography at 18–20 weeks gestation is controversial,(Ewigman BG,et al 1993) it is practiced bymanyobstetricians in the United States.(Chervenak FA , Mc Cullough L,1994) In addition to screening for fetal anomalies, sonographic gestational age assessment may be of clinical value in that it has been shown to decrease the incidence of post term as well as preterm diagnoses and thus the administration of tocolytics.(Romero R , et al 1993) (Taiple P , et al 2001) In addition, uncertain gestational age has been associated with higher perinatal mortality rates and an increase of low birth weight and spontaneous preterm delivery.

- **Ultrasound Parameters**

When choosing the optimal parameter for estimating gestational age, it is essential that the structure has little biologic variation, is growing at a rapid pace, and can be measured with a high degree of reproducibility.(Compbell S 1993) In the past, the biparietal diameter

(BPD) had been described as a reliable method of determining gestational age.While the BPD was the first fetal parameter to be clinically utilized in the determination of fetal age in the second trimester, more recent studies have evaluated the use several other biometric parameters including head circumference (HC), abdominal circumference (AC), femur length (FL), foot length,ear size, orbital diameters, cerebellum diameter (Hadlock Faet al ,1982) and others.

In a large study by Chervenak et al that evaluated pregnancies conceived by in vitro fertilization and thus had known conception dates, head circumference was found to be the best predictor of gestational age compared with other commonly used parameters (Table 2-1). This finding is in agreement with that ofHadlock,10 Ott11 and Benson48 who compared the performance of HC, BPD, FL and AC in different populations.(Benson CB ,Doubilet PM, 1991).

Table 2-1: Comparison of ste regression in estimation of fet age for singletons using different second trimester biometric parameters by Chervenak et al:

Biometric parameters	Random error (days)
HC	3.77
AC	3.96
BPD	4.26
FL	4.35
HC+AC	3.44
HC+FL	3.55
HC+AC+FL	3.35

(Adapted from Chervenak FA, Skupski DW, Romero R, et al. How accurate is fetal biometry inthe assessment of fetal age? American Journal of Obstetrics and Gynecology 1998; 178:678–87).

The head circumference should be measured in a plane that is perpendicular to the parietal bones and traverses the third ventricle and thalami (Fig. 2.17) The image should also demonstrate smooth and symmetrical calvaria and the presence of a cavum septum pellucidum. The calipers should be placed on the outer edges of the calvaria and a computer-generated ellipse should be adjusted to fit around the fetal head without including the scalp.

Fig (2.16): Ultrasound image demonstrating the head circumference measurement in a second trimester fetus " Asim Kurjak & A Chervenak , 2004.

The biparietal diameter can be taken in the same plane by placing the calipers on the outer edge of the proximal calvarium wall and on the inner edge of the distal calvarium wall. The BPD, while highly correlated with HC, is less accurate as a predictor of gestational age as a result of variation in head shape.(Manning FA,1999).

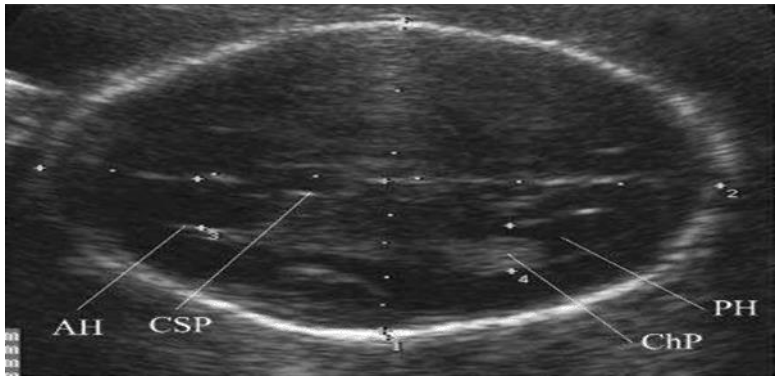

Fig 2.17. Transverse section of the fetal head with the callipers placed on the outer border of both the proximal and distal parietal bones

(diameter 1). The measurement therefore produces an 'outer to outer' BPD measurement. The occipitofrontal diameter has also been measured in this image (diameter 2). Note the placement of the calipers to produce an 'outer to outer' OFD measurement. Measurements of the anterior and posterior horns of the distal lateral ventricle and distal hemisphere have also been taken (diameters 3, 4 and 1, respectively)." Teish Chudleigh T. , Thilaganathan B., 2004.

Multiple parameters have been shown to improve the accuracy of gestational age assessment. Along with head circumference, the addition of one parameter (AC or FL) or two parameters (AC and FL) is slightly superior to head circumference alone in the prediction of fetal age. Table 2-1 demonstrates the relative error associated with the use of different biometric parameters. The use of multiple parameters also reduces the effect of outliers caused by biologic phenomena (i.e. congenital anomalies or growth variation) or technical error in measurement of a single structure. Still, with multiple parameters, it is important to take the images in the proper plane and place the calipers appropriately. For example, when assessing FL, the long axis of the femur should be aligned with the transducer measuring only the osseous portions of the diaphysis and metaphysis of the proximal femur. While not included in the FL measurement, the proximal epiphyseal cartilage (future greater trochanter) and the distal femoral epiphyseal cartilage (future distal femoral condyle) should be visualized to assure that the entire osseous femur can be measured without foreshortening or elongation (Fig.2.19).

Similarly, the AC must be measured appropriately in order to obtain an accurate estimate(Goldstein RB,1987). The image should taken in a plane slightly superior to the umbilicus at the greatest transverse abdominal diameter, with the liver, stomach, spleen and junction of the right and left portal veins visualized (Fig.2.20).

Figure 2.18: Ultrasound image demonstrating the femur length measurement in a second trimester fetus“ Asim Kurjak & A Chervenak , 2004.

Fig 2.19: Ultrasound image demonstrating the abdominal circumference measurement in a second trimester fetus“ Asim Kurjak & A Chervenak , Donald school 2004.

Most modern ultrasound machines are equipped with computer software that will automatically calculate the estimated gestational age based on the entered measurements. Using a large singleton in vitro fertilization (IVF) population from 14–22 weeks, Chervenak et al derived an optimal gestational age prediction formula using stepwise linear regression with a standard deviation (SD) of 3.5 days between the predicted and true gestational age. This formula was compared it to 38 previously published equations. Nearly all equations produced a prediction within one SD of gestational age is applicable and accurate across populations and institutions. Clinically, when a discrepancy greater than seven days (2SD) exists between the menstrual and ultrasound dating in the second

trimester, the biometric prediction should be given preference.(“ Asim Kurjak & A Chervenak , 2004).

2.1.4.9 Third trimester ultrasound

While ultrasound has proven to be useful in the assessment of gestational age in the first and second trimesters, accuracy in the third trimester is not as reliable. Biologic variation can be a major factor that affects accuracy in gestational age prediction, and this variability greatly increases with advancing pregnancy. Doubilet and Benson evaluated late third trimester ultrasound examinations of women who had also received a first trimester exam and found the disparity in gestational age assessments to be three weeks or greater. Thus, third trimester sonographic estimates of gestational age should be used with caution, if at all (Asim Kurjak & A Chervenak ,2004)

2.3 Previous Studies:

A study was perfomed to evaluating placental thickness, which measured at the insertion of the umbilical cord, to be as a parameter for estimating gestational age of the fetus. The study was conducted on 600 normal antenatal women of all gestational ages (10 weeks of gestation) attending antenatal clinic at the department of obstetrics and gynecology, S.M.S. Medical Collage, Jaipur (Rajasthan) from august 2001 to February 2002. USG was done by using Toshiba Canasee II machine with a 3.75 MHz sector probe. After estimating the fetal age by CRL, BPL, HC, AC and FL. The placental thickness with standard deviation was calculated for all gestational ages. It was observed that the placental thickness gradually increased from 15mm at 11 weeks of gestation to 37.5 mm at 39 weeks. From the 22^{nd} week to 35^{th} week of gestation the placental thickness coincide almost exactly with the gestational age in weeks. To conclude , the measurement of placental thickness is an important parameter for estimation of fetal age along with other parameters especially in the late mid trimester and early trimester, where the exact duration of pregnancy is not known (p mital ,etal 2002).

Also a study was established normal values of placental thickness during the first half of pregnancy. Normal pregnant women with singleton pregnancies between 8 and 20 weeks of gestation were recruited into the study. All the newborns were normal at birth. Placental thickness was measured perpendicularly through the thickest part of the placenta on transabdominal scans. The placental thickness data were analyzed for mean, standard deviation, 95% confidence interval, and 2.5^{th} $.5^{th}$, 50^{th} , 95^{th} and 97.5^{th} percentile for each week of gestational age. The best fit mathematical model was derived by regression analysis. The study find out the total number of measurements was 333 and the number of measurements for each week of gestational age ranged from 9 to 37. Regression analysis yielded the

following linear equation of the relationship: placental thickness (in mm) = gestation age (in weeks) x 1.4-5.6 (r= 0.82) (Tongsong T,2004).

Anna J, Lee, Michael Bethune , Hiscock . Richard J MBBS Franzcog, Franzco, COGU. They sought to determine the normal sonographically measured placental thickness in millimeters at the second-trimester scan (18 weeks to 22 weeks 6 days) and determine whether the measurement should be adjusted for gestational age and the placental site. They conducted a cross-sectional observational pilot study involving 114 consecutive patients with singleton pregnancies presenting for routine second-trimester sonography between 18 weeks and 22 weeks 6 days. And the result is the unadjusted overall mean placental thickness was 24.6 (SD, 7.29) mm. The placental thickness was normally distributed. On multivariable analysis, the predicted mean thickness was 6.6 mm (95% confidence interval, 4.4 to 8.8 mm; P< .001) less in anterior compared to posterior or fundal placentas and increased by 0.6 mm (95% confidence interval, −0.5 to 1.7 mm; P = .27) for each week increase in gestation after 18 weeks .They conclusions The placental position and possibly gestational age need to be considered when determining placental thickness. Anterior placentas are approximately 7 mm thinner than posterior or fundal placentas. Anterior placentas of greater than 33 mm and posterior placentas of greater than 40 mm should be considered abnormally thick. (J Clin Ultrasound. 2004).

Mr.Christopher performed a study to investigate placental thickness as a parameter for estimation gestational age in normal singleton pregnancies in Nigerian women. 730 Nigerian women with normal singleton pregnancies who were attending antenatal clinic at Federal Medical Centre, Makurdi, Nigeria were studied by transabdominal ultrasound between February 2007 and January 2008. Sonography was carried out using sonoscape SSI 600 ultrasound machine with 3.5 MHz transducer. Gestational age was estimated by crown- rump length (CRL), biparaital diameter (BPD), femur length (FL)

and abdominal circumference (AC) and the composite average recorded while placental thickness was measured at the point of insertion of the umbilical cord. Mean placental thickness with standard deviation was calculated for each gestation age. Correlation analysis was used to determine the relationship between placental thickness and gestational age while regression analysis yielded mathematical relationships between placental thickness and gestation age. The maximum mean placental thickness of 45.1 + 6.4 mm was recorded at 39 weeks gestation. There was a fairly linear increase in mean placental thickness with gestational age. There was significant and strong positive correlation between placental thickness and gestational age. Placental thickness appears promising as an accurate indicator of gestational age in singleton pregnancies in Nigerian women (Mr.Christopher,2008).

Mohammad tahir sheikh performs study to evaluating the placental thickness, measured at or close to the insertion of the umbilical cord, as a parameter for estimating gestational age of the fetus. The study was conducted on 100 normal antenatal women of all gestational ages (> 13 weeks of gestation) attending Afro- Asian institute of medical sciences, Lahore, Pakistan, and Tahir Medical Centre, Lahore, Pakistan, from February 2005 to October 2005. USG was done by using abdominal ultrasound machines, Toshiba Nemio 20 & Honda HS 200 at Afro- Asian Institute of Medical Sciences and with Belson 200 at Tahir Medical Centre with convex probe 3.5-5 MHz after estimating the fetal age by BPD & FL the placental thickness was measured in millimeters in each case. It was observed that the placental thickness gradually increased from start of 2^{nd} trimester to 37^{th} week of gestation.from the 21th week th 35^{th} week of gestation , the placental thickness coincide almost exactly the gestational age in weeks. The conclusion is the measrment of placental thickness is an

important parameter for estimation of fetal age along with other parameters (Mohammad tahir sheikh, 2008) .

Hammad Y H, (2008) Performed a study to evaluate placental thickness in third trimester in Sudanese women, his result showed linear relationship between placental thickness in mm and gestational age in weeks. He found that placental thickness increased with the fetal age .He concluded that the measurement of the placental thickness in an important parameter for estimating gestational age in normal singleton pregnancies along with other parameters (hammad, 2008).

Chapter Three

Materials and Method

Chapter Three

Materials and Method

3.1 Materials and method:

3.1.1 subjects:

This study was carried out in University of Khartuom Hospital in Khartoum state . A number of hunderd normal pregnant women were be taken for the study in third trimester without any chromosomal or structural defect of the fetus.

the study was concerned the estimation of fetal age by different methods (BPL/FL) and relation between them and placental thickness.

3.1.2 Included criteria:

The patient was scanned in third trimester at different ages which include 28 till 37 weeks.

3.1.3 Excluded criteria:

The period below 28 weeks or above 37 weeks Pregnant which had history of hypertensive or diabetes, intrauterine growth retardation, uterine or adenexal mass. Also had history of placental mass or anomaly, fetal mass or anomaly and multiple pregnancies.

3.1.4 Area of the study

University of Khartoum Hospital.

3.1.5 Period of the study

The data was collected in 3 monthes during 2018-2019.

3.1.6 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.

3.2.7 Technique:

Patients were examined in supine position and ultrasound coupling gel was applied.

The fetuses were scanned for viability and congenital anatomical defect and gestational age was estimated using BPD / FL .

3.2 Method:

Study design: this has adopted the analytical descriptive pattern

3.2.1 The equipment used :-

ultrasound machine used was" mindray –digiprince DP-6600" with a 3.5 MHz convex transducer.

3.2.2 Method of scanning:

Two fetal biometric parameters will be done which include :

- Biparaital diameter (BPD).
- Femur length (FL).

First, placenta thickness will be measured at core insertion by using ultrasound and then the measurements will be compared with growth parameter.

3.2.3 Ethical clearance:

The procedures of the scanning with ultrasound was explained to the patient and the purpose of study. Permission from the hospital and the department The data of study were kept in confidentiality.

Chapter four

Results

Table (4.1) frequency distribution of age of pregnant women

Age	Frequency	Percent	Valid Percent	Cumulative Percent
15-21 years	25	25.0	25.0	25.0
22-28 years	47	47.0	47.0	72.0
29-35 years	19	19.0	19.0	91.0
36-40 years	9	9.0	9.0	100.0
Total	100	100.0	100.0	

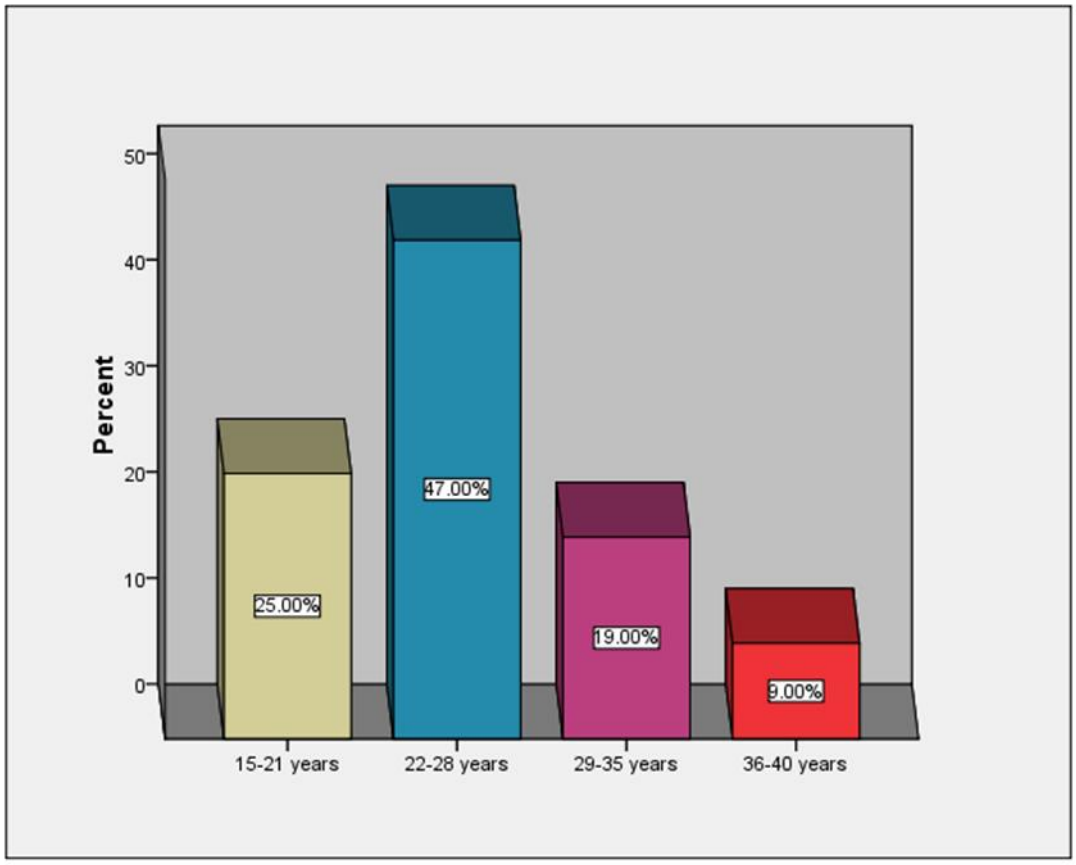

Figure (4.1) frequency distribution of age of pregnant women

Table (4.2) frequency distribution of gravida

Gravida	Frequency	Percent	Valid Percent	Cumulative Percent
1-3	52	52.0	52.0	52.0
4-6	39	39.0	39.0	91.0
7-9	7	7.0	7.0	98.0
10-12	2	2.0	2.0	100.0
Total	100	100.0	100.0	

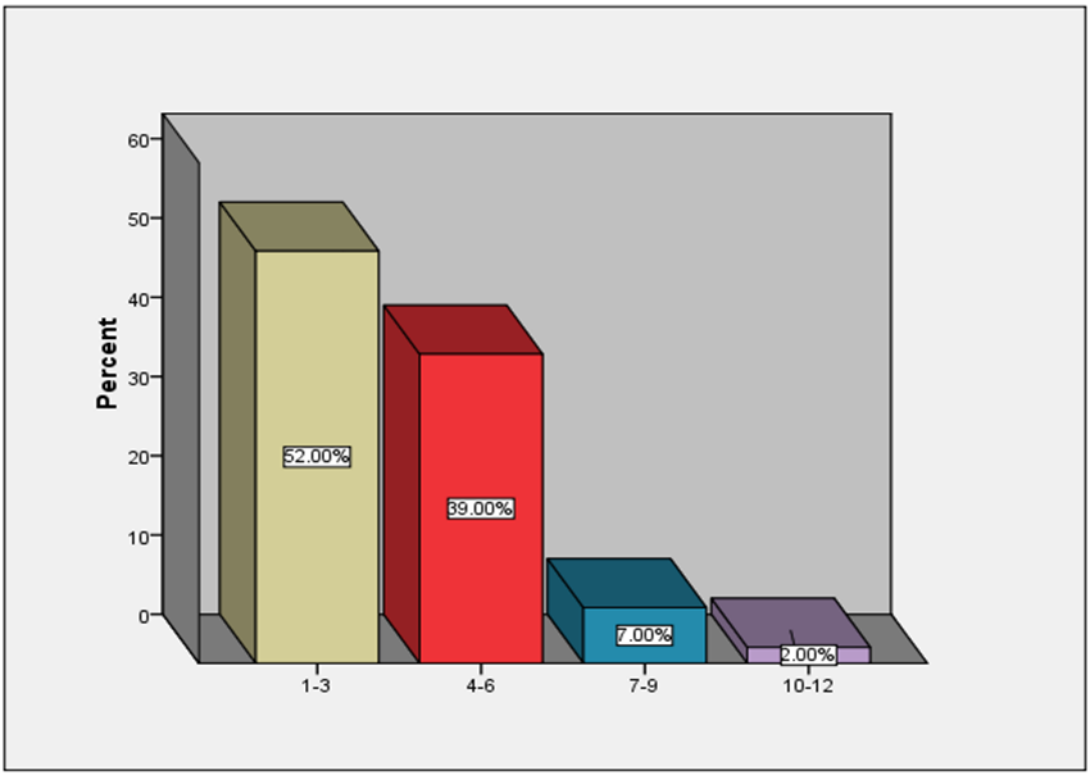

Figure (4.2) frequency distribution of gravida

Table (4.3) frequency distribution of placenta location

Location	Frequency	Percent	Valid Percent	Cumulative Percent
Anterior	44	44.0	44.0	44.0
Anterior fundal	25	25.0	25.0	69.0
Fundal	11	11.0	11.0	80.0
Posterior	10	10.0	10.0	90.0
Posterior fundal	10	10.0	10.0	100.0
Total	100	100.0	100.0	

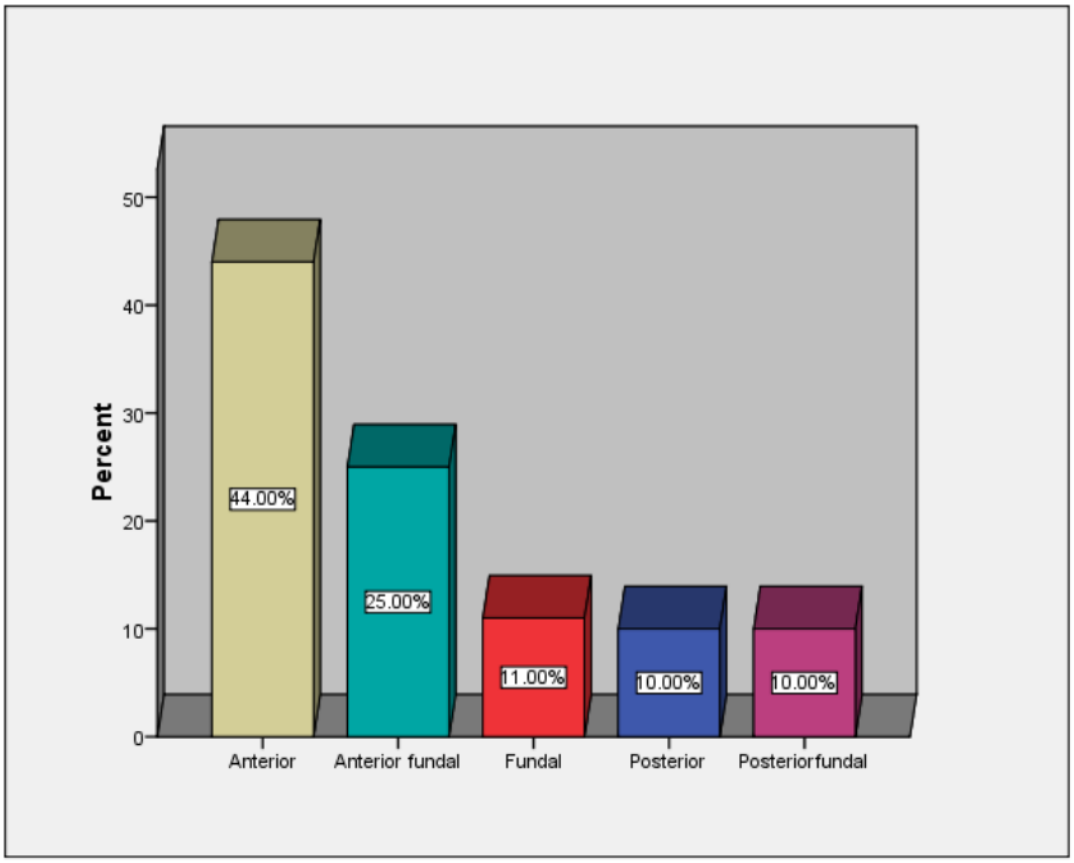

Figure (4.3) frequency distribution of placenta location

Table (4.4) descriptive statistic(minimum, maximum, means ±Std Deviation) for. age ,gravida ,GA and placenta thickness

		Age (years)	gravida	GA (weeks)	Placenta thickness (mm)
Age(in years)	Pearson Correlation	1	.588**	0.018	0.036
	Sig. (2-tailed)		0	0.857	0.725
	N	100	100	100	100
Gravida	Pearson Correlation	.588**	1	-.045-	-.033-
	Sig. (2-tailed)	0		0.657	0.746
	N	100	100	100	100
GA(weeks)	Pearson Correlation	0.018	-.045-	1	.974**
	Sig. (2-tailed)	0.857	0.657		0
	N	100	100	100	100
Placenta thickness(mm)	Pearson Correlation	0.036	-.033-	.974**	1
	Sig. (2-tailed)	0.725	0.746	0	
	N	100	100	100	100
**. Correlation is significant at the 0.01 level (2-tailed).					

Table (4.5) correlation between age , gravida ,GA and placenta thickness

Variables	N	Minimum	Maximum	Mean	Std. Deviation
Age(in years)	100	15	40	25.94	5.557
Gravidity	100	1	12	3.58	2.383
GA(in weeks)	100	27	40	31.3	3.06
Placenta thickness(in mm)	100	27	38	31.18	2.858
Valid N (listwise)	100				

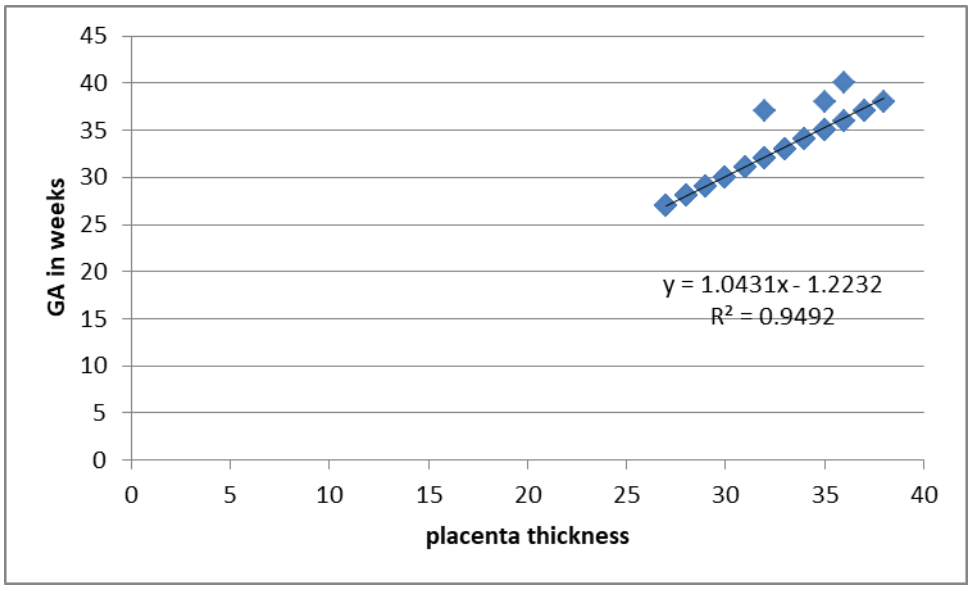

Figure (4.4) scatter plot shows linear relationship between GA and placenta thickness

Table (4.6) compare mean placenta thickness in different GA \weeks

Placenta thickness(in mm)					P value
Placenta site	Mean	Std. Deviation	Minimum	Maximum	
Anterior	31.64	2.754	27	38	>0.05
Anterior fundal	30.32	2.641	27	35	
Fundal	32.18	3.763	27	38	
Posterior	31.70	2.830	28	36	
Posterior fundal	29.70	2.058	27	32	
Total	31.18	2.858	27	38	

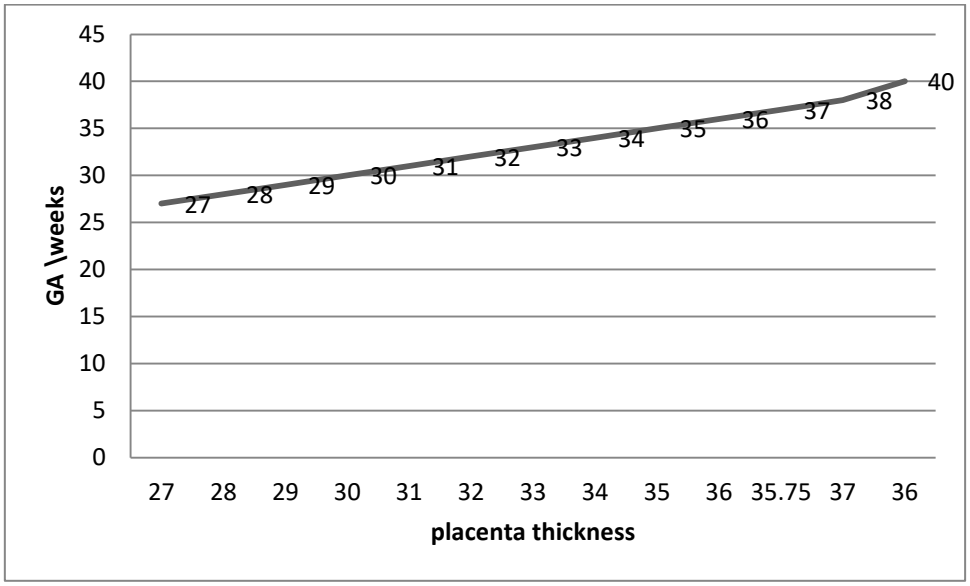

Figure (4.5) shows chart for mean placenta thickness in different week of gestations (placenta thickness increased by increasing GA)

Table (4.7) compare mean placenta in different placenta site

Placenta thickness(in mm)					P value
GA(in weeks)	Mean	Std. Deviation	Minimum	Maximum	
27	27	0	27	27	0
28	28	0	28	28	
29	29	0	29	29	
30	30	0	30	30	
31	31	0	31	31	
32	32	0	32	32	
33	33	0	33	33	
34	34	0	34	34	
35	35	0	35	35	
36	36	0	36	36	
37	35.75	2.5	32	37	
38	37	1.732	35	38	
40	36	.	36	36	
Total	31.18	2.858	27	38	

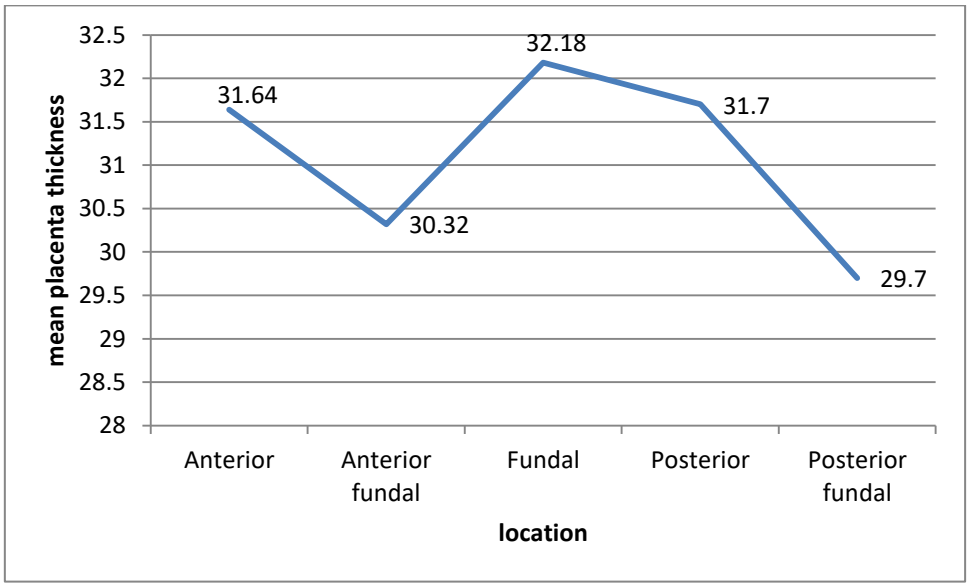

Figure (4.6) Graph line shows mean placenta thickness in different placenta location

Chapter Five

Discussion, conclusion and recommendations

Chapter five

Discussion, Conclusion and recommendations

5.1 Discussion:

This study showed linear relationship between placental thickness in millimeters and gestational age in weeks in Sudanese mothers with normal singleton pregnancies in the third trimester.The placental thickness increase with increased gestational age as shown in (fig 4.3). This result typically is consistent with A Nigeria study by Mr. Christopher Ohagwn (3 November 2008) in Nigerian women with normal singleton pregnancies, but it was in consistent An Indian study done in 2002 by P. Mital et-al, in which the positive correlation between placental thickness and gestational age only from 22 to 35 weeks and in late third trimester showed A decrease in placental thickness with about 1-2 mm . In this study there was no obvious direct or reverse correlation between placental thickness in millimetres and age of the mothers in years as showed in fig (4.1).Also there was a high percentage of gravidity between (1-3) which was observed in (52%) of all women understudy as showed in (table 4.2).There was no obvious direct or reverse correlation between gravidity and placental thickness in the third trimester as shown in figure(4.2).The placenta usually had different normal site localization. This study showed no influence of placental localization on it's thickness.The localizations in this study were anterior localization (44%) as higher percentage , and lower percentage in both posterior and posteriofundal (10%) as shown in (fig4.3)

5.2 conclusion:

The researcher concluded that :

The measurement of placental thickness an important parameter for estimation of fetal age along with other parameters especially in the early 3rd trimester where the exact duration of pregnancy was un known.

Placental thickness measured at the level of umbilical cord insertion can be used as an accurate sonographic indicator in the measurement of gestational age in the single tone pregnancies because of its linear correlation. Therefore, it can be used as an additional sonographic tool in case where LMP was not known.

There was strong positive correlation between placental thickness in millimeters and gestational age in weeks (fig4.3).

5.3 Recommendations:

Equipment adjustment, operator skills and breathing technique play great role in measurement placental thickness accurately.

Placental thickness should be used to estimate fetal age in the third Trimester of pregnancy.

Equipment companies should install placental thickness as an indicator for gestational age in their machines.

The operators should update their knowledge about techniques used and any information regarding ultrasonography.

Governmental hospitals and private clinics should provide an excellent advanced ultrasound machines.

Further studies should be carried out in this field sush as using color Doppler ultrasonography.

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Appendices

Images of the research

Image (1): measurement of placental thickness in anterior placenta (two stars) was 27 mm for 27wks gestational age.

Image (2): measurement of placental thickness in posterior placenta (two stars) was 31 mm for 31wks gestational age.

Image (3): measurement of placental thickness in anterior placenta (two stars) was 27 mm for 27wks gestational age.

Image (4): measurement of placental thickness in posterior placenta (two stars) was 38mm for 38wks gestational age

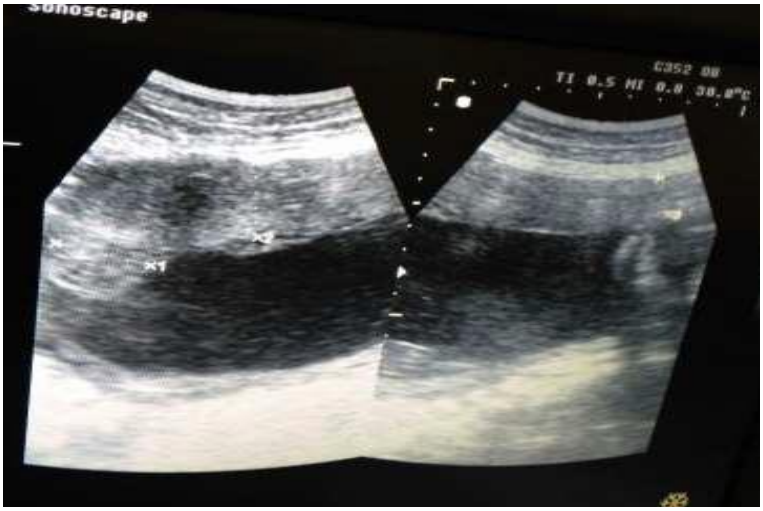

Image (5): measurement of placental thickness in anterior placenta (two stars) was 29mm for 29wks gestational age

Image (6): measurement of placental thickness in anterior placenta (two stars) was 28 mm for 28 wks gestational

Data collection sheet

PLACENTAL THICKNESS –FOR ESTIMATION OFGESTATIONAL AGE

Name:

Age:

LMP:

EDD:

Gestational age (by LMP) :

Menstrual History:

Regular/Irregular; Cycles-

Obstetrics History

USG details:

No. of Fetus:

Presentation:

BPD: _____ mm _____ weeks

AC: _____ mm _____ weeks

FL: _____ mm _____ weeks

Placental thickness:

Placental Location:

Maturity:

Amniotic Fluid:

LIVE FETUS_____WEEKS OF GESTATION

Patient's data

Number	GA(in weeks)	Placenta thickness(in mm)	Age(in years)	Gravidity	Placenta site
1	27	27	35	5	3
2	27	27	20	1	2
3	27	27	20	1	5
4	27	27	25	1	1
5	27	27	25	5	2
6	27	27	31	6	5
7	27	27	25	2	2
8	28	28	34	10	2
9	28	28	26	3	2
10	28	28	19	1	1
11	28	28	23	1	2
12	28	28	21	1	3
13	28	28	21	1	2
14	28	28	26	4	2
15	28	28	25	4	1
16	28	28	27	5	1
17	28	28	19	1	2
18	28	28	15	1	2
19	28	28	36	9	4
20	28	28	20	3	1
21	28	28	25	4	4
22	28	28	25	4	1
23	28	28	28	4	1
24	28	28	27	5	5

25	28	28	26	4	5
26	28	28	37	9	1
27	29	29	25	3	2
28	29	29	21	1	1
29	29	29	20	2	1
30	29	29	20	2	4
31	29	29	27	4	3
32	29	29	37	9	1
33	29	29	16	1	1
34	30	30	23	7	1
35	30	30	31	3	2
36	30	30	23	1	2
37	30	30	29	4	1
38	30	30	27	1	1
39	30	30	25	3	1
40	30	30	23	1	1
41	30	30	27	3	2
42	30	30	25	12	5
43	30	30	27	1	3
44	30	30	32	6	5
45	30	30	25	3	3
46	31	31	35	3	3
47	31	31	27	6	1
48	31	31	37	6	2
49	31	31	25	4	5
50	31	31	25	1	2
51	32	32	22	2	1
52	32	32	30	6	1

53	32	32	28	5	4
54	32	32	22	2	1
55	32	32	31	6	1
56	32	32	27	1	2
57	32	32	23	5	5
58	32	32	27	4	4
59	32	32	19	1	4
60	32	32	31	6	2
61	32	32	22	4	4
62	32	32	30	5	5
63	32	32	19	3	1
64	32	32	22	4	2
65	32	32	30	5	5
66	32	32	37	6	1
67	32	32	21	1	1
68	32	32	19	1	4
69	33	33	36	5	1
70	33	33	25	3	1
71	33	33	32	5	1
72	33	33	37	7	2
73	33	33	25	1	1
74	33	33	32	5	1
75	33	33	27	6	2
76	33	33	21	3	1
77	33	33	25	1	1
78	33	33	29	1	1
79	33	33	19	3	1
80	33	33	29	1	1

81	34	34	29	6	2
82	34	34	27	3	1
83	34	34	16	1	2
84	34	34	27	2	1
85	34	34	16	1	3
86	35	35	25	4	2
87	35	35	23	4	1
88	35	35	37	8	3
89	35	35	40	5	2
90	35	35	21	3	1
91	36	36	29	4	4
92	36	36	20	1	4
93	37	37	20	1	1
94	37	37	31	5	1
95	37	37	25	7	3
96	37	32	24	2	1
97	38	35	18	2	3
98	38	38	20	1	3
99	38	38	28	3	1
100	40	36	28	5	1