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A Study of Placental Thickness Using Ultrasonography

دراسة سمك المشيمة باستخدام الموجات فوق الصوتية

A Thesis Submitted for Partial Fulfillment of the Requirements
of M.Sc in Medical Diagnostic Ultrasound

B y:

Maram Saeed Hemaïdan Ibrahim

Supervisor:

Dr. Babiker Abdalwhab

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الآية

قال تعالى:

رَفَعَ اللَّهُ الَّذِينَ آمَنُوا مِنْكُمْ وَالَّذِينَ أُوتُوا الْعِلْمَ دَرَجَاتٍ

وَاللَّهُ بِمَا تَعْمَلُونَ خَبِيرٌ

صدق الله العظيم

سورة المجادلة الآية (11).

Dedication

To my dad may god have
mercy on him.

To my mother, always support
me.

To my only brother.

To my husband.

To my little daughter Eiren.

Acknowledgements

I would like to offer acknowledgements to my supervisor: Dr. Babiker Abdalwhab, for his unique help and advice throughout the study.

Also I have been very fortunateto have been helped by dedicated individuals such as DR. Mohammed Alfadil-SUST, for his unique and valuable advice in the field of research method and biostatistics.

Also I would like to acknowledgements to my colleagues for their helpful. Specifically Ahmed M. ELTAYB (HNDAB).

Table of Contents

Contents	No
Quran	I
Dedication	II
Acknowledgment	III
Abstract	IV
Abstract in Arabic	V
Chapter one: Introduction	
Introduction	2
1-2 problem of the stud	3
1-3 importance of the study	4
1-4 over view of the study	4
Chapter two: Background and literature review	
2-1 placenta: anatomy, grading and abnormalities	6
2-2 placental thicknes	28
Chapter three: Methods and materials	
3-1 methods	31
3-2 materials	31
Chapter four: Result	
results	34
Chapter five: Discussion, conclusion and recommendation	
5-1 discussion	41
5-2 conclusion	43
5-3 recommendation	44
References	45
Appendices	49

Abstract

This is prospective study which was done during July 2016 to September 2016 and was carried out in (Bashair Educated hospital, Madani educated hospital) Sudan. The study discusses the study of placental thickness using ultrasonography. A total of “50” pregnant ladies were selected randomly; all those ladies have age from 20-45. Any pregnant have twins, diabetes mellitus or any critical cases was excluded from this study. All patients were subjected to be examined by U/S scanning using ‘Mendray and Toshiba ’ with 3,5MHz probe. Trans abdominal Scanning were performed for all patients to evaluate fetus viability , if it is normal or abnormal; also evaluate placental thickness, also I measure mother weight and height to evaluate the BMI by electronic scale and measurement tape. Data was collected using a data collecting sheet and in data analysis the author uses the gross tabulation, linear regression, discriminate analysis. Placental thickness and efficiency in relation to maternal body mass thickness BMI and its efficiency in relation to LMP gestational age in 50 pregnancies. Placental thickness increased with increasing BMI through underweight, normal, overweight categories and accordingly underweight women were more likely to experience placental growth restriction, while placental hypertrophy was more common in overweight .in figure (4-4) the placental thickness in A location increase by 0.4403mm per one unit of BMI, also in figure(4-5)the placental

thickness in B location increase by 0.3699mm per one unit of BMI, therefor in C location of placental thickness the increasing by 0.3421 mm per one unit of BMI.

Also LMP gestational age have observable relation with placental thickness. there in figure (4-1) the placental thickness in A position increase by 0.7431mm per week, also in figure(4-2) the placental thickness in B position increase by 0.8914mm per week. And in C position the placental thickness increasing by 0.6884mm per week.

I was also research in relation between placental thickness and other maternal parameters (parity and number of normal delivery) but there is no significant relation between them. By using ANOVA test.

مستخلص البحث

هذه الدراسة تم إجرائها في الفترة من شهر (7-9) 2016 في مستشفى بشائر التعليمي ومستشفى ود مدني التعليمي. تم تطبيق الموجات فوق الصوتية على الحوامل لتقييم حيوية الجنين- وتقييم سمك المشيمة وأيضا تم قياس كل من وزن وطول الحوامل لإيجاد مؤشر كتلة الجسم عن طريق الميزان الالكتروني وشريط القياس

تم جمع البيانات في ورقة مخصصة لجمع البيانات وتم تحليل البيانات باستخدام برنامج أيكسل 2010. الهدف من هذه الدراسة هو إيجاد العلاقة بين سمك المشيمة ومؤشر- كتلة الجسم وأيضا علاقة سمك المشيمة بعدد مرات الحمل وعدد مرات الولادات الطبيعية.

سمك المشيمة يزيد بزيادة مؤشر- كتلة الجسم. ونلاحظ زيادة نمو خلايا المشيمة او الحجم المفرط في حالة وزن الأم الزائد. في الشكل (4-4) فان سمك المشيمة عند قياسها في مستوى فوق مستوى التحام الحبل السري بالمشيمة يزيد بمعدل 0.4403 ملم لكل وحدة من مؤشر- كتلة الجسم. وفي الشكل (4-5) فان سمك المشيمة في مستوى التحام الحبل السري بالمشيمة

يزيد بمعدل 0.3699 ملم لكل وحدة من مؤشر- كتلة الجسم. وأيضا في

الشكل (4-6) سمك المشيمة في مستوى تحت التحام الحبل السري بالمشيمة

يزداد بمعدل 0.3421 ملم لكل وحدة مؤشر كتلة الجسم.

أيضا هناك علاقة واضحة بين عمر الحمل الجنيني وسمك المشيمة حيث أن

سمك المشيمة يزيد بزيادة عمر الحمل الجنيني. ففي الشكل (4-1) فإن سمك

المشيمة في مستوى فوق التحام الحبل السري مع المشيمة يزيد بمعدل

0.7431 لكل أسبوع. وفي الشكل (4-2) فإن سمك المشيمة في مستوى

التحام الحبل السري يزداد بمعدل 0.8914 لكل أسبوع. وفي الشكل (4-3)

سمك المشيمة في مستوى تحت التحام الحبل السري بالمشيمة يزداد بمعدل

0.6884 لكل أسبوع .

أيضا الدراسة عرضت أن هنالك علاقة بين سمك المشيمة وعوامل الأمومة

الأخرى مثل عدد مرات الحمل وعدد مرات الولادة الطبيعية حيث أظهرت

انه ليس هناك علاقة واضحة بينهما.

يجب أن نضع في الاعتبار صحة الأم وذلك بأخذ وزنها وطولها لإيجاد

مؤشر- الكتلة للجسم، وسمك المشيمة.لأن بالرجوع إلى الدراسة نجد أن

مؤشر الكتلة للجسم يعتبر مؤشراً لصحة الجنين.

Chapter one

Introduction

Chapter one

Introduction

Placenta is a vital organ of connection between the fetus and mother allowing physiological exchanges between the fetus and maternal circulation. And it's formed by: maternal part: the decidua basalis, and fetal part: the chorionfrondosum.

Decidua basalis: Is the most important part of the placenta; it is the part which lies between the blastocyst and the uterine wall; Chorionfrondosum: The outer trophblast of the embryo develops into the chorion when it implants into the maternal decidua and develops villous.

After about 9 weeks, placenta differentiates into the chorion leave (smooth) which becomes membranous, fusing with the amnion, and the chorionfrondosum (frond-like) which becomes the true placenta.

Diseases and abnormalities affecting fetus; can be indicated by an abnormal size of the placenta during the second and third trimesters.

Large placenta maybe associated with maternal diabetes, Rh sensitization, congenital neoplasm & Non-immune Hydrops, and Small placenta may be associated with: IUGR "Intra Uterine Growth Retardation", and Placental insufficiency.

Therefore it is very important to know the dimensions of the placental size especially the thickness, i.e. the anteroposterior diameter. And this is highly dependent on a normal value as a reference to compare obstetric follow up measurements.

Foetal growth parameters such as Biparietal diameter (BPD) and abdominal circumference (AC) are used in the sonographic estimation of gestational age and weight of the foetus in the second and third trimesters. Femur length has been established as an accurate parameter for estimating gestational age in the second and third trimesters (Ziylan and Murshid, 2003) while foetal weight can be estimated by Sherpard's method using only BPD and AC with a deviation of 295g from the actual birth weight (Hebbar, 2003). These growth parameters are adversely affected by insufficient nutrients reaching the foetus through the placenta. In these foetuses the

Placenta is often thin. A placental thickness of less than 2.5 cm is usually associated with intrauterine growth retardation (IUGR) (Kunlmann and Warsof, 1996). 134 Afr. J. Biotechnol. (Ohagwu et al -2009

1.1 Problem of the study:

The researcher believes that placental thickness should have a certain relationship with body habits (body mass index) The aim of my study was to investigate this relationship in normal singleton pregnancies. and relation with LMP gestational age certainly. also relation between placental thickness and parity /no. of normal pregnancy.

1.2 Objective of the study

The general objective of this study was to study normal fetal placental thickness using ultrasound.

Specific objectives

- ↯ To measure the placental thickness
 - ↯ To calculate the gestational age using LMP
- To correlate placental thickness with normal normal body habits, no. of normal parity & GA-LMP.

1-3 Importance of the study

The available literature and previous studies had been established in different societies, with different ethnic groups and races, which make it imprecise to generalize the value of placental thickness according to them.

1-4 Overview of the study

Chapter one includes the proposal and general introduction. Chapter two: literature review; which is divided into: Section one: that highlights some of the important basic information about: placental physiologic anatomy, grading and abnormalities. Section two which is a review of previous studies regarding assessment of placental thickness using ultrasound, and Section three: which overviews the previous studies regarding placental thickness regionally and internationally.

Chapter three, presents methods and materials used during the study, Chapter four: reviews the results of this study, Chapter five: recommendations and conclusion, and finally the references and appendices are put on the last pages.

Chapter two

Literature review

Chapter two

Literature review

2.1 Placenta: Anatomy, Grading and Abnormalities:

Placenta is essentially a fetal organ and represents the link between the developing fetus and the mother. In the human placenta, trophoblast erodes into the decidua so that endothelium of the maternal blood vessels is destroyed and maternal blood is in direct contact with the chorion. Because of that, placenta enables the fetus to take oxygen and nutrients from the maternal blood and serves as the excretory organ for carbon dioxide and other waste products of fetal metabolites. As well as that the placenta forms a barrier against the transfer of infection to the fetus and secretes a large amount of hormones in maternal circulation. Many clinical problems are attributed to the placenta despite the fact that they cannot always be explained on pathologic explanation. As placenta has attained its final thickness and shape at the end of the fourth gestational month, this is an ideal time to perform initial ultrasound examination (Kurjak, 2006).

2.1.1 Developmental and Physiologic Anatomy of the Placenta

While the trophoblastic cords from the blastocyst are attaching to the uterus, blood capillaries grow into the cords from the vascular system of the newly forming embryo. By the 16th day after fertilization, blood also begins to be

pumped by the heart of the embryo itself. Simultaneously, blood sinuses supplied with blood from the mother develop around the outsides of the trophoblastic cords. The trophoblast cells send out more and more projections, which become placental villi into which fetal capillaries grow. Thus, the villi, carrying fetal blood, are surrounded by sinuses that contain maternal blood.

The final structure of the placenta is shown in Figure 2-1.

Note that the fetus's blood flows through two umbilical arteries, then into the capillaries of the villi, and finally back through a single umbilical vein into the fetus. At the same time, the mother's blood flows from her uterine arteries into large maternal sinuses that surround the villi and then back into the uterine veins of the mother. The lower part of Figure 2-2 shows the relation between the fetal blood of each fetal placental villus and the blood of the mother surrounding the outsides of the villus in the fully developed placenta.

The total surface area of all the villi of the mature placenta is only a few square meters—many times less than the area of the pulmonary membrane in the lungs. Nevertheless, nutrients and other substances pass through this placental membrane mainly by diffusion in much the same manner that diffusion occurs through the alveolar membranes of the lungs and the capillary membranes elsewhere in the body.

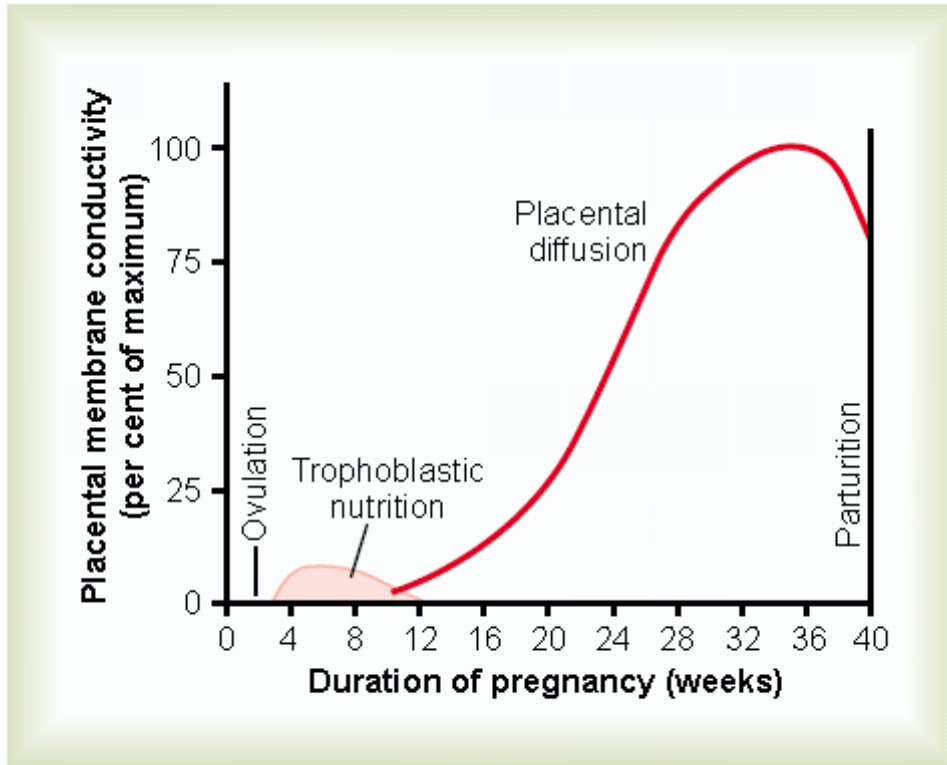


Fig:2-1 Nutrition of the fetus.

Most of the early nutrition is due to trophoblastic digestion and absorption of nutrients from the endometrial decidua, and essentially all the later nutrition results from diffusion through the placental membrane. “Adapted from Guyton Arthur C. and Hall John E., text book of medical physiology, eleventh edition, 1029”.

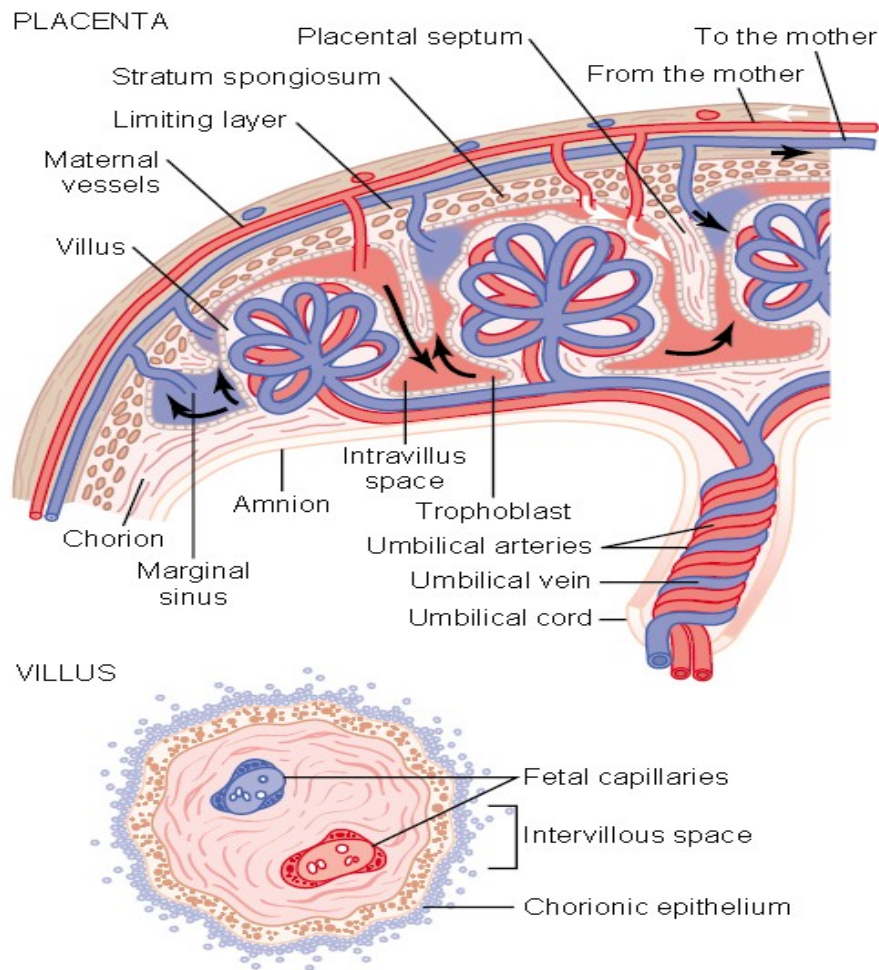


Fig 2-2 Above, Organization of the mature placenta.

Below, Relation of the fetal blood in the villus capillaries to the mother's blood in the intervillous spaces. (Modified from

Gray H, Goss CM: *Anatomy of the Human Body*, 25th ed.

Philadelphia: Lea &Febiger, 1948; and from Arey LB:

Developmental Anatomy: A Textbook and Laboratory Manual of Embryology, 7th ed. Philadelphia: WB Saunders, 1974.)

"Adapted from Guyton Arthur C. and Hall John E., *text book of medical physiology*, eleventh edition, Philadelphia, Pennsylvania, Elsevier,1030."

2.1.1.1 Secretion of Estrogens by the Placenta:

The placenta, like the corpus luteum, secretes both estrogens and progesterone. Histochemical and physiological studies show that these two hormones, like most other placental hormones, are secreted by the syncytial trophoblast cells of the placenta. Toward the end of pregnancy, the daily production of placental estrogens increases to about 30 times the mother's normal level of production. However, the secretion of estrogens by the placenta is quite different from secretion by the ovaries. Most important, the estrogens secreted by the placenta are not synthesized de novo from basic substrates in the placenta. Instead, they are formed almost entirely from androgenic steroid compounds, dehydroepiandrosterone and 16 hydroxyde hydroepiandrosterone, which are formed both in the mother's adrenal glands and in the adrenal glands of the fetus. These weak androgens are transported by the blood to the placenta and converted by the trophoblast cells into estradiol, estrone, and estriol. (The cortices of the fetal adrenal glands are extremely large, and about 80 per cent consists of a so-called fetal zone, the primary function of which seems to be to secrete dehydroepiandrosterone during pregnancy.)

Function of Estrogen in Pregnancy:

These hormones exert mainly a proliferative function on most reproductive and associated organs of the mother. During pregnancy, the extreme quantities of estrogens cause (1) enlargement of the mother's uterus, (2) enlargement of the mother's breasts and growth of the breast ductal structure, and (3) enlargement of the mother's female external genitalia. The estrogens also relax the pelvic ligaments of the mother; so that the sacroiliac joints become relatively limber and the symphysis pubis becomes elastic. These changes allow easier passage of the fetus through the birth canal. There is much reason to believe that estrogens also affect many general aspects of fetal development during pregnancy, for example, by affecting the rate of cell reproduction in the early embryo.

2.1.1.2 Secretion of Progesterone by the Placenta:

Progesterone is also essential for a successful pregnancy—in fact, it is just as important as estrogen. In addition to being secreted in moderate quantities by the corpus luteum at the beginning of pregnancy, it is secreted later in tremendous quantities by the placenta, averaging about a 10-fold increase during the course of pregnancy. The special effects of progesterone that are essential for the normal progression of pregnancy are as follows:

Progesterone causes decidual cells to develop in the uterine endometrium, and these cells play an important role in the

nutrition of the early embryo, decreases the contractility of the pregnant uterus, thus preventing uterine contractions from causing spontaneous abortion, contributes to the development of the conceptus even before implantation, because it specifically increases the secretions of the mother's fallopian tubes and uterus to provide appropriate nutritive matter for the developing morula and blastocyst. There is also reason to believe that progesterone affects cell cleavage in the early developing embryo. The progesterone secreted during pregnancy helps the estrogen prepare the mother's breasts for lactation.

2.1.1.3 Human Chorionic Somatomammotropin:

A more recently discovered placental hormone is called human chorionic somatomammotropin. It is a protein with a molecular weight of about 38,000, and it begins to be secreted by the placenta at about the fifth week of pregnancy. Secretion of this hormone increases progressively throughout the remainder of pregnancy in direct proportion to the weight of the placenta. Although the functions of chorionic somatomammotropin are uncertain, it is secreted in quantities several times greater than all the other pregnancy hormones combined. It has several possible important effects. First, when administered to several types of lower animals, human chorionic somatomammotropin causes at least partial development of the animal's breasts and in some instances causes lactation. Because this was

the first function of the hormone discovered, it was first named human placental lactogen and was believed to have functions similar to those of prolactin. However, attempts to promote lactation in humans with its use have not been successful. Second, this hormone has weak actions similar to those of growth hormone, causing the formation of protein tissues in the same way that growth hormone does. It also has a chemical structure similar to that of growth hormone, but 100 times as much human chorionic somatomammotropin as growth hormone is required to promote growth. Third, human chorionic somatomammotropin causes decreased insulin sensitivity and decreased utilization of glucose in the mother, thereby making larger quantities of glucose available to the fetus. Because glucose is the major substrate used by the fetus to energize its growth, the possible importance of such a hormonal effect is obvious. Further, the hormone promotes the release of free fatty acids from the fat stores of the mother, thus providing this alternative source of energy for the mother's metabolism during pregnancy. Therefore, it appears that human chorionic somatomammotropin is a general metabolic hormone that has specific nutritional implications for both the mother and the fetus (*Guyton Arthur C. and Hall John E - 2004*)

2.1.2 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. 2-3”. 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 a low-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 ,2001)
(Thilaganathan,2004)

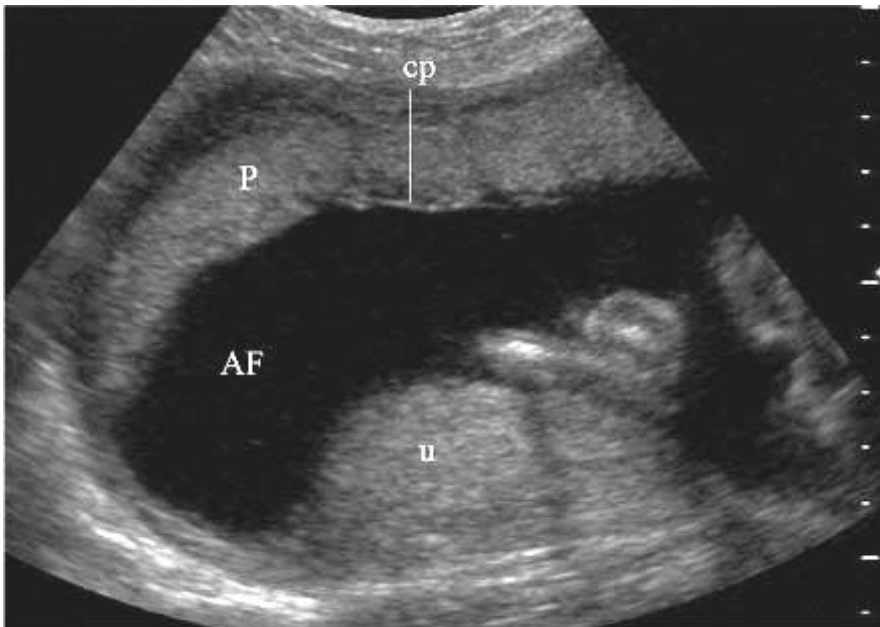


Fig 2-3 Localizing the placenta from a longitudinal, midline section of the uterus.

Note:

the homogeneous 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 the amniotic fluid (AF). Posterior uterine wall (u). "Adapted from (**Chudleigh , 2004**)

2.1.3 Normal Variations In Placental Morphology:

2.1.3.1 Succenturate lobe:

This is defined as one (or more) accessory lobes of the placenta that is attached to the bulk of the placenta by blood vessels. Making the diagnosis important because it is possible to have a fundal placenta together with a succenturate lobe that is centrally placed over the internal os. These women have the same problems as those with placenta previa. Very rarely, the intervening vessels overlie the internal cervical os (vasa previa) and can rupture during labor (Fig. 2.4). This leads to massive fetal bleeding. Finally, the succenturate lobe might be retained after delivery and could be the source of postpartum hemorrhage or infection.

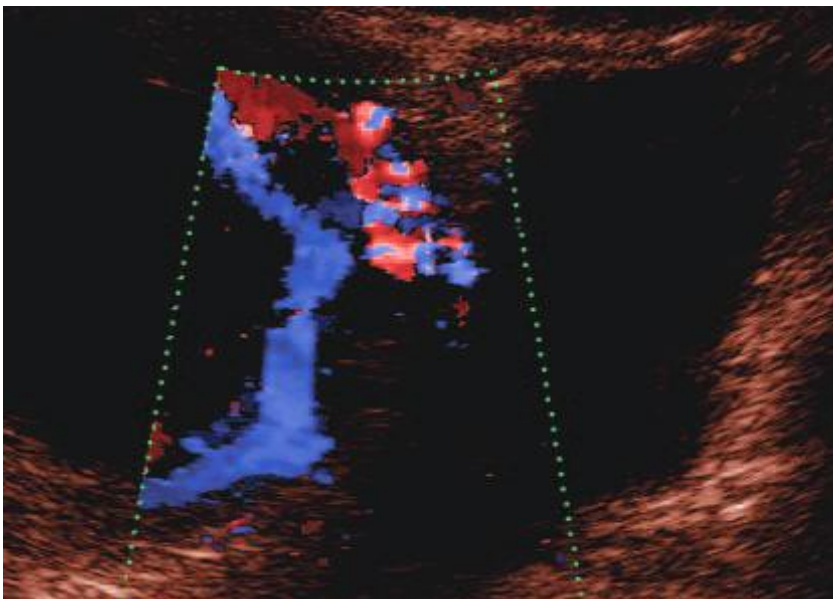


Figure 2.4 Longitudinal.

Midline section of the uterus demonstrating the vessels connecting the succenturate lobe with the body of the anterior placenta overlying the cervical os. The connecting

vessels are better imaged using color Doppler. “Adapted from (**Chudleigh ,2004**)

2.13.2 Placental lakes

These lie within the bulk of the placenta and are filled with slowly moving blood (Fig. 2.5). They probably represent the intervillous space in an area lacking fetal villi. Although there is a relationship between the presence of placental lakes and uteroplacental insufficiency, it is so weak to be of little apparent significance.

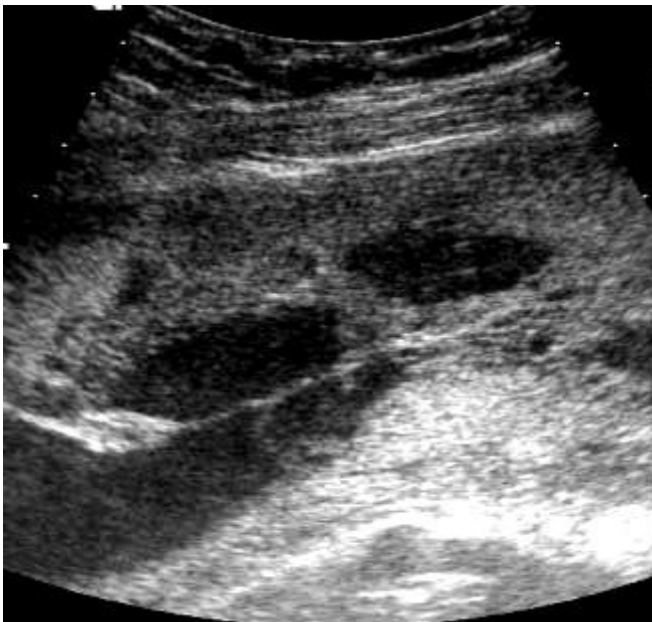


Figure 2.5 Placental lakes in an anterior placenta.

Note:

The lakes lie within the bulk of the placenta. Adpted from (Chudleigh, 2004.

2.1.3.3 Placental cysts:

These are found immediately beneath the chorionic plate (Fig. 2.6). 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.



Fig 2.6 Placental cyst.

Note:

The position of the mass, immediately beneath the chorionic plate. Adapted from (Chudleigh, 2004)

2.1.3.4 Highly echogenic areas:

Echogenic areas seen in the placenta in late pregnancy represent normal changes that occur with increasing gestation.

2.1.4 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. Figure 2.7 illustrates the Grannum grading criteria and Figure 2.8 the ultrasound appearances associated with a Grannum grade III placenta.

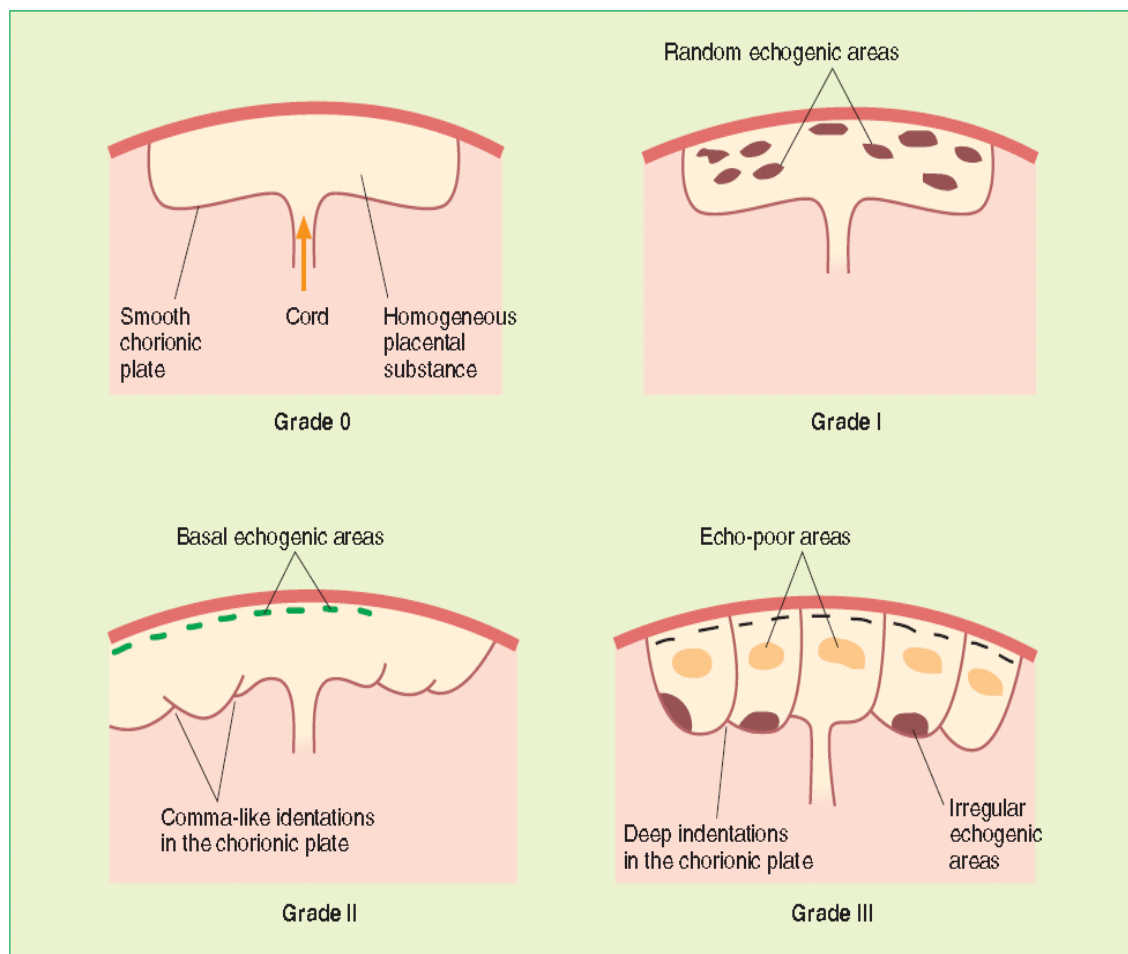


Figure 2.7 Diagram of the ultrasound appearances of placental grading (Chudleigh,2004)



Figure 2.8 Grannum grade III anterior placenta at 38 weeks' gestation. "Adapted from Chudleigh,2004)

2.1.5 Placental abnormalities:

Placenta previa: With the exception of women undergoing chorion villus sampling, accurate assessment of placental position is not necessary when examining the first trimester uterus. Because of positional changes of the body of the uterus in early pregnancy, the placental site can change relative to the internal os.

Approximately 95% of women will have an obviously fundal placenta at the 20 to 22 week gestation and, therefore, will not have placenta previa in later pregnancy. The remaining 5% will have a lowlying placenta at 20-22 weeks and should therefore be rescanned in the third trimester. One in five of these women will have a true placenta previa.

If the woman has had no bleeding it is probably only necessary to request a rescan in the third trimester. If the woman has bled or if she has lost several previous pregnancies she might be admitted to hospital or advised to refrain from sexual intercourse.

Classifications Of Placenta Previa: illustrates the most commonly used classification of placenta previa. The typing of placenta previa from I to IV was developed before the introduction of ultrasound. Placenta previa was typed on vaginal examination under general anesthesia, usually in early labor. Hence, the existence of type III, in which the placenta partially covers an open internal cervical os. Since the widespread introduction of ultrasound, placenta previa is generally classified as 'major' and 'minor'. Minor previa is diagnosed when the placenta encroaches into the lower segment of the uterus, whereas major previa describes the leading edge of the placenta encroaching to, or covering the internal cervical os.

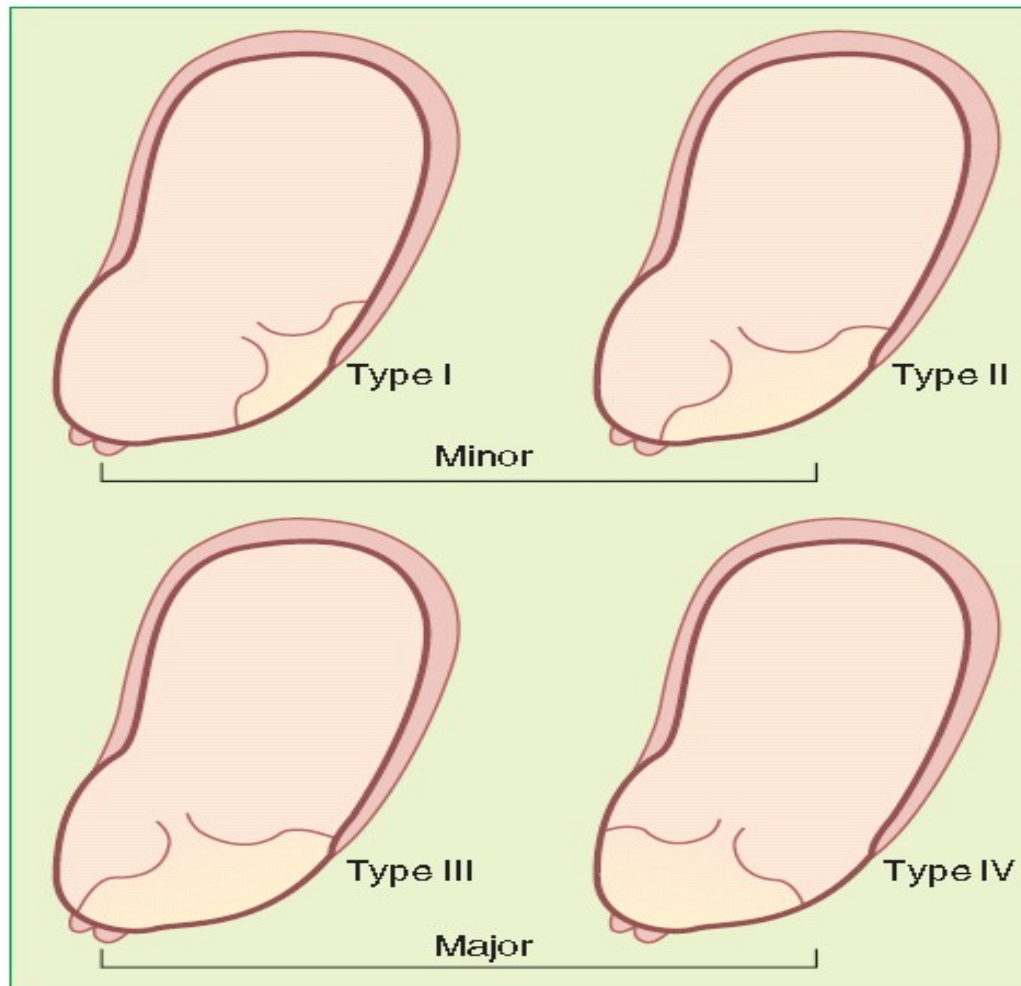


Fig 2-9 The typing of placenta previa. (Chudleigh , 2004)

The clinical problem: If the placenta overlies the internal os, then vaginal delivery can occur only through the placenta. With the major degrees of placenta previa, life-threatening bleeding will occur when the uterus contracts and the placenta separates. In some cases this will not occur until the woman goes into labor, but it could occur at any time during the pregnancy, either spontaneously or in response to premature contractions. Women known to have major degrees of placenta previa are usually kept in hospital

(with cross- matched blood permanently available) and are delivered by elective cesarean section at about 39 weeks, or earlier if they have had a large hemorrhage. It should be noted whether the placenta is anterior or posterior, because the surgeon could encounter and even cut through the placenta during caesarean section if it is positioned anteriorly.

In the case of a minor placenta previa, a clinical decision has to be made regarding suitability for a trial of vaginal delivery. In this instance, the distance of the leading placental edge from internal cervical os and the relative position of the fetal head in relation to the leading placental edge are important. These factors, together with gestational age and any previous episodes of antepartum hemorrhage are considered when assessing the pregnancy for delivery.

Management of Women with Placenta Previa: If the woman has bled during pregnancy or has a major degree of placenta previa, the obstetrician will advise hospital admission. Two units of blood, correctly cross-matched, should be kept available. Serial scans to monitor fetal growth and placental position will be requested, although fetal growth is rarely affected in women with placenta previa. The woman with a major degree of placenta previa will be delivered by cesarean section at 39 weeks, or before if she has had a sizeable hemorrhage.

Placental Abruptio: About 3% of the pregnant population will bleed after 28 weeks' gestation. Approximately one-third of these women will have suffered a placental abruptio, in which all or some of the placenta separates from the underlying myometrium before the fetus has been delivered. If this is a major abruptio, 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 abruptio, although it might be needed to determine whether the fetus is still alive.

Minor abruptions: These can produce few or no symptoms. The woman presents with slight abdominal pain and/or an antepartum hemorrhage. The diagnosis is difficult to make either clinically or by ultrasound. The main role of ultrasound in these cases is in excluding placenta previa, although occasionally a retroplacental clot can be seen as a hypoechoic area between the placenta and the myometrium. It must be stressed, however, that ultrasound is very unreliable in refuting or confirming the diagnosis of minor abruptio and should not be part of the routine management of this clinical diagnosis. Recurrent antepartum hemorrhage and abruptio can be associated with uteroplacental insufficiency, hence assessment of fetal wellbeing would be indicated in this situation.

Placenta Circumvallata: In the normal placenta, the fetal membranes insert into the edge of the placenta. In placenta

circumvallata they insert some distance along the fetal surface, leaving an area of placenta free of membranes. The site of insertion is usually marked by a depression in the surface of the placenta. The membranefree area tends to separate and bleed, but rarely causes more than a little spotting. However, the condition has a high incidence of fetal growth restriction. It is probably responsible for a small proportion of all antepartum hemorrhage.

Bleeding From The Marginal Sinus: This is often a brisk, moderately heavy bleed that is often mistaken clinically for placenta previa. It is not commonly diagnosed on ultrasound but very occasionally the subsequent clot can be seen.

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 highoutputcardiac failure with subsequent polyhydramnios and hydropsfetalis. (*Chudleigh T. ,Thilaganathan B. 2004*)

Placental Thickness: A very small placenta may be associated with growth restriction. More than 3cm thickness before 20 weeks and more than 5cm before 40 weeks is considered abnormal. An excessively large placenta may be

associated with infection, anaemia or triploidy and there are usually other markers of fetal compromise. (*Smith* ,2006)

Primary maternal CMV “cytomegalovirus” infection and fetal or neonatal disease are associated with sonographically thickened placentas, which respond to administration of hyperimmune globulin. These observations suggest that many of the manifestations of fetal and neonatal disease are caused by placental insufficiency. (*Torre et al*, 2006)

Elchalal et al, said in their research “Thick Placenta: a Marker for Increased Perinatal Risk”: a linear increase of placental thickness was found to correlate with gestational age throughout pregnancy. No statistical differences were observed between the two groups with regard to obstetrical variables such as maternal age, parity and gestational age at delivery. No correlation was found between placental thickness and maternal age or parity. The incidence of perinatal mortality was significantly higher among gravidae with thick placentae (6.82% versus 0.66 per cent, $P=0.037$, 95 per cent confidence interval 1.71–70.29). Birthweight at term was found to be above 4000 g in 20.45 per cent of the thick-placenta group as compared to 5.3 per cent in the control group ($P=0.001$, 95 per cent CI 2.08–13.85), and birthweight of less than 2500 g was found in 15.9 per cent of the thick-placenta group as compared to 7.3 per cent in the control group ($P=0.03$, 95 per cent CI 1.11–8.14). The incidence of fetal anomalies was 9.1 per cent in the thick-

placenta group and 3.97 per cent in the control group (not significant).

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

2.1.6 Assessing gestational age using last menstrual period:

Traditionally, the first day of the last menstrual period (LMP) (*Walker EM, Lewis M, Cooper W, et al 1988*) has been used as a reference point, with a predicted delivery date 280 days (*Chiazzer, et al 1968*) 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. Similarly, Chi 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.

Another barrier in using a 2menstrual 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 , et al. 1985*).

1.2.7 Clinical methods 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 (*Robinson HP. 1993*) Similarly, fundal height estimation does not provide a reliable guide to predicting gestational age. Beazly et al found up to eight weeks variation in gestational age for any particular fundal height measurement during the second and third trimesters. (*Beazley and Underhill ,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.

2.1.8 Body mass index, weight gain during pregnancy:

Maternal weight gain in pregnancy can offer a good means of assessing the wellbeing of the pregnant mother and, by inference of her baby. Inadequate prenatal weight gain is a significant risk factor for intrauterine growth restriction, pre-term delivery and low birth weight in infants. Obesity and excessive weight gain on the other hand can lead to adverse maternal and foetal outcomes. These have led to suggestion for optimal weight gain to ensure the best outcome. The institute of medicine (IOM) published recommended weight gain by pre-pregnancy BMI which have been the standard for subsequent research.

In earlier research the relationship between maternal height and weight with pregnancy complication were extensively explored, but in recent times BMI is widely accepted as a better measure of over or underweight.

2.1.9 Effect of maternal body mass index on pregnancy outcome:

The increasing incidence of obesity among women worldwide has become one of the most significant public health concerns. High maternal body mass index is related to adverse maternal pregnancy outcomes such as pre-eclampsia, eclampsia, pre- and post-term delivery, induction of labor, macrosomia, caesarean section and postpartum hemorrhage. In 1990 the institute of medicine of the national academies in the united state suggested that maternal

weight gain during pregnancy should be based on pre-pregnancy BMI. For women with BMI<19.8KG/M, A WEIGHT GAIN OF 28-40lb was recommended; with a BMI of 19.8-24.9kg/m, a weight gain of 25-35lb;with a BMI of 25.0-29.9kg/m, a weight gain of 15-25lb; and finally with a BMI>29.9kg/m, weight gain of at least 15 lb with upper is recommended.in 2006 attendees at the institute of medicine conference on the impact of pre-pregnancy weight on maternal and child health recommended that further research be done on the influence of weight gain in pregnancy.

Some researchers have agreed with the institute of medicine initial recommendations for maternal weight gain during gestational:however, recent studies suggest that lower gestational weight gain may be preferable. In developing Asian countries , such as iran, women generally have a lower BMI and/or a smaller gestational weight gain than in developed countries. In the USA , for example 2% of pregnant women have a BMI <18.5 and more than 50% have a BMI>25 hence,BMI seems to differ across population. Taking this into account in combination with the possible effect of maternal BMI on pregnancy outcomes. There is a requirement to examine whether the current recommendation for pregnant women from the USA also apply to women from other countries such as iran.

2.2 Previous studies:

Wallace JM, et al. placenta , 2012. Reported placental weight and efficiency in relation to maternal BMI, adjust placental weight increase with increasing BMI through underweight, normal, overweight, obese and morbidly obese categories and accordingly underweight women were more likely to experience placental growth restriction, while placental hyperatrophy was more common in overweight, obese and morbidly obese . in contrast the ratio of fetal to placental weight was lower in overweight, obese and morbidly obese than in both normal and underweight women which were equivalent.

Another study by (Hammad 2009); measured the Placental thickness by Ultrasound in the third trimester in AlNothoom – Sudan agreed with the previously mentioned of (Ohagwu, et al 2009) in Nigeria. Hammad study showed direct correlation between the increase in Placental thickness and Gestational age in the third trimester, with a mean \pm standard deviation of placental thickness = 31 ± 2.86 mm; and standard error of mean 0.286 mm, and no correlation between maternal age or gravidity with the Placental thickness.

Elchalal et al, said in their research “thick placenta” a marker for increase perinatal

Risk”: a linear increase of placental thickness was found to correlate with gestational age throughout pregnancy. No statistical differences were observed between the two

groups with regard to obstetrical variables such as maternal age, parity and gestational age at delivery. No correlation was found between placental thickness and maternal age or parity. The incidence of perinatal mortality was significantly higher among gravidae with thick placentae (6.82% versus 0.66 per cent, $P=0.037$, 95 per cent confidence interval 1.71–70.29). Birthweight at term was found to be above 4000 g in 20.45 per cent of the thick-placenta group as compared to 5.3 per cent in the control group ($P=0.001$, 95 per cent CI 2.08–13.85), and birthweight of less than 2500 g was found in 15.9 per cent of the thick-placenta group as compared to 7.3 per cent in the control group ($P=0.03$, 95 per cent CI 1.11–8.14). The incidence of fetal anomalies was 9.1 per cent in the thick-placenta group and 3.97 per cent in the control group (not significant).

Chapter three

Methodology

Chapter three

Methodology

3.1 Methodology

3.1.1 Study design: this is a prospective study

3.1.2 Study population:

This Study includes normal mothers between the aged 20-45 years old were scanned using transabdominal scan. Cases were singleton of normal pregnancy

3.1.3 Exclusion criteria:

The cases found to be of high risk including IUGR, hypertention, diabetes mellitus, fetal anomalies and multiple pregnancies were excluded

3.1.4 Study area:

Wad-Madani educated hospital & bashair educated hospital

3.1.5 Study duration:

The study was conducted in 3 months from June to September 2016

3.2 The materials:

3.2.1 The equipment used:

Ultrasound machine used was mindray-digiprince DP- 20 with a 3.5mhz convex transducer.

Toshiba xario 200.

Electronic scale “clikon”

Tape measurement 5m “16ft”

3.2.2 Technique:

Patients were examined in the supine position, and ultrasound coupling agent was applied

The fetuses were scanned for viability and congenital anomalies defects

The placenta was localized in a longitudinal section, and placental thickness was then measured near the insertion of the umbilical cord

The mothers were rise over the scale to take their weights and take their height.

3.3 Data collection:

All data was collected in sheet of paper "data collection sheet" which were designed especially for the study, and ultrasound images

Method of data analysis:

The collection data was analysed using Office Excel 2010 statistical analysing program.

Chapter four

Result

Chapter four

Result

After applying the previously stated Methodology; and the application of regression analysis, the results of analyzing the whole data.

Figure (4-1): The relation between LMP gestational age "x axis" and placental thickness in mm" in yaxis" A=measuring above the level of amblicalinsersion."A"

Figure (4-2): Relation between Impgestaional age and placental thickness at the level of amblicalinsersion."B"

Figure (4-3): Relation between LMP gestational age and placental thickness below amblical cord insertion" C"

Figure (4-4): relation between BMI(body mass index)" in x axis" and placental thickness "iny axis" A= above amblical cord insertion.

Figure (4-5): relation between BMI and placental thickness.B=at the level of amblical cord insertion.

Figure (4-6): relation between BMI and placental thickness, c=below amblical cord insertion.

Table (4-1): distribution of number of parity

parit y	placent thickness A	placent thickness B	placent thickness C
0	29.9	42.3	29.9
1	25.4	39.8	21.6
2	34.5	46.6	33.7
3	29	39.4	25.4
4	32.4	36.7	30.4
5	41.1	52.15	36.2
6	39.7	42.2	36.2
7	20	29	19
8	29.6	40.4	32.8
15	37.4	48.5	40.8

Table (4-2) the relationship between parity and placental thickness by **ANOVA** test

ANOVA parity effects

		Sum of Square s	Mean Squar e	F	Si g.
placenta_thickne ss_A	Betwe en Group s	716.26 2	79.58 5	.576	.8 0 8
	Within	5523.0	138.0		

	Groups	83	77		
	Total	6239.345			
placenta_thickness_B	Between Groups	737.432	81.937	.377	.939
	Within Groups	8690.283	217.257		
	Total	9427.715			
placenta_thickness_C	Between Groups	926.252	102.917	.776	.639
	Within Groups	5307.536	132.688		
	Total	6233.788			

Table (4-3) the relationship between no. of normal parity and placental thickness by **ANOVA** test

ANOVA No of normal delivery.

		Sum of Square s	Mean Squar e	F	S
placenta_thickne ss_A	Betwe en Group s	358.33 3	44.79 2	.312	.
	Within Group s	5881.0 12	143.4 39		
	Total	6239.3 45			
placenta_thickne ss_B	Betwe en Group s	1377.4 91	172.1 86	.877	.
	Within Group s	8050.2 24	196.3 47		
	Total	9427.7 15			
placenta_thickne ss_C	Betwe en Group s	364.50 7	45.56 3	.318	.
	Within	5869.2	143.1		

	Group s	82	53		
	Total	6233.7 88			

Chapter Five

Discussion, Conclusion and Recommendation

5.1 Discussion

The results presented above, indicate that there is a linear correlation between placental thickness and (maternal body mass index, BMI, parity, number of normal delivery and LMP gestational age certainly)

I take the measurements of the placenta from 3 places in longitudinal scan (above amblical cord insertion, at the level of amblical insertion and below amblical insertion).

After analyzing the total number of the data, the relationship between placental thickness and BMI have positive correlation coefficient at three levels of placental measurement (A, B and C), the figures explain that.

These results agreed with the ones from Wallace JM, et al. placenta, 2012. Report placental weight and efficiency in relation to maternal BMI.

However the relationship between LMP gestational age and placental thickness (A, B and C) have positive correlation coefficient.

These also agreed with the ones from (Hammad 2009); (Measurement of the Placental thickness by Ultrasound in the third trimester) in AlNothman - Sudan agreed with the previously mentioned of (Ohagwu, C. C et al 2009) in Nigeria. Hammad study showed direct correlation between the increase in Placental thickness and Gestational age

In table (4-2) The relationship between maternal parity and placental thickness analyzed by ANOVA test. But there is no significant between them.

Which agreed with the ones from Elchalal et al said in their research; No correlation was found between placental thickness and maternal age or parity.

In table (4-3) Also the relationship between placental thickness and no. of normal delivery analyzed by using ANOVA test which given no significant result.

5.2 Conclusion:

- There was a fairly linear relationship between placental thickness and BMI
- There was strong correlation between placental thickness and gestational age by LMP.
- There was no significant correlation between maternal parity and placental thickness.
- Also there was no significant correlation between no. of normal delivery and placental thickness.
- Placental weight increase with increasing BMI through underweight, normal, overweight, obese and morbidly obese categories.

5.3 Recommendations:

It is highly informative to use placental thickness; however caution must be taken during performing the investigation technically; because of the different locations and grades of placenta, in addition to the limitations of placental thickness as a parameter, in the case of maternal or fetal abnormalities related to it; because in such case the placenta will never give accurate measurement. So be sure the patient and her fetus are completely normal, before attempting to measure the placental thickness. I recommend that this same study be done again from a wider prospective. At last, we must put in our mind the mother health .and we must routinely take their weight and height to calculate their BMI. Because according to this study BMI give us an indicator to baby health.

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Appendices:



Appendix 1: Ultrasound image of pregnant woman of 34 years age show placenta thickness.



2:

image of pregnant woman of 28 years age show placenta thickness.

Appendix
Ultrasound



Appendix 3: Ultrasound image of pregnant woman of 25 years age show placenta thickness.



Appendix 4: Ultrasound image of pregnant woman of 30 years age show placenta thickness.