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**Assessment of Fetal Biometry in
Diabetic Patients**

تقويم قياسات الجنين لدى مرضى السكر

A thesis submitted for partial fulfillment of M.Sc. degree in Medical ultrasound

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Dedication

To:

To whom in all the world languages don't find suitable words to
write about you

The heart, the soul, the beginning and the end

To Fatima Shareef Salih

My mother

To whom leave us by his body and still with us as soul, thinking
and thought

To the soul of my father.

To whom make their fingers candles to light my way

My support, help and my pleasant.

To my sisters.

To the thirteen flowers and four

To my sisters sons and daughters.

To our small angel, our sun which shine recently

To Doha

Acknowledgment

I pay my thanks for help, support and encouragement, to God firstly, who bless me in each step of my life.

And special and great thanks for my favorite teacher Dr. Mohammed Elfadil Mohammed who kept on pushing, guiding, advising and supervising till the end of my research.

And very special thanks for Dr Mohammed Alamin Hamed. for guiding, advising and supervising and supporting to see this work in good view.

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To all sonologist in hospitals who help me in collecting my images, and to everyone who help me in presenting my research in its last picture.

And at last and not the least to every sweet person who surround and help me by words, deeds and even thoughts to my friends and colleagues.

Abstract

Pregnancy-associated diabetes mellitus poses a risk of fetal growth alterations. Fetal abdominal perimeter can be used as predictive of fetal weight in full-term fetuses with normal growth, along with biparietal diameter, abdominal circumference and length of femur to estimate fetal weight through set of parameters; therefore the general objective of this study was to assess the fetal weight for diabetic maternal. The results of this study showed that 70% of the ladies enrolled in this study were housewife and 30% were employers, their means age were 29.4 ± 5.5 years, average weight was 65.2 ± 11.9 and height was 152.5 ± 18.7 (Table 4-1 and 4-2). Forty percent of the patients were primegravida, 42% multipara, and 18% grandmultipara (Table 4- 3). The history of the patient showed that 36% of the cases had diabetes for the first time and 64% known cases. Also the family history of the patients indicates that 84% have past history of disease and 16% with no previous family history. In respect to parity with its three groups there is no significant differences between the primegravida, multipara, and grandmultipara incase of diabetes, lab test and fetal measurement using ANOVA test at $p = 0.05$, except biparietal diameter where there is a significant differences with $p = 0.045$. It has been found that parity status increases the fetal biparietal diameter by a coefficient of 0.05cm/parity. But the associated diseases like hypertension, infections, myomas and any other diseases did not affected fetal weight using ANOVA at $p = 0.05$. Also in respect to diabetes status this study found that when the level of glucose increases arbitrary the fetal weight increases by 1.71mg/dl/week, and the fetal weight inversely affected by the amount of hemoglobin when it increases the fetal weight decreases by 11.09 g/dl.

ملخص الدراسة

هذه الدراسة تناولت موضوع قياس اوزان الاجنة للحوامل التواتي اصبن بداء السكر . أظهرت نتائج هذه الدراسة أن 70% من السيدات المسجلات في هذه الدراسة كن ربات منزل و30% موظفات ومتوسط اعمارهن 5.5 ± 29.4 سنوات ومتوسط أوزانهم 11.9 ± 65.2 غرام ومتوسط أطوالهن 18.7 ± 152.5 سنتمتر (الجدول 4-1 و 4-2) . 40% حصل الحمل للمرة الاولى و42% متكررة الولادة و18% ست مرات أو أكثر (الجدول 4-3) . أظهر تاريخ المرض أن 36% من الحالات كان السكري للمرة الاولى و64% من الحالات المعروفة . التاريخ العائلي للمرضي يشير الي ان 84% لديهم تاريخ مرضي سابق و16% ليست لديهم تاريخ عائلي سابق. وفيما يتعلق بمجموعات الدراسة الثلاث للانجاب لا يوجد فروق ذات دلالة إحصائية بين السيدات الحوامل للمرة الاولى ومتكررات الولادة وذوات الحمل السادس أو اكثر طارئ لمرض السكري. وفحص المعمل وقياس وزن الجنين باستخدام اختبار ANOVA بمعامل تصحيح خطأ 0.05 باستثناء قطر بين الجدارين حيث توجد فروق ذات دلالة احصائية بمعامل تكافؤ 0.045 قد وجد ان معامل التكافؤ يزيد البعد بين الجدارين ب0.05 سنتمتر/انجاب ارتفاع ضغط الدم والالتهابات والحميات واي امراض اخري لا تؤثر في وزن الجنين باستخدام اختبار ANOVA بمعامل تصحيح 0.05 . فيما يتعلق بمرض السكر وجدت هذه الدراسة انه عندما يرتفع مستوي الجلوكوز في الدم يزيد وزن الجنين ب1.71 ملغرام/ديسلتر في الاسبوع ووزن الجنين يتاثر عكسيا مع كمية الهموغلوبين عندما يزيد يقل وزن الجنين ب 11.9 غرام/ديسلتر.

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List of abbreviation

AC	Abdomen circumference
BPD	Biparietal diameter
DM	Diabetes mellitus
FSH	Gonadotropine releasing hormone
FL	Fumer length
FUS	Focusing ultrasound surgery
GS	Gestation sac
HTN	Hypertension
HB	Hemoglobin
LH	Luteinizing hormone
LMP	Last menstrual period
MRI	Magnetic resonance image
HIFU	High intensity focused ultrasound
US	Ultrasound
TWBCs	Total white blood cells count

Chapter one

Introduction

1-1Diabetes Mellitus:-

Diabetes mellitus (sometimes called "sugar diabetes") is a condition that occurs when the body can't use glucose (a type of sugar) normally. Glucose is the main source of energy for the body's cells. The levels of glucose in the blood are controlled by a hormone called insulin, which is made by the pancreas. Insulin helps glucose enter the cells (Gabbe.S.G 2002) (White.P.1949) In diabetes, the pancreas does not make enough insulin type-I diabetes or the body can't respond normally to the insulin that is made type-II diabetes The third main form, (gestational diabetes) occurs when pregnant women without a previous diagnosis of diabetes develop a high blood glucose level. It may precede development of type 2 DM (Gabbe.S.G 2002) (White.P.1949). Other forms of diabetes mellitus include (congenital diabetes) (White.P.1949), which is due to genetic defects of insulin secretion, cystic fibrosis -related diabetes, steroid diabetes induced by high doses of glucocorticoids, and several forms of monogenic diabetes. This causes glucose levels in the blood to rise, leading to symptoms such as increased urination, extreme thirst, and unexplained weight loss. During a normal pregnancy, many physiological changes occur such as increased hormonal secretions that influence blood glucose levels, such as a glucose-'drain' to the fetus, slowed emptying of the stomach, increased excretion of glucose by the kidneys and resistance of cells to insulin (Gabbe.S.G 2002) (White.P.1949) For women with diabetes mellitus, pregnancy can present some particular challenges for both mother and child. If the woman who is pregnant has diabetes, it can cause early and very large babies (Gabbe.S.G 2002) (White.P.1949). Planning in advance is emphasized if one wants to have a baby and has type I diabetes mellitus or type II diabetes

mellitus. Pregnancy management for diabetics needs stringent blood glucose control even in advance of having pregnancy (Gabbe.S.G 2002) (White.P.1949). All forms of diabetes have been treatable since insulin became available in 1921, and type two diabetes may be controlled with medications. Insulin and some oral medications can cause hypoglycemia (low blood sugars), which can be dangerous if severe. Both types 1 and 2 are chronic conditions that cannot be cured. Pancreas transplants have been tried with limited success in type 1 DM; gastric bypass surgery has been successful in many with morbid obesity and type 2 DM.

Gestational diabetes usually resolves after delivery (Hohler CW. Ultrasound estimation of gestational age) Fetal biometry with the help of ultrasound scanning provides the most reliable and important information about the fetal growth and wellbeing. A wealth of important and relevant factors is gathered covering the fetal anatomy, physiology and fetal behavior. A good scanning ultrasound machine and an experienced hand are essential for obtaining maximum advantage (Hohler CW. Ultrasound estimation of gestational age).

1-2. Problem of the study:

Estimation of fetal weight during pregnancy is one of the crucial task using ultrasound where a lot of catastrophic problem can be avoided like increased risk and complications of labor during delivery due to fetal macrosomia in diabetic patients, maternal and fetal outcome such as prolonged labor with increasing use of cesarean section, postpartum hemorrhage and neonatal asphyxia, therefore ultrasound can give a clue about these ramification subjectively and objectively if projected in a quantitative format.

1-3 Objectives:

The general objective of this study was to estimate and assess the fetal weight in diabetic patients in order to find the impact of diabetes in the pregnant outcome.

Specific objectives:-

- To measure the femur length, biparietal diameter and abdominal circumference.
- To estimate the fetal weight and gestational age using the fetal measured parameters.
- To correlate between the estimates and patient body characteristic (weight, height, BMI and age)
- To find the impact of glucose on fetal weight
- To find the significant difference between the diabetic and none diabetic measurement.

1-4 Significance of the study:-

This study will give a coefficient that will relate the increases of fetal weight versus the amount of glucose (mg/dl/week), also about the weight increases versus gestational age (g/week) as well as the impact of hemoglobin level on the fetal weight.

1-5 Overview of the study

This study consisted of five chapters; with chapter one is an introduction, which included the brief introduction, problem of the study objectives and significance of the study. Chapter two will highlight the literature review. Chapter three presented the method and material used to collect the data, while chapter four portrayed the results of the collected data, finally chapter five discusses the results and offer conclusion and recommendations.

Chapter two

Literature review

2-1 Anatomy (female pelvis):-

The understanding of the anatomy as it relates to the female pelvis is very important for the sonographer to build a foundation before learning patho- physiology. There are many pelvic landmarks, ligaments, and muscular structures within the pelvis that help the sonographer differentiate the normal reproductive organs from muscular and vascular structures(Snell 1995).

2-1-2 Pelvic landmarks:-

2-1-3Bony pelvis:-

Anatomically, the pelvis is divided by an oblique line that separates the greater (false) and lesser (true) pelvis. This pelvic brim passes through the prominence of the sacrum to the superior margin of pubic symphysis. The greater pelvis is cephalic to this brim and communicates with the abdomen cephalically and with the lesser pelvis caudally. The lesser pelvis represents the area caudal to pelvic brim (Snell. 1995) .

2-1-4 Pelvic cavity and perineum:-

The pelvic cavity is that part of the abdominal cavity found below the pelvic brim. The posterior wall is formed by the sacrum and coccyx. The piriformis and coccygeus muscles overlie the sacrum and coccyx. Along the lateral margins of the pelvic cavity lie the hip bones, which are covered by the obturator internus muscles, the lower margin of the pelvic floor is formed by the levator ani and coccygeus muscles. The region above the pelvic diaphragm is the pelvic cavity; the smaller area below the pelvic floor is the perineum. The lowest part of the peritoneal cavity is the recto-uterine pouch (pouch of Douglas) (Snel. 1995).

2-1-5 Muscles of the pelvis:-

There are several primary muscles groups in the pelvis that the sonographer should be able to identify as land marks to help distinguish the reproductive organs. The psoas major muscle extends from the abdominal cavity into the pelvic cavity from the lateral margins of the lumbar spine to the anterior side wall. The iliacus is closely related to the psoas major muscles as it forms the pelvic side wall. The piriformis and obturator internus muscles pass out from the pelvis through the sciatic foramina to become attached to the greater tuberosity of the femur (Snel, 1995).

The coccygeus muscle is the muscular part of the sacrospinous ligament and forms the posterior part of the pelvic diaphragm; the anterior part of the diaphragm is formed by the levator ani muscles. In addition to forming the floor of the pelvis, the levator ani muscles also have an important role in rectal and urinary continence and maintain the position of the uterus and vagina (Snel .1995).

2-1-6 Pelvic vasculature:-

The common iliac artery provides blood to the pelvic cavity through the external and internal iliac arteries. The external iliac artery and vein cross along the pelvic brim. The internal iliac artery runs down into the pelvis on the posterior wall to provide multiple branches to the pelvic structures. The ureter also enters the pelvis as it courses anterior to the internal iliac artery to runs down into the pelvis on the posterior wall to provide multiple branches to the pelvic structures. The ureter also enters the pelvis as it courses anterior to the internal iliac artery to drains into the posterior base of the bladder (Chummy. 1998).

Blood is supplied to the uterus from the uterine artery which arising from the internal iliac artery. It courses medially over the ureter in the base of the broad ligament to the

uterus at the cervical level. It is tortuous and spirals up the sides of the uterus with many anastomotic sites giving off branches and blood supply.

The vagina has two sources of blood supply. The anterior surface of the vagina and the cervix are supplied with blood from a branch of the uterine artery before it reaches the uterus. The posterior surface of the vagina is supplied with blood from a branch of the internal iliac vessel.

The ovary receives its blood supply from the aorta. The ovarian arteries also have a tortuous course from the lateral posterior border of the ovary to anastomose with the uterine artery in the broad ligament adjacent to the cornual area. This is considered the ovarian branch of the uterine artery, which is the most consistent and successful area for assessing ovarian Doppler flow (Hagen .2002).

2-1-7 Bladder and ureters:-

The bladder is located in the anterior segment of pelvic cavity, posterior to the pubic symphysis. The function of the bladder is to collect and store urine until it passes through the urethra. When the bladder is empty or slightly filled it remains entirely within the pelvis, as it becomes distended, it rises up behind the lower anterior abdominal wall and pushes the peritoneum away from the wall (Snel, 1995).

The internal organs of the female pelvis consist of two ovaries and fallopian tubes, a uterus and the vagina. The external genitalia include the mons pubis, labia majora, labia minora, clitoris bulb of the vestibule, greater vestibular glands, and vestibule of the vagina.

Uterus and Uterine tubes

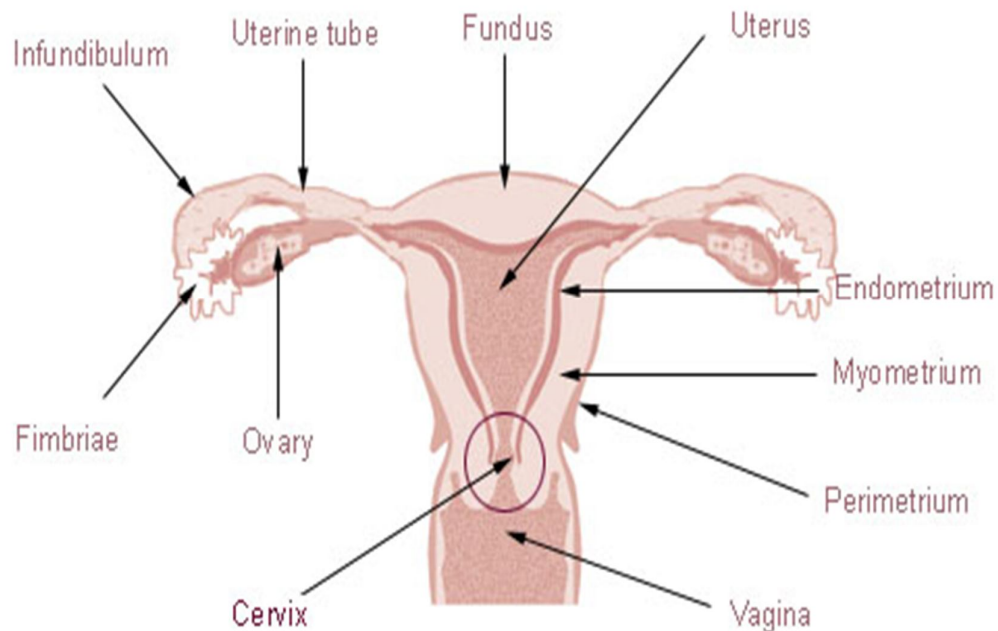


Figure (1-1): shows uterus and uterine tubes

2-1-8 Vagina:-

The vagina is a muscular tube composed of primarily smooth muscle with skeletal muscle fibers at the lower end. It measures about 10cm in length.

The vagina lies anterior to the rectum and anal canal and posterior to the pubic symphysis, urinary bladder, and urethra. It is the pass way for the products of the menstrual cycle and is easily distensible (especially during child birth). The vagina has a mucous membrane lining its muscular walls to receive secretions from the vaginal wall and the mucous glands of the cervix and vestibular glands (during sexual excitement) (Hagen .2002).

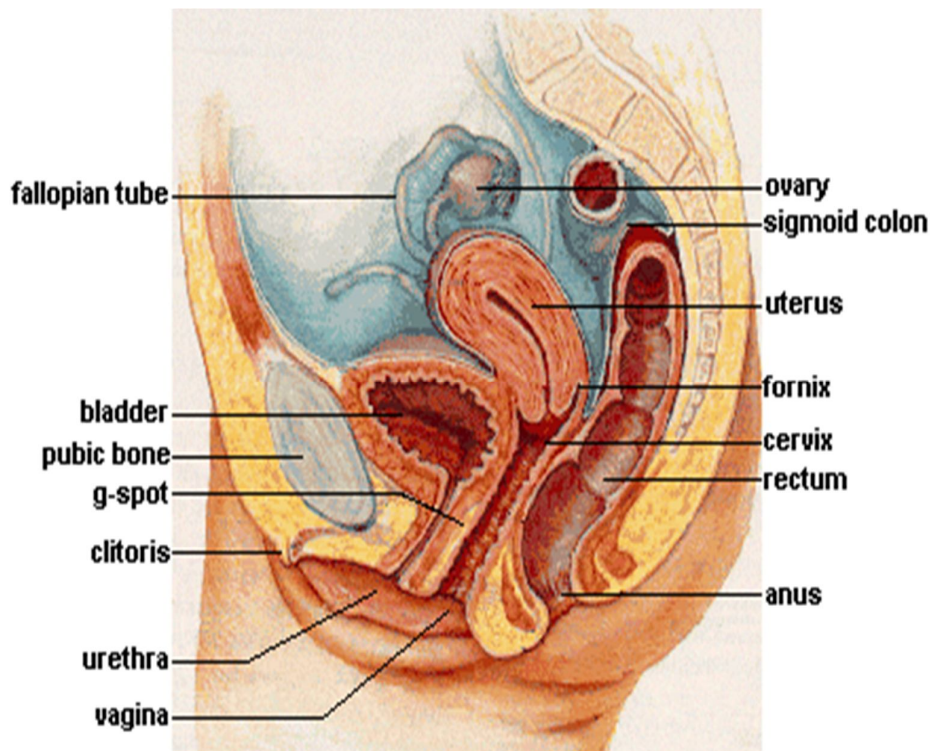


Figure (1-2): shows lateral view of internal female reproductive organs

2-1-9 Urethra:-

The urethra is located in the lower part of the anterior vaginal wall. The opening (the external urethral meatus) is anterior to the opening of the vagina (Snel, 1995).

2-1-10 Fornix:-

The fornix is found at the upper end of the vagina, near the external cervix. The fornix is further classified into an anterior and posterior segment. The posterior part of the fornix is covered on the pelvic cavity side by the peritoneum, instruments that are directed into the area of the cervix may be misdirected and perforate the posterior fornix, causing the instruments to enter into the peritoneal cavity and risk peritonitis (Snel, 1995).

2-1-11 Uterus:-

The uterus becomes the largest organ in the normal female pelvis when the urinary bladder is empty. It is a mobile, hollow, muscular pear-shape structure, partially covered by peritoneum. The normal menarchal uterus measures about 7.5cm long, 5cm wide and 2.5cm thick. The uterus is composed of the external layer or serous coat, the middle layer or muscular coat, and the internal mucous layer (Elberhard, 2002) .

The external layer, the peritoneum, surrounds the uterus except where the bladder layers against it at the cervical-vaginal connection. The middle, the myometrium, composes the majority of uterus. It is primarily smooth muscle that is longitudinal and circular. The inner, the endometrium is a thin, smooth mucous. This membrane is contiguous with the lining of the vagina. The inner lining of the uterus varies in appearance and histologic structure, depending on the period of life in which it is studied.

The uterus consists of the fundus or most upper portion, the body or central area, and the cervix, or the lower cylindric portion that joins the uterus to the vagina. At the lateral borders of fundus there are cornua, where the fallopian tubes are attached to the uterine cavity. The central cavity is a potential space allowing for the dynamic changes during the normal menstrual cycle and pregnancy. The upper portion of the cervix is constricted by the internal os and the lower portion by the external os.

The uterus is supported in its midline position by paired broad ligaments, round ligaments, and uterosacral ligaments, as well as other lesser ligaments. The broad ligaments are a double fold of peritoneum and provide bilateral support for the uterus. They attach to the lateral walls of the pelvis, surrounding the fallopian tubes, round

ligaments, parovarium, connective tissue, unstriated muscular fiber, blood vessels, and nerves. The upper edge of the broad ligament encloses the fallopian tube as it extends from the cornua of the uterus (Elberhard, 2002).

The round ligaments occupy space between the layers of the broad ligament and occur in front of and below the fallopian tube. These two cords commence in each side of the superior aspect of the uterus and course upward and lateral through the inguinal canal to be inserted into the labia majora. The uterosacral ligaments (cardinal ligament) originate laterally at the level of the internal os of the cervix and pass downward along the sides of the rectum extending to the third and fourth, bones of the sacrum (Asim, 1986).

The body of the uterus is normally "bent" forward, or ante flexed, to make a slight angle with the cervix. The cervix makes a similar angle with the vagina, also called anteverted. In some females the uterus tips backward rather than forward, becoming "retroverted and/or retroflexed". The broad ligaments and round ligaments help somewhat to hold the uterus in position. In addition, there are condensation of connective tissue under the peritoneum in the region of the cervix of the uterus and fornix of the vagina. Those condensations are known as the lateral ligament, cervical ligaments and cardinal ligaments.

The ligaments passing on either side of the rectum are uterosacral ligaments. The clinical of "prolapse" of the uterus is found when these ligaments are stretched or abnormal (Snel, 1995).

2-1-12 Endometrium:-

The endometrium consists primarily of two layers: the functional layer (zona functionalis) and the deep basal layer (zona basalis). The functional layer is a superficial layer of glands and stroma. The basal layer is a thin layer of blind end of

endometrial glands that regenerates new endometrium after menses. It is well known that the endometrium of uterus changes dynamically in response to cyclic hormonal flux (Snel, 1995).

2-1-13 Fallopian tubes:-

After evaluation of the uterus and cervix is complete, the adnexae are interrogated. It is important to assess the fallopian tube in its normal and pathologic states. The normal fallopian tube is about 12cm in length and 1 to 4cm in diameter. It is difficult to distinguish from the surrounding ligaments and vessels. It is contained in a special fold of the broad ligaments called the mesosalpinx. The tubes lie above the utero-ovarian ligaments, the round ligaments and tubo-ovarian vessels (Asim, 1986).

Doppler imaging may help distinguish vessels from tubes. The fallopian tube has three anatomic parts (the infundibulum distal), ampulla (mid), and isthmus (proximal).

2-1-14 Ovaries:-

The ovaries are almond-shaped structures, each measuring about 3cm long. They usually lie near the cornua of the uterus, along the side wall of the pelvis, suspended from the back of the broad ligament of the uterus in a fold of peritoneum called the mesovarium. The ovaries are usually medial to the external iliac vessels and anterior to the ureter. The blood supply to the ovary is from the ovarian artery. Early embryologic development shows the ovary to develop high on the posterior abdominal wall and then migrates into the pelvis, retaining its original blood supply, originating bilaterally of the cornua of the uterus are the ovarian ligaments, the uterine tube, and the round ligaments of the uterus. The ovary is attached to the broad ligament via the mesovarium and to the lateral pelvic wall via the suspensory

ligament. The area of the broad ligament superior to the mesovarium is called the mesosalpinx

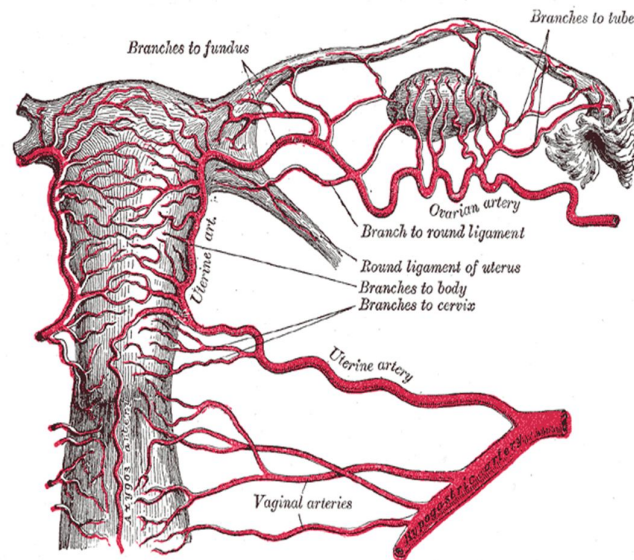


Figure (1-3) shows lateral view for blood supply of uterus, ovaries & vagina

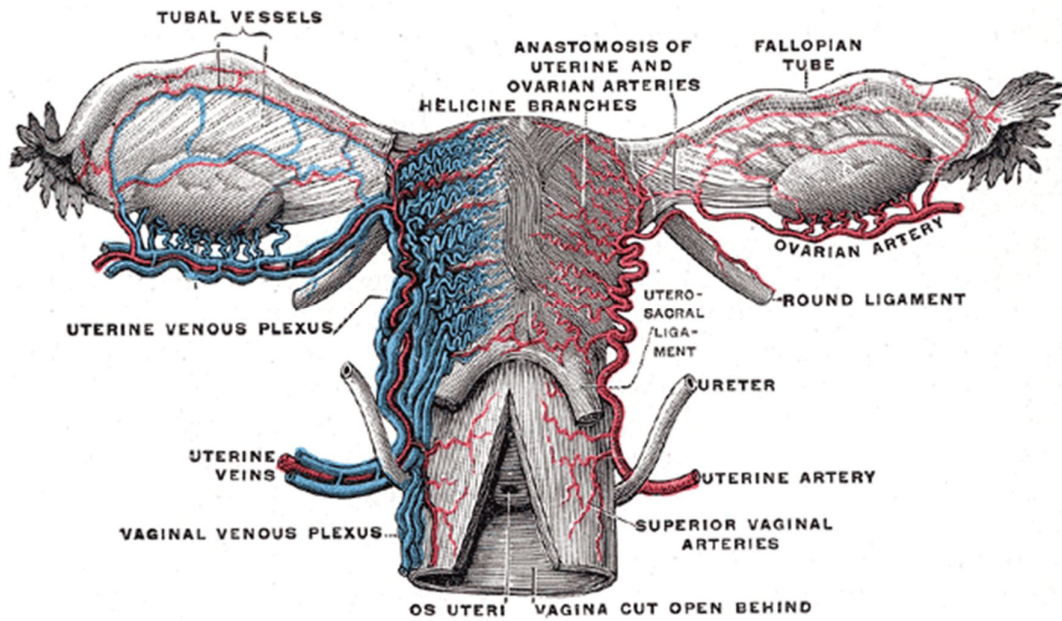


Figure (1-4): shows blood supply of uterus, ovaries & vagina

2-1-15 Uterine position:-

Midline anterversion: Most common, degree of anteversion is bladder distention dependent.

Right or left: Normal variant in absence of pelvic masses.

Retroverted: Entire organ displaced posteriorly.

Retroflexed: Body displaced with respect to cervix.

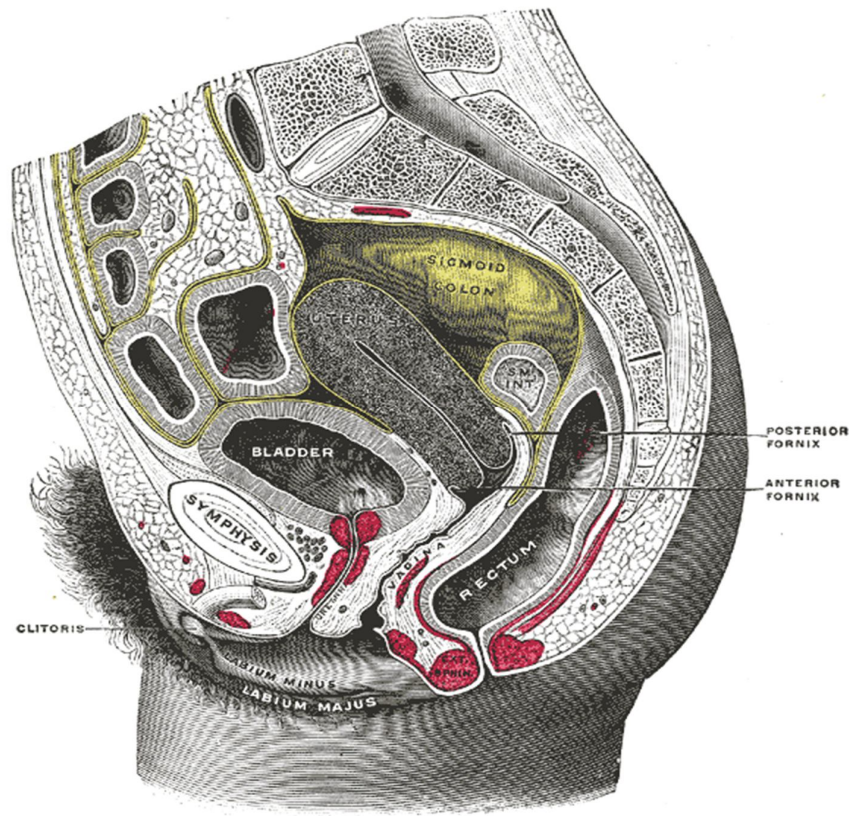


Figure (1-5): shows sagittal section of the lower part of female Trunk

2-1-16 Early development:-

The sonographic diagnosis of any early intra uterine gestation requires the sonographer to be familiar with certain aspects of early reproductive physiology and anatomy that have sonographic and clinical significance.

2-1-17 Fertilization:-

Ovulation is the release of the mature, secondary oocyte or ovum from the dominant follicle triggered by the rise of serum estrogen and the release of luteinizing hormone (LH) from the pituitary gland. Ovulation occurs on approximately day 14 of the normalized 28 day menstrual cycle. With ovulation the wall of the follicle collapses and the antrum fills with blood and lymph to form the corpus hemorrhagicum, which

develops into the corpus luteum. Fertilization or conception is the cellular union of the secondary oocyte released during ovulation with a single sperm cell. It generally occurs with 24 hours of ovulation (day 14 to 15) in the ampullar portion of the ipsilateral fallopian tube (WWW.E medicine.com).

2-1-18 Zygote, cleavage and morula formation:-

The zygote represents the first product of conception. The zygote represents the fertilized secondary oocyte. Half of the 46 chromosomes in the nucleus of the zygote arise from the secondary oocyte and half from the sperm. A normal oocyte and sperm consist of only 23 chromosomes (referred to as a haploid number). A normal zygote has 46 chromosomes (referred to a diploid number) of which determine the genetic sex of developing embryo. Cellular division of the zygote occurs by the process of cleavage . The dividing cell mass (2.4.8 and 16 cell stages) moves slowly towards the uterine cavity with the effort of tubal peristalsis and the ciliary action of the tubal mucosa. The 16-cell stage is referred to the morula and is the last stage before blastocyst formation (Clemant, 1969).

2-1-19 Blastocyst formation and implantation:-

The morula is transformed into the blastocyst which enters the uterine cavity approximately 5 days following conception. The blastocyst is the precursor to the gestational sac seen on ultrasound but it is too small to be sonographically visualized at this stage of development.

The preimplantation blastocyst has three components – an outer zone yet undifferentiated cells called trophoblast, an inner cell mass, and a fluid space or antrum called the blastocyst cavity or blastocele. The inner cell mass is destined to form the embryo whereas the trophoblast involves into the chorion from which forms the fetal component of placenta. The trophoblast serves as a source of nutrition for the

rapidly developing blastocyst and also secretes human chorionic gonadotropine (HCG) . An adequate amount of HCG is essential at this stage to maintain the activity of the corpus luteum. The corpus luteum secretes estrogen and progesterone during the first trimester of pregnancy which is essential for normal uterine and decidual (endometrium) function. The end of the blastocyst with the inner cell mass attaches to the endometrium to begin the process of implantation about 6 days following formation of the zygote (day 19 to 20 of the menstrual cycle).

The trophoblast mysteriously starts invade the endometrium with digestive action. This invading mass of trophoblast is known as the syncytiotrophoblast. The blastocyst embeds completely in the functional layer of the thickened endometrium by about day 24 last menstrual periods (LMP). A new layer of blastocyst being completely surrounded by endometrium which results from layer of endometrium form over the burrowed blastocyst. The covering endometrium is referred to a decidua capsularis whereas the deeper zone of endometrium which is the site of the future placenta is called deciduas basalis. There is a thin transparent membrane known as the zona pellucida which surrounds the conceptus including the primitive preimplantation blastocyst ([http://www. CDC.gov/mmwr/preview](http://www.CDC.gov/mmwr/preview)).

The zona pellucida should normally disintegrate automatically at the time of implantation to allow the blastocyst to implant in the uterine cavity. If transit of the blastocyst has been delayed, implantation will occur in the fallopian tube (tubal pregnancy) or anywhere the blastocyst happens to be at the time of implantation. The invading syncytiotropho-blast proliferates rapidly and erodes endometrial blood vessels to form pools of maternal blood within the syncytiotrophoblast known as lacunae. The numerous lacunae around the blastocyst eventually communicate together to form a lacunar network near the basal layer of the endometrium which

becomes the intervillous spaces of the future placenta (<http://www.CDC.gov/mmwr/preview>). .

2-1-20 Chorion and chorionic cavity:-

The wall of the rapidly developing blastocyst consists of three tissue layers that form a tissue called the chorion. In an exophytic fashion, the chorion gives rise to villi which completely covers the blastocyst. The chorion differentiates into two zones known as the smooth chorion (chorion leave) and the chorion frondosum (villous chorion). The chorion frondosum proliferates in the region of the basal endometrium (decidua basalis) and eventually forms the placenta. The smooth chorion is formed by compression and disintegration of the villi beneath the deciduas capsularis. The chorionic cavity emerges by day 26 to 27 LMP and grows rapidly with the production of chorionic fluid from the inner layer of cells lining the chorion (<http://www.CDC.gov/mmwr/preview>).

2-1-21 Amnion and amniotic cavity:-

The amnion and amniotic cavity emerge at about 22-23 last menstrual period (LMP) (8 days following conception). Initially, the amniotic cavity is small and lines one side of embryo while the other side is lined with the yolk sac. With growth and folding of the embryo, the amniotic cavity completely envelopes the embryo. The amnion and chorion fuse together to form the amniochorionic membrane. This process is variable in duration but fusion is usually complete by 20 weeks LMP midterm (<http://www.CDC.gov/mmwr/preview>).

2-1-22 Yolk SAC:-

The primary yolk sac forms by day 23 LMP. By day 27-28 LMP, the primary yolk sac starts to shrink and is replaced by a secondary yolk sac which persists for the duration

of pregnancy. The secondary yolk sac which is connected to the embryo via a yolk stalk which contains paired viteline arteries and veins (which supply the yolk sac) and the viteline or omphalomesenteric duct which is connected to the embryo's mid-gut (future bowel) (WWW.garlikov.com) (WWW.CDC.gov.com) (Therapeutic abortions 1996 &1997) .

The human yolk sac plays a role in the transfer of nutrients to the embryo during the second and third weeks of embryonic development while the uteroplacental circulation is being established. It is the center of primitive fetal blood formation until hemopoietic activity begins in the liver during the 6th embryonic week. The dorsal part of the yolk sac incorporated into the embryo as the primitive gut. The primordial germ cells appear in the wall of yolk sac in the third embryonic week and subsequently migrate to the developing gonads where they become the fetal germ cells (WWW.CDC.gov.com).

It is postulated that errors in yolk sac development is responsible for abnormal embryogenesis in some cases as demonstrated in rat studies.

2-1-23 Embryo:-

The embryo is the early developing human prior to becoming a fetus. The fetus (term) is applied to the developing human at the end of the embryonic period to the end of pregnancy. The embryonic period extends until 10th menstrual weeks. The embryo arises from the embryonic disk which is located at the edge of yolk sac between the yolk sac and the amniotic cavity. The trilaminar embryo consists of a layer each of ectoderm, mesoderm and endoderm from which develops all future tissues in the embryo. During 5th week LMP, the embryo's heart forms as two paired tubes that fuse and pump blood by about day 36 LMP (Therapeutic abortions 1996 and 1997).

2-1-24 Umbilical cord:-

The umbilical cord forms at the end of the 6th menstrual week as the amnion expands and envelops the connecting stalk, yolk sac and the allantois. The normal cord is there for covered by amnion and contain two umbilical arteries, a single umbilical vein, and a moulding substance known as the Wharton's Jelly. Remnants of the allantois and yolk stalk in the cord and are the potential source of cord cysts. The allantois arises as a small diverticulum of the yolk sac and associated with bladder development. The allantois becomes the urachus, which in turn becomes the median umbilical ligament persistence of the urachus may be associated with urachal abnormality including cysts. The allantois extends from the bladder to the proximal portion of the umbilical cord. The yolk stalk connects the primitive gut to the yolk sac (Snel 1995), (Therapeutic abortions 1996 and 1997) .

2-1-25 Deciduas:-

Decidua is the term applied to the endometrium during pregnancy decidual reaction is a term used by pathologist to describe the histological changes observed in the endometrium in pregnant patient. These changes are brought by the continued production of progesterone elaborated by the corpus luteum in response to the presence of HCG in the maternal circulation. Decidual reaction occurs regardless of implantation site.

Decidualized endometrium is obviously distinguished under the microscope from normal secretory endometrium seen in the non-pregnant patient however these histological differences are too subtle to be appeared with ultrasound technique. Decidual reaction is associated with hypertrophic changes in the endometrial cells and glands as well as an increase in the uterine blood flow however these changes are too subtle to be diagnostic of pregnancy (Snel, 1995).

The decidua is anatomically divided into three zones with reference to the implantation site and the deep and superficial poles of the burrowed sub- endometrial blastocyst. The deepest pole of the blastocyst forms the chorion frondosum. The region of decidua associated with the chorion frondosum is referred to as the decidua basalis. Together the chorion frondosum and the deciduas basalis form the fetal and maternal components of the placenta (Snell.1995).

The new endometrium which regenerates over the superficial pole of the blastocyst is called the deciduas capsularis which associated with the smooth chorion. Prior to about the 8th wk LMP, the chorion is completely covered with a uniformly thick layer of chorionic villi. The villi beneath the decidua capsularis are compressed and degenerate to form the smooth, a villous chorion. The remainder of deciduas not directly related the blastocyst is called deciduas Vera or deciduas parietalis (Snell. 1995).

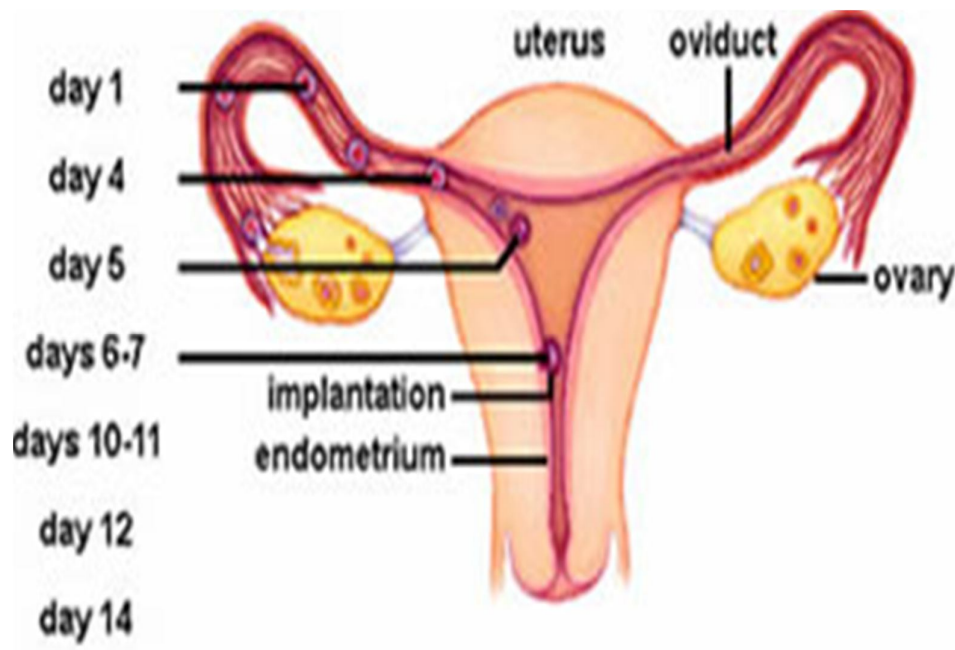


Figure (1-6): shows Diagram illustrates normal conception

2-1-26 The viable intrauterine pregnancy:-

2-1-26-1 Gestational sac:-

The first visible structure with the uterus is a gestational sac. During the 5 gestational weeks, it measures 2 to 3mm in diameter as estimated by transvaginal ultrasound. The measurement should be obtained from the outer to inner part of the gestational sac. The gestational sac grows approximately 2mm in size per day. Biometric and morphological characteristics of gestational sac and embryonic echo can be used as a predictive factor in diagnosis of abnormal early pregnancy. Decreased values of gestational sac diameter and/or its irregular shape can suggest upcoming incident and may be used as a marker for chromosomopathies for example, early spontaneous abortion as one of the complications in early pregnancy usually connected with triploidy and trisomy is followed by abnormal gestational sac growth (WWW.Religionand abortion.com) (WWW.abortion , miscarriage and abortion in India. Com).

2-2 Diabetes mellitus and pregnancy:-

For women with diabetes mellitus, pregnancy can present some particular challenges for both mother and child. If the woman has diabetes as a concomitant disease in pregnancy, it can cause early labor, birth defect and very large babies ((Gabbe.S.G 2002 (White.P.1949)

Women who know they are diabetic should get themselves into the best shape possible, even before trying to get pregnant. They should be under the care of someone who understands the needs of diabetics during their child-bearing years. A “preconception checkup” is essential. There is a lot of research showing that poorly-controlled diabetes before pregnancy is associated with a higher risk of congenital

abnormalities, as well as the death of the baby soon after birth ("Diabetes Blue Circle Symbol". International Diabetes Federation. 17 March 2006). If diabetes is controlled before and during your pregnancy, the risks will go down significantly, but are still higher than in women without diabetes. In addition to finding out how well-controlled a woman's diabetes is, the preconception checkup, which includes laboratory tests, let the doctor know whether or not she has other diseases associated with diabetes, such as heart disease. Some conditions, such as high blood pressure, may need to be treated before pregnancy, and will continue to be treated during pregnancy. Other conditions will be monitored closely, including any damage to the kidneys or the back of the eyes ("Diabetes Blue Circle Symbol". International Diabetes Federation. 17 March 2006). Ideally, pregnant diabetic women should be followed by a team specializing in their care. This would include an obstetrician experienced in managing high-risk pregnancies. Other team members might include a doctor specializing in the care of diabetics, a dietitian, and a nurse ("Diabetes Blue Circle Symbol" International Diabetes Federation. 17 March 2006).

Both type 1 and type 2 diabetics must have their sugars controlled. Type 1, or insulin-dependent diabetes, is due to a lack of insulin and is treated with insulin. Type 2 diabetes is caused by insensitivity to insulin, as well as a relative lack of insulin. It is usually managed by diet and oral medications, but is often treated with insulin during pregnancy ("Diabetes Blue Circle Symbol". 17 March 2006).

There is another group of women who only have diabetes during pregnancy, called **gestational diabetes**. This is discovered by doing an oral glucose tolerance test during the middle of the pregnancy. Whether or not, and when, to do this test depends on the woman's weight and her personal and family history, which might point to a risk of diabetes. Some doctors screen all their pregnant patients for gestational diabetes.

Those who have it may be able to control their blood sugars with diet and exercise. Those who still have elevated blood sugars may need insulin or an oral agent ("Diabetes Blue Circle Symbol". 17 March 2006).

2-3 Ultrasound background:-

2-3-1 Ultrasound physics:-

The creation of an image from sound is done in three steps - producing a sound wave, receiving echoes, and interpreting those echo(WWW.medical ultrasound instrument .com) .

2-3-2 Producing a sound wave:-

A sound wave is typically produced by a piezoelectric transducer encased in a probe. Strong, short electrical pulses from the ultrasound machine make the transducer ring at the desired frequency. The frequencies can be anywhere between 2 and 18 MHz. The sound is focused either by the shape of the transducer, a lens in front of the transducer, or a complex set of control pulses from the ultrasound scanner machine. This focusing produces an arc-shaped sound wave from the face of the transducer. The wave travels into the body and comes into focus at a desired depth (WWW.medical ultrasound instrument .com).

Older technology transducers focus their beam with physical lenses. Newer technology transducers use phased array techniques to enable the sonographic machine to change the direction and depth of focus. Almost all piezoelectric transducers are made of ceramic(WWW.medical ultrasound instrument .com). Materials on the face of the transducer enable the sound to be transmitted efficiently into the body (usually seeming to be a rubbery coating, a form of impedance matching). In addition, a water-based gel is placed between the patient's skin and the probe (WWW.medical ultrasound instrument .com).

The sound wave is partially reflected from the layers between different tissues. Specifically, sound is reflected anywhere there are density changes in the body: e.g. blood cells in blood plasma, small structures in organs, etc. Some of the reflections return to the transducer (WWW.medical ultrasound instrument.com).

2-3-3 Receiving the echoes and forming the image:-

The return of the sound wave to the transducer results in the same process that it took to send the sound wave, except in reverse. The return sound wave vibrates the transducer; the transducer turns the vibrations into electrical pulses that travel to the ultrasonic scanner where they are processed and transformed into a digital image (WWW.medical ultrasound instrument.com).

2-4 Modes of ultrasound:-

Four different modes of ultrasound are used in medical imaging. These are:

2-4-1 A-mode: -

A-mode is the simplest type of ultrasound. A single transducer scans a line through the body with the echoes plotted on screen as a function of depth. Therapeutic ultrasound aimed at a specific tumor or calculus is also A-mode, to allow for pinpoint accurate focus of the destructive wave energy.

2-4-2 B-mode:-

In B-mode ultrasound, a linear array of transducers simultaneously scans a plane through the body that can be viewed as a two-dimensional image on screen.

2-4-3 M-mode:-

M stands for motion. In m-mode a rapid sequence of B-mode scans whose images follow each other in sequence on screen enables doctors to see and measure range of motion, as the organ boundaries that produce reflections move relative to the probe.

2-4-4 Doppler mode:-

This mode makes use of the Doppler effects in measuring and visualizing blood flow.

2-5 Diagnostic applications:-

In physics the term "ultrasound" applies to all acoustic energy with a frequency above human hearing (20,000 hertz or 20 kilohertz). Typical diagnostic sonographic scanners operate in the frequency range of 2 to 18 megahertz, hundreds of times greater than the limit of human hearing. The choice of frequency is a trade-off between spatial resolution of the image and imaging depth: lower frequencies produce less resolution but image deeper into the body (WWW. Medical ultrasound instrument.com).



Fig (2-7) Medical ultrasound instruments.

Sonography (ultrasonography) is widely used in medicine. It is possible to perform both diagnosis and therapeutic procedures, using ultrasound to guide interventional procedures (for instance biopsies or drainage of fluid collections). Sonographers are medical professionals who perform scans for diagnostic purposes. Sonographers typically use a hand-held probe (called a transducer) that is placed directly on and moved over the patient. A water-based gel is used to couple the ultrasound between the transducer and patient.(WWW.medicalultrasoundinstrument.com)

Sonography is effective for imaging soft tissues of the body. Superficial structures such as muscles, tendons, testes, breast and the neonatal brain are imaged at a higher

frequency (7-18 MHz), which provides better axial and lateral resolution. Deeper structures such as liver and kidney are imaged at a lower frequency 1-6 MHz with lower axial and lateral resolution but greater penetration.

Medical sonography is used in, for example:

2-6 Therapeutic applications:-

Therapeutic applications use ultrasound to bring heat or agitation into the body. Therefore much higher energies are used than in diagnostic ultrasound. In many cases the range of frequencies used are also very different. Ultrasound may be used to clean teeth in dental hygiene. Ultrasound sources may be used to generate regional heating and mechanical changes in biological tissue, e.g. in occupational therapy, physical therapy and cancer treatment. However the use of ultrasound in the treatment of musculoskeletal conditions has fallen out of favor. Focused ultrasound may be used to generate highly localized heating to treat cysts and tumors (benign or malignant), This is known as Focused Ultrasound Surgery (FUS) or High Intensity Focused Ultrasound (HIFU). These procedures generally use lower frequencies than medical diagnostic ultrasound (from 250 kHz to 2000 kHz), but significantly higher energies. HIFU treatment is often guided by MRI. Focused ultrasound may be used to break up kidney stones by lithotripsy. Ultrasound may be used for cataract treatment by phacoemulsification.

Additional physiological effects of low-intensity ultrasound have recently been discovered, e.g. its ability to stimulate bone-growth and its potential to disrupt the blood-brain barrier for drug delivery.

2-4 Previous studies:-

2-4-1 Patients and methods:-

A descriptive correlational research was done, with study of the biometric parameters of fetal weight estimation during the third trimester of gestation of 59 diabetic pregnant patients, who were studied in the University of Carabobo's Diabetes and Pregnancy Unit and Perinatology Unit at the Enrique Tejera Hospital City in Valencia, Venezuela, 2004.

Sixty-four percent had gestational diabetes mellitus, 24% diabetes mellitus type 2, and 12% diabetes mellitus type 1. Serial ultrasound scans were performed on 33 women during the three trimesters of pregnancy, and to 16, it was performed another ultrasound scan one week prior to delivery or cesarean section, for fetal weight estimation. Gestation mean time was 37.5 +/- 0.51 weeks. Average estimated fetal weight was 3555.87 +/- 455.41 g. normalcy tests: 0.200 (estimated fetal weight), 0.116 (birth weight), 0.000 (assessment week). T test: -0.506 Sig: 0.620 $p > 0.05$. Estimated fetal weight/birth-weight correlation: Pearson: 0.749 Sig: 0.001 < 0.005 , r : 0.749, r^2 : 0.561, F : 17.870 Sig: 0.001 < 0.05 , thus demonstrating that correlation does exist. Prediction: newborn weight: 95.2 +/- 0.987 (estimated weight). Estimated fetal weight at the end of the third trimester constitutes a good predictive parameter of fetal weight in newborn of diabetic mothers.

Chapter three

Material and Methods

3-1Patients:-

Hospital and Doctor Mohammed Alamean clinic The target population amount for this study had 50 patients at ultrasound department in Almanagil teaching.

3-2Machined used:-

All patients were scanned with Mindray 6600 ultrasound machine with 3.5 MHZ type of probes used.

3-3 design of the study:-

This is an analytical study deal with the patients who were come to the department of Obstetrical ultrasound investigation.

3-4 Duration and place of the study:-

This study carried out in Almanagil teaching hospital and Doctor Mohammed Alamean clinic in the period from October 2010 to 2013

3-5 Ultrasound technique:-

For ultrasound examination each patient had scanned twice firstly by student and then by senior sonographer to confirm the diagnosis trans abdominal ultrasound scanning technique is performed with patient lying in supine position both longitudinal and transverse views of patient uterus contains was applied.

The patient is examined while reclining, with the abdomen exposed. after applying a sonic coupling agent, most sonographers begin their evaluation with a simple sweep of transducer up to down the abdomen and side-to-side across the uterine contents before focusing on specific areas of interest.

Return to the longitudinal section that demonstrates the full length of the fetal spine and rotate the probe through 90 degree to obtain a transverse section of the fetal chest to evaluate fetal heart for viability, continue to evaluate the cross-section anatomy while sliding the probe down the fetal body to the abdominal circumference section then measure it (Obstetric ultrasound, Trish Ch, B TH, 3th edition).

Evaluate the cross-sectional anatomy of the lower fetal abdomen while sliding the probe down the fetal body to the sacrum find the femur and measure it.

3-5-1Biparietal diameter:-

The biparietal diameter is among the most accurate second trimester measures of gestational age .measured from the beginning of the fetal skull to the inside aspect of the distal fetal skull (outer to inner) at the level of cavum septum pelucidum, this is one of the basic fetal measurement.

3-5-2Abdominal circumference:-

The abdominal circumference is a transverse section (coronal) through the fetal abdomen at the level where the umbilical vein enters the liver. The abdominal circumference may be measured directly, or calculated from the antro-posterior and transverse abdominal measurements.

3-5-3Femur length:-

The femur length can be used to determine gestational age, but it is more useful in helping evaluate fetal weight. Identify the fetal pelvis. Keeping one end of the transducer over the fetal pelvis, slowly sweep the other end of the transducer in a clockwise fashion toward the fetal small parts. The fetal femur will be found at about 45 degree angle away from the fetal spine.

Slowly move the transducer back and forth until the longest bright echo within the femur is identified. This is the femur length.

3-6 Data storage methods:-

Data is correspondence with the thesis procedure had been stored in personal computer.

3-7 Method of data analysis:-

This had been solved by using T-test and ANOVA .

Chapter four

Results

Table 4-1 the mean and standard deviation of age, weight and height

Variable	Mean±SD
Age	29.4±5.5
Weight	65.2±11.9
Height	152.5±18.7
BMI	28.5±5.7

Table 4-2 a frequency distribution table show the frequency of occupation

Occupation	Frequency	Percent
Housewife	35	70.0
Employer	15	30.0
Total	50	100.0

Table 4-3 a frequency distribution table show the frequency of parity

Parity	Frequency	Percent
Primegraveda	20	40.0
Multipara	21	42.0
Grandmultipara	9	18.0
Total	50	100.0

**Table 4-4 a frequency distribution table show the frequency of the history
disease of patients**

History	Frequency	Percent
First	18	36.0
Unknown	32	64.0
Total	50	100.0

Table 4-5 a frequency distribution table show the frequency of family history

family history	Frequency	Percent
Yes	42	84.0
No	8	16.0
Total	50	100.0

Table 4-6 a significant test (t-test) for testing the significant effect of family history

Independent Samples Test using family history as factor		
	t-test for Equality of Means	
	T	Sig. (2-tailed)
lab_test	.913	.366
Diabetes	-.739	.463
GA_MC	.125	.901
FL	.482	.632
BPD	.084	.934
AC	-.744	.460
FW	.078	.938

Table 4-7 a frequency distribution table show the frequency of associated diseases

Diseases	Frequency	Percent
Infection	12	24.0
Myomas	13	26.0
Others	25	50.0
Total	50	100.0

Table 4-8 a significant test table using ANOVA test to test the significant difference between the disease groups (Infection, Infection, Myomas and Others) in respect to lab test, diabetes and fetal measurements.

ANOVA using disease as factor				
		Sum of Squares	F	Sig.
Labe test	Between Groups	99.081	1.041	.361
	Within Groups	2236.599		
	Total	2335.680		
Diabetes	Between Groups	9018.173	1.083	.347
	Within Groups	195726.147		
	Total	204744.320		
GA_MC	Between Groups	10.813	.672	.516
	Within Groups	378.307		
	Total	389.120		
FL	Between Groups	20.616	.206	.815
	Within Groups	2351.464		
	Total	2372.080		
BPD	Between Groups	291.571	1.978	.150
	Within Groups	3464.049		
	Total	3755.620		
AC	Between Groups	435.126	.239	.788
	Within Groups	42769.754		
	Total	43204.880		
FW	Between Groups	38317.509	.046	.955
	Within Groups	19398515.871		
	Total	19436833.380		

Table 4-9 a significant test table using ANOVA to test the significant difference between parity groups (primegravida, multipara, and grandmultipara) in respect to lab test, diabetes and fetal measurements.

ANOVA using parity as a factor				
		Sum of Squares	F	Sig.
lab test	Between Groups	72.086	.748	.479
	Within Groups	2263.594		
	Total	2335.680		
Diabetes	Between Groups	22107.710	2.845	.068
	Within Groups	182636.610		
	Total	204744.320		
GA_MC	Between Groups	4.360	.266	.767
	Within Groups	384.760		
	Total	389.120		
FL	Between Groups	107.974	1.121	.335
	Within Groups	2264.106		
	Total	2372.080		
BPD	Between Groups	462.829	3.303	.045
	Within Groups	3292.791		
	Total	3755.620		
AC	Between Groups	536.953	.296	.745
	Within Groups	42667.927		
	Total	43204.880		
FW	Between Groups	571037.478	.711	.496
	Within Groups	18865795.902		
	Total	19436833.380		

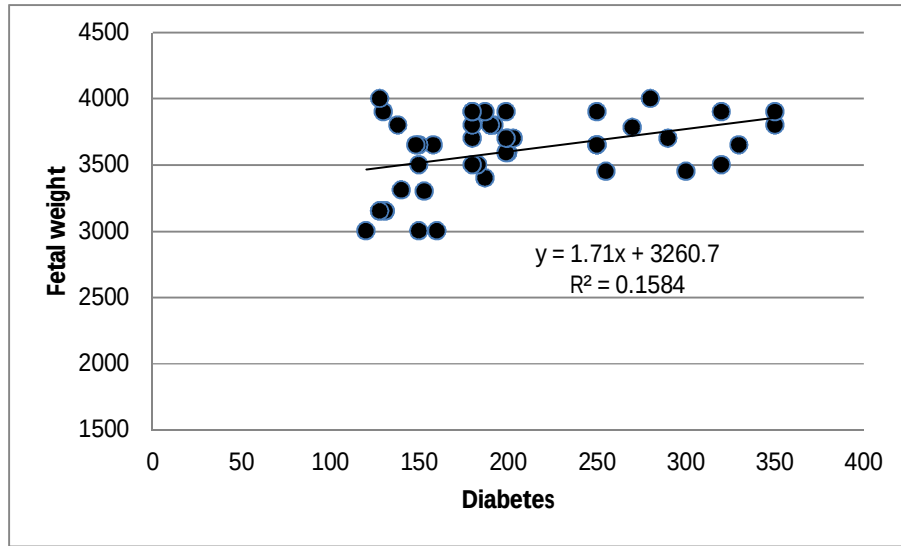


Figure 4-10 scatter plot shows a direct linear relationship between diabetes (sugar level) and the fetal weight

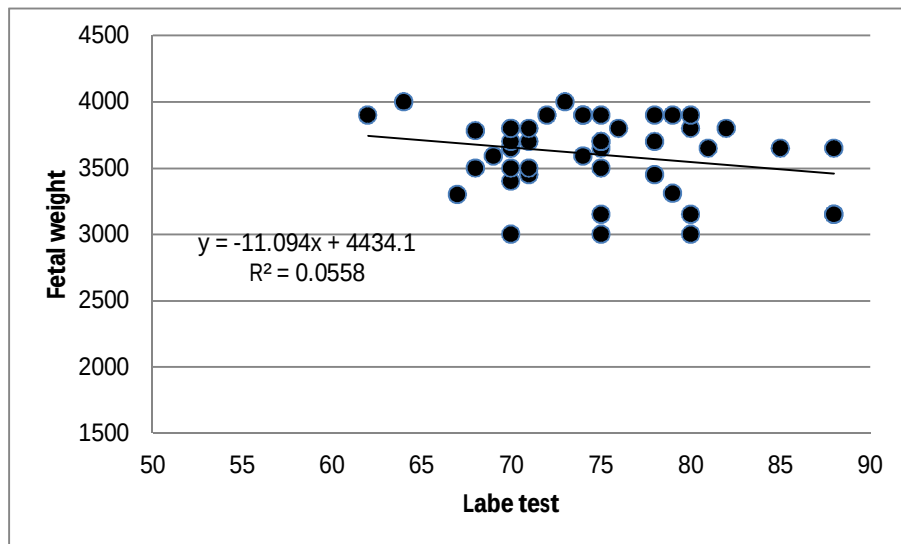


Figure 4-11 scatter plot shows a direct linear relationship between lab test and fetal weight

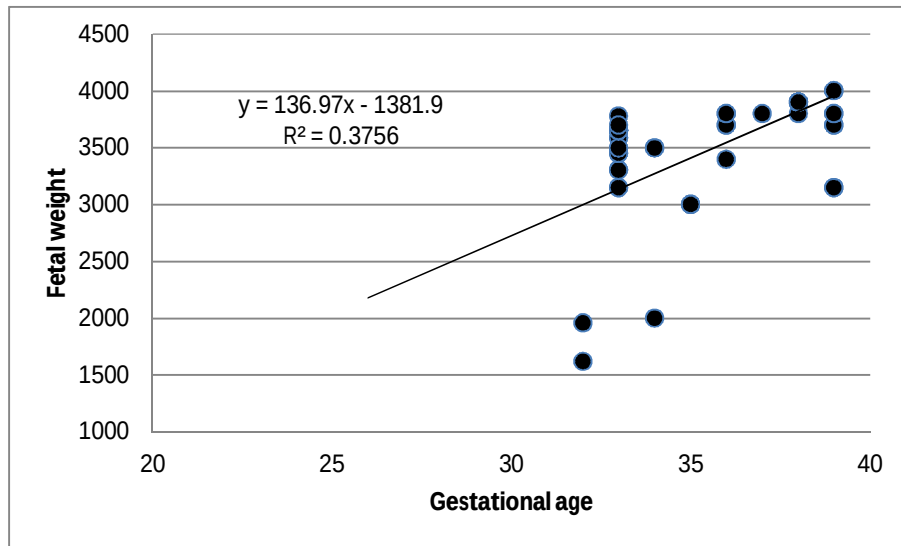


Figure 4-12 scatter plot shows a direct linear relationship between gestational age and fetal weight

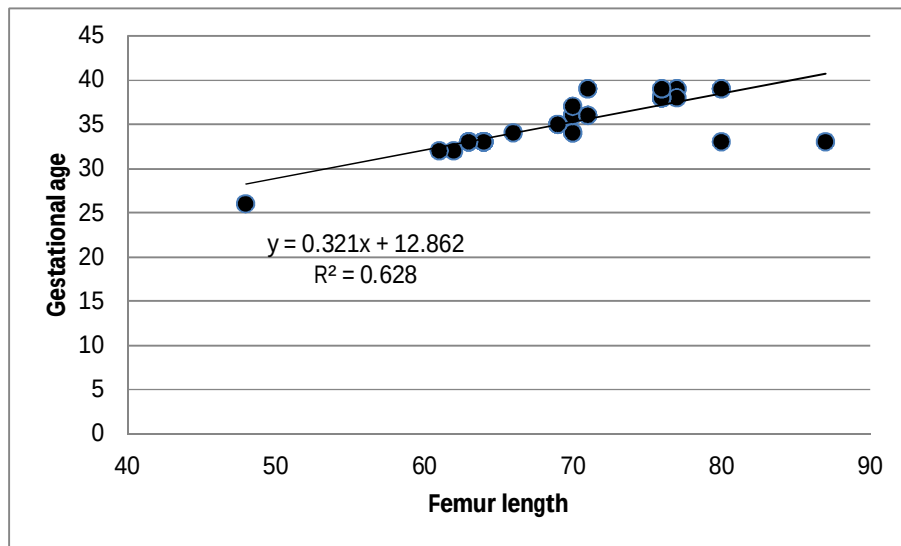


Figure 4-13 scatter plot shows a direct linear relationship between femur length and gestational age

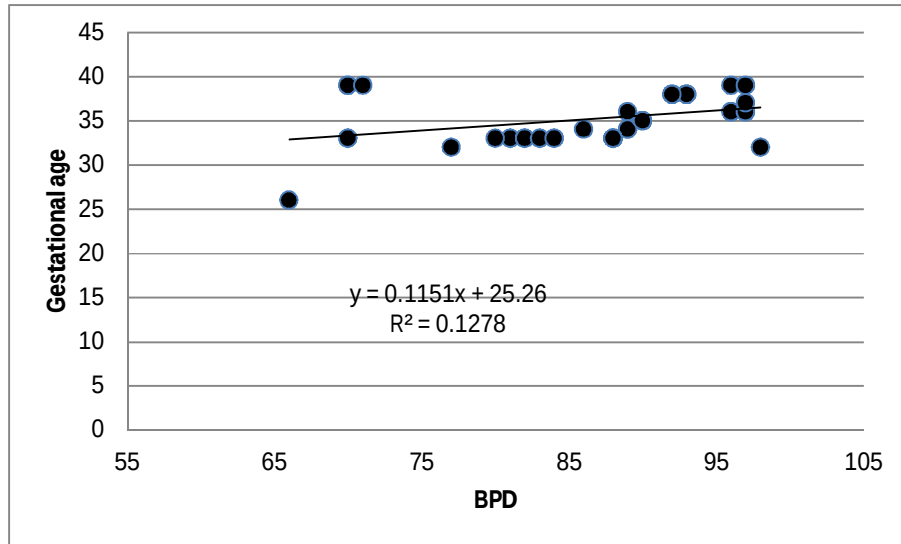


Figure 4-14 scatter plot shows a direct linear relationship between BPD and gestational age

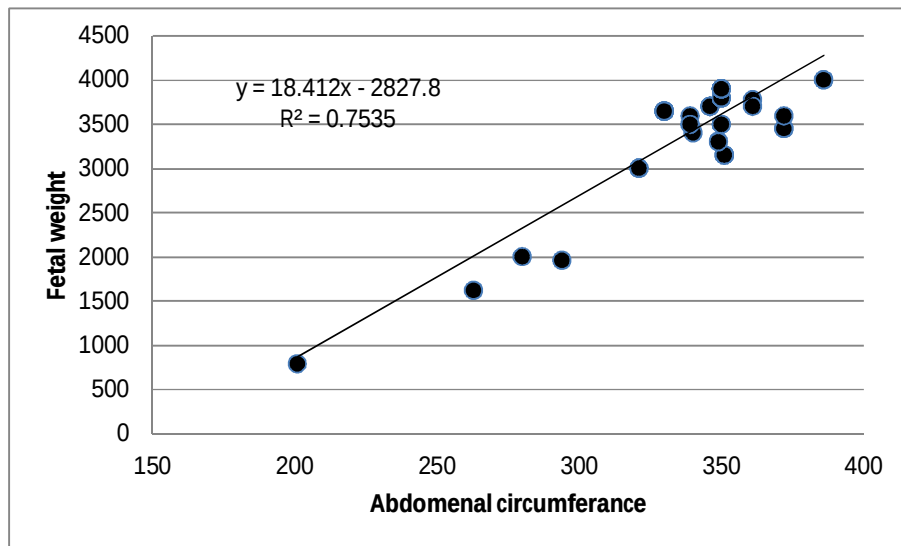


Figure 4-15 scatter plot shows a direct linear relationship between abdominal circumference and fetal weight

Chapter Five

Discussion, conclusion and recommendation

Pregnancy-associated diabetes mellitus poses a risk of fetal growth alterations. Fetal abdominal perimeter can be used as predictive of fetal weight in full-term fetuses with normal growth, along with biparietal diameter, abdominal circumference and length of femur to estimate fetal weight through set of parameters; therefore the general objective of this study was to assess the fetal weight for diabetic maternal.

The results of this study showed that 70% of the ladies enrolled in this study were housewife and 30% were employers, their means age were 29.4 ± 5.5 years, average weight was 65.2 ± 11.9 and height was 152.5 ± 18.7 (Table 4-1 and 4-2). 40% percent of the patients were primegravida, 42% multipara, and 18% grandmultipara (Table 4-3). The history of the patient showed that 36% of the cases had diabetes for the first time and 64% known cases. Also the family history of the patients indicates that 84% have past history of disease and 16% with no previous family history.

In respect to parity with its three groups there is no significant differences between the primegravida, multipara, and grandmultipara in case of diabetes, lab test and fetal measurement using ANOVA test at $p = 0.05$, except BPD where there is a significant differences with $p = 0.045$. It has been found that parity status increases the fetal biparietal diameter by a coefficient of 0.05cm/parity. But the associated diseases like hypertension, infections, myomas and any other diseases did not affected fetal weight using ANOVA at $p = 0.05$.

Also in respect to diabetes status this study found that when the level of glucose increases arbitrary the fetal weight increases by 1.71mg/dl/week, and the fetal weight

inversely affected by the amount of hemoglobin when it increases the fetal weight decreases by 11.09 g/dl.

The means gestation age was 35 ± 0.5 weeks, and arbitrary the fetal weight increases as the gestational age increase linearly with a coefficient of 136.9 g/ weeks (Figure 4-12). This increment was higher than the normal fetal weight which is 115gm/weeks. Also femur length showed a linear association with the gestational age where it increases by 0.3 cm/weeks (Figure 4-13). Similarly biparietal diameter was increases linearly with the gestation age by 0.12 cm/weeks (Figure 4-14), and abdominal circumference increases by 18.41 cm/weeks (Figure 4-15).

In summary gestational age according to the data of this study can be predicted with an error of ± 1.5 week using FL and BPD in a multiple regression equation as follows:
 $GA = (FL \times 0.31) + (BPD \times 0.098) + 4.91$. In the same essence fetal weight can be predicted using abdominal circumference (AC) and BPD using multiple regression equation as follows: $FW = (AC \times 17.75) + (BPD \times 21.87) - 4498.37$.

Conclusion: -

The main objectives of the study was to estimate the fetal weight using the femur length, biparietal diameter and abdominal circumference order to find the impact of diabetes in the pregnant outcome.

From previous study it was known that the diabetes increase the fetal weight. The data of this study was collected from 50 pregnant ladies in third trimester suffering from diabetes, where the fetal weight measured by measuring the femur length, biparietal diameter and abdomen circumference

In summary gestational age according to the data of this study can be predicted with an error of ± 1.5 week using FL and BPD in a multiple regression equation as follows:
 $GA = (FL \times 0.31) + (BPD \times 0.098) + 4.91$. In the same essence fetal weight can be predicted using abdominal circumference (AC) and BPD using multiple regression equation as follows: $FW = (AC \times 17.75) + (BPD \times 21.87) - 4498.37$.

Recommendations:-

- Fetal weight should be evaluated for all diabetic patients.
- All pregnant women when missed their cycle should be examined by ultrasound.
- Most of the pregnant women do not give real information about her condition so; attention must be given to certain these data by checking the credibility, especially for researches.
- Ultrasound scanning should be routine component to all pregnant who visit the clinic for the first time.

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Appendices:-



Figure1 showed AC for fetal of 35 years of daibetic female



Figure2 showed AC of fetal for 32years of diabetic lady

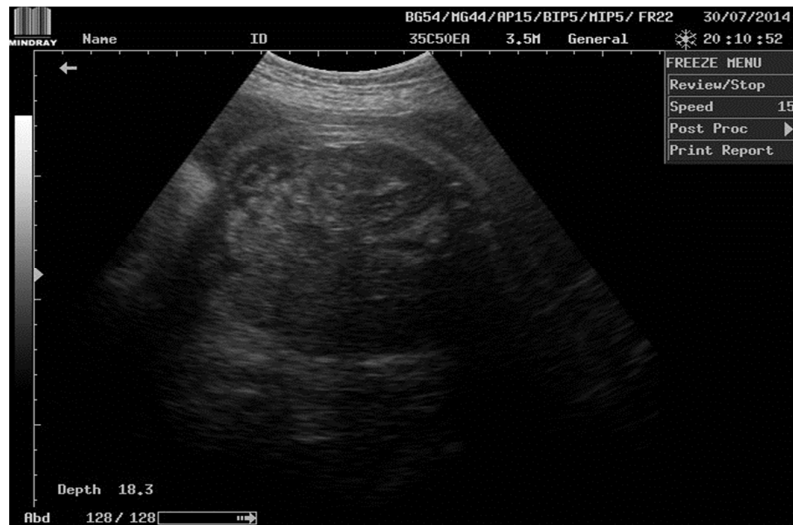


Figure3 showed BPD of fetal for 32years of diabetic lady

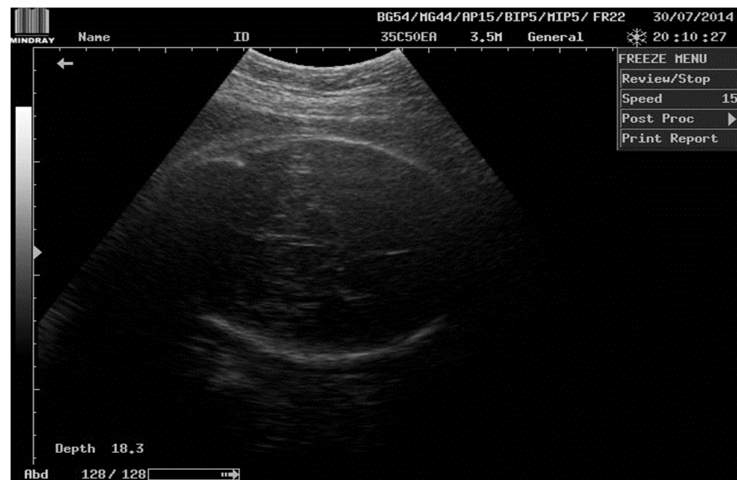


Figure4 showed BPD for fetal of 35 years of daibetic female

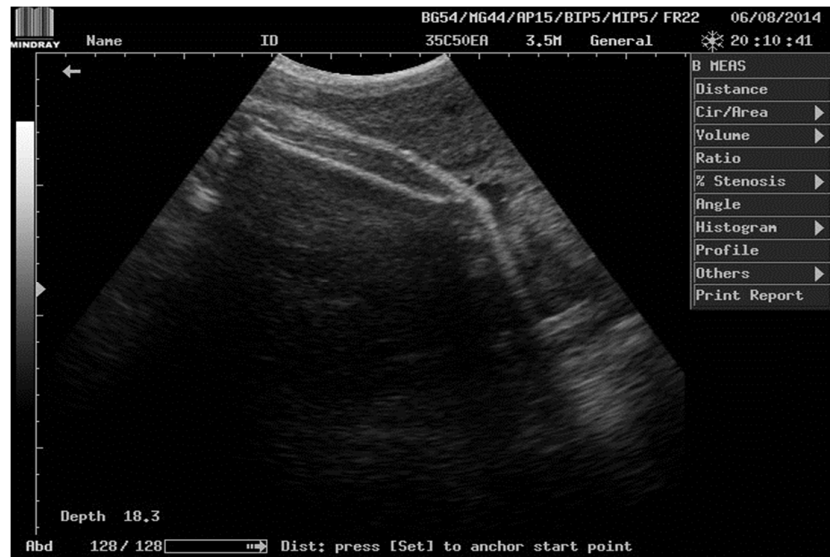


Figure5 showed FL for fetal of 35 years of daibetic female



Figure6 showed FL of fetal for 32years of diabetic lady



Figure7 showed BPD of fetal for 32years of diabetic lady

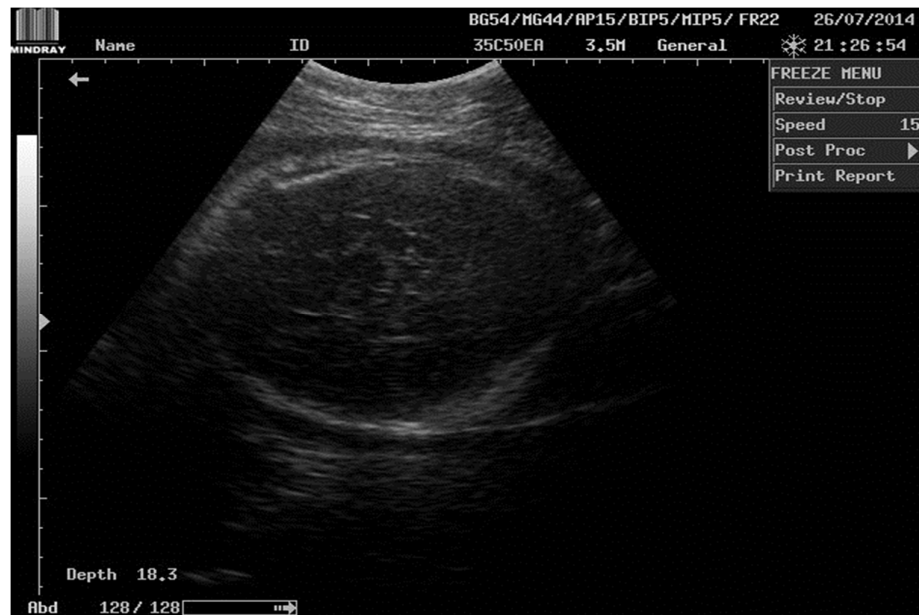


Figure8 showed BPD of fetal for 30 years of diabetic lady

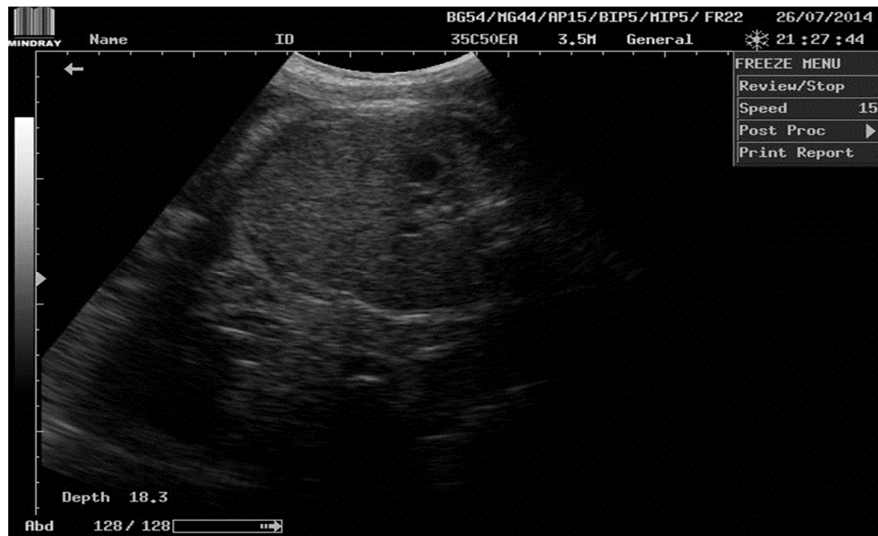


Figure9 showed AC for fetal to a 33 years diabetic female

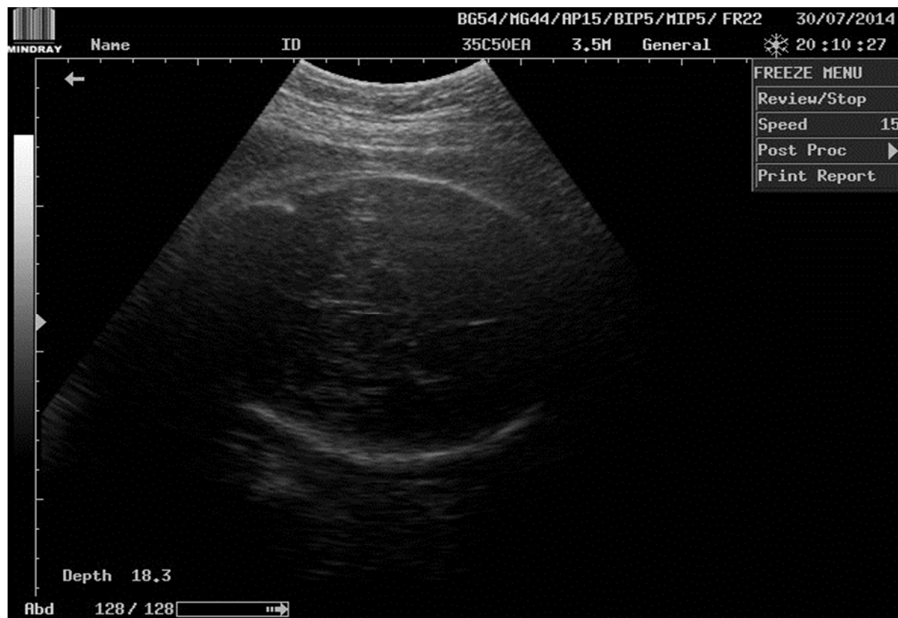


Figure10 showed BPD for fetal to a 33 years diabetic female

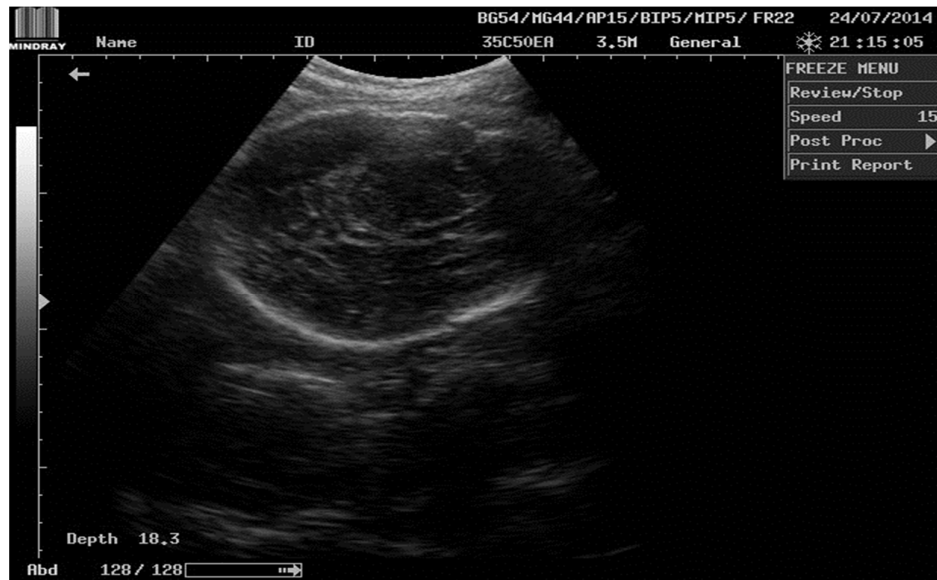


Figure11 showed BPD for fetal to a 23 years diabetic female



Figure12 showed FL for fetal to a 23 years diabetic female



Figure13 showed FL for fetal to a 35 years diabetic female

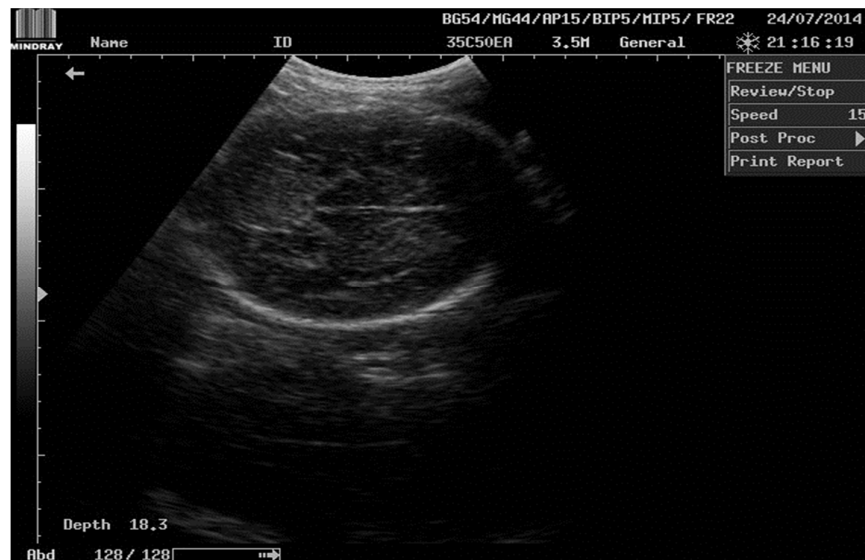


Figure14 showed BPD for fetal to a 35 years diabetic female

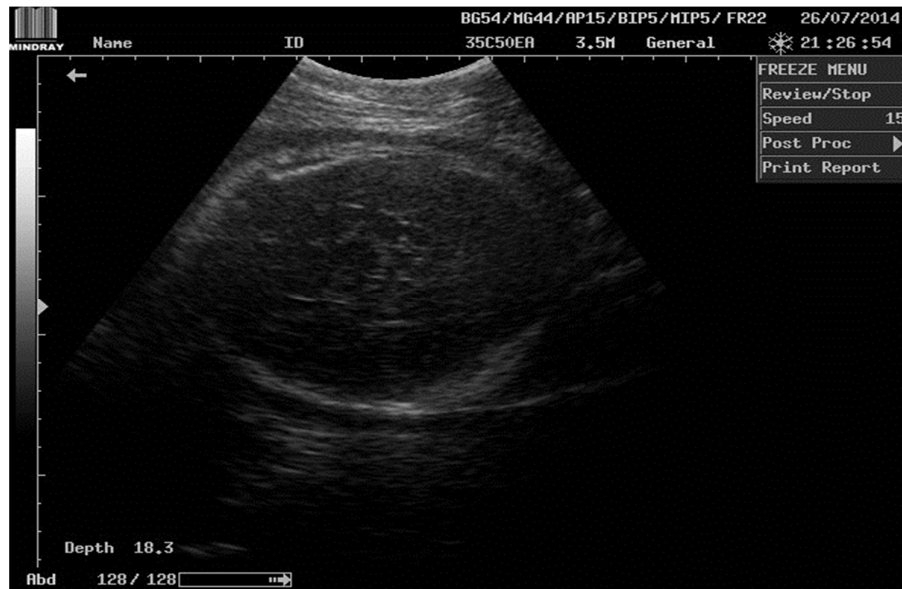


Figure15 showed BPD for fetal to a 23 years diabetic female

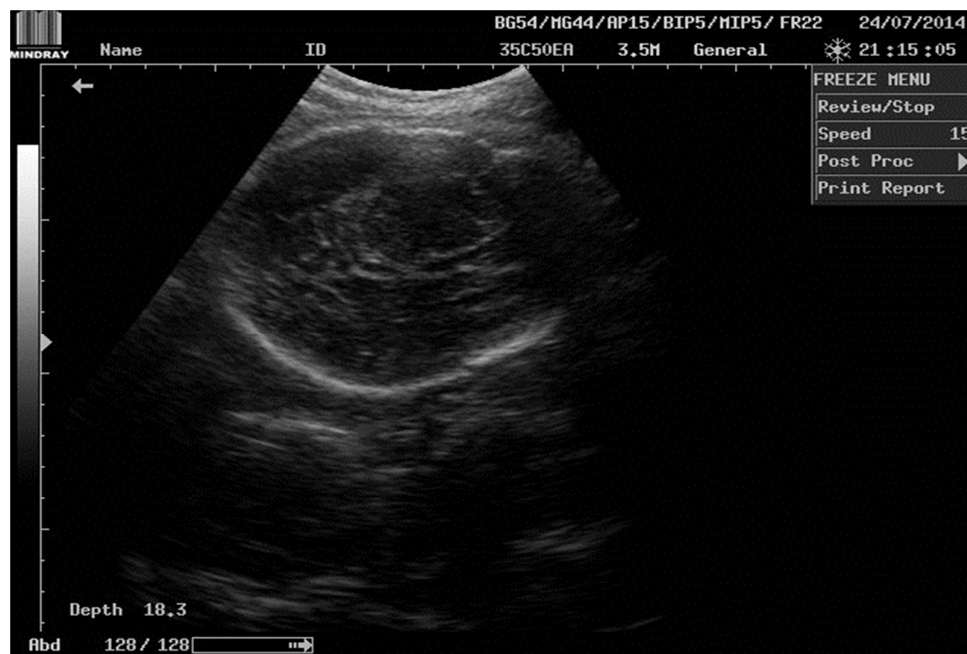


Figure16 showed BPD for fetal to a 32 years diabetic female

بسم الله الرحمن الرحيم

Sudan University of Science & Technology

College of graduate studies

Assessment of Fetal Biometry in Diabetic Patients

Data collection sheet

1-Age : Measured	2-Tall Measured	3-Occupation a-house wife b-employers	4-Social habits:- a-smoking b-alcohol consumption c-nothing	5-Habits in early pregnancy: a-drugs ingestion b-exposure to radiation c-nothing	6-parity a-primegraveda b-multipara c-grandmultipara
a-	a-	a- b-	a- b- c-	a- b-	a- b- c-

7-Past history of the patient a-first b-known	8-family history a-yes b-no	9-Associated diseases a-HTN b-infections c-myomas	10-laboratory tests a-HB b-TWBCs	11-Diabetes mellitus a-controlled(measured) b-uncontrolled (measured)	12- Types of probes a- trans-abdominal b- trans-vaginal	13-U/S finding a-BPD (measure) b-femur length (measured) c-AC(measured)
a- b-	a- b-	a- b- c-	a- b-	a- b-	a- b-	A- B- C- Fetal weight