Sudan University of Science and Technology

College of Graduate Studies

Sonographic Evaluation of Amniotic Fluid Volume in Diabetic Pregnant Women During Second and Third Trimesters

تقييم حجم السائل الأمنيوني بالموجات فوق الصوتية لدى النساء الحوامل المصابات بمرض السكر في الثلث الثاني و الثالث من الحمل

A thesis Submitted for Partial Fulfillment of MSc Degree in Medical Diagnostic Ultrasound

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بسم الله الرحمن الرحيم

الآية

قال تعالى:
﴿ اللَّهُ نُورُ السَّمَوَاتِ وَالأَرْضِ مَثَلُ نُورِهِ كَمِشْكَاةٍ فِيهَا مِصْبَاحٌ الْمِصْبَاحُ فِي زُجَاجَةٍ الزُّجَاجَةُ كَأَنَّهَا كَوْكَبٌ دُرِّيٌّ يُوقَدُ مِنْ شَجَرَةٍ مُبَارَكَةٍ زَيْتُونِةٍ لا شَرْقِيَّةٍ وَلا غَرْبِيَّةٍ يَكَادُ زَيْتُهَا يُضِيءُ وَلَوْ لَمْ تَمْسَسْهُ نَارٌ نُورٌ عَلَى نُورٍ يَهْدِي اللَّهُ لِنُورِهِ مَنْ يَشَاءُ وَيَضْرِبُ اللَّهُ الأَمْثَالَ لِلنَّاسِ وَاللَّهُ بِكُلِّ شَيْءٍ عَلِيمٌ ﴾.

صدق الله العظيم

[سورة النور:35]

Dedication

I dedicated this work to:

My parents.

My brothers and sisters.

My teachers.

My colleagues and friends.

Acknowledgement

Firstly I would like to thanks Allah because everything in this world belongs to him.

I want to express my sincere thanks and deep graduate to my faithful supervisor **Dr. Afraa Siddig Hassan Omer** for her guidance throughout this thesis and sharing her knowledge through the entire study.

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I would also like to pass my special thanks to my friends and colleagues whom help me, ***Uz\ Gady Osman and Uz\ Marwa Hessin***

Abstract

This descriptive study was conducted in order to assess the amniotic fluid volume in diabetic pregnant women to see the effect of diabetes on the amniotic fluid volume and its effect on the fetus. This study was used the Universal Protocol in the work of ultrasound for pregnant diabetic women through data collection sheet that were collected in the period from November 2016 until March 2017. The Statistically Package for Social Sciences program was used in statistical analysis, data were collected from hospitals and different diagnostic centers in the Khartoum state, including Omdurman Maternity Hospital , Alsaikh Mohmmed Ali Fadul Hospital ,Alemtias Medical Center ,Alomran Center and Alsenhory Medical Center. The equipments by which ultrasound exams was done: Mindray Chinese-made, and Sonoscape Chinese-made. This study included fifty diabetic pregnant women in the second and third trimesters of pregnancy and fourty seven non diabetic pregnant women in the second and third trimesters of pregnancy (control group) , the study was found the majority of mother ages between 30-40 years 56% of the sample size. This study measuring the amniotic fluid volume by using (SVP) and AFI (4 Pockets), the study found abnormally increase in amniotic fluid volume (polyhydramnios) represent 60% of sample size, the highest rate of diabetes from gestational diabetes 58%. The study also found that 16% of the sample size have debris (echo) in the fluid surrounding the fetus and 4% of the sample size have macrosomic fetus (large fetus size) .

The study recommended special care for diabetic pregnant women followed periodically frequently also recommended studying other factors that effect in the amount of amniotic fluid as well as diabetes and the effect of diabetes in the size of the placenta and see them

overlapping relationships. The study also recommended the training of medical staff and urged them to measure amniotic fluid volume for early diagnosis to any abnormality (polyhydrmnios or oligohydrmnios) that may affect either the fetus or the pregnant diabetic women and to treat it early. It is also recommended to facilitate ultrasound machine in every hospital and medical health centers.

Abstract Arabic

هذه دراسة وصفيه اجريت بغرض تقيم حجم السائل الامنيوني في النساء الحوامل المصابات بمرض السكر لمعرفه تاثير مرض السكر علي حجم السائل الامنيوني ومدي تاثيره علي الجنين.

استخدمت هذه الدراسة البروتوكول العالمي في عمل الموجات فوق الصوتية للنساء الحوامل المصابات بمرض السكر باستخدام استمارة جمع البيانات في الفترة من نوفمبر 2016 حتى مارس 2017 وقد تم تحليل النتائج باستخدام برنامج حزمة التحليل الاحصاى للعلوم الاجتماعية.

تم جمع البيانات من مستشفيات ومراكز تشخيصيه مختلفه في ولاية الخرطوم منها مستشفي الولاده ام درمان و مستشفي الشيخ محمد علي فضل ومركز الامتياز الطبي ومركز العمران ومركز السنهوري الطبي وكانت الاجهزة التي اجريت بها اختبارات الموجات فوق الصوتية ميندري صيني الصنع وسونواسكيب صيني الصنع.

شملت هذه الدراسة خمسين امراة حامل في الفتره الثانية والثالثة من الحمل مصابه بمرض السكر وسبع واربعون امراة غير مصابات بمرض السكر ووجد ان الغالبية من المصابات بمرض السكر تتراوح اعمارهن بين 30-40 سنة بنسبة 56% من حجم العينة.

باستخدام قياس اكبر جيب للسائل الامنيوني وقياس الاربعة جيوب وجدت الدراسة ان نسبة السائل الامنيوني في النساء الحوامل المصابات بمرض السكر وكانت اعلي من المعدل الطبيعي بنسبة 60% من حجم العينة وكانت اعلي نسبة في نوع السكر ما يسمي بسكر الحمل 58%

وجدت الدراسة ايضا ان% 16من حجم العينة لديهن حطام في السائل الامنيوني و 4% من حجم العينة لديهم علقمة الجنين (الجنين كبير الحجم).

اوصت الدراسة برعاية خاصه للنساء الحوامل المصابات بمرض السكر ومتابعتهن بصورة دورية ومتكرره وايضا اوصت الدراسة بدراسة العوامل الاخري التي تؤثر في كمية السائل الامنيوني وتاثير مرض السكر في حجم المشيمة ومعرفة العلاقة المتداخلة بينهم.

كما اوصت الدراسة بتدريب الكوادر الطبية وحثهم علي قياس السائل الامنيوني وعدم اهماله للتشخيص المبكر تفاديا للاثار الناتجة عن الزيادة او النقصان الغير طبيعي وعلاجها مبكرا كما اوصت بتوفير اجهزة التشخيص بالموجات فوق الصوتية في جميع المستشفيات والمراكز الصحية .

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List of Abbreviations

3-D	Three Dimension
4-D	Four Dimension
AC	Abdominal Circumference
AF	Amniotic Fluid
AFI	Amniotic Fluid Index
AFV	Amniotic Fluid Volume
ALARA	As Low As Reasonably Achievable
ARM	Artificial Rupture of Membrane
BPD	Biparital Diamter
BPP	Biophysical Profile
CNS	Central Nerves System
DM	Diabetes Mellitus
EFW	Estimate Fetal Weiglt
FL	Femoral Length
GA	Gestational Age
GD	Gestationa l Diabetes
GIT	Gastrointestinal Tract
GUT	Genitourinary Tract
Hz	Hertz
IUGR	Intrauterine Growth Retardation
LMP	Last Menestral Period
MHz	Megahertz
PROM	Premature Rupture Of Membrane
ROM	Rupture Of Membranes
SDP	Single Deepest Pool
SPSS	Statistically Package for Social Sciences

SROM	Spontaneous Rupture Of Membranes
SVP	Single Vertical Pocket
T/A	Transabdomenal Scans
T/V	Transvaginal Scans
U/S	Ultrasound

CHAPTER ONE

Introduction

Chapter one

Introduction

1.1 Overview:

The fluid in the amniotic cavity bathing the fetus is known as amniotic fluid (AF). Normal amount of AF is important for normal fetal development and growth, an excess or deficiency of AF is associated with different conditions and places the fetus at risk for perinatal complications. Amniotic fluid consist of desquamated fetal epithelial cells and approximately equal portions of organic and inorganic salts, in 98 - 99% water. It provides a medium in which the fetus can move, grow, and develop symmetrically without pressure on its delicate tissues Amniotic fluid is derived from several sources and the contribution of these sources varies during the pregnancy. In early pregnancy, the primary source of the fluid appears to be the amniotic membrane and transudate from the maternal blood by transport across the amniotic membrane. The fetal kidneys begin to function in the second trimester and contribute fluid volume to the amniotic fluid. Fetal urinary output as a source of amniotic fluid becomes increasingly important as pregnancy advances. It is estimated that about 500 ml of fetal urine is added daily to the amniotic fluid. The fluid is constantly being formed and reabsorbed with replacement about every 3 hours. Large volumes of fluid move in both directions between the fetal and maternal circulations The amniotic fluid volume increases from approximately 250 ml at 16 weeks to 1000 ml at 34 weeks, declining there after to approximately 800 ml at term. The amniotic fluid volume reflects the status of both the mother and the fetus and is altered in many physiological and pathological conditions (Dean-2005).

The subjective term used to describe amniotic fluid volume is virtually none (oligohydramnios), average (normal), and excess (polyhydraminos) (Norman.2006).

Oligohydramnios is defined as reduced of amniotic fluid volume for a given gestational age.

Polyhydramnios is described as a subjective increase of amniotic fluid volume.

About 15% of cases of Polyhydramnios are due to maternal diabetes mellitus which causes fetal hyperglycemias and resulting polyuria (fetal urine is a major source of amniotic fluid) and also rh-isoimmunisation can cause it (Dean 2005).

Now days the number of diabetes has increase, so the chance of development during pregnancy is very high and cause health risk to the mother and unborn babies, so especial care with especial diagnosis and treatment of this problem should be available.

Ultrasound is a readily available, noninvasive, and safe means of evaluating fetal health, determining gestational age, and assessing the intrauterine environment. The information gained from routine obstetric ultrasound may provide reassurance, guide therapy, or identify a pathologic condition that merits further investigation (Rumacketal-2011).

In accordance with the guidelines for obstetric scanning, every obstetric examination should include an evaluation of amniotic fluid volume. When extremes in amniotic fluid volume (polyhydramnios or oligohydramnios) are found, targeted studies for the exclusion of fetal anomalies are recommended (Sandra .2012).

1.2 Problem of study:

Diabetes mellitus is one of the common causes of abnormality and changes of high risk. So this research is an attempt to evaluate the amniotic fluid volume in diabetic pregnant women by ultrasound .

1.3 Objectives:

1.3.1 General objectives:

Sonographic evaluatution of amniotic fluid volume in diabetic pregnant women in second and third trimesters.

1.3.2 Specific objectives:

- To determine the effect of diabetes on amniotic fluid volume in diabetic Pregnant womens in second and third trimesters .
- To evaluate the consistency of amniotic fluid in diabetic pregnant women in second and third trimesters.
- To estimate fetal weight (EFW) in diabetic pregnant women in second and third trimesters.
- To determine any congenital fetal abnormalities in diabetic pregnant women in second and third trimesters.
- To correlate between the amniotic fluid volume and GA.
- To correlate between the amniotic fluid volume and EFW
- To correlate between the amniotic fluid volume and diabetes status.

1.4 Thesis outline:

This study consists of five chapters:

Chapter one deal with introduction ,problem of study and objectives Chapter two include Literature review, Anatomy- Physiology ,Pathology and previous studies, Chapter three deal with Material and methods, Chapter four include Data collection - analysis and results and Chapter five deal with Discussion–conclusion and recommendation.

CHAPTER TWO

Literature review

Chapter two

Literature review

2.1 Anatomy

2.1.1 Amnion and Amniotic Cavity

The amnion is a membranous sac which surrounds and protects the embryo. It is the first of the three cavities (amnion, chorion and yolk sac) in the embryo and is formed on about day 22-23 LMP (8 days following conception). (El-Rakhawy .2008)

At the eighth day of development, the blastocyst is partially embedded in the endometrial stroma. In the area over the embryoblast, the trophoblast has differentiated into two layers: inner layer of mononucleated cells, the cytotrophoblast and the outer multinucleated zone without distinct cell boundaries, the syncytiotrophoblast. Thus, cells in the cytotrophoblast divide and migrate into the syncytiotrophoblast, where they fuse and lose their individual cell membranes. Cells of the inner cell mass or embryoblast also differentiate into two layers: a layer of small cuboidal cells adjacent to the blastocyst cavity, known as the hypoblast layerand layer of high columnar cells adjacent to the amniotic cavity, the epiblast layer. Together, the layers form a flat disc. At the same time, a small cavity appears within the epiblast. This cavity enlarges to become the amniotic cavity (Sadler .2012).

Initially, the amniotic cavity is small and lines one side of the embryo while the other side is lined with the yolk sac. With growth and folding of the embryo, the amniotic cavity completely envelops the embryo. The amniotic cavity expands at a faster rate than the chorionic cavity resulting in the amnion coming into contact with the chorion by about 9

weeks LMP and obliterating the chorionic cavity. 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 or midterm (Dean-2005).

The amniotic cavity starts as a small space which soon expands to fill the whole uterine cavity. This occurs in the following way. The amniotic cavity appears – during implantation of the blastocyst -as small clefts between the ectoderm (of the inner cell mass) and trophoblast ; very early in pregnancy the ectodermal cells are attached to the trophoblast. As the development proceeds (at about day (8)) small intracellular clefts appear between the ectoderm and trophoblast. When these clefts join together they form a small space called the amniotic cavity.As the amniotic cavity enlarges, layer of large flattened cells called amnioblasts develops from the inner surface of the trophoblast and form the roof of the amniotic cavity(El-Rakhawy-2008).

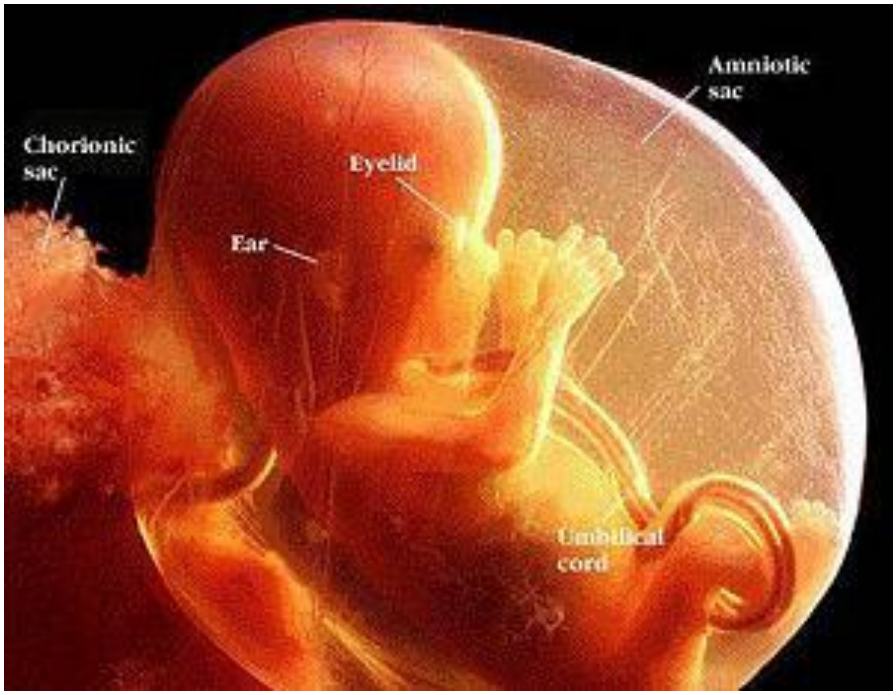

Figure (2.1): Embryo within amniotic sac(cityimaging.com.au).

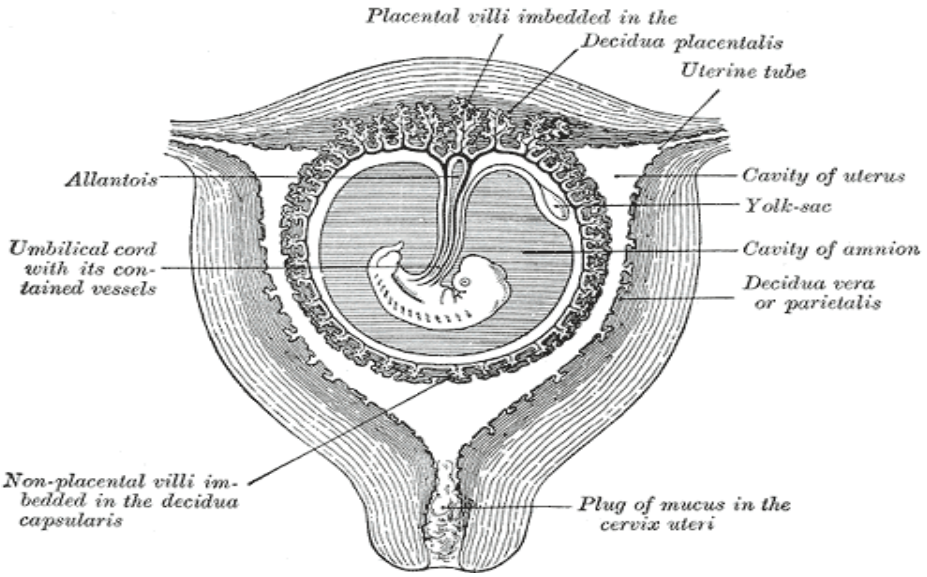

Figure (2.2): Embryo within the uterine cavity (Dean-2005).

2.1.2 Amniotic Fluid:

2.1.2.1 Development of amniotic fluid:

The fluid in the amniotic cavity bathing the fetus is known as amniotic fluid or liquor amnii. A normal amount of AF is important for normal fetal development and growth. Too little or too much AF is associated with different conditions and places the fetus at risk for perinatal complications (Dean-2005).

Amniotic fluid originates from the maternal plasma, and passes through the fetal membranes by osmotic and hydrostatic forces. As the Placental and fetal vessels develop, the fluid passes through the fetal tissue, as the exsudatum of the skin (Carter.2012).

Amniotic fluid volume normally increases with linear regression to the growth of fetus. AFV normally peaksat about 36 weeks and then decreases at term. Studies have determined the AFV to be approximately 25 ml at 10weeks, 400 ml at 20 weeks, 1000 ml at 35 weeks, and 250 ml at 43 weeks gestation (Dean -2005).

From the 8th week, when the fetal kidneys begin to function, fetal urine is also present in the AF. Approximately in the 10th week the breathing and swallowing of the fetus slightly decrease the amount of AF, but neither urination nor swallowing contributes significantly to AF quantity changes, up until the 25 week, when keratinisation of skin is complete.

The waters are released when the amnion rupture. This is commonly known as the time when a woman's "water breaks". When this occurs during labour at term, it is known as (SROM).

If the rupture precedes labour at term, however, it is referred to as (PROM).The majority of the hind waters remain inside the womb until the baby is born. A manual rupture of the amniotic sac can also be

performed to release the fluid if the amnion has not spontaneously ruptured (ARM). (https://en.wikipedia.org -2009)

2.1.2.2 Components of amniotic fluid:

Amniotic fluid is a solution in which undissolved material is suspended. It consists of desquamated fetal epithelial cells and approximately equal portions of organic and inorganic salts, in 98 - 99% water. Half of the organic constituents are protein; and the other half consists of carbohydrates, fats, enzymes, hormones, and pigments. As pregnancy advances, the composition of the amniotic fluid changes as fetal excreta(fetal urine, meconium) are added. Because fetal urine is added to amniotic fluid, studies of fetal enzyme systems, amino acids, hormones, and other substances can beconducted on fluid obtained by amniocentesis (Dean -2005).

2.2 Physiology:

The normal amniotic fluid volume is essential for normal fetal development. An excess or deficiency of amniotic fluid is associated with an increased incidence of fetal and neonatal morbidity and mortality.

2.2.1 Functions of amniotic fluid:

Amniotic fluid provides a medium in which the fetus can move, grow, and develop symmetrically without pressure on its delicate tissues. Blood flow is also unrestricted as it is transported through the umbilical cord. The fluid also helps to maintain an even environment temperature for the fetus. An adequate amount of amniotic fluid helps to promote normal development and maturation of the fetal lung. Amniotic fluid also allows the fetus to exercise its limbs freely (Dean-2005).

Analysis of amniotic fluid, drawn out of the mother's abdomen in an amniocentesis procedure, can reveal many aspects of the baby's genetic health. This is because the fluid also contains fetal cells, which can be examined for genetic defects (Dinaael ,Mowa Fe-2004).

2.2.2 Production and absorption:

The umbilical cord and membranes, lungs, skin, and kidneys all contribute to the production of amniotic fluid. Fetal urination into the amniotic sac accounts for most of the total volume of amniotic fluid by the second half of pregnancy, and the quantity of fluid is directly related to kidney function. A fetus lacking kidneys or with malformed kidneys produces little or no amniotic fluid. The amount of amniotic fluid is regulated not only by the production of amniotic fluid but also by removal of fluid by swallowing, by fluid exchange within the lungs, and by the membranes and cord. Normal lung development is critically dependent on the exchange of amniotic fluid within the lungs.

Inadequate lung development may occur when severe oligohydramnios is present, placing the fetus at high risk for developing small or hypoplastic lungs (Sandra.2012).

Amniotic fluid production is attributed initially to the amniotic fluid epithelium and later to fetal kidneys. The fetal membrane and umbilical cord are the most important structures for continues exchange of water and electrolytes, while the swallowing of amniotic fluid by the fetus and fetal urine output into the amniotic fluid are intermittent process (Phelan etal-2004).

2.2.3 Source and regulation of amniotic fluid volume:

Amniotic fluid is derived from several sources and the contribution of these sources varies during the pregnancy. In early pregnancy, the primary source of the fluid appears to be the amniotic membrane and transudate from the maternal blood by transport across the amniotic membrane. The fetal kidneys begin to function in the second trimester and contribute fluid volume to the amniotic fluid. Fetal urinary output as asource of amniotic fluid becomes increasingly important as pregnancy advances. It is estimated that about 500 ml of fetal urine is added daily to the amniotic fluid. The fluids constantly being formed and resorbed with replacement about every 3 hours. Large volumes of fluid move in both directions between the fetal and maternal circulations. Fetal swallowing of amniotic fluid begins at about 11-13 weeks of gestation. Most of the fluid passes into the fetal gastrointestinal tract, but some of it also passes into the fetal lungs. In either case, the fluid is absorbed into the fetal circulation and then passes into the maternal circulation via the placental membrane. In the final stages of pregnancy, the fetus swallows up to 400 ml of amniotic fluid per day. Some fluid also passes from the amniotic cavity into the maternal blood across the chorioamniotic membrane. If the fetus is unable to swallow adequate amounts of amniotic fluid or if the fetus swallows the fluid but it is not absorbed properly because of an obstruction in the upper fetal (GIT), polyhydramnios will occur (Dean-2005).

2.3 Assessment of amniotic fluid volume:

The amniotic fluid volume reflects the status of both the mother and the fetus and is altered in many physiological and pathological conditions. Ultrasound has a potential role in the management of such conditions, by the assessment of amniotic fluid volume (Trish,Basky -2004)

There are three methods for assessing amniotic fluid volume:

1- Subjective assessment:

With experience, it is possible to classify amniotic fluid volume into the broad categories absent, low, normal, Increased and excessive. Although reliable in the hands of an experienced operator, this method has proved impossible to standardize in clinical and research terms (Trish,Basky -2004)

2- Single deepest pool or Single vertical pocket:

The size of the deepest, cord-free pool of amniotic fluid is assessed with the ultrasound probe perpendicular to the maternal abdomen. The vertical depth of the largest pool is measured. When this method was first introduced, a 1-cm pool was considered acceptable in normal pregnancy, but subsequent studies have suggested that minimum depth of 2–3 cm is a more appropriate threshold. Deepest vertical pocket is the most commonly used method for biophysical profiles and multiple pregnancy examinations (Trish,Basky -2004)

Table (2.1): Quantitative determination of amniotic fluid volume by single vertical pocket (Dean-2005)

Chamberlain Method Single Vertical Pocket Measurement	
< 1 cm	severe oligohydramnios
1-2 cm	significant oligohydramnios
2-8 cm	Normal
8-12 cm	mild polyhydramnios
12-16 cm	moderate polyhydramnios
> 16 cm	severe polyhydramnioss

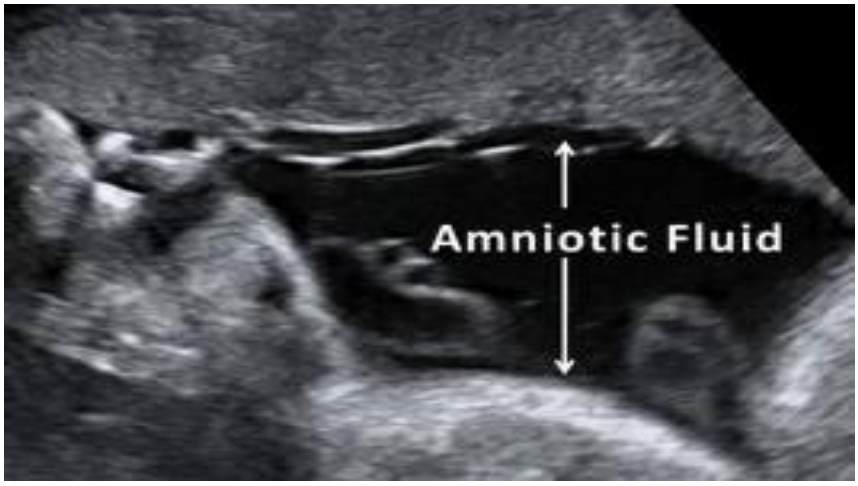

Figure (2.3): Single deepest pool of amniotic fluid. (Trish,Basky .2004)

3- Amniotic fluid index:

This is a semi quantitative technique for assessing amniotic fluid volume. Using the maternal umbilicus as a reference point, divides the uterine cavity into four equal quadrants by two imaginary lines running perpendicular to each other. The largest vertical pocket of amniotic fluid, excluding fetal limbs or umbilical cord loops, is measured. The sum of the four quadrants is called the amniotic fluid index (Sandra .2012).

Although the AFI is known to vary with gestational age, an AFI < 5 cm is classified as oligohydramnios and an AFI > 20 cm is classified as polyhydramnios .Even though this method is accepted as superior to the single deepest pool technique, AFI is one of the essential component of fetal BPP (Trish,Basky .2004).

Table (2.2): Quantitative determination of amniotic fluid volume by amniotic fluid index .(Dean.2005)

Phelan Method Four Quadrant Amniotic Fluid Index	
<5 cm	severe oligohydramnios
5.1 - 8 cm	significant oligohydramnios
8.1 - 18.0 cm	Normal
> 18 cm	Polyhydramnios

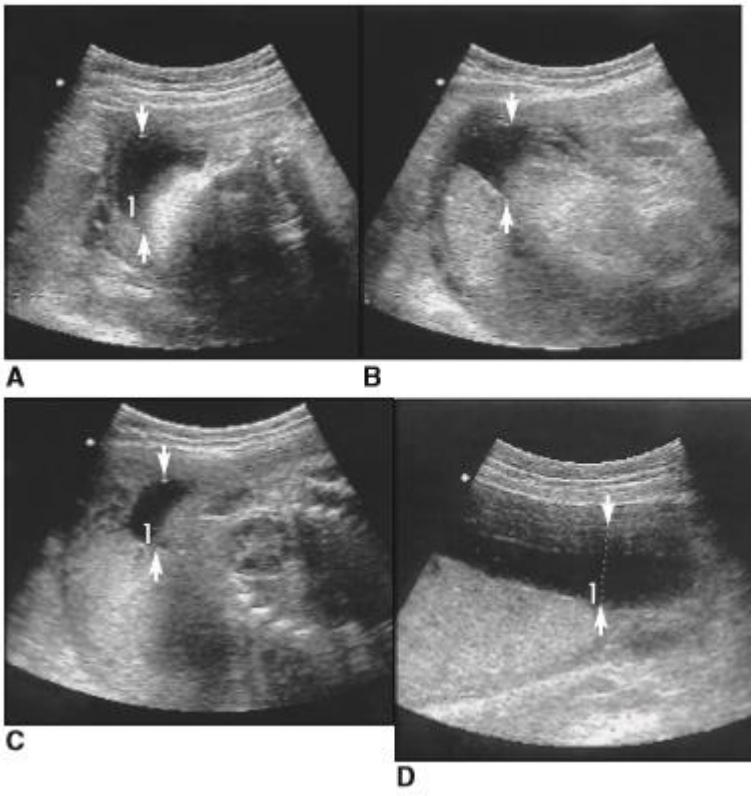

Figure (2.4): four-quadrant technique assessment AFI (Sandra .2012).

2.4 Consistency of Amniotic Fluid:

In general, amniotic fluid appears anechoic throughout pregnancy in the majority of patients at normal gain settings and transducer frequencies. Echogenic amniotic fluid at different stages of gestation can occur and is associated with different etiologies, some physiological and others pathological. In the first trimester of pregnancy, normal amniotic fluid should appear echo free. In contrast, chorionic fluid frequently appears to have dispersed low amplitude echoes which are especially evident at higher transducer frequencies and gain settings. In the second and third trimesters of pregnancy, amniotic fluid echoes may be seen in normal pregnancies or may be associated with underlying pathological causes including anencephaly and intra-amniotic bleeding. The source of amniotic fluid debris echoes in normal pregnancies is mainly related to desquamated or exfoliated fetal skin cells and vernixcaseosa.

Vernixcaseosa is the normal oily substance produced by fetal skin and covering the fetal skin to protect it in its aqueous environment.Near term, meconium released into the amniotic fluid by the fetus may be another source of amniotic fluid debris echoes. Under ordinary circumstances, meconium is usually not released in utero although it may be a normal event that occurs with progressive fetal maturation, without evidence of fetal distress or poor outcome. Other causes associated with meconium passage in utero include hypoxia-induced peristalsis and sphincter relaxation, and umbilical cord compression-induced vagal stimulation in mature fetuses. There appears to be a link between gestational age and meconium passage after the 38th week.The cause of the meconium passage may vary from patient to patient, and in some patients may result from a combination of causes which may explain why there has not been a clear relationship demonstrated between its passage in utero and fetal outcome. Other potential causes of

amniotic fluid debris echoes include fetal bleeding associated with percutaneous umbilical cord sampling, rupture of an umbilicalvessel associated with velamentous insertion of the umbilical cord, chorioamnionitis, and idiopathic causes (Dean -2005).

2.5 Pathology:

2.5.1 Polyhydramnios (hydramnios):

Polyhydramnios is defined as excess amniotic fluidvolume for a given gestation of pregnancy. This is a physiological finding in approximately 1% of pregnancies in the third trimester. The pregnancies with polyhydramnios are dependent on the cause of the condition. In idiopathic/physiologic cases, the prognosis is usually very good, with the only complication being premature delivery due to uterine over distention.(Trish,Basky.2004)

Polyhydramnios is caused by reduced fetal swallowing, or increased fetal urine production. This occurs in 0.5–1% of pregnancies. The diagnosis is usually made subjectively, but it is defined as an amniotic fluid index more than 20 cm or a single deepest pocket measurement of fluid of at least 8 cm. If the deepest pool is greater than 11 cm it is termed moderate, and if more than 20 cm, severe polyhydramnios (Baskyetal -2007).

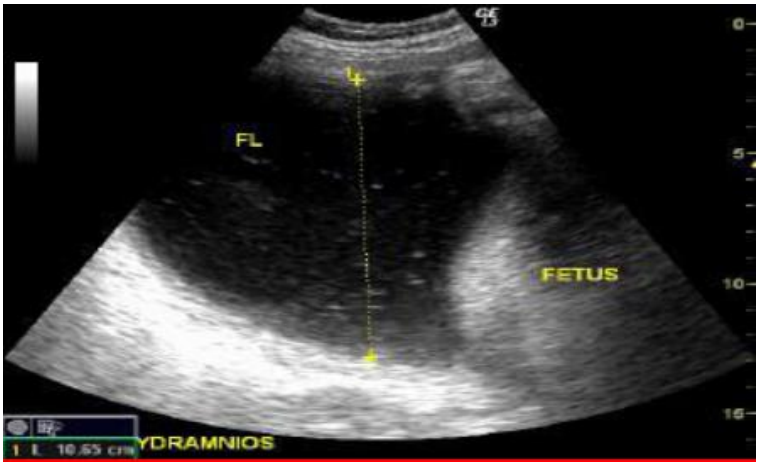

Figure (2.5):polyhydramnios with debris

2.5.1.1 Polyhydramnios Classification:

Chronic polyhydramnios characterized by gradual accumulation of amniotic fluid. Acute polyhydramnios characterized by sudden and rapid accumulation of amniotic fluid.

2.5.1.2 Causes of polyhydramnios:

-***Maternal abnormalities:*** Diabetes mellitus (15 to 25 percent), Pre eclampsia (6 to 15 percent), erythroblastfetalis induced RH is oimmunisation, congestive heart failure, Syphilis , anemia , Pregnancy-induced hypertension ,multiple gestations may associate with polyhydramnios.

-***Fetal anomalies:*** Anomalies of the C.N.**S** anomalies of G.I.T, abdominal wall defects, Fetal and placental tumor's, cardiovascular disorders, fetal hydrops.

2.5.1.3 Complications of polyhydramnios:

Premature labor, (PROM), Umbilical cord prolapsed , Abruption placenta, Increased prenatal mortality , Placenta previa. Polyhydramnios complicated by fetal C.N.S anomalies, usually diagnosed earlier than 30

weeks. Disorder is diagnosed later than 30 weeks in pregnancies associated with G.I.T anomalies. Sever polyhydramnios is associated with a high incidence of fetal anomalies 75%. (Dinael,Mowa -2004)

2.5.1.4 Symptoms of Polyhydramnios:

Mild polyhydramnios may not cause any noticeable signs in the mother. However, severe polyhydramnios can lead to the following symptoms: Difficulty breathing unless standing or sitting in an upright position, difficulty climbing stairs, decreased urine production, larger belly size for one's gestational age, swelling of the abdominal wall and legs, indigestion, constipation ,abdominal pain ,heartburn and varicose veins. (Dean-2005).

2.5.1.5 Polyhydramnios Diagnostic Criteria:

The principal diagnostic criterion is an amniotic fluid index over 20 cm or largest pocket over 8 cm shown on ultrasound findings. A detailed ultrasound may be ordered to estimate the amniotic fluid levels by assessing the deepest pockets in four particular regions of the uterus. These measurements are then used for determining the AFI (Dinael,Mowa -2004)

2.5.1.6 Treatment of polyhydramnios:

Definite clinical symptoms such as abdominal pain or dyspnea are indication for the treatment of polyhydramnios. Minor and moderate degrees of polyhydramnios can usually be managed without intervention until labor starts or until the membranes rupture spontaneously. There is no satisfactory treatment for symptomatic polyhydramnios other than removal some of the excessive amniotic fluid by amniocentesis.(Dean - 2005)

Large fluid volume should not be removed in one sitting, as excessive decompression can lead to placenta abruption. Indomethacin, a prostaglandin synthesise inhibitor, is available for the medical treatment of polyhydrmnios. It acts by decreasing the fetal urine output (Dinael,Mowa -2004).

2.5.1.7 Amniocentesis:

Amniocentesis is the percutaneous, transabdominal, fine-needle aspiration of amniotic fluid. It is generally performed under direct continuous real-time ultrasound monitoring in order to visualize the path of the needle during insertion and to monitor the location of the needle tip in the selected pocket of amniotic fluid (Dean -2005).

Amniocentesis was used as a technique to relieve polyhydramnios, to predict Rh is oimmunization, and to document fetal lung maturity, to study fetal cells from amniotic fluid that allowed the analysis of fetal chromosomes .(Sandra -2012)

2.5.2 Oligohydramnios(Anhydramnios) :

Oligohydramnios is defined as diminished AFV. Anhydramniosis defined as severe oligohydramnios and is indicated when there are no detectable amniotic fluid pockets on ultrasound examination.

Oligohydramnios occurs in 0.5–1% of pregnancies. The diagnosis is usually made subjectively. It is defined as an amniotic fluid index is less than 5 cm or a deepest single pocket measurement of 1 cm or less. Oligo-anhydramnios is caused because there is reduced production of fetal urine (e.g. placental insufficiency, renal agenesis), or because the fetus cannot urinate due to an obstruction (e.g. posterior urethral valves), or because the fluid that is produced drains away due to (ROM). With anhydramnios there is marked fetal deformation due to fetal

compression, including flattened face, hypertelorism, low-setears, and micrognathia (Potter syndrome) (Baskyetal -2007).

Oligohydramnios may be suspected clinically if the measured uterine fundal height is small-for-dates (Dean -2005).

2.5.2.1 Most Common Causes of Oligohydramnios:

Premature rupture of membranes, chronic fetal death, postterm pregnancy ,advanced intrauterine growth retardation ,Fetal (GUT) anomalies associated with decreased renal function and diminished urinary output , anomalies compromising the flow of urine into the ureters, bladder, or urethra:(Bilateral renal agenesis, bilateral ureteropelvic junction obstruction, bilateral multicystic dysplastic kidneys, infantile polycystic kidneys ,posterior urethral valves, Urethralagenesis) and chromosome defects (Dean -2005)

Oligohydramnios related to fetal GUT anomalies typically manifests early in the 2nd trimester. The fetal bladder is a good place to start when assessing the cause of oligohydramnios. Certain visualization of a normal appearing fetal bladder and fetal kidneys rules out bilateral renal agenesis and points to ruptured membranes as the cause of oligohydramnios. Inability to visualize the fetal bladder is suspicious of bilateral renal agenesis and should prompt careful evaluation of the fetal kidneys. The diagnosis of bilateral renal agenesis is indicated if the fetal kidneys cannot be visualized (Dean -2005).

Oligohydramnios due to a renal problem is always bilateral therefore both kidneys will be affected and appear abnormal. Demonstration of an abnormally enlarged fetal bladder (megacystis) with evidence of bilateral hydronephrosis indicates a bladder outlet level obstruction which is most commonly due to posterior urethral valves. There is an increased risk of a chromosome abnormality when oligohydramnios is

associated with IUGR or renal abnormalities. In the early 2nd trimester, the presence of severe oligohydramnios favours the diagnosis of a serious fetal abnormality with a poor prognosis (most often involving the GUT).Whereas in the 3rd trimester, the etiology of severe oligohydramnios is more commonly associated with ruptured membranes and placental insufficiency. The presence of an adequate volume of amniotic fluid is a factor in normal fetal lung maturation, since in infants with prolonged reduction there is usually severe pulmonary hypoplasia (Dean-2005) .

2.5.2.2 Oligohydramnios Diagnostic Criteria:

Lack of an amniotic fluid space between the anterior uterine wall and the fetal body, relative crowding of fetal parts and difficulty outlining the umbilical cord (Dean-2005).

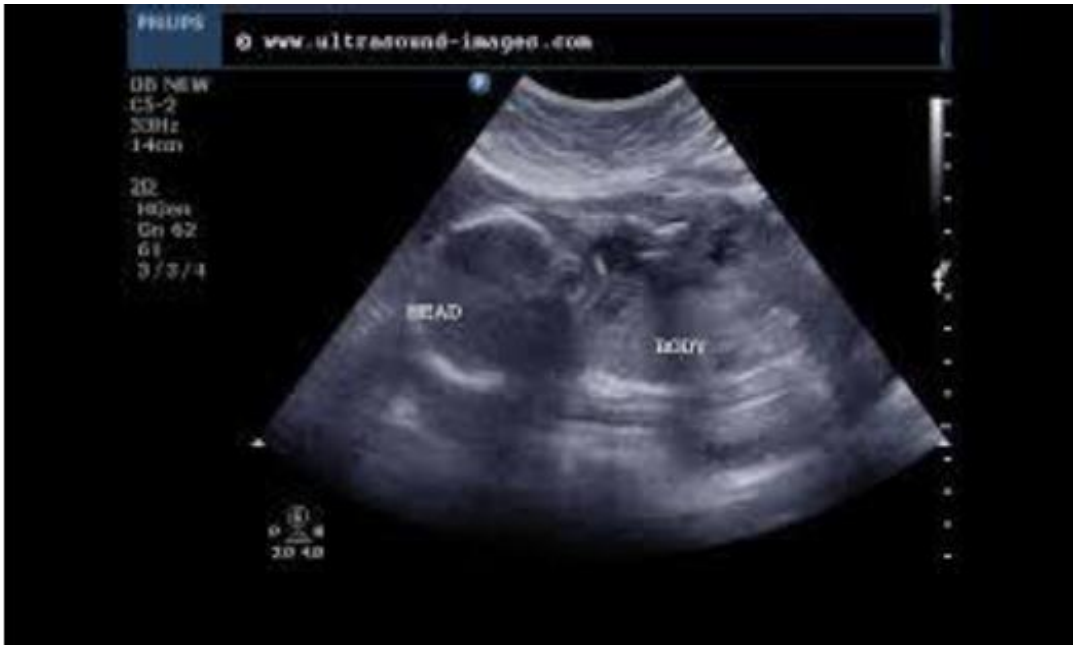

Figure (2.6): Oligohydramnios

2.5.2.3 Complications of Oligohydramnios:

In the first half of pregnancy: Compression of fetal organs resulting in birth defect and increased chance o f miscarriage. In second half of pregnancy (IUGR) and Preterm birth.

2.6 Diabetes Mellitus:

Diabetes is a condition in which the body cannot change sugars and starches (carbohydrates) into energy. This happens when the body cannot make enough insulin or cannot use the insulin it makes. As a result extra sugar in the blood can lead to damage in the blood vessels, eyes, kidneys, heart, and nerves (El-Rakhawy.2008).

2.6.1 Types of diabetes mellitus:

A- Type 1 diabetes (Insulin dependent):

Is a condition in which the body makes no insulin or so little insulin that the body cannot change blood sugar into energy. Type 1 diabetes usually develops during childhood or adolescence, before a woman gets pregnant (www.diabetes .org).

B- Type 2 diabetes (Non-insulin dependent):

Is a condition in which the body makes too little insulin or cannot use the insulin it makes to change blood sugar into energy, Type2 diabetes often occurs after childbearing age (www.diabetes .org).

C- Gestational diabetes:

Gestational diabetes is a condition characterized by high blood sugar (glucose) levels that is first recognized during pregnancy. The condition occurs in approximately 4% of all pregnancies (www.diabetes.webmd.com).

Gestational diabetes usually goes away after pregnancy, but if it does not go away, it is known as type 2 diabetes. Many women who have had GD will develop type 2 diabetes later (El-Rakhawy.2008).

Approximately 87.5% of pregnancies complicated by diabetes are due to gestational diabetes, 7.5% are due to type 1 diabetes and 5% are due to type 2 diabetes. (www.healthinsite.gov.au)

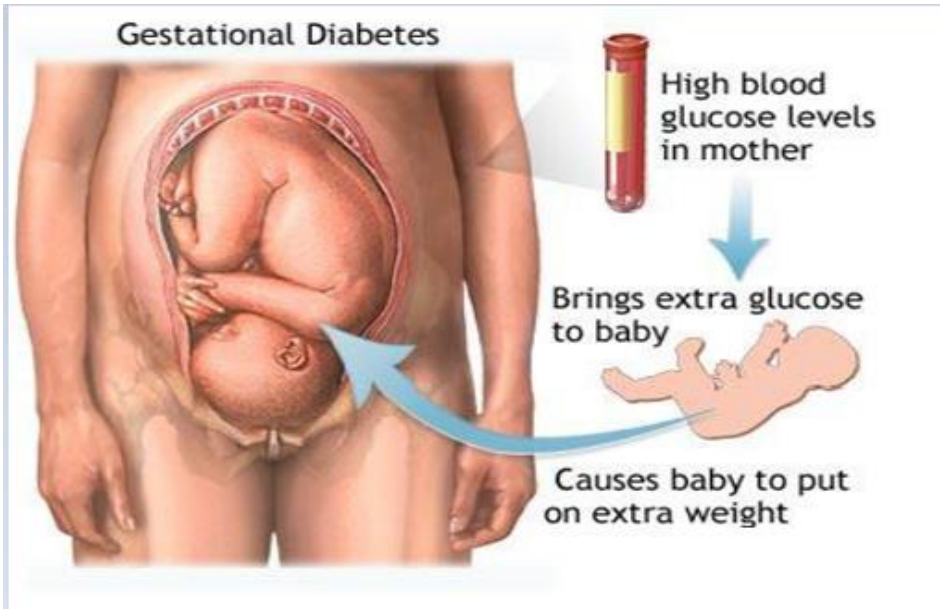

Figure (2.7):Sgestational diabetes.

2.6.2 Causes of Gestational Diabetes in Pregnancy:

Almost all women have some degree of impaired glucose intolerance as a result of hormonal changes that occur during pregnancy. That means that their blood sugar may be higher than normal, but not high enough to have diabetes. During the later part of pregnancy (the third trimester), these hormonal changes place pregnant woman at risk for gestational diabetes. During pregnancy, increased levels of certain hormones made in the placenta (the organ that connects the baby by the umbilical cord to the uterus) help shift nutrients from the mother to the

developing fetus. Other hormones are produced by the placenta to help prevent the mother from developing low blood sugar. They work by stopping the actions of insulin. Over the course of the pregnancy, these hormones lead to progressive impaired glucose intolerance (higher blood sugar levels). To try to decrease blood sugar levels, the body makes more insulin to get glucose into cells to be used for energy. Usually the mother's pancreas is able to produce more insulin (about three times the normal amount) to overcome the effect of the pregnancy hormones on blood sugar levels. If, however, the pancreas cannot produce enough insulin to overcome the effect of the increased hormones during pregnancy, blood sugar levels will rise, resulting in gestational diabetes (www.diabetes.webmd.com).

2.6.3 Risks of Diabetes on Pregnancy :

-Miscarriages: Women with poor blood sugar control or many severe complications are at greater risk for miscarriage. In otherwise healthy diabetic women, the risk of miscarriage is no greater than that of the general population - approximately one out of every nine or ten early-stage pregnancies. (www.healthinsite.gov.au)

-Large Babies (macrosomia): Women with diabetes may have large babies because of their high blood sugar levels. This effect can be reduced by keeping blood sugar levels as close to normal as possible. Obviously, a big baby makes delivery more difficult and for this reason, Caesarean sections are frequently performed. (www.healthinsite.gov.au)

-Polyhydramnios: This condition - excessive amounts of amniotic fluid throughout pregnancy is somewhat less common. Aside from the discomfort of an overly distended belly, polyhydramnios rarely has harmful consequences. However, it is a sign that the diabetes has not

been under optimal control. The fluid builds up because the baby is urinating large quantities due to elevated glucose levels. (www.healthinsite.gov.au)

-***Toxaemia:*** Toxaemia is characterized by an increase in blood pressure, the presence of protein in the urine, and the swelling of hands and feet. Toxaemia was once a common complication of diabetic pregnancy, but with good blood sugar control, this problem is no more common than in a non-diabetic pregnancy. (www.healthinsite.gov.au)

2.7 Ultrasound:

Ultrasound is defined as sound with frequencies above the human audible range (20 Hz and 20.000 Hz). Diagnostic medical ultrasound uses frequencies from 3 to 15 MHz .Knowledge of basic ultrasound physics is essential for understanding image formation, echo machine settings optimization, advantages and limitations of the technique (Dean-2005).

2.7.1 General principles:

Sound is a longitudinal mechanical wave transmitted through the medium by local displacement of particles within the medium. The displacement of the particle from their equilibrium position produces changes in the medium density (Dean-2005).

2.7.2 U/S Components:

Ultrasound scanners are complex and sophisticated imaging devices, but all consist of the following basic components to perform key functions:

• Transmitter or pulser to energize the transducer

• Ultrasound transducer converting the electric energy provided by the transmitter to the acoustic pulses directed into the patient and serving as

the receiver of reflected echoes, converting weak pressure changes into electric signals for processing.

• Receiver and processor to detect and amplify the backscattered energy and manipulate the reflected signals for display

• Display that presents the ultrasound image or data in a form suitable for analysis and interpretation

• Method to record or store the ultrasound image (Thomas-2004)

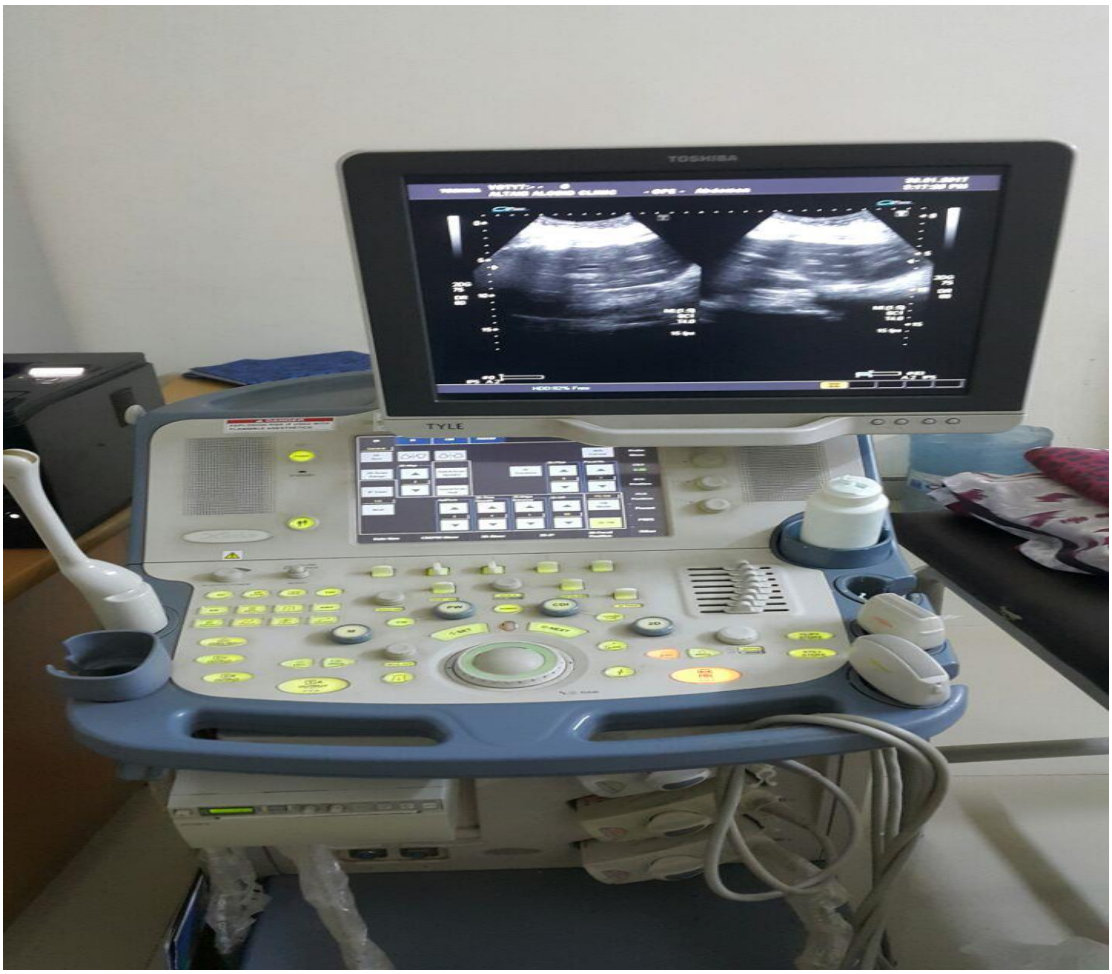

Figure (2.8): Ultrasound Machine

2.7.3 Obstetric Ultrasound:

Obstetrics ultrasound is safe investigation for fetus to evaluating fetal health, determining gestational age and assessing the intrauterine environment. Very high frequency sound waves of between 3.5 to 7.0

MHz are generally used for this purpose. It is plays an important role in the care of every pregnant woman by using (T/A) scans or (T/V) scans . Other specialized examinations might include fetal Doppler, biophysical profile, fetal echocardiogram, or additional biometric measurements, 3-D and 4-D Ultrasound (ACR web-2007) .

2.7.4 Fetal Safety:

Diagnostic ultrasound studies of the fetus are generally considered to be safe during pregnancy. This diagnostic procedure should be performed only when there is a valid medical indication, and the lowest possible ultrasonic exposure setting should be used to gain the necessary diagnostic information under the (ALARA) principle (ACR web-2007).

2.8 Previous Studies:

The study was done by Department of Obstetrics and Gynecology - 2006 to evaluate the amniotic fluid patterns and fetal biometric parameters in third trimester pregnancies with and without diabetes. Reported that AFI in normal pregnancies was less than that in diabetic pregnancies throughout the gestational ages studied (27–42 weeks). In normal pregnancy, the mean AFI was 14.0 cm at 27 weeks and decreased to 11.4 cm at 42 weeks (r¼0.25, p¼0.0005), where as in diabetic pregnancies, the values remained stable throughout the gestational ages studied. There exist significant differences in AFI, estimated fetal weight, abdominal circumference head circumference, and head circumference to abdominal circumference ratio between the two groups. In both Normal and diabetic pregnancies, there is a positive correlation between the AFI and the percentile of abdominal Circumference (p50.0001), and between the AFI and the percentile of estimated fetal weight (p50.0001). Amniotic fluid volume reflects recent glycemic status in gestational diabetes mellitus. Significantly

higher mean blood glucose values 1 day (114.7 mg/dl vs. 102.8 mg/dl, $p < 0.01$) and 1 week before (111.0 mg/dl vs. 102.0 mg/dl, $p < 0.05$) were calculated for examinations resulting in elevated amniotic fluid index values compared with normal amniotic fluid index values, respectively. Similarly, significantly higher percents of hyperglycemia 1 day (32% vs. 16.5%, $p < 0.05$) but not 1 week (30.8% vs. 21.7%, $p > 0.05$) before the elevated amniotic fluid index were documented .

Another study was conducted by Rian-2012 to evaluate the amniotic fluid volume in diabetic pregnant women to show the effects of diabetes in pregnancy. The study done on 49 women with diabetes mellitus pregnant women in the third trimester at period from December 2011 to April 2012. Ultrasound was done by using mindray 6600, 2200 with 3.5 MHZ convex probe .after measuring amniotic fluid volume by deepest pocket (large pocket) and AFI (4 pocket) in the third trimesters .it was observed that the AFI in millimeters in all patient with diabetes mellitus 26% of pt have increasing AFV. It is concluded that the measurement of AFV by two measurement and compared with type of diabetic and diabetic status is important to show the effect of diabetic in pregnant women's.

Another study was done by Moaz-2012 in Khartoum state hospitals ,In the period of 8 months, from 18 of March 2012 to 13 of November 2012.100 diabetic pregnant Sudanese women in their second and third trimesters come to obstetric and gynecological department for evaluation with Ultrasound were randomly selected with accurate menstrual dates. The data was collected using ultrasound machine. The study depended on the large single vertical deepest pocket. Most Sudanese population has abnormal incidence of polyhydramnois with the normal maximum vertical pocket ranging between 2 to 8 cm. Abnormally increase in amniotic fluid volume polyhydramnios

represent (56%) of sample size. Normal amniotic fluid volume represent (41%) of sample size. Abnormal decrease in amniotic fluid volume oligohydramnios represent (3%) of sample size. It is concluded that the measurement of AFV by two measurement and compared with type of diabetic and diabetic status is important to show the effect of diabetic in pregnant women's. The majority of diabetic pregnant women are well controlled from D.M represent (56%) of the sample size with (44%) of sample with uncontrolled treatment. Therefore, the majority of diabetic pregnant women is among type1 D.M with (38%) ,the age group (31 to 40) which represent (46%) of the sample size, and treated by using insulin represent (54%) of the sample size.

Another study was done by Joy-2007 to correlate between amniotic fluid index and fetal weight. The result of research was found that the uncontrolled diabetic population with linear relationship existed between AFI and EFW (P< .0001)

CHAPTER THREE

Methodology

Chapter three

Material and Method

3.1 Method

3.1.1 Study design:

This study was descriptive study deal with the role of ultrasound in evaluation of amniotic fluid volume in diabetic pregnant women among Sudanese population .

3.1.2 Study area:

The study was conducted in:

-Alsaikh Mohmmed Ali Fadul hospital.

-Omdurman maternity hospital.

- Alemtias Medical Center ,

-Alomran Center

-Alsenhory Medical Center.

3.1.3 Study duration:

The study was carried out From November 2016 to March 2017.

3.1.4 Study Sample:

Sudanese pregnant women in second and third trimesters, 50 diabetic pregnant women and 47 non diabetic pregnant women (controll group).

3.1.5 Exclusion criteria:

Sudanese pregnant women in first trimesters.

3.1.6 Study variables:

-Maternal age.

-Type of diabetes mellitus.

-Gestational age.

-Single vertical pocket .

-Consistency of amniotic fluid.

-EFW

-Any anomalies seen.

3.1.7 Tool of data collection:

- The data was collected by using ultrasound machine.
- Data collection sheet .

3.1.8 Data analysis:

The data analyzed by SPSS.

3.1.9 Data storage:

The data was stored on personal computer and compact disk.

3.1.10 Ethical consideration:

Data was collected from different patient with maintain privacy and confidentiality. No patient information was published throughout this study.

3.2 Material:

3.2.1Equipments:

Different types of ultrasound machines were used:

- MINDRAY 1100 with TA 3.5MHZ , made of manufacturing : china.
- SONOSCOPE portable ultrasound diagnostic system, model: A5, probe T.A 3.5 MHZ, made Of Manufacturing: china.

3.2.2 Guideline protocol:

Any diabetic patient comes to the obstetrics department: Firstly identify myself to patient, and explain about study in simple language then clinical information was taken and data collection sheet filled.

3.2.3 Patient position:

All transabdominal study was generally performed with the patient in supine position.

3.2.4 Transducer Frequency:

3.5 MHz transabdominal transducers and 5 MHz for thin women was used.

3.2.5 Ultrasound procedure:

An ultrasound procedure used to assess the amount of amniotic fluid. The single largest pocket measured, then the amniotic fluid index is measured by dividing the uterus into four imaginary quadrants. The lineanigra is used to divide the uterus into right and left halves. The umbilicus serves as the dividing point for the upper and lower halves. The transducer is kept parallel to the patient longitudinal axis and perpendicular to the floor. The deepest vertical pocket of fluid was measured in each quadrant in centimeters. The four pocket measurements are then added to calculate the AFI.

Each patient was scanned twice, in an international scan guidelines and protocols. Firstly by the researcher then by a qualified sinologist to confirm the findings and diagnosis.

Chapter four

The Results

Chapter four

The results

The data in this study was collected from 50 diabatic pregnant women and 47 non diabatic pregnant women (controle group) in secand and third trimester of pregnancy.

Table (4.1): Descriptive statistic minimum, maximum, means and std. Deviation for age of mother and deep vertical pocket of amniotic fluid, weight of fetus and gestational age

Variables	N	Minimum	Maximum	Mean	Std. Deviation
Age of mother	50	19.00	43.00	32.5400	6.38305
Single vertical pocket	50	4.60	12.00	8.3460	1.95315
Weight of fetus	50	.788	3.900	2.41694	.669128
Gestational age	50	20.57 (20w 4d)	41.00	32.1257 (32w1d)	5.38780
Valid N (listwise)	50				

Table (4.2): Frequency distribution of age of mother in diabetic patients

Mother age	Frequency	Percent	Valid Percent	Cumulative Percent
19- 29 years	16	32.0	32.0	32.0
30-40 years	28	56.0	56.0	88.0
more than 40 years	6	12.0	12.0	100.0
Total	50	100.0	100.0	

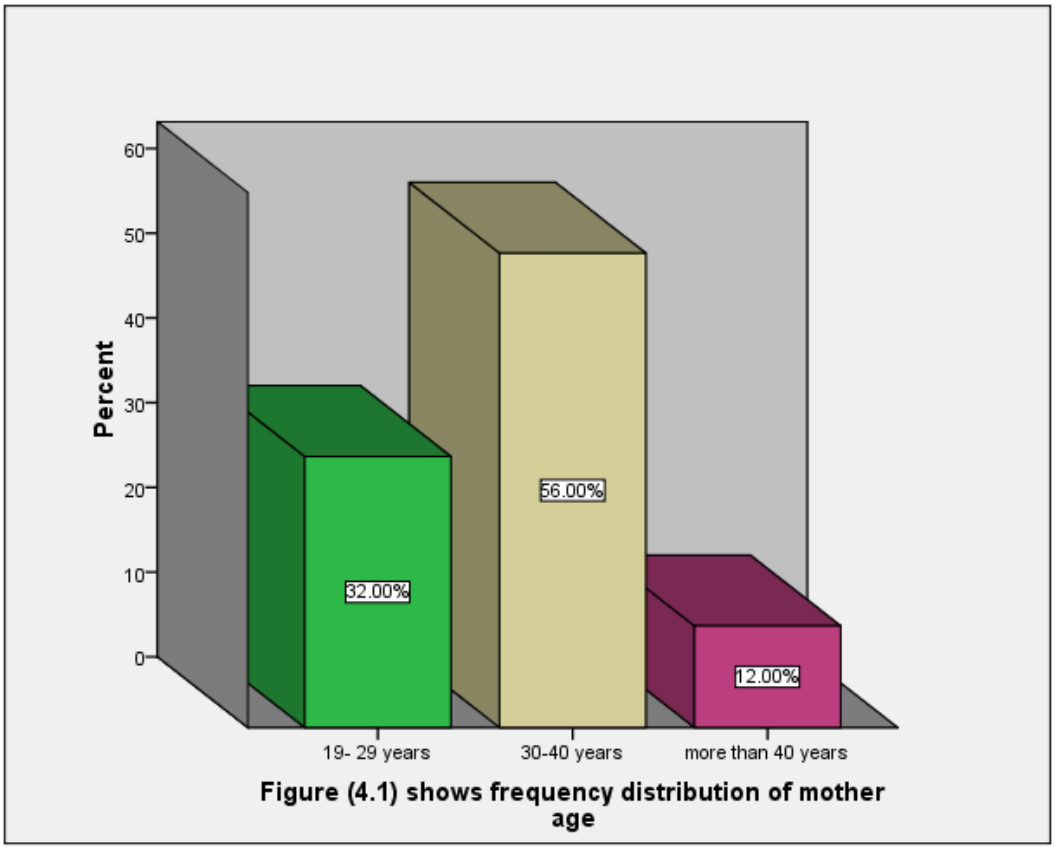

Figure (4.1) shows frequency distribution of mother age

Table (4.3): Frequency distribution of types of diabetes

Type	Frequency	Percent	Valid Percent	Cumulative Percent
Gestational Diabetes	29	58.0	58.0	58.0
Type I	7	14.0	14.0	72.0
Type II	14	28.0	28.0	100.0
Total	50	100.0	100.0	

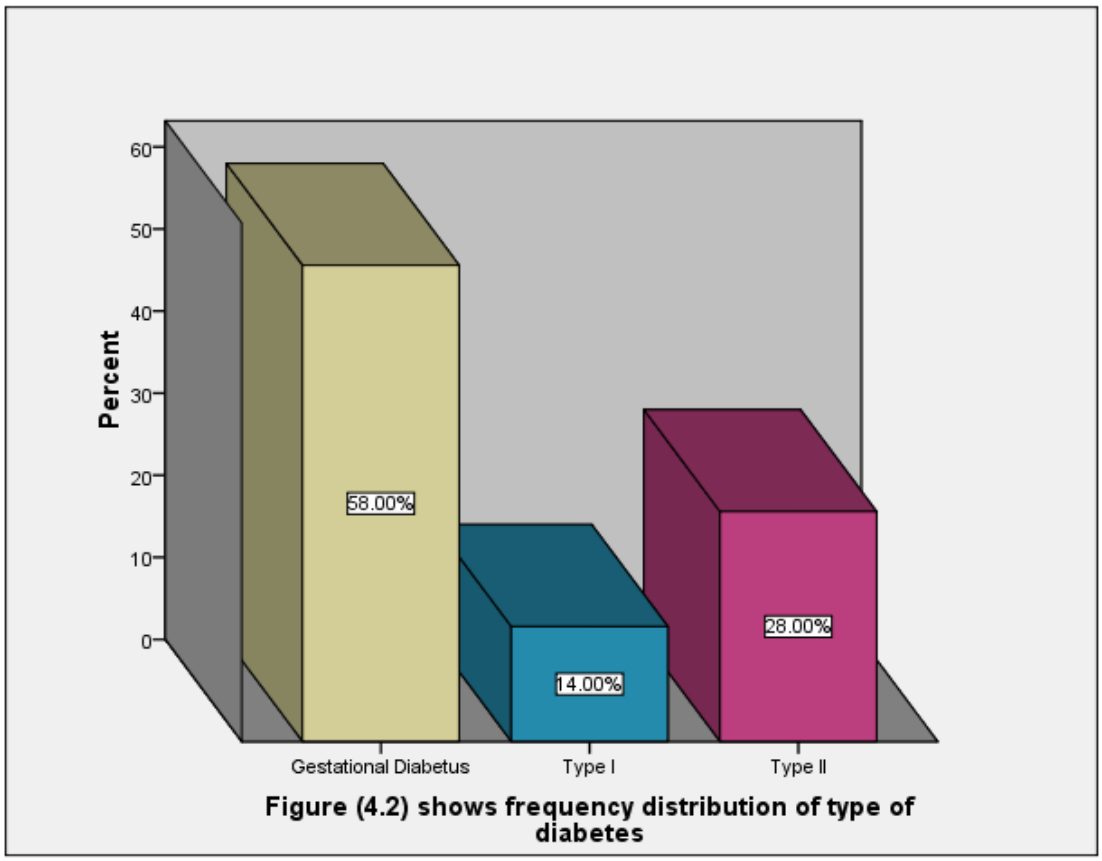

Figure (4.2) shows frequency distribution of type of diabetes

Table (4.4): Frequency distribution of diabetes status

Status	Frequency	Percent	Valid Percent	Cumulative Percent
Controlled	30	60.0	60.0	60.0
Uncontrolled	20	40.0	40.0	100.0
Total	50	100.0	100.0	

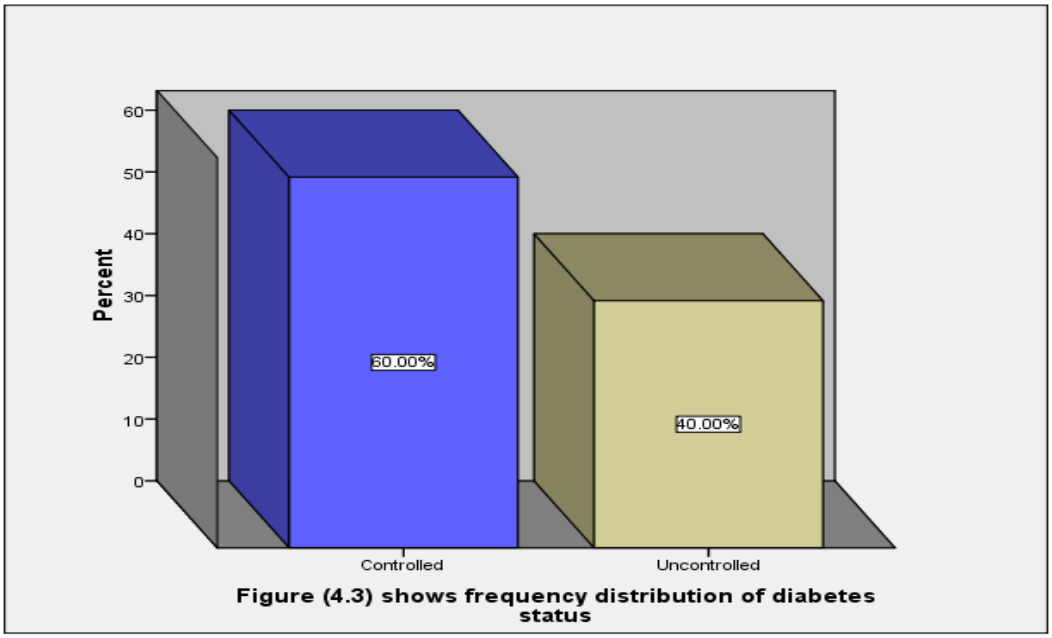

Figure (4.3) shows frequency distribution of diabetes status

Table (4.5): Frequency distribution of measurement of deep vertical pocket

DVP	Frequency	Percent	Valid Percent	Cumulative Percent
4-6 cm	8	16.0	16.0	16.0
6.1-8 cm	12	24.0	24.0	40.0
8.1-10 cm	18	36.0	36.0	76.0
10.1-12 cm	12	24.0	24.0	100.0
Total	50	100.0	100.0	

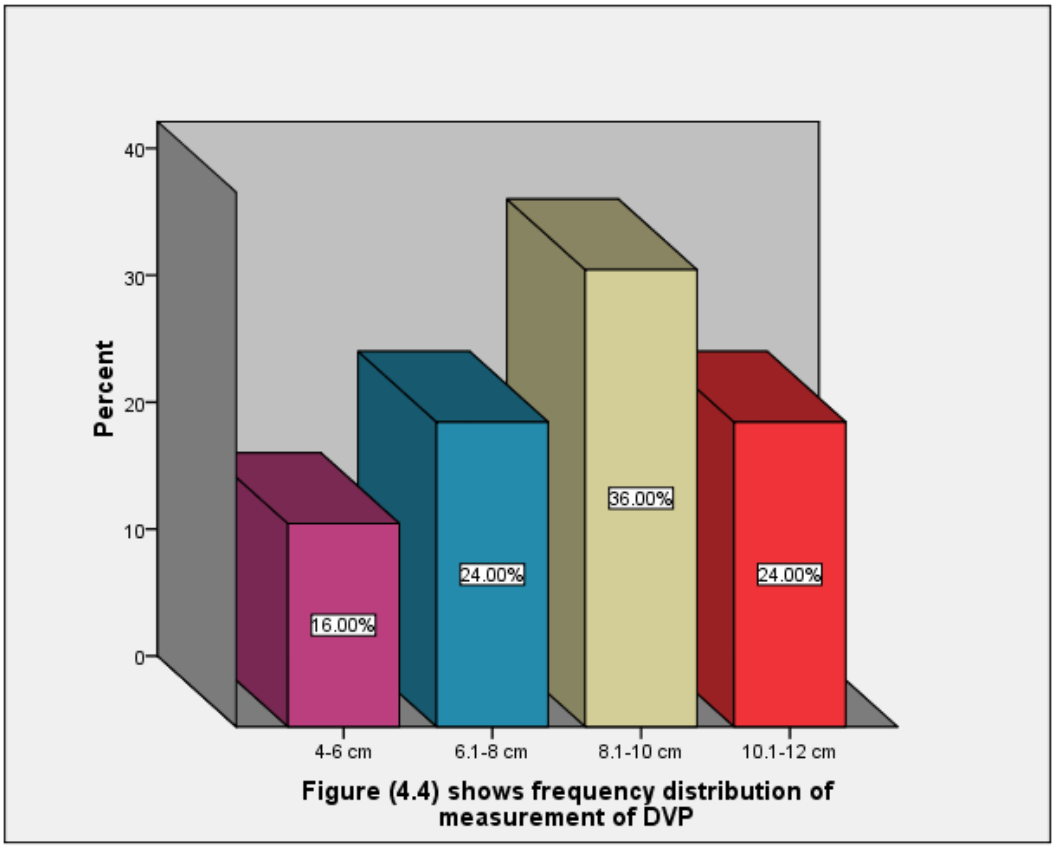

Figure (4.4) shows frequency distribution of measurement of DVP

Table (4.6): Frequency distribution of echogenicity of amniotic fluid

Echogenicity	Frequency	Percent	Valid Percent	Cumulative Percent
Debris	8	16.0	16.0	16.0
Echo free	42	84.0	84.0	100.0
Total	50	100.0	100.0	

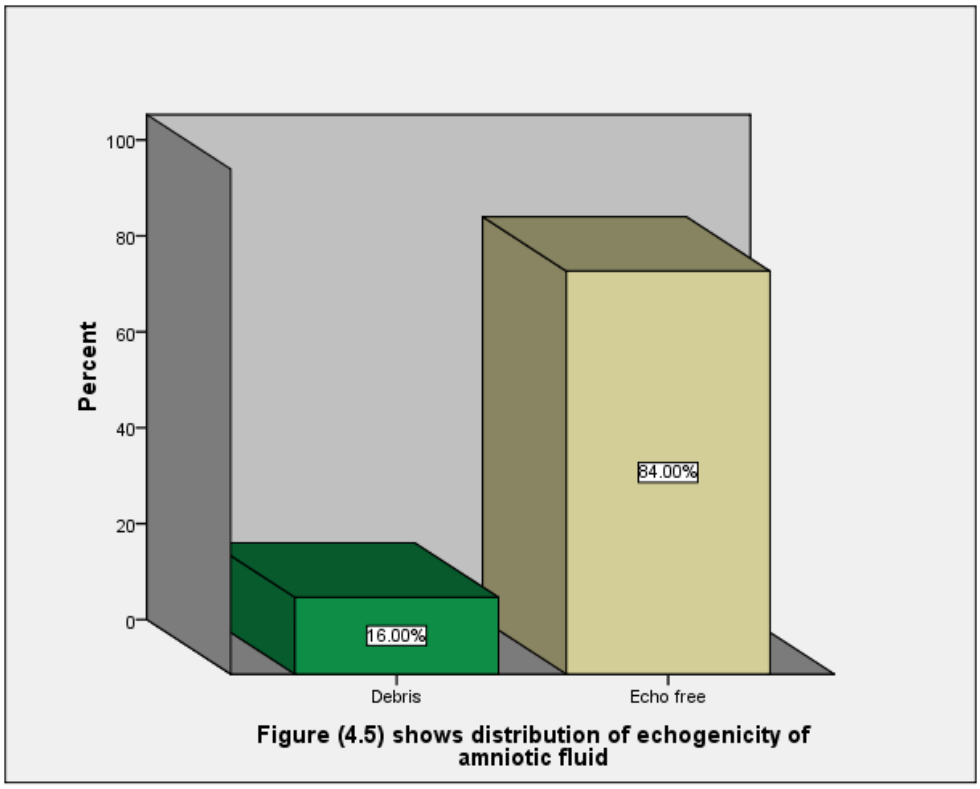

Figure (4.5) shows distribution of echogenicity of amniotic fluid

Table (4.7): Frequency distribution of weight of fetus

Fetal weight	Frequency	Percent	Valid Percent	Cumulative Percent
less than 1 kg	2	4.0	4.0	4.0
1- 2.5 kg	27	54.0	54.0	58.0
2.6 -3.5 kg	19	38.0	38.0	96.0
3.6-4 kg	2	4.0	4.0	100.0
Total	50	100.0	100.0	

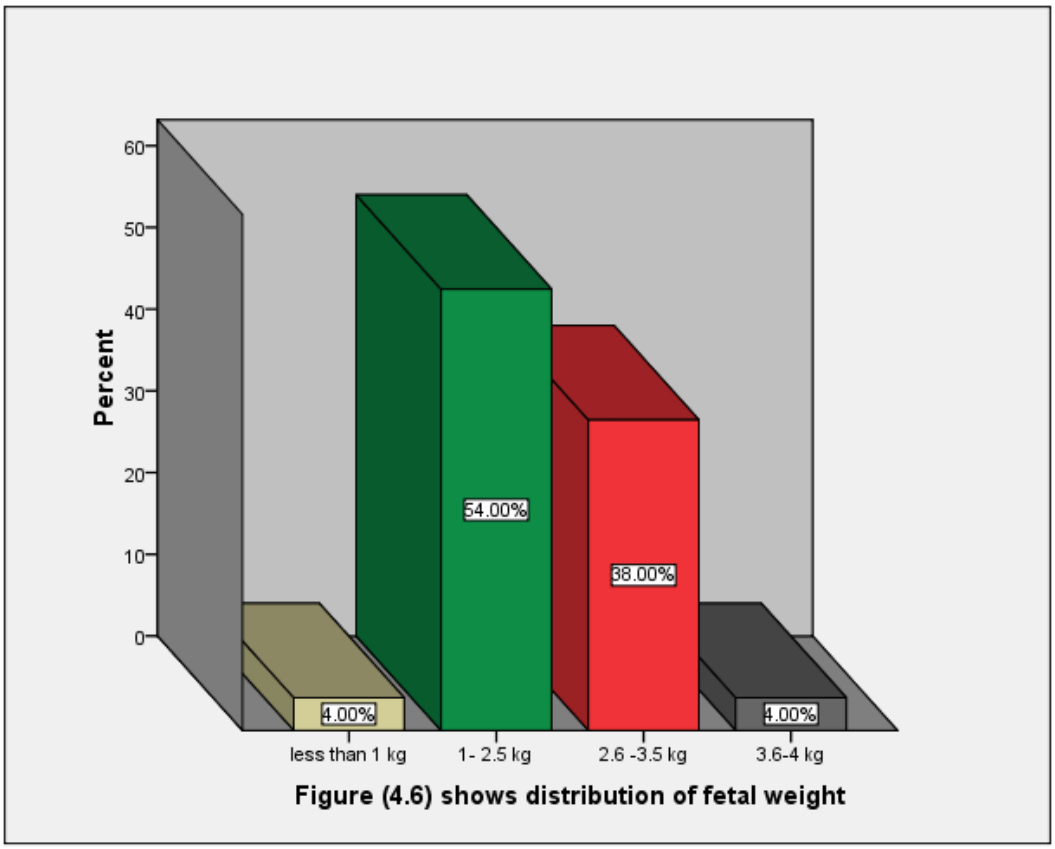

Figure (4.6) shows distribution of fetal weight

Table (4.8): Frequency distribution of age of fetus

GA	Frequency	Percent	Valid Percent	Cumulative Percent
20-28weeks	14	28.0	28.0	28.0
28.1-41 weeks	36	72.0	72.0	100.0
Total	50	100.0	100.0	

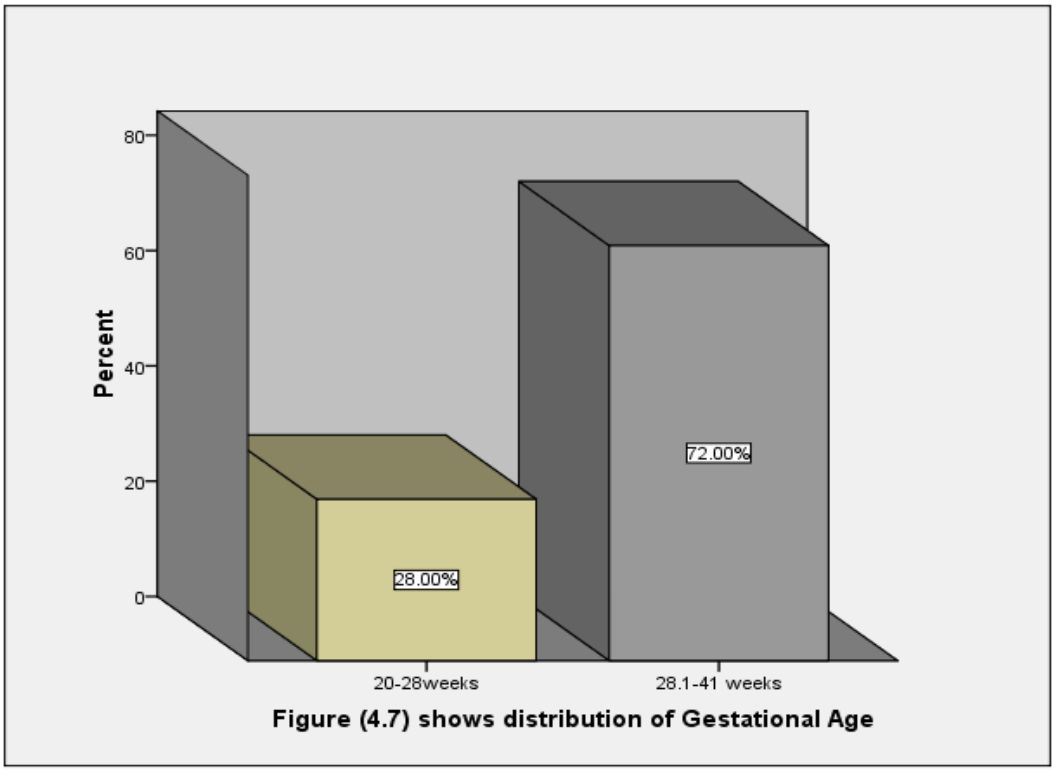

Figure (4.7) shows distribution of Gestational Age

Table (4.9): Frequency distribution of presence of congenital anomalies

Congenital	Frequency	Percent	Valid Percent	Cumulative Percent
No	49	98.0	98.0	98.0
Yes	1	2.0	2.0	100.0
Total	50	100.0	100.0	

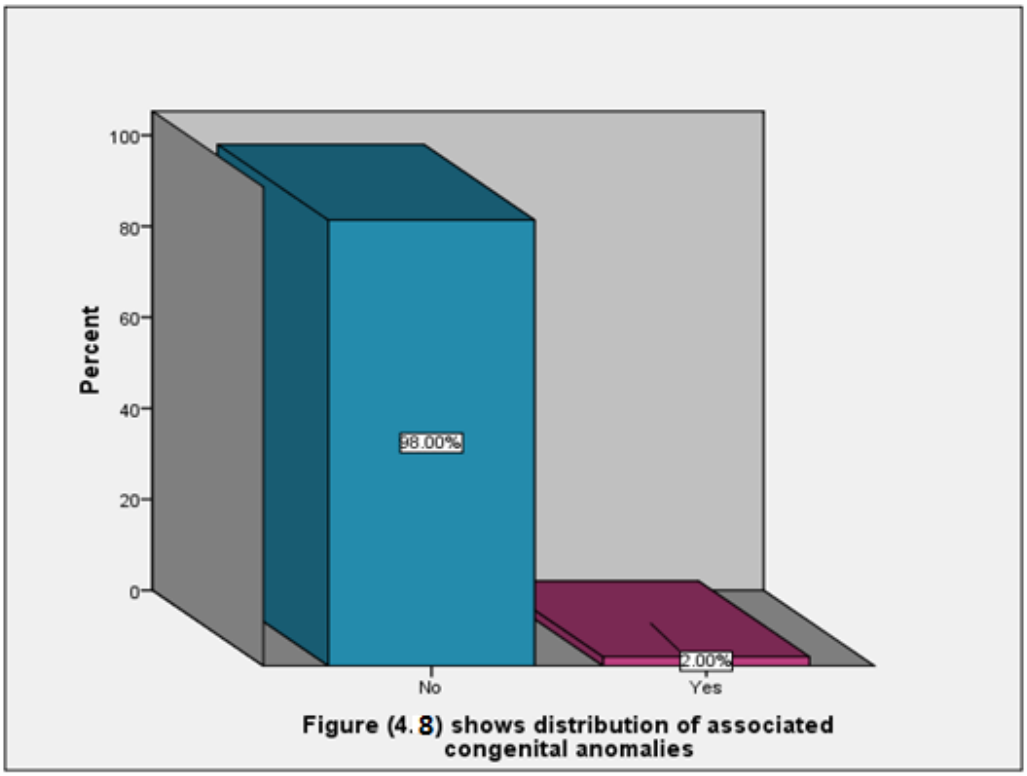

Figure (4. 8) shows distribution of associated congenital anomalies

Table (4.10): Correlation between SVP measurement ,gestational age and fetal weight

		SVP	Weight of fetus	GA
Single vertical pocket	Pearson Correlation	1	.499**	.351*
	Sig. (2-tailed)		.000	.013
	N	50	50	50
Weight of fetus	Pearson Correlation	.499**	1	.782**
	Sig. (2-tailed)	.000		.000
	N	50	50	50
Gestational age	Pearson Correlation	.351*	.782**	1
	Sig. (2-tailed)	.013	.000	
	N	50	50	50
**. Correlation is significant at the 0.01 level (2-tailed).				
*. Correlation is significant at the 0.05 level (2-tailed).				

Table (4.11): Cross tabulation between SVP measurement and type of diabetes

Type of diabetes	Measurement				Total
	4-6 cm	6.1-8 cm	8.1-10 cm	10.1-12 cm	
Gestational Diabetes	4	5	13	7	29
Type I	2	2	1	2	7
Type II	2	5	4	3	14
Total	8	12	18	12	50
P value =0.666					

Table (4.12): Cross tabulation between SVP measurement and status of diabetes

Status	Measurement				Total
	4-6 cm	6.1-8 cm	8.1-10 cm	10.1-12 cm	
Controlled	7	10	6	7	30
Uncontrolled	1	2	12	5	20
Total	8	12	18	12	50
P value = 0.014					

Table (4.13): cross tabulation between SVP measurement and GA

GA	Measurement				Total
	4-6 cm	6.1-8 cm	8.1-10 cm	10.1-12 cm	
20-28weeks	3	5	4	2	14
28.1-41 weeks	5	7	14	10	36
Total	8	12	18	12	50
P value =0.469					

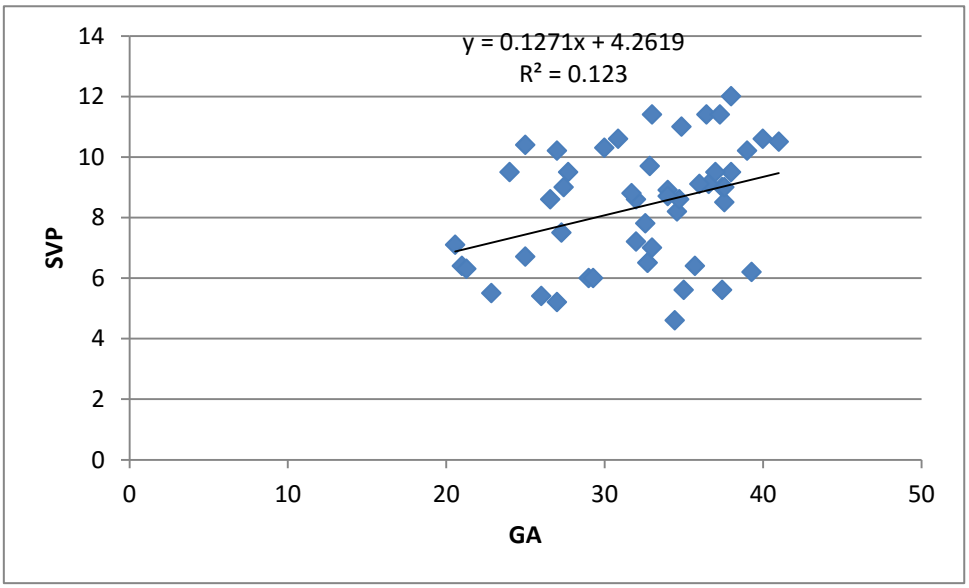

Figure (4.9): Scatter plot shows relationship between SVP and GA

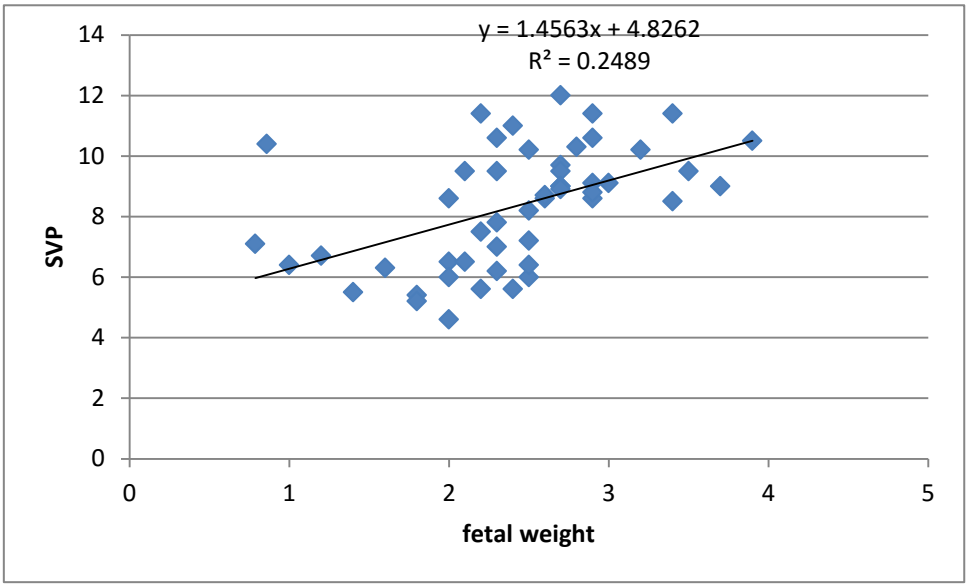

Figure (4.10): Scatter plot shows relationship between SVP and fetal weight

Table (4.14): Descriptive statistic minimum, maximum, means and std. Deviation for age of mother and deep vertical pocket of amniotic fluid, weight of fetus and gestational age for controlled DM

	N	Minimum	Maximum	Mean	Std. Deviation
age	30	21.00	41.00	32.5000	5.90003
SVP	30	4.60	12.00	7.8300	2.11695
Weight of fetus	30	.788	3.900	2.17823	.695002
GA	30	20.57	41.00	30.9905	5.89719
Valid N (listwise)	30				

Table (4.15): Descriptive statistic minimum, maximum, means and std. Deviation for deep vertical pocket of amniotic fluid, weight of fetus and gestational age for uncontrolled DM

Variables	N	Minimum	Maximum	Mean	Std. Deviation
SVP	20	5.60	11.40	9.1200	1.39533
Weight of fetus	20	2.100	3.700	2.77500	.438748
GA	20	24.00	39.00	33.8286	4.08597
Valid N (listwise)	20				

Table (4.16): Correlation between SVP measurements (for normal and polyhydramnious status)

Measurement	Frequency	Percent	Valid Percent	Cumulative Percent
4- 8cm	20	40.0	40.0	40.0
8.1 -12 cm	30	60.0	60.0	100.0
Total	50	100.0	100.0	

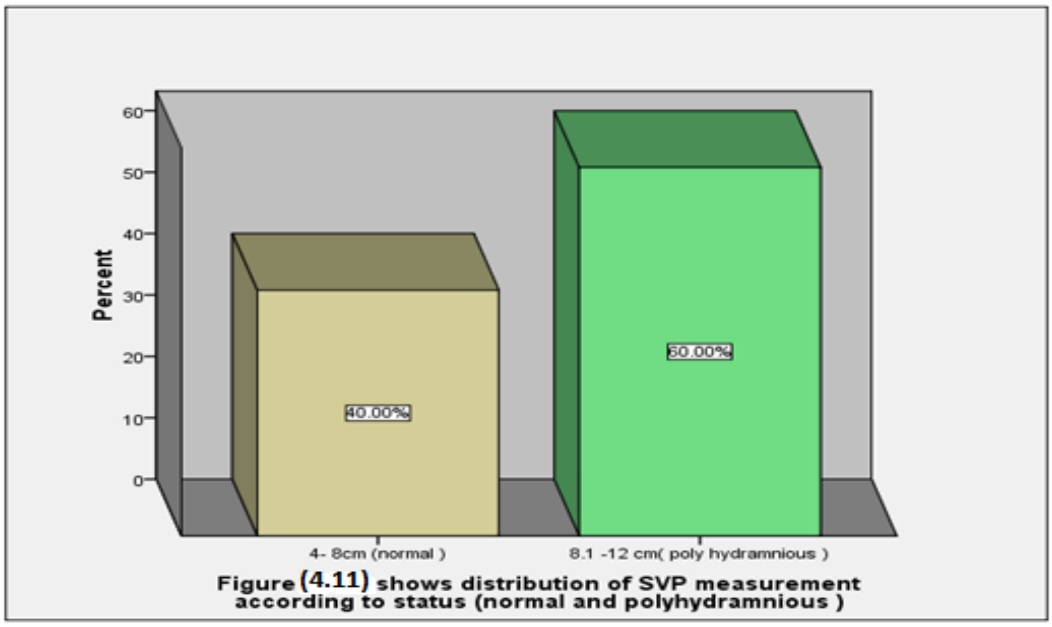

Figure (4.11) shows distribution of SVP measurement according to status (normal and polyhydramnious)

Table (4.17): Correlation between SVP measurements (for normal and polyhydramnious status)

Type of diabetes	SVP		Total
	4- 8cm (normal)	8.1 -12 cm (polyhydramnios)	
Gestational Diabetes	9	20	29
Type I	4	3	7
Type II	7	7	14
Total	20	30	50

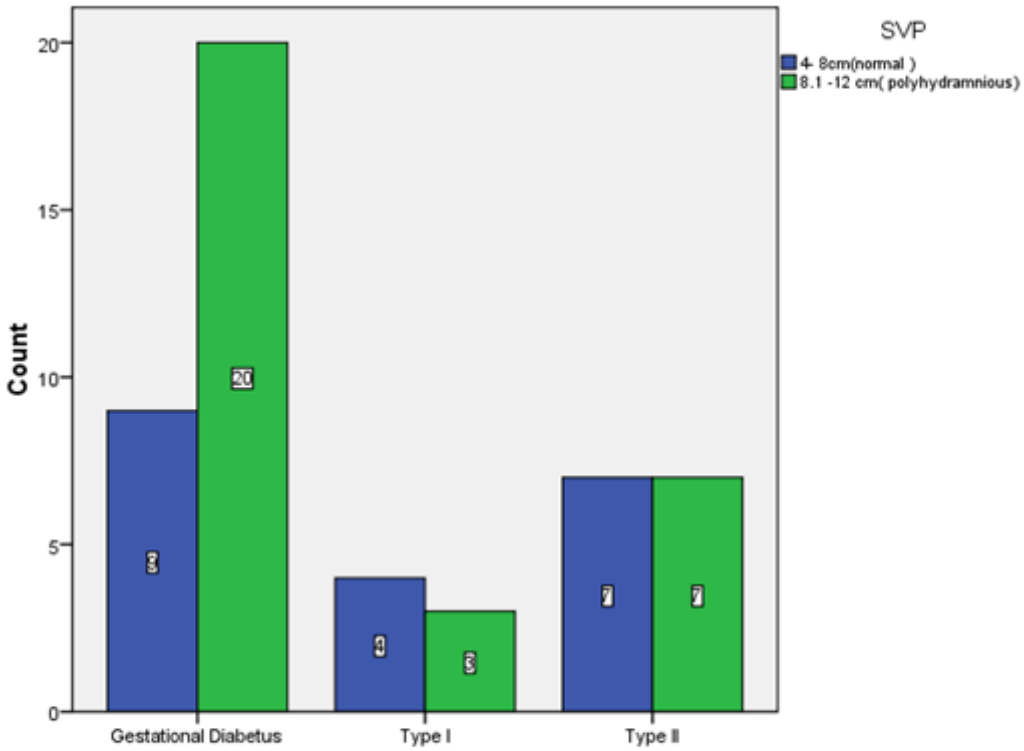

Figure (4.12) cross tabulation type of DM and SVP status

Table (4.18): Distribution of SVP measurements (for normal and polyhydramnious status) in each one type of DM

Type of diabetes	SVP		Total
	4- 8cm (normal)	8.1 -12 cm (polyhydramnios	
Gestational Diabetes	9(31.03)	20(68.97)	29(100%)
Type I	4(57.14)	3(42.86)	7(100%)
Type II	7(50%)	7(50%)	14(100%)

Table (4.19): Descriptive statistic minimum, maximum, means and std. Deviation for age of mother ,deep vertical pocket of amniotic fluid, weight of fetus and gestational age for controlled group (healthy non diabetes women)

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Age of mother	47	18.00	44.00	31.1702	6.80575
SVP measurement	47	2.00	9.00	5.0511	1.81634
Fetal weight	47	1.10	2.90	2.1404	.40736
Gestational age	47	21.43(21w3d)	40.29(40 w2d)	32.8967(32w6d)	5.13912
Valid N (listwise)	47				

Table (4.20): correlation between SVP measurement, gestational age and fetal weight

		SVP	Weight	GA
SVP	Pearson Correlation	1	-.427**	-.579**
	Sig. (2-tailed)		.003	.000
	N	47	47	47
Weight	Pearson Correlation	-.427**	1	.870**
	Sig. (2-tailed)	.003		.000
	N	47	47	47
GA	Pearson Correlation	-.579**	.870**	1
	Sig. (2-tailed)	.000	.000	
	N	47	47	47
**. Correlation is significant at the 0.01 level (2-tailed).				

Table (4.21): Frequency distribution of echogenicity of amniotic fluid for controlled group (healthy non diabetes women)

Echogenicity	Frequency	Percent	Valid Percent	Cumulative Percent
Debris	3	6.4	6.4	6.4
Echo free	44	93.6	93.6	100.0
Total	47	100.0	100.0	

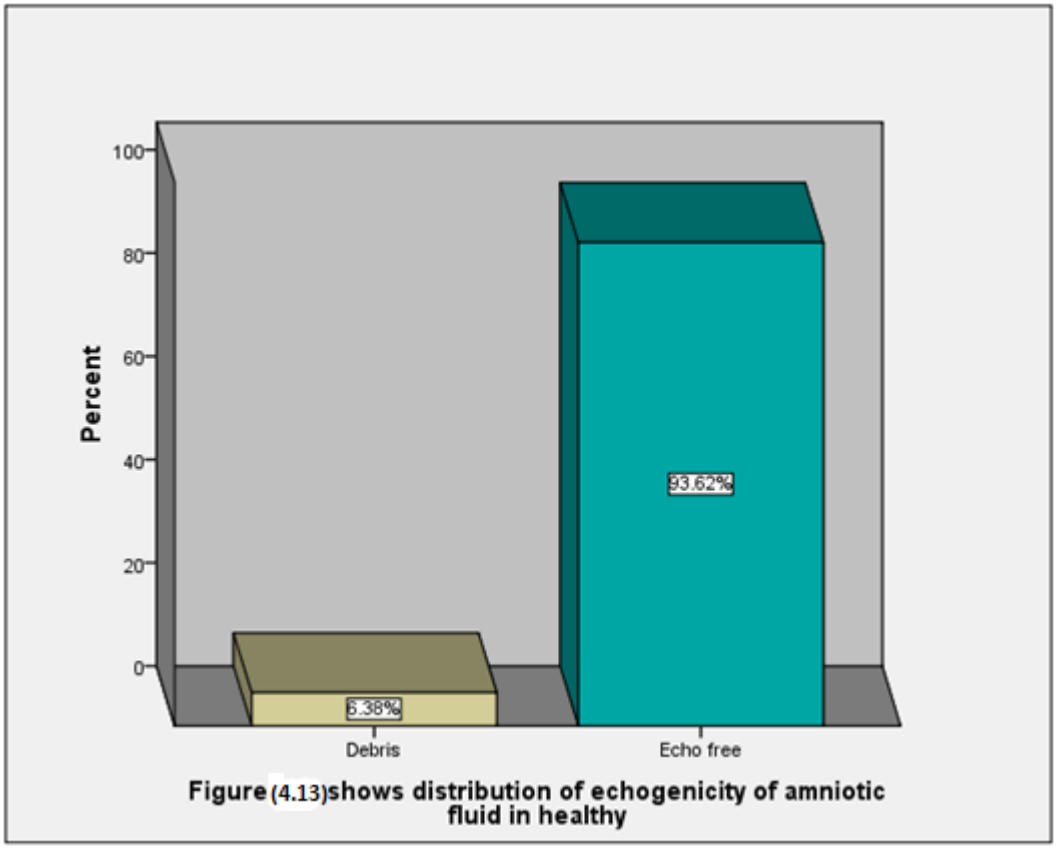

Figure (4.13)shows distribution of echogenicity of amniotic fluid in healthy

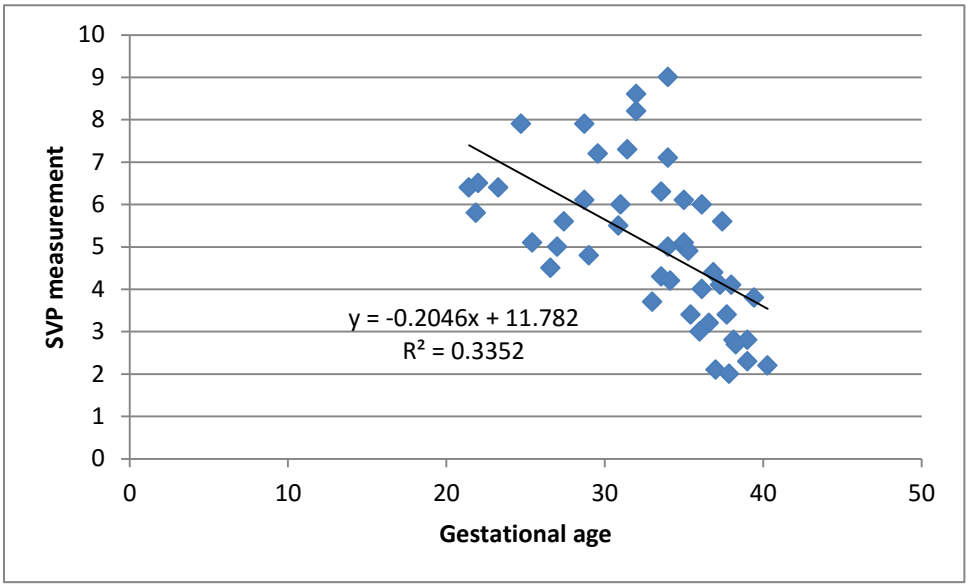

Figure (4.14): Scatter plot shows relationship between SVP and GA in healthy group

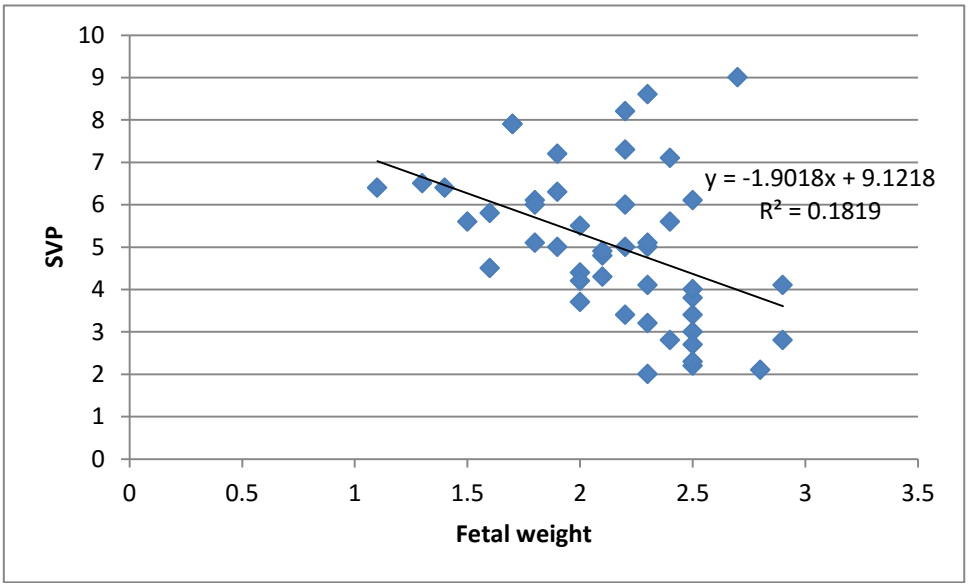

Figure (4.15): scatter plot shows relationship between SVP and fetal weight in healthy group

CHAPTER FIVE

Discussion,Conclusion and Recommendation

Chapter five

Discussion,Conclusion,Recommendation

5.1 Discussion:

This study was analytical and descriptive study deal with the role of ultrasound to evaluation of amniotic fluid volume in diabetic pregnant women among Sudanese population,the data in this study was collected from 50 diabatic pregnant women and 47 non diabatic pregnant women (controle group) in secand and third trimester.

- Concerning the pt age most of diabetic pregnant women were among the age group (30 to 40) years which represent 56% of sample volume, this agree with research done by Rian -2012 and also agree with that done by Moaz -2012 .

- The majority of patients among group of gestational diabetes represent 58% this result was dissagree with that finding by Rian -2012 and Moaz -2012 which were the majority of patients among the type 1 DM, this different for unknown cause.

- Also study found that the majority of patients were well controlled for DM, which represent 60%, and this agree with that finding by Rian -2012, Moaz -2012 and also agree with Joy -2007.

study found that 60% of patients had polyhydramnios (abnormal increase in amniotic fluid volume), and 40% of patients had normal amniotic fluid volume, There was strong correlation with that result of Rian -2012. Also this result agree with study of Department of Obstetrics and Gynecology -2006 and also agree with result of Moaz – 2012.

- From the type of DM, the majority of polyhydramnios which represented that the SVP in millimeters in all patients with diabetes mellitus 20 out of 29 patients had increasing AFV 68.97% of GD , 50% type 11,and type1 represented 42.86%.

-The study found that Strong positive correlation between SVP and weight of fetus (p=0.01) this agree with study of Department of Obstetrics and Gynecology -2006 .

- The study found that the positive correlation between SVP and GA (p=0.05) this agree with Joy -2007, Also this result agree with study of Department of Obstetrics and Gynecology -2006 .

-In the controle group (non diabatic) the mean of mother age 31.17,mean of SVP 5.05,mean of fetal weight 2.14,mean of GA 32w6d. So there was Strong nagitive correlation between SVP and weight of fetus and GA and Strong positive correlation between weight of fetus and GA(p=0.01) this result agree with study of Department of Obstetrics and Gynecology -2006 .

5.2 Conclusion

This study deals with diabetic pregnancies to measure AFV the concluded that:-

- The commonest type of diabetes in Sudanese pregnant women was type of gestational diabetes (58%) of sample size.
- Most diabetes pregnant women have abnormally increased of amniotic fluid volume 60% of Sudanese pregnant women have polyhydramnios, while 40% of sample size has normal amniotic fluid volume.
- 40% from patients they have uncontrolled diabetes status, and 60% from patients they have controlled diabetes status.
- 4% of sample size has macrosomic fetuses.
-The mean of amniotic fluid volume (SVP) for controlled is 7.83 (that means the mean of amniotic fluid volume (SVP) is normal for controlled), and the mean of amniotic fluid volume (SVP) for uncontrolled is 9.12 (that means the mean of amniotic fluid volume (SVP) is Polyhydramnios for uncontrolled).
- Diagnostic ultrasound is a good modality for assessing the AFV with high accuracy and efficiency.

5.3 Recommendations

With reference to the results and conclusion concerning this research, it's to be recommended that:

- Diabetes is a common causes of many maternal and fetal complications during pregnancy so; special care with special diagnosis and treatment of this problem should be available.
- Any diabetic pregnant lady should be assess by u/s several scans from 20weeks up to delivery date.
- Primary health care centers should be with ultrasound machine.
- All doctors and sonologists should be well training in fetal well-bearing and mother health , the assessment of fetal well-bearing to decrease the mortality and morbidity.
- The operators should update their knowledge about techniques useand any information regarding ultrasound.
- It is recommended that other factors which can effect on accuracy of amniotic fluid volume and contribute to differences should evaluate in further studies.
- Further studies should be established for effect of diabetes in AFV, placenta, fetal biometry and fetal weight, employing large samples to confirm these findings.

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Appendices

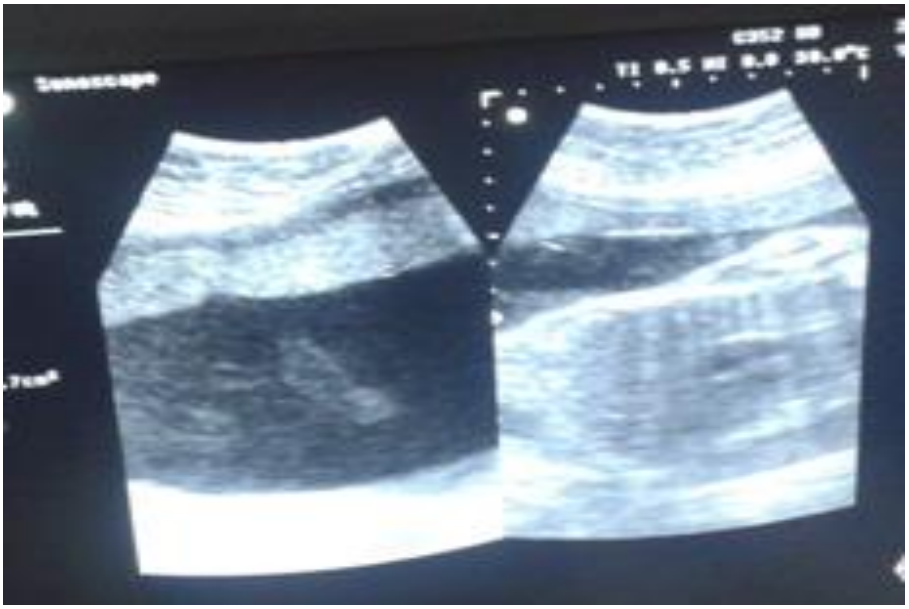

Figure (1): 27 weeks + 5day gestation show polyhydramnios (SDP=9.5CM), controlled GDM

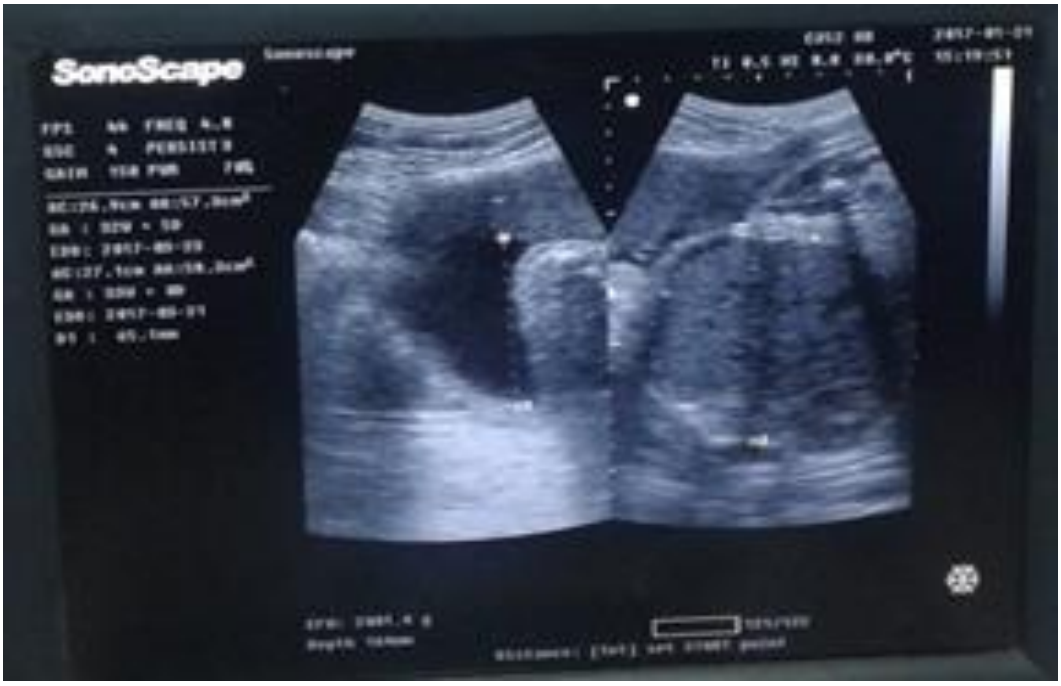

Figure (2): 32 weeks + 5day gestation show normal AFV (SDP=6.5Cm) controlled T2DM women

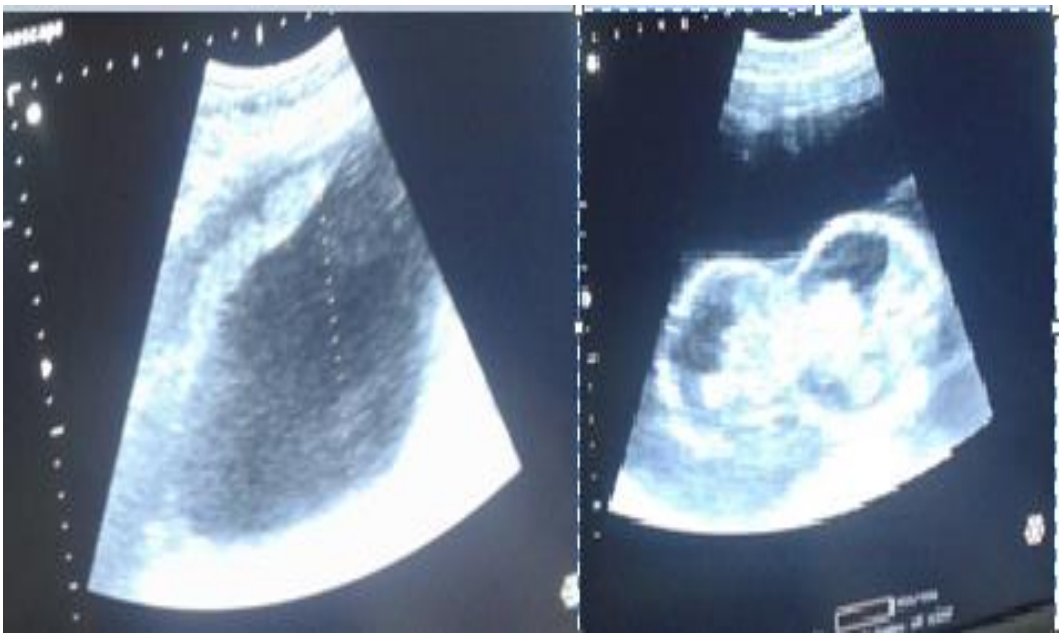

Figure (3): 30 weeks gestation show polyhydramnios (SDP=10.3Cm) controlled GDM women

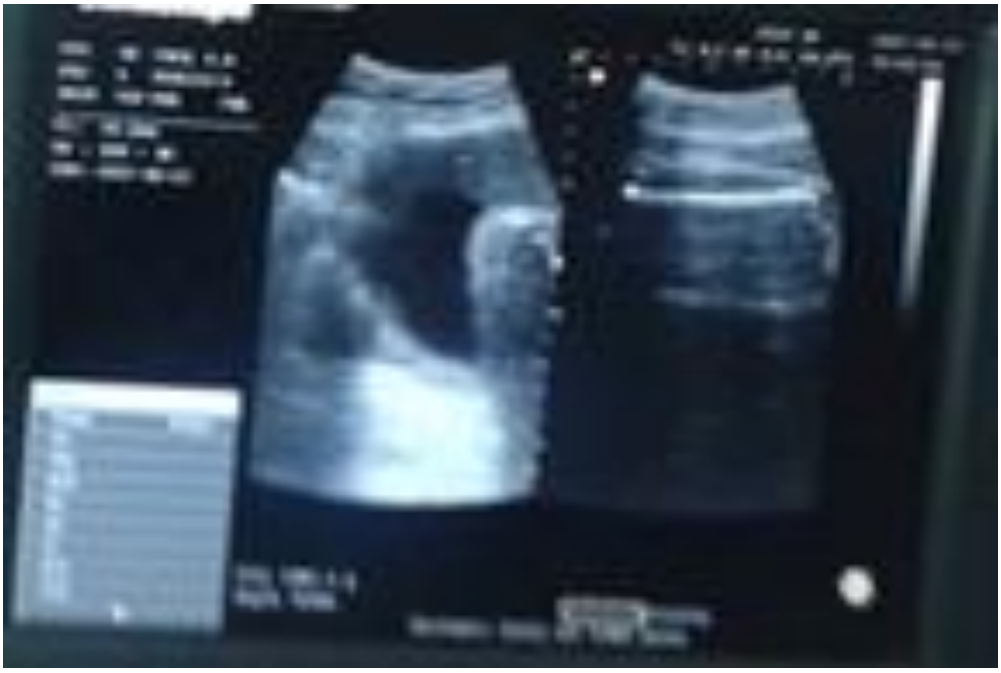

Figure (4): 32 weeks gestation show polyhydramnios (SDP=8.8 Cm) un controlled T1DM women

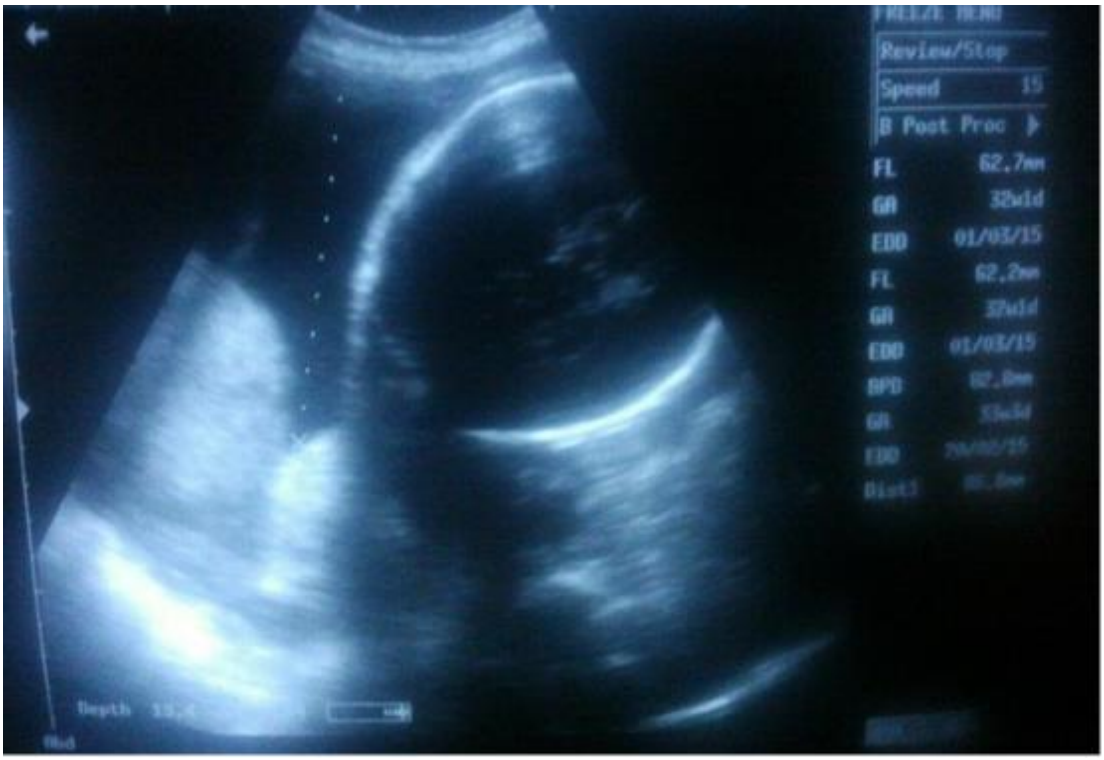

Figure (5): 32 weeks + 1day gestation show polyhydramnios (SDP=8.6Cm), uncontrolled GDM women

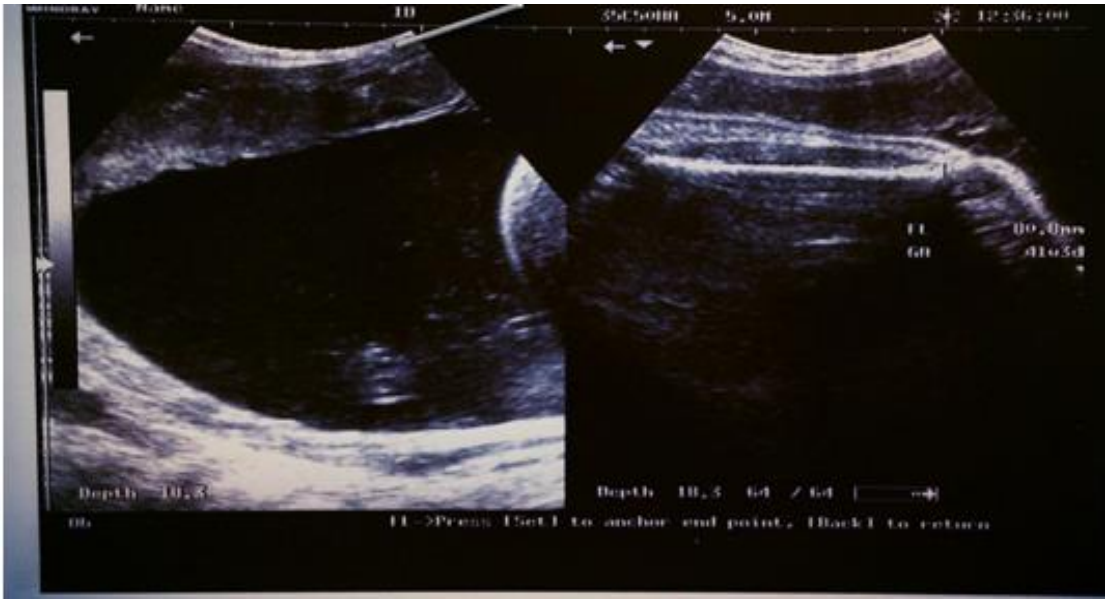

Figure (6): 41 weeks gestation show polyhydramnios of controlled type1 DM lady

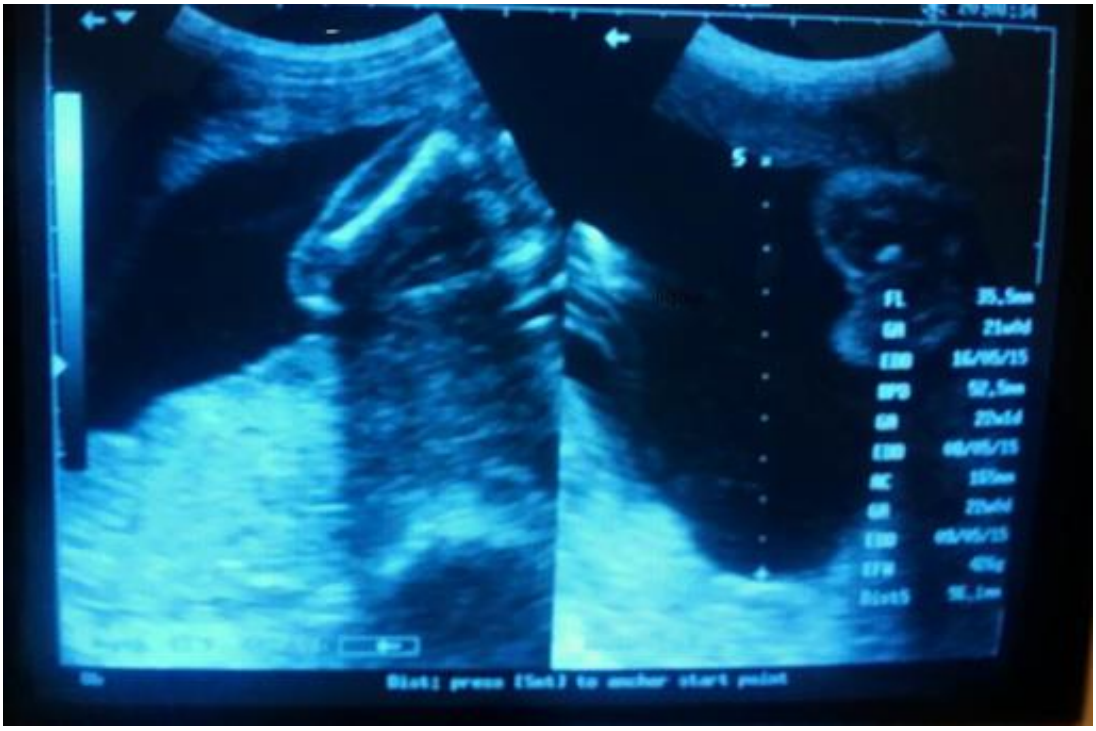

Figure (7): 21 weeks+ 3 days gestation with polyhydramnios , controlled type1 DM.

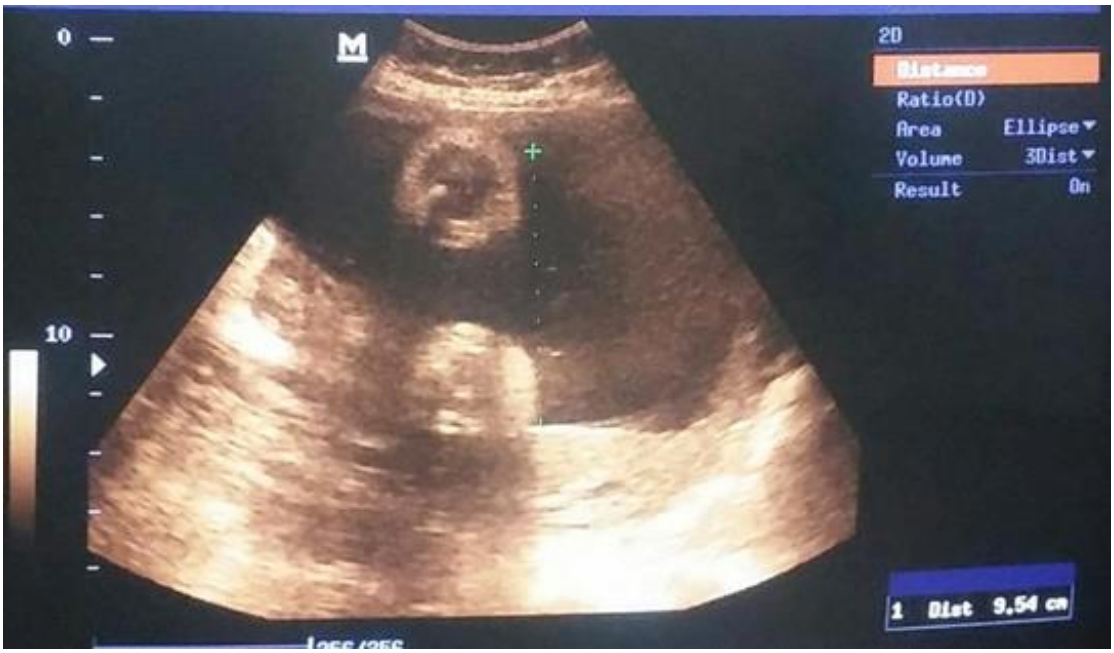

Figure (8): 38weeks+2days gestation show polyhydramnios (SDP=9.5Cm) , uncontrolled GDM women

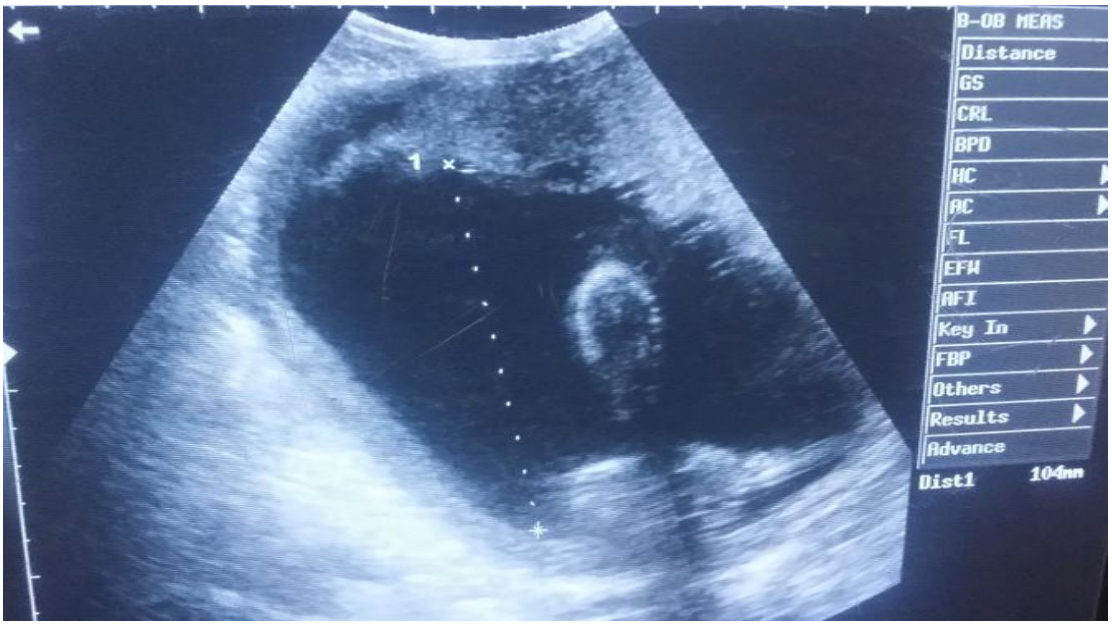

Figure (9): 25 weeks gestation show polyhydramnios(largest pocket =10.4cm), Controlled type2 D

SUDAN UNIVERSITY OF SCIENCE AND TECHNOLOGY

Collage of Graduate studies

Data Collection Sheet

Sonographic Evaluation of Amniotic Fluid Volume in Diabetic Pregnant women During 2nd & 3rd Trimesters in Khartoum State

Patient Number:(……). Date:.....\.....\2016.

1-Patient age: (……) Years.

2-Type of DM:

Type1(……..).Type2(...……..)=GD (……..).

3-Diabetes status:

Controlled (……..). Uncontrolled (……).

4- Gestational Age :(…….) weeks. BPD (……...….), FL (……..……), AC (…….…….).

5-Amniotic fluid volume: SDP (…..…).4pockets (…….).

Normal (…….…) Polyhydramnios (…….).

6- Consistency of amniotic fluid:

Echo free (……..). With debris (……).

7- EFW :(……..…) kg.

Normal (…….) Macrosomia (……).

8- Congenital fetal anomalies:Yes (…….) No (……..)